UNIVERSITY OF SOUTHAMPTON

FACULTY OF HUMANITIES

Archaeology

A Deep History of Emotion: an interpretive framework

By

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Thesis for the degree of Doctor of Philosophy

June 2018

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

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This thesis represents the first extended attempt by an archaeologist to construct an evolutionary theory of emotion. The handful of attempts that have appeared since the 1990s have failed to gain any real traction with archaeologists caught in a theoretical deadlock over the way in which an 'archaeology of emotion' should be approached.

This thesis will attempt to break the deadlock by reframing the debate around a 'deep history of emotion'. It will be argued that it is only through a comprehensive *longue durée* approach that emotion can be understood in a prehistoric context. This requires the construction of a theory that can explain both the early biological origins of emotion and the later cultural constructions that characterize modern human societies.

This will be achieved through an appraisal of the interdisciplinary literature on emotion in search of a definition of emotion amendable for the archaeological enterprise. It is argued that rather than seeking discrete emotions directly, archaeologists should focus on the process by which emotional experiences are psychologically constructed and the cognitive traits that combine to produce complex emotional experience. Child development will be proposed as a starting point to understand how emotions are constructed from more basic cognitive ingredients.

Ultimately, three hypothetical mindstates will be proposed as heuristics through which hominin emotional capacities may be approached. Archaeological evidence for life history patterns and the cognitive ingredients of emotion will be used to anchor these mindstates in the past, providing predictions for the emotional vocabulary of hominins and possible new ways to interpret behaviour and material culture.

This thesis demonstrates that archaeologists can consider the emotional abilities of ancestral hominin by using innovative theoretical methods. An approach of this sort can provide new ways of looking at old data with the objective of expanding our appreciation of the decision-making processes that inform action.

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Academic Thesis: Declaration Of Authorship

I, …… declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

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I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
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3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
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Acknowledgements

Yvonne Marshall and Yannis Hamilakis provided comments on the upgrade. Clive Gamble and William Davies provided supervision and patience.

Introduction

Archaeologists have devised a plethora of ways to approach the study of the ancient mind. It has been variously characterised by its capacity for symbolism (Henshilwood & d'Errico 2011), language (Nobel & Davidson 1996), cognitive fluidity (Mithen 1996), encephalisation and theory of mind (Dunbar, Gamble and Gowlett 2014), among others. Archaeologists are, however, yet to consider the ancient mind in relation to its capacity for emotion.

For some archaeologists, the reconstruction of emotions from a fragmentary material record can only ever be speculative. However, this professional scepticism has not deterred others from tackling the topic (e.g. Gosden 2004; Harris & Sørenson 2010; Spikins et al 2010; Tarlow 1999, 2000). These attempts have, however, failed to gain traction and have become bogged down in a theoretical quagmire. This has left some "timorous and fearful… [about] venturing into the territory of affect and emotion" (Kus comment on Tarlow 2000).

Commonly, such topics are not addressed by evolutionary archaeology, with traditional approaches taking a 'very narrow view of what the data can tell us about' (Gamble 1999, p.8). A few notable attempts have emerged over recent years (e.g. Dobres 2000; Coward & Gamble 2008; Gosden 2004), however, they have been restricted to the Upper Palaeolithic and there has been a general failure to apply the sociocultural theory of later periods to Palaeolithic contexts (Wobst 2000, p.43). This has created a 'moving interpretive curtain' (Gamble 1999, p.5), with a discontinuity between what we believe to be ancient and modern.

Part of the 'obvious unease with alternative interpretations among Palaeolithic archaeologists' (Gamble 1995, p.85) is the nature of Palaeolithic data, 'those mere fragments of stones and bones' (Wobst 2000, p.43). According to this argument, Palaeolithic archaeologists need more and 'better' data before the sorts of questions raised by this improved sociocultural theory can be addressed (see Wobst 2000, p.43; Clark 2001, p.139). Claims such as this are used to justify why "investigating society in the Palaeolithic has never achieved the same research prominence as studies of the subsistence economy, the spatial analysis of settlements, cave art, or lithic typology and technology' (Gamble 1999, p.1), the

more archaeologically 'achievable' rings of Hawkes's 'ladder of inference' (Hawkes 1954).

However, it is unclear that *more* and *better* data will help archaeologists to address nebulous topics: 'empirical insufficiency is only part of the problem' (Clark 2001, p.139; see also Miracle 2002, p.85). Rather, innovative theoretical approaches are required to tease the finer details out of the archaeological record. Recent developments in the field of deep history have begun to ask what interpretations of evolution would look like if approached with the theoretical frameworks available to those in the humanities and social sciences (Shryock & Lord Smail 2011).

As such, the objective of this thesis is to draw on such developments by presenting an interpretive framework to allow the exploration of emotion within an evolutionary context. Recruiting the interdisciplinary literature it will seek to reframe the exercise of the 'archaeology of emotion' from the perspective of deep history to construct a model to predict the emotional repertoire of ancestral hominins, and break down emotion into ingredients that can be identified in the archaeological record.

Chapter 1 will consider previous attempts by archaeologists to address the topic of emotion and will highlight the theoretical problems that must be overcome in order to construct a coherent archaeological theory of emotion. It will be seen that bridging the divide between biological and cultural concerns is vital.

Chapter 2 will review the evolutionary theories of emotion considering the benefits and drawbacks of current theories. It will be seen that a polarised debate between biological universalist and cultural constructivist perspective has risked ignoring new research from neuroscience which illuminates the basic mechanisms underlying complex emotion.

Chapter 3 will review the interdisciplinary literature on emotion with a view of arriving at a definition of emotion that is amenable for the study of emotion in the deep past. It will be seen that complex emotions are psychologically constructed from a multicomponent process and that an evolutionary theory of emotion should be concerned with explaining this process rather than seeking the ontology of discrete emotions.

Chapter 4 will present literature on child development as a way to understand the process of psychological construction. It will be seen that the emergence of a number of cognitive traits in the development of human children scaffolds an expansion in emotional experience.

Chapter 5 will demonstrate that the sensitive period of infant brain development is a fundamental component in the evolution of modern humans. It will be seen that there is a distinct difference between the developmental trajectory of modern human and chimpanzee brains, and that this difference can be observed in the fossil remains for ancestral hominins.

Chapter 6 will use the lessons from child development to construct a proposal for the emergence of emotion cognition in hominins. Three hypothetical mindstates will be proposed as heuristic for thinking about hominin emotions.

Chapter 7 will seek evidence for the cognition ingredients of complex emotion in the archaeological record. It will be seen that the hypothetical mindstates can be anchored in the story of human evolution helping to make predictions about the emotional capacity and behaviours of ancestral hominins.

Chapter 8 will explore the value of the three hypothetical mindstates for the interpretation of the archaeological record. Evidence for the funerary practices of the ancestral hominins will be reinterpreted in light of the psychological ingredients that underlie the construction of separation distress and grief experiences.

1 Emotion and Human Origins: grounds for consilience

The study of emotion is inherently interdisciplinary. Researchers from the humanities and natural sciences have been investigating the role that emotions play in human lives in earnest for some 50 years, with a philosophical and scientific tradition going back much further. Yet archaeologists have been slow on the uptake. For some, the reconstruction of emotions from a fragmentary material record can only ever be speculative. However, this professional scepticism has not deterred others from tackling the topic (e.g. Gosden 2004; Harris & Sørenson 2010; Spikins et al 2010; Tarlow 1999, 2000). Whilst the archaeological literature on emotion remains small, it is disparate, with division the order of the day. The movement from the material to the emotional is not easy, particularly in preliterate cultures, which has lead the archaeologists into major conceptual problems, with the major fault line falling at the boundary between prehistoric and historic cultures.

Despite these early teething problems, the archaeology of human origins is uniquely placed to set disciplinary boundaries aside and seek a new consilience in emotion research. Here I will seek to reframe the study of emotion in the context of human origins. Three main disagreements that characterise archaeological approaches to emotion are outlined: 1) the failure to agree on a suitable definition of emotion 2) a failure to agree on an appropriate scale of analysis 3) a failure to establish a robust methodology. It will be seen that researchers are talking at cross purposes, and in order to move forward it is necessary to respect conceptual differences and to develop coherent methodologies that are complementary when applied in the right contexts. Dichotomous definitions of emotion need to be set aside and replaced with an appreciation of process and long term change. Archaeology is perfectly placed to address such questions and in so doing can contribute to the interdisciplinary discussion of emotion.

1.1 Disagreement 1: how should emotion be defined?

Archaeology has yet to arrive at a definition of emotion amenable to the study of the past. For the most part, contrasting definitions have been borrowed from broad movements within the interdisciplinary study of emotion.

Those working within an evolutionary tradition (e.g. Mithen 1991; Spikins et al 2010; Spikins 2015) have tended to favour a definition of emotion derived from the work of evolutionary psychologists and neuroscientists. Typically, the emphasis is on the continuity of human and animal emotions (e.g. Darwin 1872; LeDoux 1999), the innate neurological mechanisms that stimulate physiological arousal (e.g. Damasio 2005; Panksepp 1998), emotions that appear to be universal and shared cross-culturally (e.g. Ekman 1992; Plutchik 2001), and the adaptive value of emotion (e.g. Cosmides & Toobey 2010). By adopting this perspective, researchers are accepting that emotions are evolved biological traits, serving a role in rational decision-making and helping individuals adapt to their environment. As such, a biological definition of emotion has led archaeologists into identifying the expressions of evolved traits in our evolutionary past. This approach has led Spikins et al (2010) to define compassion as 'a biologically derived motivation to help others we "care" about' and proceed to review the Palaeolithic record for evidence of caregiving behaviour towards 'non-productive' individuals. As such, researchers seek to identify, in archaeological contexts, certain emotions that are presumed to exist as biological adaptations (e.g. Mithen 1991).

The adoption of a biological definition of emotion has been vociferously contested. Both Thomas (1991) and Tarlow (2000) reject the conception of emotions as biological and universal, preferring a view borrowed from sociology and anthropology, 'in which the full range of human emotions would be infinite, culturally varied, and not within the experience of any single human being' (Tarlow 2000, 721). Along these lines, emotions are seen as wholly the product of human social interactions (e.g. Harre 1986; Averill 1986) or culture (e.g. Lutz 1988; Rosaldo 1980). It is through these phenomena alone that emotions attain their meaning, expression and behavioural products. Whilst some acknowledge that biology must play a role in emotion, they argue that human cognitive

development has subsumed the biological components, making them obsolete (Wentworth and Yardley 1994). Others (e.g. Gosden 2004; Harris & Sørenson 2010) have also taken up this approach to emotion research within archaeology, generally focusing on the role of the material world in the construction of emotional experiences in the past.

The difficulty in reconciling these two approaches has proved to be somewhat of a stumbling block to attempts to build a cohesive programme of archaeological research on emotion. Indeed, disagreements have been so severe as to prompt Thomas (1991) to argue that 'evolution and adaptation are redundant concepts when dealing with the interpretation of purposive human actions', and that Mithen 'reduced emotion to the instrumental' by adopting a biological approach. However, it would seem impossible not to deny the preponderance of evidence now available from neuroscience (Dalgleish 2004) that emotions have an important biological component. This is not to dismiss the significant social and cultural aspects of emotion. Indeed, as Leavitt (1996) argues the reason why emotions are interesting is that they bridge the domain of cultural meaning and bodily feelings.

It is argued here, that the dichotomous distinction between biological and cultural factors is a red herring for the study of emotion in human origins and archaeology more generally. Existing definitions have been developed to facilitate the study of humans in modern humans or non-human animals. Archaeologists, particularly evolutionary archaeologists do neither. As such, rather than imagining humans as either biological or cultural, it may be more fruitful to understand that humans are susceptible to social or cultural influence because they have evolved mechanisms that make them so (Nettle 2008). Within this context, the task for the archaeological study of emotion is to understand the movement from the biological to the social.

In order to full understand emotion a research framework is needed that incorporates both the biological and the cultural elements. Indeed, some anthropologists are beginning to conceptualise emotions as biological phenomena that respond to cultural differences (Abu-Lughod & Lutz 1990; Lyon 1998; Milton 2005), while some psychologists are looking into the construction of emotional experience from cognitive processes (e.g. Feldman Barrett, Gendron & Huang,

2009; Feldman Barrett & Russell 2015), and some neuroscientists are leaving space for cultural and social factors to influence the brain mechanisms for emotion (e.g. Panksepp 1998).

1.2 Disagreement 2: what should be the objective?

A product of the dichotomous definitions of emotion within archaeology points to a fundamental disagreement over what it is that archaeologists should be studying.

Spikins et al (2010) explicitly state their aim of discussing the 'evolution of “key” human emotions,' which they argue play 'broadly similar roles in cultures across the world' despite 'cultural differences in [their] recognition and expression.' Spikins et al. focus on compassion as 'something [they] feel defines "humanity"' and thus suitable for analysis as a basic universal emotion. This is the basic premise of the evolutionary approach to emotion, with a focus firmly on long term change, without dwelling too much on the details of individual experience.

A similar sentiment is shared by Cowgill (1993) who called for a 'middle range theory of mind'. Acknowledging the difficulties of reliably reconstructing every detail of past lives, especially experiential factors, he suggested that it was self defeating to aim for 'Tolstoyan or Proustian complexities. It would be better to aim for vague and weakly quantitative predictions that are usually right… than predictions that have a more exact look but are often wrong' (Cowgill 1993, 556).

However, Cowgill's desire for 'middle range theory of mind' and meaningful generalisations does not sit well with Tarlow, who questions whether this approach can tell us 'anything but the most banal truths about the human past' (2000, 722). For Tarlow, nuance cannot be overlooked if we are to study the past in which meaning, emotion and experiences are essential to the way societies are structured and enacted: 'It is unclear that cutting back on detail, even if it were possible would make our task any easier.' (Tarlow 2000, 722)

The argument, generally hinges on the nature of archaeological epistemology, with researchers of different time periods asking questions guided by their data. It is possible to do justice to the full complexity of the human experience as massively variable, socially constructed, culturally specific, and

requiring local and contextual explanation when studying historical periods (Tarlow 1999; Cannon and Cook 2015) or ancient civilization (Meskell 1999). The material cultural and textual sources available for these periods allows such details to be explored and it would be negligent for such details to be glossed over. However, it is nigh on impossible for such fine resolution analysis to be conducted convincingly in the preliterate societies that make up the vast majority of the human past, without straying into the sort of affective 'retrojection' of which Tarlow (2000) is so critical (e.g. Spikins 2015). Further difficulties are attested to by the problems of vocabulary that have arisen when such attempts have been made (Harris & Sørenson 2010). In this respect, perhaps, Cowgill's (1993) generalisations may be all that can be achieved.

Whilst the observations made by prehistoric and evolutionary archaeologists may seem modest to those working with richer material culture, this does not make them less profound. While the observation that compassionately motivated behaviour may not be significant for a group living 500 years ago, it does rattle the cages of those studying a group of *Homo erectus* living 1.8 million years ago. At such a great time depth, it is enough to ask broad questions, as it cannot be assumed that emotional experience was the same as it is today. As such, the two approaches can be seen as opposite ends of a spectrum, with prehistoric approaches addressing the underlying processes of emotional experience, and historical approaches addressing the constructed cultural reality. The task for an 'archaeology of emotion' is to connect the two, to explore the processes that led our species into the social and cultural. From this perspective, archaeological approaches to emotion can coalesce around joint project of understanding long term change in emotional experience that goes back far further than the several hundred years of change available to historians (e.g. Stearns 2008). Any 'deep history of emotion' should be malleable enough to operate on a sliding scale of analysis.

1.3 Disagreement 3: how should emotions be reconstructed?

With heated debate surrounding the definition of emotion and the resulting objective of research, the development of a coherent, robust methodology has taken a back seat (but see Cowgill 1993).

In archaeology, it seems difficult to escape the assumption that something of emotional experience is transcendent and can be easily inferred through a shared understanding of human experience (Tarlow 2000, 724). This can be seen more generally in phenomenological approaches to embodied landscapes (e.g. Tilley 1994), post-processual approaches to symbolic thought (Hodder 1992) and recent considerations of the senses within archaeological contexts (Hamilakis 2014). The risk is that interpretations may be culturally under-theorised, and there is a danger of imposing ones own emotional responses onto the archaeological past, saying less about past cultures and more about how we perceive, or want to perceive, them. Indeed, Thomas (1991, 16) has argued that: 'whenever we seek to imply that some aspect of human existence is universal… the danger exists that we are doing no more than inflicting present-day values on the past'.

In an extended discussion of the theoretical problems pertaining to the study of emotion in archaeology, Tarlow (2000, 740) goes to great lengths to highlight the issues of 'psychological universalism and empathy'. She criticises the approach of some archaeologists who project their own emotional responses onto the past. Unfortunately, it has proved difficult to eliminate this from either evolutionary or historical approaches.

Evolutionary approaches have assumed a sort of 'biological universalism', assuming that it is possible to interpret past behaviour as emotionally motivated because, in Mithen's (1991, 10) words: "we can assert with confidence that each individual (except those with cognitive pathologies)… experienced the full range of human emotions simply by virtue of being Homo sapiens sapiens" . The presence of biological emotions common to all humans is taken as justification for identifying instances of that emotion in the past. Even when the targets are not necessarily modern humans (e.g. Spikins 2015) some seem to have no qualms assuming a biological connection.

As an alternative, Tarlow has proposed her own 'contextual' approach to emotion, which she believes facilitates the study of vastly complex cultural variations. She (2000, 725) argues that archaeologists should see emotions as a set of societal emotional values that are products of particular historical contexts and cannot be understood when divorced from this social and cultural context. Interpretations should arise from the socio-cultural context itself, rather than through the projection of the archaeologist's emotional response. Tarlow considers her own work to take this approach, as well as that of Treherne (1995) and Meskell (1994; 2004).

Whilst it may be possible to do this for historical periods, replete with contextual data, it is difficult to see how the cultural context of a prehistoric emotional experience can be reconstructed with sufficient detail. Gosden (2004, 33) has argued that emotions play an important role in the way we interact with, and learn about the world and can be seen as an extension of rational intelligence. As such, he suggests that we can start to examine the overall emotional texture of people's lives and how this was manifested through objects, because 'emotions are materially constituted and material culture is emotionally constituted' (Gosden 2004, 39).

Harris & Sorenson (2010) also aim to move beyond the understanding of emotions as internal, immaterial phenomena towards an appreciation of how the encounter with the material world is inherently affective. They create a vocabulary to aid understanding of how emotions are produced through engagement with the material world. Perhaps the most important of their terms is 'affective field,' which promotes the view that bodily emotions are relational and generated through interactions between people, places and things.

In reality, however, neither approach gives the specifics that are required for Tarlow's approach. They do little to aid interpretation beyond stressing that emotion must be considered. What emotions are inferred from artefacts, and how this improves understanding of the culture, remains entirely subjective. The 'archaeology of emotion' finds itself in a catch-22. It is difficult to see how it is possible to make any inferences about the past if emotional continuity is rejected out of hand (Kus 2000).

Again, this is seen to be an issue arising from problems of definition and scale. Whilst it is appropriate for those studying historical periods to explore contextual nuance, this is unrealistic at greater time depths. As such, it is argued that the focus of a 'deep history of emotion', grounded in the material culture of prehistoric societies, may have to diverge from that of a 'shallow history of emotion', with the addition of widespread literacy. Where those studying recent periods may investigate the contexts that gave rise to emotions that may be only a few hundred years old, it is the job of the prehistoric archaeologists to speak more broadly. Rather than attempting to reconstruct the specifics of emotional experience a few thousand, or even a few hundred thousand years ago, prehistoric and evolutionary archaeologists can seek to explain the more basic processes that cause emotional experiences to be constructed. As such, Gosden and Harris & Sorenson are correct to explore the general process of affective meaning making. It may never be possible to know the exact content of emotional experiences (c.f. Mithen 1991; Spikins 2015), but this does not reduce the significance of coming to understand the important role that emotion played in the formative construction of the human social reality.

1.4 Conclusion

Tarlow (2000, 729) was correct when she stated that there should not be an 'archaeology of emotion'. The archaeological remit for the study of emotion is simply too broad to be housed under a single roof. Rather than seeking unity, archaeologists must understand where research agendas diverge. The study of emotion in prehistory is caught between two extremes. On the one hand, emotions are biological, a throw back to our evolutionary past. On the other, they are cultural constructs. These two extremes are not, however, irreconcilable. Humans are, after all, a mix of the biological and the cultural.

In order for archaeology to make a contribution to the interdisciplinary study of emotion, the multifaceted nature of the human animal must be accepted. With the deep time perspective unique to archaeologists, it is possible to explore the history of emotion with a sliding scale of resolution, allowing research

objectives to be guided by the data available. A focus on issues of long term change can lead narratives to move from broad themes to nuanced detail as appropriate.

Rather than focusing on what emotions are present, a prehistory of emotion must focus on how emotional experience is constructed and this changes over time. The question for pre-historians should not concern what people felt, so much as how they felt it. It is less interesting to say that an emotion may have been present, than it is to ask the biological, social and cultural process that brought that emotion into being and the implications this has for our interpretation of past behaviours.

Pursuit of this line of enquiry will require a return to the literature in seek of a new definition of emotion.

2 How did humans "evolve" emotions?

As with all topics evolutionary, Charles Darwin has had a profound influence on the study of emotion. In his final monograph *On the Expression of the Emotion in Man and Animals*, published in 1872, Darwin sought to draw attention to what he saw as continuity between the emotional expressions of humans and non-human animals. He had good reason for doing this. Before the publication of Expression, the most popular work on emotion was Sir Charles Bell's Essays on the Anatomy and Physiology of Expression (1824). Bell, a well-respected academic and theologian, argued that God had given humans special facial muscles that allowed them to express uniquely human sentiments of which animals were incapable. This view was incompatible with Darwin's own theory of evolution: that humans had evolved from other animals, apes as described in The Descent of Man (1871), and inherited traits through the process of natural selection. As such, Darwin set out in *Expression* to support his theory of evolution by showing how humans could have inherited psychological traits from their animal ancestors. Whilst not all of Darwin's ideas are accepted today, it seems hard to argue with the central thesis that human emotions must have a natural, evolutionary ontogeny.

Yet, researchers were slow to follow up on Darwin's line of reasoning. For over one hundred years, Expression was best known not for its ideas on the origins of human emotion, but as an important early example of the inclusion of illustrations in printed publications. There was an initial spurt of discussion, Darwin's work had a direct influence on William James (1884), and subsequently Walter Cannon (1927), who proposed two theories of emotion process that continue to underpin debate about how human emotions work. Freud (Breuer & Freud 2004), the father of psychoanalysis, cites Darwin as a key influence in the development of his psychoanalytic method, and Crichton-Brown (1895), an influential psychiatrist, worked closely with Darwin, helping him to develop his ideas. Darwin also had a direct influence on the work of early Behaviourist psychologists (McDougall 1921; 1923; Watson 1919; Allport 1922; 1924; Newman et al. 1930; see also Gendron & Feldman Barrett 2009 for a review of the history of emotion in psychology). However, interest was short lived and by 1962 Sylan

Tomkins was resigned to expressing dissatisfaction at the neglect of emotion by American psychology.

The failure to capitalise on Darwin's lead may in part be due to the Victorians' selective reading of evolutionary theory. Whilst the general idea of evolution fitted with broader scientific developments, and Darwin's work was the culmination of a larger intellectual shift, there was discomfort at the materialist implications of natural selection (Bowler 2005). Faced with mounting evidence directly contradicting conventional origin myths, but unwilling entirely to abandon the idea of a divine plan, the Victorians looked to scientific theories for evidence of God's intervention (Corkey 2004, 93). As such, evolution was adapted to fit a progressionist ideology, with nature seen as predetermined to advance life along a hierarchy of stages towards a human level of complexity, preserving the position of God as a 'director of operations' (Bowler 1989). This conception of evolutionary theory dominated the evolutionary psychology of Romanes, the cultural evolutionism of Tylor, and the recapitulation theory of Lamarckian biology. With Darwinian theory seemingly providing a secular explanation for human physiology, the mind became the last thread on which the preservation of human unicity hung. Accordingly, Darwin's assertion in The Descent of Man that it was a full bipedal gait that set our ancestors on the road to 'humanness', was generally rejected in favour of seeing the increase in human brain size and associated complexity of mental abilities as the main distinguishing factor between humans and non-human animals (Bowler 2005).

The result was the reproduction of a Cartesian split between the mind and the body. Descartes (1649) made the distinction between a physiological body and a non-corporeal mind that is the locus of the soul and consciousness. For him, the soul was a distinctly human affair: animals only have bodies (Strongman 2003, p.11). By placing emotion firmly within the soul, Descartes preserved them as a distinguishing feature of the human mind. Animals may be able to react bodily as though experiencing emotions, but conscious experience is impossible for them. By restating this dualism, the Victorians were able to set the mind, and therefore emotions, outside of the temporal realm and beyond the explanation of evolutionary theory. As such, there was no room for a theory of the natural ontogeny of emotion.

Whilst this may have underpinned the philosophy of some early 20th century psychologists, there was likely a second, more fundamental barrier to the scientific study of emotion. Before the development of modern methods and techniques under the rubric of the animal sciences, such as comparative psychology and ethology, rigorous scientists had limited resources to explore the minds and motivations of their subjects. Following the guidance of Watson (1924) and Skinner (1938), researchers focused on environmental factors as the constraints that regulate action. The resulting Behaviourist psychology would concern itself with observable events that could be objectively and scientifically measured. In the words of Watson (1913, p.158): "psychology as behaviourists view it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behaviour. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness." As such, anything internal and unobservable, thoughts, feelings and the subtleties of motivation, were deemed irrelevant and unreliable. Instead, behaviour was reduced to the result of stimulus response mechanisms, with Watson (1930, p.11) again arguing that the purpose of psychology should be to: "to predict, given the stimulus, what reaction will take place; or, given the reaction, state what the situation or stimulus is that has caused the reaction".

Under this rubric, the emotional lives of humans and non-human animals could only be discussed in terms of easily observable bodily states and physiological responses. Emotions could serve to support homeostatic urges (McDougall 1921; 1923) or shock an organism into a behavioural response (Watson 1919), but there was not space to consider the subjective experience of emotion. This led to two trends in the study of emotion: the rejection of emotionally motivated behaviour in animals on first principles; and a continued focus on the description of emotional behaviours in humans with categories becoming increasingly more specific. It is only recently that scientific techniques have developed sufficiently to provide a new framework from which to understand emotion.

Begin in the 1950s, researchers within several disciplines began to mount a challenge to the dominat behaviourist paradigm. There was growing discontent

for the neglect of internal representations caused by the focus on observable behaviour. For instance, Chomsky (1959), in a review of Skinner argued that language could only be understood though an understanding of internal thought process. The result of criticisms from Chomsky and others was a "revolution that wasn't", extending the remit of psychology to include the study of mental states, which, through a process of technological and intellectual advancement, could now be tested experimentally in much the same way that Behaviourists tested behaviour.

Regrettably, the cognitive revolution that lifted the conceptual constraints of academic psychology was not well grounded in evolutionary principles (Gardner 1985). Thus, whilst accepting the complexity of the human mind, most psychological theories of emotion, and perhaps cognition in general, do not pay enough attention to ontogeny, and, when they do, application of evolutionary theory is poor. They can be seen as operating in a temporal vacuum, failing to engage with the archaeological or palaeoanthropological evidence for human evolution.

What follows is an overview of the most explicitly evolutionary theories of emotion, starting with current evolutionary psychology, before moving back in time to consider some of the approaches coming from the new cognitive psychology, that led to the evolutionary position. It will be seen that the evolutionary agenda is not only philosophically problematic, but is based on some basic tenets that can no longer be supported.

2.1 Evolution and Emotion

It is easy to see the appeal of an evolutionary approach to emotion. Considering that all humans, across cultures display emotions, and non-human animals can behave in ways that appear to us indicative of emotional experiences, it is easy to draw the conclusion we are observing ancestral traits that have been preserved across all mammals. Emotions also appear to serve adaptive functions that would have been advantageous in our evolution: fear driving subjects away from danger, happiness reinforcing positive behaviours. In the words of Keltner et al (2006, p.117), "Emotions have the hallmarks of adaptations: They are efficient,

coordinated responses that help organisms to reproduce, to protect offspring, to maintain cooperative alliances, and to avoid physical threats".

This is the view taken by evolutionary psychologists, who argue that specific emotions evolved in response to challenges faced by hominins during human evolution (Tooby & Cosmides 1990; Nesse 1990; Buss 2005; Keltner et al. 2006; Cosmides & Tooby 2010). The resulting evolutionary theories are proposed to have taken place within an unspecified period of human evolution, anywhere between the divergence of the human lineage from other apes roughly 5 to 8 million years ago and the emergence of modern humans at least 150,000 years ago, with modern hunter-gatherers seen to be a reasonable analogy for those living during this period. Table 2.1. offers a brief outline of some of the evolutionary scenarios proposed for the evolution of specific emotions.

Table 2.1: evolutionary psychology and emotion (after Johnson 2018)

Problem	**Emotion**	**Reference**
Being alone at night	Fear of being stalked by a predator	Cosmides & Tooby 2000, 93
Sexual infidelity	Sexual jealousy	Cosmides & Tooby 2000, 100
Social ridicule	Social anxiety	Nesse 1990, 272
Uneven reciprocity exchanges	Pride, humiliation, obligation	Nesse 1990, 276-77
Being cheated	Anger	Nesse 1990, 277
Considering cheating or not fulfilling an expectation	Anxiety	Nesse 1990 278
Having cheated others	Guilt	Nesse 1990, 278; Keltner et al 2006, 121
Another individual has an unjustified favourable status	Envy	Keltner et al 2006, 121
Finding a mate	Desire, love	Keltner et al 2006, 119
Protecting offspring	Love, compassion	Keltner et al 2006, 120

Archaeology *could* help significantly in clarifying this period,, however, conversations between archaeologists and evolutionary psychologists are rare (e.g. Dunbar, Gamble, and Gowlett 2014), and where citations are made, there is a great deal of cherry picking from both sides. For instance, Turner (2000), a sociologist, argues that emotions evolved to promote socialisation in our innately individualistic ancestors. He suggests that all great apes are, ultimately, individualistic, tending towards independence and self-preservation over group living and cooperation, and thus, our common ancestor would have been too. Whilst this is fine in a forested habitat, when our ancestors were forced out into an open savannah environment it would have been maladaptive, and they would have needed to find a new way to combat issues of predation and resource acquisition. By this point, it was too late in our evolution to completely rewire the brain for a monkey-like collectivist model of socialisation, so evolution developed emotional capacities that overlay our innate individualism in favour of sociality. Emotion, then, serves as positive and negative reinforcements for cooperation and reciprocal altruism. Turner also sees emotions as pre-linguistic and therefore based on non-verbal communication, including body language and facial expressions. As far as basic emotions go, Turner only proposes four - satisfaction-happiness; aversion-fear; assertion-anger; and disappointment-sadness – although he suggests that once volitional control over language was attained, these emotions would be co-opted and elaborated. The appeal of this theory is that it sits well with considerable evidence that currently exists for the importance of increased sociality in our evolutionary trajectory. However, Turner's theory suffers from an underuse of archaeological data, and reliance on the out-dated savannah hypothesis as the stimulus for increased socialisation.

Evolutionary psychology, and evolutionary theories of emotion in general, seek to explain the origins of *specific* behavioural strategies and propensities caused by *specific* emotional responses. As such, it is implicitly argued that an 'emotion' should be seen as a discrete programme that guides cognitive, physiological, and behavioural processes when a specific type of problem is encountered (Nesse 1990; Tooby & Cosmides 1990; Cosmides and Tooby 2000). In Ness's words "the emotions are specialised modes of operation shaped by natural selection to adjust the physiological, psychological, and behavioural

parameters of the organisms in ways that increase its capacity and tendency to respond adaptively to the threats and opportunities characteristic of specific kinds of situations" (1990, 268). In order to be sustainable, this approach is based on two assumptions; the first, that it is correct to assume that a retained trait was necessarily actively 'selected' to solve and adaptive problem; the second, that 'emotions', defined as discrete neural mechanism with specific behavioural responses, are a natural kind, existing as an irreducible unit within nature, upon which evolution can act. Neither of these assumptions can be supported.

2.1.1 Assumption 1: Evolutionary Premise

To deal with the first, evolutionary psychology is founded upon a misconception of Darwinian evolutionary theory. To assume that every aspect of the modern human animal must have its own evolutionary origin story is to adopt the adaptive premise; the idea that 'if a particular strategy exists, it must be adaptive in some way' (Preucel & Hodder 1996, p.207; see also Shanks & Tilley 1987, p.133). Whilst often quoted to the contrary by evolutionary psychologists, Darwin himself never argued that emotions evolved to solve adaptive problems for humans. Instead, he suggested that emotional expressions derive largely from habits and reflex mechanisms that were useful in our evolutionary past, even though "they may not be of the least use" to us now. Emotions were seen as vestigial parts of the body; fossils that could allow us to trace our origins back to ancestral species we shared with non-human animals. For example, Darwin observed that humans often present their canines when sneering in rage, and suggested that this probably occurs because an ancestor used their teeth in an aggressive action. Although he did make some concessions to function, for instance, expressions could facilitate communication between a mother and infant, an emphasis on the function of expressions came later with a re-interpretation of Darwin's ideas by Allport (1924). Thus, Darwin's greatest contribution to the scientific understanding of emotion was not to propose an adaptive scenario for their evolution, but to emphasise the similarity between emotional expressions in humans and non-human, and to stress the natural ontogeny of emotion as a psychological trait.

Indeed, the relationship between trait and function is complex. Natural selection does not play an active role in 'selecting for' traits, rather, it is more accurate to say that it culls deleterious traits from the gene pool (Grosz 2011). Thus, the survival of a trait need not imply that it evolved to solve an adaptive problem, but simply that it was not sufficiently detrimental to survival that it died out. To suggest an adaptive scenario as evolutionary psychologists do is dangerous, as it endangers retroactively assigning adaptive advantage to a trait. Instead, traits may find a purpose and be actively retained, either in their own right or in collusion with other traits, but this need not have been the scenario that brought it into existence. The result is the use of evolutionary theory to justify 'just so stories' (O'Brien & Holland 1992, pp.36–37), conjecturing on how emotions, or other behaviours, may have been adaptive, and using this to explain why they exist today. This leads to a very restricted view of emotions, cognition, and behaviour, where all aspects of variability are swept under the carpet in favour of top down, unfalsifiable, evolutionary histories. This is true of the vast majority of evolutionary psychology, and the entire discipline has been roundly critiqued (see Rose & Rose 2000).

This leads to theories fraught with the danger of retrojecting modern emotion back into the past; attempting to explain the present by devising antecedents. As such, evolutionary theories often derive their subjects from personal or anecdotal perceptions of which emotions are most important and pervasive. Many echo Kemper's (1987) list of the emotions most frequently self-reported by respondents to a survey. The use of common vernacular to describe emotional states belies a lack of scientific understanding. Folk psychology tells us that emotions are experienced as discrete units, labelled and easy to distinguish. These folk psychological categories, based solely on received wisdom and subjective experience, have long been taken as the correct unit of scientific study. However, criticisms for evolutionary approaches to emotion raise the question of whether our own folk psychological categories are necessarily the best way to define 'emotions' for scientific study.

2.1.2 Assumption 2: Emotions as Natural Kinds

The idea that specific emotions are "basic" and therefore universal has a long history, but the basic premise, as with evolutionary psychology, posits that emotions are discrete neurological units that evolved to serve specific adaptive functions in our evolutionary past. As such, these emotions will be hard wired into the brains of all humans and should be cross-culturally universal.

Perhaps the most ardent, although not the first, proponent of basic emotion theory has been Paul Ekman (1973; 1993; 1994). Based on extensive study of facial expressions spanning some 40 years, Ekman and his colleagues claim to have proved that certain emotions can be observed in all cultures. He found that people from a diverse range of literate Western and Eastern cultures were able to correctly label the facial expressions for six emotions: anger, fear, sadness, happiness, surprise, and disgust. Ekman was able to extend these finding to preliterate cultures with a study of the isolated Fore tribesmen from Papua New Guinea, free from western influence (Ekman and Friesen 1971).

Ekman's basic emotion theory has grown into a research paradigm that dominated emotion theory for sometime. An august lineage was drawn, recruiting the likes of Darwin, James, and Allport, and researchers expanded Ekman's ideas well beyond the initial work on facial expressions. This approach has been popular with biologists, neuroscientist, and some psychologists. The number of basic emotions posited by researchers varies from as low as two (Rolls 2007; Soloman 1980) to about eight (Plutchik 1980; Plutchik 2001) (Table 2.2). Generally, those promoting basic emotion theories agree that: "a small number of basic emotions exist; basic emotions are universal to all human beings; and basic emotions are products of biology and evolution" (Reeve 2014, p.348). The traditions diverge in their specifications of what constitutes the precise biological core that orchestrates emotional experience.

Table 2.2: Some proposed lists basic emotions (after Ortony & Turner 1990)

	Basic Emotions	**Basis for Inclusion**
Arnold (1960)	Anger, aversion courage, dejection, desire, despair, fear, hate, hope, love,	Relation to action tendencies

	sadness	
Ekman (1992)	Anger, disgust, fear, joy, sadness, surprise	Universal facial expressions
Frijda (1994)	Desire, happiness, interest, surprise, wonder, sorrow	Forms of action readiness
Gray (1994)	Rage and terror, anxiety, joy	Hardwired animal brain circuits
Izard (1991)	interest; joy; surprise; sadness; anger; disgust and contempt; fear and anxiety; shyness; shame; guilt, conscience; love.	Discrete emotions observable in children
James (1884)	Fear, grief, love, rage	Bodily involvement
Levenson (2011)	Enjoyment, anger, disgust, fear, surprise, sadness	Hardwired solutions to challenges
McDougall (1928)	Anger, disgust, elation, fear, subjection, tender-emotion, wonder	Homeostatic motivational impulses
Mowrer (1960)	Pain, Pleasure	Unlearned emotional states
Oatley and Johnson Laird (1987)	Anger, disgust, anxiety, happiness, sadness	Do not require propositional content
Panksepp (1998; 2012)	Seeking, fear, anger/rage, lust, care, sadness/grief, play	Separate neuroanatomical pathways in the subcortical brains of animals.
Plutchik (1980; 2001)	Acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise	Adaptive biological processes common to all living organisms
Stein and Trabasso (1992)	Attainment, loss, obstruction, uncertainty	Life's essential pursuits
Rolls (2007)	Positive valence, negative valence	Hardwired approach-aversion mechanism
Solomon (1980)	Pleasure, aversion	Hedonic, unconscious, "opponent" brain systems
Stein and Trabasso	Happiness, sadness, anger, fear	Essential life pursuits

(1992)		
Tomkins (1984)	Anger, interest, contempt, disgust, distress, fear, joy, shame, surprise	Density of neural firing in central nervous system
Vytal and Hamann (2010)	Happiness, sadness, fear, anger, disgust	Patterns of brain activity based on analysis of 100 neuroimaging studies
Watson Watson & Raynor 1920)	Fear, love, rage	Hardwired
Weiner and Graham (1984)	Happiness, sadness	Attribution independence

There are a number of characteristics that researchers use to identify basic emotions including: distinct facial expression, distinct pattern of physiology, automatic (unlearned) appraisal; distinct antecedent cause; inescapable (inevitable) activation; presence in other primates; rapid onset; brief duration; distinctive subjective experience; distinct cognition (thoughts, images, memories) (based on Ekman 1992; Levenson 1994; Ekman & Cordaro 2011).

There are, however, a number of notable absentees from many lists of basic emotion. In order to be discounted as basic, an emotion may be deemed to a 'mood' (e.g. irritation), an 'attitude' (e.g. hatred), a 'personality trait' (e.g. hostile), or a 'disorder' (e.g. depression), an experience built on a basic emotion (e.g. anxiety is a derivative of fear), a blend of basic emotions (e.g. romantic love blends interest, joy, and the sex drive), or only an aspect of a basic emotion (e.g. the cause of an emotion [homesickness] or a behaviour motivated by an emotion [aggression]) (Ekman 1992).

Whilst not explicitly evolutionary, basic emotion theories rely on an evolutionary story to account for the presumed universality. Izard (1991), a developmental psychologist, is a good example of this. He argued that emotions developed primarily to facilitate communication between infants and caregivers by strengthening the social bond, something that was particularly important during our evolutionary history as increasing brain size began to necessitate earlier birth and a longer period of maturation making extended infant care vital

for survival. In this regard, all emotions are seen to serve adaptive functions, and emerged to provide new types of motivation and new action tendencies as well as a greater variety of behaviours to cope with the environment and life demands. With this in mind, Izard proposed 11 basic emotion types that he believed were innate and universal: interest-excitement; enjoyment-joy; surprise-astonishment; sadness; anger; disgust and contempt; fear and anxiety; shyness; shame; guilt, conscience and morality; and love.

Plutchik (1980; 2001) proposed one of the most influential basic emotion theories, arguing that eight basic emotions, or types of behaviour, are found in all animals and are 'basic adaptations needed by all organisms in the struggle for individual survival' (1980, 145). He places their evolution in the Cambrian era, 600 million years ago, rather than in human origins itself. His eight adaptations are incorporation (acceptance and trust), rejection (disgust and loathing), destruction (anger and rage), protection (fear and terror), reproduction (joy and ecstasy), reintegration (sadness and grief), orientation (surprise and astonishment), and exploration (expectancy and anticipation). Human emotions are more complex than those found in other species, 'but the basic functional patterns remain invariant in all animals, up to and including humans' (1980, 130). To account for emotional variation in humans, Plutchik (2001) argues that two or three of his basic emotions can be combined, or one can be experienced at greater or lesser intensity.

Rolls (2007) has presented perhaps the most strictly biological version of this approach. He sees emotions as essentially positive and negative reinforcement stimuli guiding an organism towards behaviours with survival value. In this regard, emotions are seen to have developed as a way for genes to increase their survival by specifying the goals for behaviours. Essentially emotions replaced the bioprogrammers found in insects, as they are an efficient way of designing a complex organism without having to specify the details.

Whilst basic emotion theories coming out of psychology imply neurological mechanism hardwired into the brain, these systems remain hypothetical, with the discrete emotion categories deduced from behavioural observation. Some neuroscientists, however, claim to have identified the underlying brain mechanisms responsible for generating basic emotions. For instance, by placing

individuals in an MRI and playing an emotion-eliciting film, Vytal & Hamann (2010) were able to observe the response of the brain during different emotional experiences. The results of their neuroimaging showed replicable patterns of neurological activity in specific brain regions for different emotions (Table 2.3). They claim that this supports the conclusion that basic emotions are associated with discernible patterns of brain activity.

Table 2.3: The results of Vytal & Hamann's (2010) neuroimaging studies (after Reeve 2014, 374)

Emotion	Brain activity
Happiness	Nine identifiable brain areas are activated, primarily the right superior temporal gyrus and rostral anterior cingulate cortex.
Sadness	35 areas activate, primarily the left medial frontal gyrus and the caudate anterior cingulate cortex
Anger	13 areas activated, primarily the left inferior frontal gyrus and parahippocampal gyrus
Fear	11 identifiable brain areas activated, primarily the left amygdala and insula
Disgust	16 areas activated: primarily the right anterior insula and right inferior frontal gyrus

Basic emotion theory has, however, never had an easy ride. Criticisms of Ekman's work have come from emotion psychologists whose own experimental and naturalistic studies did not find evidence to support Ekman's proposed taxonomy of discrete emotions and discrete facial expressions (Russell and Fernandez-Dols 1997). Division within the ranks has often served to undermine the objective of the research paradigm. There is, as yet, no consensus on how may basic emotions there are, a point that critics have seized upon.

2.2 The constructivist challenge

Robust refutations have also come from those identifying with a constructionist position. Drawing extensively on anthropological literature, the

constructivists of the 1980s highlighted the differences between the emotional repertoire of different cultures. Harré (1986), one of the earliest and most influential constructivists, was particularly polemical in his views. He condemned theorists such as Darwin, Izard, and Plutchik as reductionist and argued that 'in the case of emotions, the overlay of cultural and linguistic factors on biology is so great that the physiological aspect of some emotional states has had to be relegated to secondary states, and are among the effects of more basic sociocultural phenomena' (Harré 1986, 4). He sees all emotions as intentional and culturally relative to the point that 'the bulk of mankind live within systems of thought and feeling that bear little but superficial resemblances to one another' (Harré 1986, 12). As a sociologist, Harré also stresses the strategic role that emotions play in social interactions, and argues that investigation must be broadened to include the social context of emotions. He got his wish, and there is now an established tradition of emotional investigation with numerous scholars arguing that emotions exist primarily within interpersonal interactions (e.g. Lyon 1998). Sociology provides a dramaturgical perspective to the study of emotion, with scholars arguing that emotions are assumed in the context of social performances (Goffman 1961; Hochschild 1990). Averill (1980), a psychologist, has proposed the most influential theory of this nature. He does not deny a biological contribution, but argues that emotions are ultimately transitory social roles adopted when an individual engages in a social interaction and are governed by social norms and expectations.

Harré was not the only one to think along these lines. Anthropologists such as Lutz (1988) disagree with the universalist view that emotions are 'a material which culture may operate upon, but which is not culture.' Her ethnographic studies showed that people in non state, non western cultures experience, and have words for, emotions that do not appear in western vocabulary. This cross-cultural variability flies directly in the face of claims for cross-cultural universality. As such, biological theories are criticised for not doing justice to the full remit of emotions observed in modern human cultures (Harre 1986; Lutz 1988; Tarlow 2000). Lutz (1988, 5) prefers to see emotions as cultural artefacts, arguing that 'emotional meaning is fundamentally structured by particular cultural systems

and particular social and material environments,' before summing up with 'emotional experience is not pre-cultural, it is pre-eminently cultural.'

Ekman (1993) has rebuked such claims arguing that there has been no quantitative data to support the claim that emotions are culture specific. According to his cross cultural studies of facial expressions, there is no instance where 70% or more of a cultural group select one of the six universal emotions while another cultural group labels the same expression as another universal emotion. As such, he argues that enough agreement in reporting exists to support his claim. By way of an olive branch, Ekman has suggested that certain emotions are associated with very specific display rules, with culturally variable prescriptions about who can show which emotion to whom and when. This can account for cultural differences that may obscure the universality of emotional expression. However, constructivists like Harré have not seen this as acquiescence.

Other rebuttals of the constructivists position have argued that scholars like Lutz have exaggerated the degree of uniformity within cultures. Bowers (1998), for instance, suggests that constructivists like Lutz largely ignore the role of context and nonverbal communication and take the role of language too seriously (e.g. Rosaldo 1980). Perhaps a more significant criticism has been the suggestion that the constructivist's instance that humans are a product of their culture rather than their genetic predispositions amounts to little more than a denial of our biological heritage (Leach 1981). Nevertheless, the constructionists stood firm, with emotions emerging from the social and cultural milieu, and constructed through cultural processes to produce cultural meaning entities. Emotions in essence become elevated above the remit of evolutionary study; as a cultural rather than a natural phenomenon. It is axiomatic to talk about emotions having "evolved".

With this in mind, there has been a recent shift in anthropology towards an appreciation of both the cultural and biological aspects of emotion. Accordingly, anthropologists are beginning to conceptualise emotions as biological phenomena that respond to cross cultural environmental differences (Abu-Lughod & Lutz 1990; Lyon 1998; Milton & Svasek 2005). Leavitt (1996) argues that the very reason why emotions are interesting is that they bridge the domain of cultural meaning and bodily feelings. This is a particularly important criticism, as it

highlights the constructivist overemphasis on the cognitive aspects of emotion. Indeed, Milton (2002) criticises constructivists for reducing the emotions to cognition and ignoring the bodily aspects that are so important, a view echoed by others (e.g. Csordas 1990; Crossley 1996; Lupton 1998).

2.3 New Perspectives from Neuroscience

The collision of basic and constructivist theories of emotion was often bitter and rarely productive. On the one hand, it was argued that basic emotion theorists did not do enough to accommodate cross-cultural differences into their theories. On the other, it was argued that constructivists were missing the evolutionary point, and that they were equally guilty of failing to account for similarities across cultures. Both criticisms were right, both positions had their merits. Scholars could not agree whether emotions existed as natural kinds to be studied scientifically, or only came into being as part of a constructed social reality. Whilst more sophisticated theories of emotion were emerging, and had emerged by this time, in psychology, the nail in the coffin for the basic-constructivist debate was increasingly promising results from neuroscience.

Just as basic emotion researchers have looked for behavioural patterns that correspond to specific emotions, brain researchers have sought patterns of brain activity (Gray 1994; LeDoux 1996; Panksepp 1998; Panksepp & Biven 2012; Vytal & Hamann 2010). Studies of the brain have a long history, and have normally been seen as supporting a basic emotion view. However, it will be seen the connection between the two is not as obvious as is often presumed.

Rather than focusing on specific emotions, early studies of the brain (Broca 1878; Papez 1937; Maclean 1952) concentrated on brain regions, such as the limbic system, a group of structures in the middle of the brain. The basic principle placed emotion in subcortical deep brain systems, whilst cognition was centred in the evolutionarily recent neocortex and higher brain regions. This view drew on reports of neuroanatomical differences between the forebrain plan of reptiles and mammals (e.g. Smith 1924; Herrick 1933; Papez 1937; Maclean 1949; 1952). The argument was that during mammalian evolution, the forebrain (made up of the cerebral cortex and limbic system) underwent structural changes with new

cortical structures overlaying older subcortical systems such as the basal ganglia. The lower brain regions present in all mammals (such as primitive cortical structures like the hippocampus and related subcortical areas such as the amygdala) served basic survival functions related to feeding, defence, and reproduction. Subsequently, the complex laminated regions of the neocortex were added, making possible enhanced processing of stimuli and cognitive functions. These regions allow learning and memory, reasoning, planning capacities, and language.

Perhaps the clearest articulation of this concept was MacLean's triune brain (Maclean 1949; 1952; 1970) (Figure 2.1). Building on the work of comparative anatomists (Cannon 1929; Bard 1928), Maclean argued that the brain developed in three main stages: a reptilian deep brain (including the basal ganglia), a 'palaeomammalian' limbic system, and the neocortex. The reptilian brain supported instinctual behaviour, before the limbic system evolved in early mammals to provide an emotional mind. Later in mammalian evolution, the emphasis shifted once more, with the neocortex prioritised for development, whilst the limbic system retained its early mammalian form. This resulted the neocortex exerting control over the limbic system, reducing its psychological dominance in favour of newer cognitive abilities.

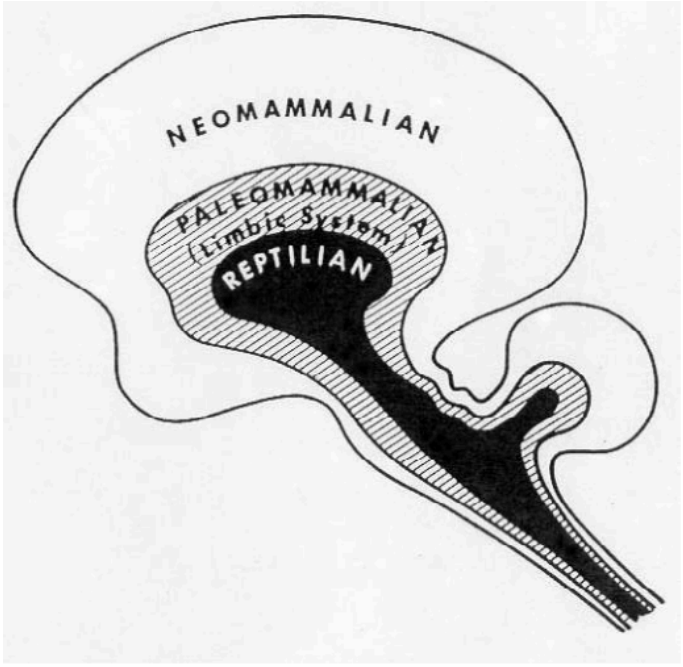


Figure 2.1: Maclean's (1970) triune brain.

The limbic system concept is now generally rejected by scientists (LeDoux 1991; LeDoux 2013; Kotter & Meyer 1992), with researchers preferring to emphasize the role that specific neural mechanisms play in the generation of affective behaviours (see Dalgleish 2004 for review). These include: the Amygdala (LeDoux 1995; Breiter et al. 1996); the Hypothalamus (Cao et al. 2012); the Hippocampus (Fischer et al. 2003); the Cingulate Gyrus (Weissman et al. 2005; Medford & Critchley 2010); the Basal ganglia (Da Cunha et al. 2012); the Orbitofrontal cortex (Bechara et al. 2000); the Prefrontal cortex (Davidson & Sutton 1995); and the Cerebellum (Parvizi et al. 2001; Turner et al. 2007; Martin-Sölch et al. 2001; Holstege et al. 2003).

The amygdala, for example, has been linked to fear responses in both mammals and humans (see LeDoux 2013 for review). This suggests a strong conservation of amygdala circuitry throughout human evolution and into modern humans. As such, the findings of neuroscientists suggest a strong link between the amygdala and the experience of fear, with similarities, at least at an anatomical level, between humans and non-human animals

This may lead to the assumption that the amygdala is the evolved neurological mechanisms underlying the discrete basic emotion of fear. However, the findings of brain research are much more nuanced and cannot be condensed into a headline that basic emotion system for fear has been found. The culmination of over 100 years of brain research has suggested that affective experience is related to activity in brain areas, rather than specific systems, that direct attention, motivate behaviour, and establish the significance of stimuli (Ledoux 2013, 6). Indeed, the amygdala is not exclusively a 'fear system' and is also associated with other emotions and related cognition, including positive reinforcement of behaviour, aggression, and maternal instincts although the specifics of these relationships is less certain (LeDoux 2013, 7).

It would be wrong then, to say that the amygdala is the 'fear system'. Rather, this brain region and others contribute to the generation of a variety of different emotions. Indeed, where researchers indicate neural mechanism linked specifically to emotions, these tend to be characterised broadly. Gray's (1994) findings in non-human mammals suggest three distinct neural circuits regulating distinctive patterns of behaviour. He proposes a behavioural approach system that

prepares animals to seek out and interact with attractive environmental opportunities; a fight or flight system that prepares animals to flee from aversive events or defend aggressively; and a behavioural inhibition system that prepares the animal to freeze in the face of aversive events (Reeve 2014, 374). These systems, he argues, underlie joy, fear, rage, and, anxiety, although the systems are not directly analogues with the emotions themselves.

Additionally, Panksepp (1998; Panksepp & Biven 2012) has presented a persuasive argument for the existence of seven affective brain mechanisms situated in the subcortical regions of the brain (fig 2.2). These are: SEEKING (inquisitiveness and exploration), LUST (sexual desire), PLAY (joy), RAGE (irritation and fury), FEAR (fear and anxiety), PANIC/GRIEF (non-sexual attachment), and CARE (maternal nurturance). Using neuroscientific methods, he shows how the stimulation of each system in non-human animals generates a specific behavioural response that has adaptive value for all animals that experience emotions through an affective consciousness. Panksepp also postulates a hypothetical eighth system, SELF, which may exist in the neocortex and would provide the means for the affective mechanisms to become elaborated, consciously experienced, and variable, as seen in modern humans. These are not discrete neural mechanisms responsible for generating specific emotion per se. Rather they are generalised systems that produce broad motivation states that underpin many of the experiences that we would call emotions.

The upshot of this is that the evidence available from neuroscience does not support the basic emotion approach. Thus far, researchers have been unable to point to discrete neural mechanisms that are responsible for specific emotions, instead, it seems that emotions occur in a more diffuse way across many brain regions, with the same neural mechanisms utilised by across a range of emotional experiences. Some of these brain regions are not primarily affective, but should properly be termed as perceptual or problem solving systems. Where brain regions can be identified as tied to apparently specific types of emotional experience this may be more an artefact of the research question than the reality of the brain. When researchers seek patterns of brain activity for an 'emotion' (e.g. Vytal and Hamann 2010), they will inevitably find something of interest. However,

they will fail to recognise that the brain systems involved are not specific to emotion per se, overlooking the other functions they may serve.

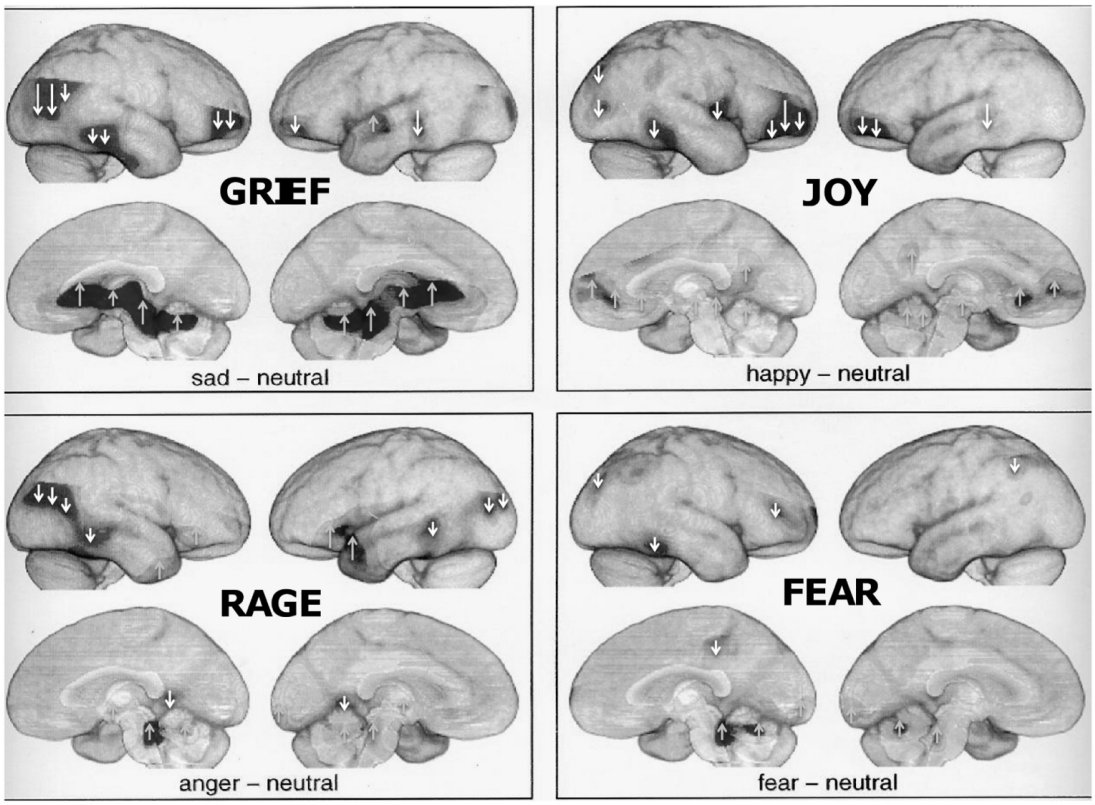


Figure 2.2: brain regions active in humans during the experience of emotion states (Panksepp 2011a Fig 4)

Ultimately, whilst the evidence from neuroscience clearly show that emotions have an important biological base, there is nothing to support the notion that folk psychological categories of emotion, as employed by evolutionary psychologists and emotion theorists exist in nature as natural kinds. If this is accepted, it is no longer possible to argue that specific emotion evolved. If there are no discrete neural mechanisms that generates shame, the emotion itself cannot have been the subject of selection pressure at any period of evolution.

2.4 Putting it all together

In most cases, evolutionary theorists accept the idea certain emotions are innate (Tomkins 1962; Ekman 1973; Izard 1977; Plutchik 1980; Izard 1991;

Ekman 1992; Plutchik 2001). These innate emotions are controlled by affect programmes in the brain: they are in effect psychological descriptions of a dedicated neural circuit (Ledoux 2013). Some neuroscientists have adopted the basic emotions idea, and have proposed specific circuits for different basic emotions (Panksepp 1998; Panksepp & Biven 2012). The wider body of neuroscientific research might be construed as supporting this approach, with researchers highlighting the specific brain regions that produce emotion. However, there is a fundamental difference between the approach taken by these researchers and that of basic emotion theorists. The goal of basic emotions theories is to understand subjective states of conscious experience that humans label with emotion words (fear, love, sadness, joy etc). Their goal is to understand "feelings." This is also true of brain science theories of emotion focused on basic emotions. Panksepp (1998; Panksepp & Biven 2012), for example, searches for brain systems in animals that underlie feelings in the animals as a way of understanding the brain systems that underlie human feelings. Vocalisations that result from tickling a rat are ways of indexing joyful or pleasurable feelings in the rat brain, and freezing, flight and fight behaviours are markers of fearful feelings.

This is not the case with most neuroscientific research. The approach taken by LeDoux (1989; 1996; 2000; 2002; 2013) for example is to view emotions as behaviours that attune animals to the situations that they are likely to encounter, and uses these responses as a guide to locate associated neurocircuitry . He argues that it is meaningless to consider the subjective feelings of animals as this cannot be measured scientifically: "….most studies that have explored conscious experience in humans have found that… the dorsolateral prefrontal cortex is active… The dorsolateral granular prefrontal cortex is a unique primate specialisation (Preuss 1995; Weiss 2008) and has features in the human brain that are lacking in other primates (Semendeferi et al. 2010)." (LeDoux 2013, 7).

Ultimately, then, it can be seen that the affective brain mechanisms posited by discrete emotions theorists and evolutionary theorists do not have any basis in the neuroscientific evidence: they are not directly associated with any specific neural mechanism (c.f. Ekman 1994). Thus, it seems doubtful that evolutionary scenarios for discrete emotions can have evolved to serve specific adaptive functions. In fact, the discrete emotions that are posited by evolution theorists are

simply descriptions of the human experience of emotion, with the resulting theories seeking to find evolutionary experiences for subjective experience. This is deeply problematic. As outlined above, numerous researchers have emphasised the cultural specificity of emotion, with the nature of emotional experience contingent on the cultural and social setting in which they are experienced. Indeed, LeDoux (2013) has argued that the neurocircuitry required for the conscious experience of emotion only appears with primates. With this in mind, it is unclear that emotions such as guilt, shame, pride, or sexual jealously, often cited by evolutionary psychologists as hardwired emotions that have evolved during human evolution, are any more basic than *fago* or *amae*. Constructing evolutionary narratives for emotions that are culturally specific is not appropriate.

Additionally, historians have noted that many of the emotions that we take for granted in western society today have a remarkably recent ontogeny. For instance, Stearns (2008) recounts a change in the atmosphere of Western Europe over the past 500 years. Following the Protestant Reformation a sense of melancholy pervaded Medieval culture, until social and religious changes in the 18th century gave rise to a more cheerful demeanour. Reddy (2013) has argued that the modern western conception of romantic love finds its origins in the early medieval period. Before this, love between a man and a woman was seen as a weakness. But the development of literary traditions in the 13th century began to portray that same love as heroic, a tradition that has continued into the 21st century with romantic love a mainstay of Hollywood and underpinning the institution of marriage. As such, it is necessary to doubt evolutionary accounts of the ontogeny of romantic love as a mechanism for increasing parental investment in children (e.g. Lovejoy 1981). Within archaeology, Tarlow's (1999) work on early modern grave epitaphs has emphasised the changing nature of grief during the last five centuries.

If no emotions can be seen as basic, the prospect of a deep history of emotion seems poor. However, the highly subjective and changeable nature of emotion labels is not reflective of emotion in general. Clearly, discrete emotion categories and subjective experience are inappropriate for the analysis of emotion in the past. However, this is only one of the component processes of the emotion heuristic. When this is discounted, what remains is an emphasis on motivation

and behaviours stimulated by hardwired brain mechanisms. As has been described, there are undoubtedly biological continuities between emotion-like behaviour in animals and emotion experience in humans. However, these similarities should not be considered as discrete neural mechanisms governing specific categories of subjective experience.

Emotion theorists have been arguing against the notion of discrete emotion categories for over 100 years. William James, one of the preeminent early emotion scholars, wrote: ''surely there is no definite affection of 'anger' in an 'entitative' sense'' (1894, p.206). His preference was for an understanding of emotion that acknowledge the interconnected relationship between the 'mind' and the 'brain' arguing that a theory of emotion "must show how the elementary ingredients of the former correspond to the elementary functions of the latter'' (1890, p.28). In this sense emotions should be broken down into their basic elements none of which were unique to emotions and were reliant on more basic cognitive processes. To ease the process, James argued that the scientific study of emotion should dispense with the linguistic labels used to describe folk experiences of emotions: ''trouble with emotions in psychology is that they are regarded too much as absolutely individual things… But if we regard them as products of more general causes (as 'species' are now regarded as products of heredity and variation), the mere distinguishing and cataloguing becomes of subsidiary importance'' (James, 1890, p.449).

Taking after James, it is argued that the only way to properly understand emotion in an evolutionary context is to focus not on the whole, but the parts. We must move away from studying our folk psychological conceptions of emotion as if they are natural kinds, and towards a more generalised understanding what emotions are, and the process that could have led to their emergence during the evolution of various species. This means understanding the processes that lead to the generation of affective experience.

3 Getting to grips with emotion

"Everyone knows what an emotion is, until asked to give a definition. Then, it seems no one knows." – Fehr & Russell (1984)

Whilst we all know intuitively what is meant by the word emotion, satisfactorily articulating this has proved notoriously problematic, and no universally accepted academic definition has been proposed (Table 3.1). There have been complaints that emotion is too heterogeneous a category to define (Mandler 1984; Griffiths 1997). Indeed, taking all aspects of emotion together produces something more akin to description than definition (Reeve 2014, p.341), as can be seen from Izard's (2010, p.367) description of emotion, derived from definitions provided by 34 researchers:

> *Emotion consists of neural circuits (that are at least partially dedicated), response systems, and a feelings state/process that motivates and organises cognition and action.*
>
> *Emotion also provides information to the person experiencing it, and may include antecedent cognitive appraisals and ongoing cognition including an interpretation of its feeling state, expressions, or social communicative signals, and may motivation approaches or avoidant behaviours, exercise/regulation of responses, and be social or relational in nature.*

Table 3.1: Some definitions of emotion advanced by researchers (after Oatley et al. 2006 Table 1.3)

James (1884, p.189)	My thesis… is that the bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur is the emotion.
Arnold & Gasson (1954, p.203)	An emotion or an affect can be considered as the felt tendency towards an object judged suitable, or away from an object judged unsuitable, reinforced by specific bodily changes.

Lutz & White (1986, p.417)	Emotions are a primary idiom for defining and negotiating social relations of the self in a moral order.
Barret & Campos (1987, p.558)	We conceive of emotions as bidirectional processes of establishing, maintaining, and/or disrupting significant relationships between an organism and the (external or internal) environment.
Tooby & Cosmides (1990, p.410)	An emotion corresponds to a distinctive system of coordination among the mechanism that regulate each controllable biological process. That is, each emotional state manifests design features "designed" solve particular families of adaptive problems, whereby psychological mechanisms assume unique configuration.
Lazarus (1991a, p.231)	Emotions are organised psychophysiological reactions to news about ongoing relationships with the environment.
Ekman (1992, p.169)	Emotions are viewed as having evolved through their adaptive value in dealing with fundamental life-tasks. Each emotion has unique features: signal, physiology, and antecedents events. Each emotion also has characteristics in common with other emotions: rapid onset, short duration, unbidden occurrence, automatic appraisal, and coherence among responses.
Frijda & Mesquita (1994, p.51)	Emotions… are, first and foremost, modes of relating to the environment: states of readiness for engaging, or not engaging, in interaction with that environment.
Scherer (2005)	Emotions are made up of five component processes. Cognitive appraisal provides evaluation of events and objects. Bodily symptoms being the physiological component of emotion experience. Action tendencies providing a motivational component for the preparation and direction of motor responses. Expression through the face and voice to communication reaction and intention of actions. Feelings, the subjective experience of emotional states once it has occurred.

Oatley et al (2006, p.29)	Multi-component responses to challenges or opportunities that are important to the individual's goals, particularly social ones.
Levenson (1994, p.123)	Emotions are short-lived psychological phenomena that represent efficient modes of adaptation to changing environmental demands.
Reeve (2014, p.342)	Emotions are the synchronised brain based systems that coordinate feeling, bodily response, purpose, and expression so to ready the individual to adapt successfully to life circumstances.

This description suggests a variety of separate components that are grouped under the collective heading of emotion. This is at the core of the multidimensional nature of emotion.

Rather than seeking to understand emotion as a single heterogeneous unit, it should be considered in terms of four component processes: feelings, bodily responses, cognitive appraisal, and socio-cultural context (Izard 1993; Mauss et al. 2005; Scherer 2005). Feelings are private to individuals and provide the subjective experience of the emotion once it has occurred, giving it meaning and personal significance. It is this subjective component of emotion that often lays the groundwork for colloquial and scientific understandings of emotion. However, emotions are also physiological responses that orient the body to the relevant stimulus. This can include the activation of neural, biological, and hormonal response systems. These physiological responses are often so intertwined with phenomenological experience as to be inseparable. Broader cognitive processes also play in important role in the generation of emotions. The experiencing of an emotion is closely related to the cognitive evaluation of the event, with the character of the emotion often dependent on the nature of the appraisal. These cognitive processes provide the motivational impulse to act, echoing the goal-oriented nature of emotion. Finally, emotions have an important social component, with private emotional experiences made public through communicative expression within a dynamic network of social relationships. Cultural norms

provide much of the emotion knowledge that informs cognitive appraisals. Emotions, therefore engage our whole person: our feelings, bodily arousal, and conscious and subconscious thought processes, nested within our socio-cultural context.

None of these separate components adequately defines emotion alone. Rather, emotion is the psychological construct that unites and coordinates these individual components (Figure 3.1). The term emotion, then, can be seen as a heuristic under which, feeling, physiological response, cognition, and socio-cultural factors are grouped into a coherent response to an eliciting event. This description highlights how different aspects of experience complement and coordinates one another to produce emotional experience (Averill 1990; LeDoux 1989; Mauss et al. 2005). Often, however, the multidimensional nature of emotion is ignored, and the heuristic broken apart, with researchers attempting to understand the component process of emotion in isolation.

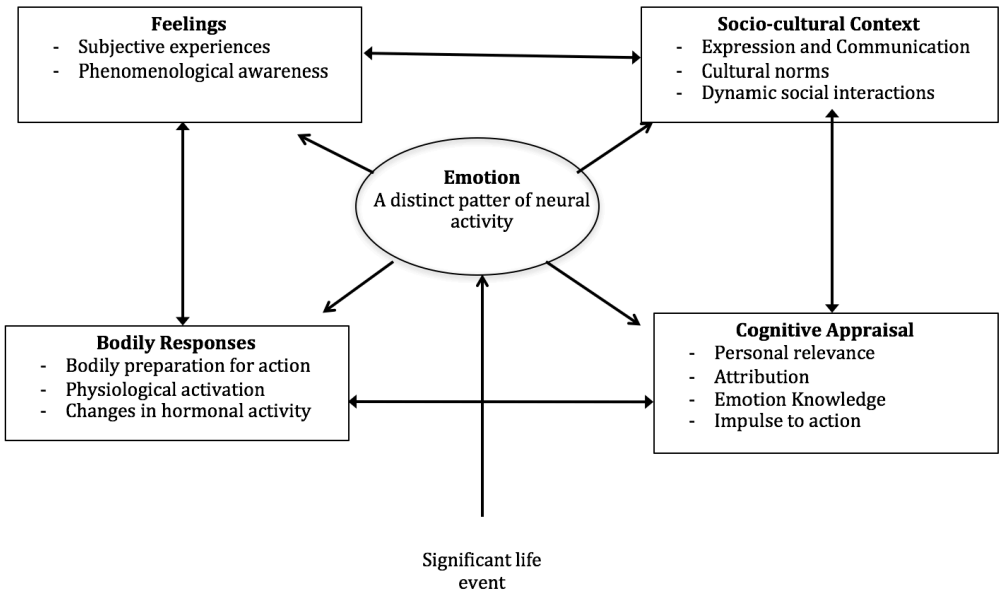


Figure 3.1: the five components of emotion (after Reeve 2014, p.Fig. 21.1)

What follows is an attempt to navigate emotion research through the lens of the component processes of emotion. It will be seen, that each plays a

fundamental, and somewhat overlapping, role in the generation of emotional experiences.

3.1.1 Bodily Response

Following the publication of Darwin's *Expression*, one of the first questions addressed by researchers concerned the role the autonomic nervous system played in the subjective experience of emotion. William James (James 1884; James 1894; James 1890) suggested the bodily responses occur prior to and therefore causes emotional experience. Hence, encountering a stimulus provokes a bodily response, alerting the body to potential danger and preparing for the appropriate action. The fight or flight response, for instance, is an autonomic bodily response. Only after this, does perception of the bodily change result in the subjective experience of emotion. James's justification for this was that the body reacts uniquely to different events, which can be equated to different emotions, and the body does not react to non-emotion eliciting events.

The James-Lange theory, named for James and Carl Lange who proposed a similar theory (1887), quickly became popular. However, a challenge was mounted as new methods of lesion studies (Cannon 1927) and electrode stimulation (Hess 1950) in animals, and reappraisals of clinical cases in humans (Harlow 1848) provided the foundation for a new understanding that emotions were governed by systems in the deep brain of animals. These studies suggested that the role of physiological arousal is to augment, rather than cause emotion (Newman et al. 1930), with emotional experience, generated within the brain, actually occurring quicker than physiological responses. In fact, bodily responses came to be seen as simply part of a generalised biological imperative for motivation action that did not vary depending on circumstances (Cannon 1929; Mandler 1975; Schachter 1964).

The James-Lange theory has, however, been the subject of prolonged criticism (e.g. Schachter & Singer 1962) and subsequently became supplanted. Despite this, James's ideas continue to be influential (Ellsworth 1994; Lang 1994), with subsequent research seeming to support his supposition that certain emotional experiences do seem to be linked to patterns of bodily responses.

For instance, research by neuroscientists has suggested that patterns of activity from the autonomic nervous system (ANS) can be associated with 'basic' emotions such as anger, fear, sadness, and disgust (Ekman et al. 1983; Levenson 1992; Sinha & Parsons 1996; Matsumoto et al. 2008). ANS activity involves blushing, crying, pupil dilation and constriction, stimulation of the salivary glands, and stimulation of hair follicles (Reeve 2014, 372). It is proposed that this small number of emotions with distinct ANS patterns supposedly emerged to promote adaptive behaviour because, as above, it is argued that if a specific pattern of behaviour has survival value for an emotion, there is little reason for the development of an ANS activity (Ekman 1992; Ekman 1994). For complex social emotions, there is no single obvious behavioural response, because adaptive coping depends of the specifics of the situation. It has also been suggested that endocrine activity contributes to the generation of emotion responses, with opiates promoting social bonding and alleviating sadness and separation distress (Panksepp 1998).

This research meshes well with basic emotion theory, as those taking a strictly biological approach will argue that the observable patterns of brain activity indicate brain structures that coordinated activity constitutive of an emotional experience (Ekman & Cordaro 2011; Ohman & Mineka 2001). The onset of subjective feelings, motivational impulses, ANS activity, and expressive signals occurs so quickly and in such a coherent and coordinated way that researchers confidently assume that stimulated brain areas must be implementing a predetermined set of responses to a particular stimulus.

3.1.2 Cognition

Whilst biology undoubtedly plays a part in the emotion process (Parkinson 2012), other researchers emphasise that emotions are deeply immersed in cognitive processes. From this perspective, emotions are not best understood as ANS responses, facial expressions, or behavioural responses, but as a cognitive understanding of what the emotion episode *means* (van Dijk et al. 1999). Shame, for instance, is not activated by subcortical brain structures, but by cognitive evaluation of a situation as *shameful* (Tangney & Dearing 2002).

The central component of cognitive approaches is appraisal (Moors et al. 2013). Appraisal determine the nature of the emotions experienced in a given situation, including the bodily response, the motivated behaviour, the nature of expression, and the subjective feeling (Frijda 2007). As such, it is the appraisal that constructs the emotional experience, not the inciting incident: no appraisal, no emotion (Lazarus 1991a; Ortony et al. 1988; Roseman 1984; Tomkins 1984; Smith & Ellsworth 1985; Weiner 1986). Equally, if two subjects experience the same situation, but appraise it differently, they will experience different emotional responses. Arnold (1960) was one of the first to explicitly address the way that appraisals work with brain systems to produce emotional experiences and motivate the concomitant behaviour and expression. For her an emotional response is caused by an appraisal, which in turn is stimulated by an event (fig. 3.2). The nature of the appraisal determines the character of the emotional response: if the situation is deemed good, the emotion is positive, if the situation is deemed bad, the emotion is negative. The emotion then motivates the appropriate behavioural response.

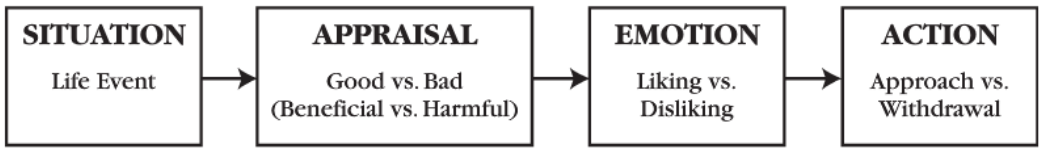


Figure 3.2: Arnold's (1960) appraisal theory of emotion (Reeve 2014, fig 13.6)

Lazarus (1991a; 1991b) expanded on Arnold's good and bad appraisals (fig3.3). Personal relevance formed the crux of his argument, an understanding of the potential impact on the individual personal wellbeing vital for the generation of an emotion. Thus, for him the appraisal process has two stages. Primary appraisal established whether the individual is involved in the situation. Stimuli appraised as irrelevant at this stage do not elicit emotional reactions. Following this, a secondary appraisal stage deals with coping strategies for situations deemed relevant. For Lazarus (1991a; 1991b) the individual's cognitive appraisal of the meaning of an event, rather than the event itself, sets the stage for emotional experience.

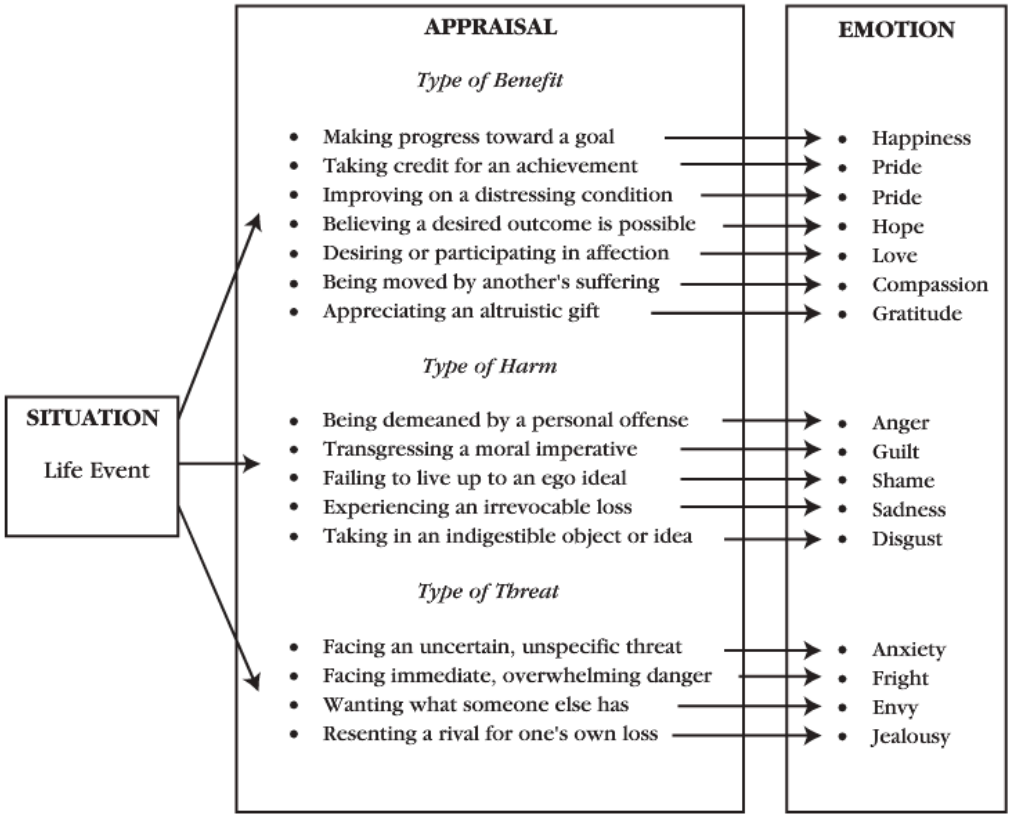


Figure 3.3: Lazarus's (1991b) complex appraisals (Reeve 2014 Fig 12.8)

Following the work of Arnold and Lazarus, cognition theorists continued to develop increasingly complex explanations of the appraisal processes that give rise to emotion states (Frijda 1988; Oatley & Johnson-Laird 1987; Ortony et al. 1988; Roseman 1984; Roseman 1991; Tomkins 1984; Scherer 2009; Smith & Ellsworth 1985; Weiner 1986). The ultimate aim of the cognitive approach is to explain each emotion as a unique pattern of compound appraisals, with various researchers developing additional types of appraisal to add to those proposed by Arnold and Lazarus (Roseman 1984; Roseman 1991; Scherer 2009; Smith & Ellsworth 1985).

Perhaps one of the most sophisticated appraisal models is the decision tree proposed by Roseman, Antoniou & Jose (1996). Here, a variety of positive and negative emotions are expressed in terms of the nature of the cognitions that lead to them (Figure 3.4). The model hinges on the nature of the eliciting event, whether it is caused by circumstances, somebody else, or the individual themselves, and if the outcome is certain or uncertain. Additionally, the amount of

control that the individual perceives they have can affect the emotion that results. So, for instance, if an individual causes a bad situation themselves and deems that they have some control of it, they may experience an emotion of shame or guilt. However, if they deem that they have little control of that same situation they may feel regret instead. The difference in emotion may be subtle, but it reflects and level of cognitive appraisal regarding ones perceived social responsibilities.

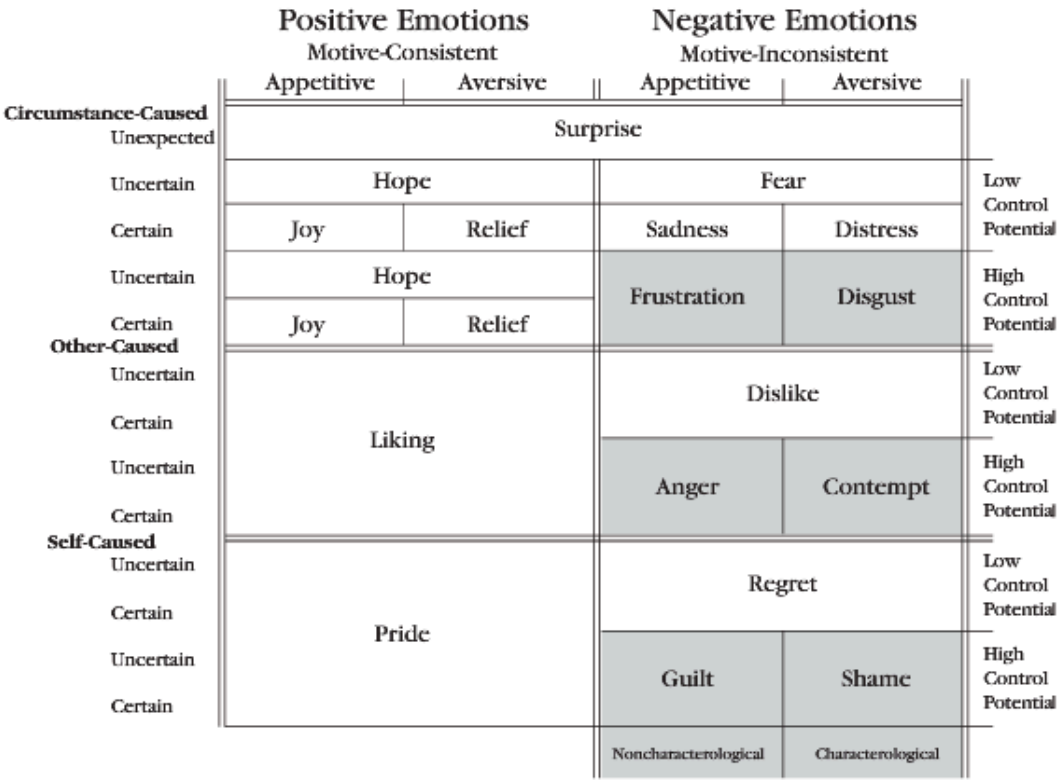


Figure 3.4: Roseman et al's (1996) decision tree (Reeve 2014, fig 13.8)

Closely related to this, is the concept of attribution. Attribution theory rests on the assumption that people want to explain outcomes. An attribution is the reason a person uses to explain an important outcome. This is particularly related to the cognitive appraisals that cause complex social emotions and should be distinguished from the experience of basic emotions such as happy and sad that simply follow good and bad outcomes.

The crux is that the nature of the emotion experienced depends on the nature of the appraisal, and especially the attribution of personal responsibility for the situation. For instance, Tracy and Robins (2007) have identified two

distinct types of pride: authentic and hubristic. They suggest that authentic pride is experienced when an individual deems themselves responsible for their achievements. Conversely, hubristic pride is self-focused and occurs when pride is taken in something that is outside the individual's control. In this model, authentic pride is related to good self-esteem, whereas hubristic pride is more closely associated with narcissism. A similar division can be seen between guilt and shame (Tangney et al. 1992; Cohen et al. 2011). Guilt appears to be experienced fleetingly and focused on specific events, with a negative evaluation causing an individual to seek reparation for the consequences of their actions. Shame, on the other hand, can linger and causes an individual to reflect on themselves as bad, without necessitating a specific inciting incident leading to negative behaviours, such as becoming angry or blaming others.

A significant factor in the development of these increasingly complex cognitive appraisals and attribution concerns the level of emotion knowledge an individual has. Infants and young children understand and distinguish between only a few simple emotions: anger, fear, sadness, joy and love (Kemper 1987; Shaver et al. 1987). However, over the course of our lives, people begin to discern between subtle different emotional experience, like that described about for shame, guilt, and hubristic/authentic pride. Additionally, anger is divided into increasingly specific categories including frustration, annoyance, rage, and so on (e.g. Russell & Fehr 1994). An individual's emotion knowledge is the number of different emotions they can distinguish (Shaver et al. 1987).

Additionally, emotion socialisation can take place when children learn about emotions from adults. This may include the passing on of information about the appropriate emotions to experience in particular situations, or the correct way to express emotion and the words to use to describe them (Pollak & Thoits 1989; Shaver et al. 1987). This provides children with socially mediated guide for the management of their emotional experiences. Through this process, individuals can acquire highly complex and personal emotion knowledge, furnishing them with a repertoire of emotions and an understanding of when and how these emotions should be felt and expressed. The upshot of this, is that there are potentially as many emotions as there are ways to appraise the situations subjects encounter (Smith & Ellsworth 1985; Smith & Ellsworth 1987; Ellsworth & Smith 1988).

Some cognitive researchers have explicitly addressed the functional reasons that could have led to the evolution of emotional abilities. For Lazarus (1991a), emotions operate in the relationship between a person and their environment, this can be natural or social, and provide increased adaptive flexibility and variability of behavioural responses. Every time an individual engages with something in their environment, they enter into an adaptive encounter with potential implications for their survival. The implications of each encounter are considered through a system of appraisal, with primary appraisal identifying whether something of relevance to a person's wellbeing has occurred, and secondary appraisal considering the potential coping options. These appraisals provide the basis for behavioural responses. Emotions come in two flavours: goal incongruent (negative) emotions and goal congruent (positive) emotions. These are not seen as hardwired pancultural emotions, as in evolutionary psychology, rather they are likely outcomes following the appraisal of adaptive encounters. These outcomes are based on, and can be altered by, social factors including learning and culture. Ultimately, society creates patterns of behaviour and biological inheritance creates the process. Lazarus explicitly states that appraisal does imply anything about rationality, deliberateness, or consciousness.

Taking a slightly different approach, Frijda (1986; 1992; 1996) argues that emotions are linked to changes in action readiness. On perception of a stimulus, appraisal is elicited which provides situational meaning and activates a biologically innate system of action readiness. Rather than allying emotion closely with motivation, Frijda sees action readiness as a state of preparedness for engaging, or not, with the environment without specifying either the behavioural response or the source of motivation. Frijda (1986) lists 17 modes of action tendencies: approach, avoidance, being with, attending, rejection, non-attending, interrupting, dominating, submitting, deactivation, bound activation, excitement, free activation, inactivity, inhibition and surrender. For Frijda, action tendencies are not linked to specific behaviours, but simply the motivation to act. These motivations can be suppressed or hidden for social reasons.

Taking a different tack, recent work by Damasio (2005). a neuroscientist, has illuminated the relationship between emotion and rational cognitive

processes. In his clinical work, Damasio established that damage to certain areas of the limbic system severely disrupted the decision-making processes of patients with brain damage and autism. As the limbic system is responsible for emotions, this means that, rather than serving to disrupt rationality, affective feelings must play an integral function. He postulates that emotions act as somatic-markers, biasing particular possibilities in the decision-making process and making us more likely to pursue a particular source of action. This is not always the most prudent or logical course, but it provides quick and instinctual decision-making. This process operates on previous experience, so the quality of decision-making is only as good as the quality of learning. Evans (2002), a philosopher, has used Damasio's work to develop a search hypothesis of emotions. He argues that emotions prevent us from getting lost in an endless cycle of possible outcomes when making a decision. They do this by limiting the amount of information taken into account, restricting the time available, and biasing particular outcomes. This allows us to make an appropriate choice reasonably quickly.

In sum, appraisal theorists begin their analysis with relatively simple appraisals, such as whether an event signifies harm, threat, or danger (Lazarus 1991a). They continue with progressively more complex appraisals, such as legitimacy (Ellsworth & Smith 1988). Then, they assimilate emotion knowledge to explain how people make fine-tuned appraisals. Finally, attributional theory adds post outcome appraisal (Figure 3.5).

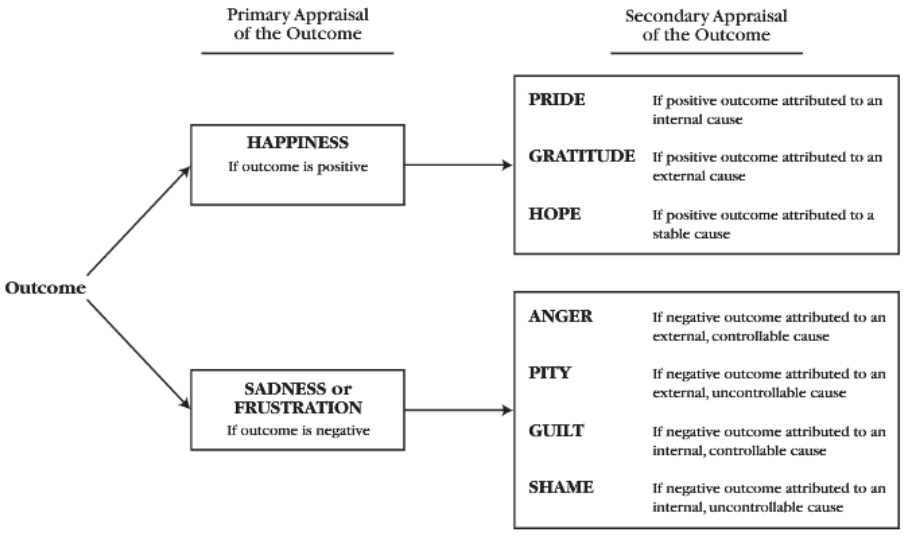


Figure 3.5: Attribution theory of emotion (Reeve 2014, Fig 12.12.)

By constructing emotion in this way, cognitive theories account for more types of emotional experiences the small number traditional addressed from a biological perspective. In light of this, they point out that several different emotions can arise from a single neural circuit. The biological response can be the same, but the emotions experienced can be different because the cognitive activity is different. As such, rather than specifying a number of basic emotions, the focus is placed on cognitive activity as a necessary prerequisite, which gives rise an almost limitless number of emotions. In Frijda's (1988, p.349) words: "emotions arise in response to the meaning structures of given situations; different emotions arise in response to different meaning structures". Appraisal is considered to play a fundamental role in emotional experience, with the way in which a stimulus is perceived affecting the type of emotion that is experienced.

Cognitive theories differ in the way emotions are generated, what happens in the split second between event and response (Arnold 1960; Ellsworth 2013; Frijda 2007; Lazarus 1991a; Oatley & Johnson-Laird 1987; Ortony et al. 1988; Roseman 1984; Scherer 2009; Smith & Ellsworth 1985; Weiner 1986). The situations can provide the context to interpret the state of arousal (Schachter 1964), the individual can interpret their own aroused state (Mandler 1984), and people can be socialised to interpret their aroused state (Kemper 1987). In addition, people can make appraisals of whether their relationship to the environment affects their personal wellbeing (Lazarus 1991a), the meaning and memories of the situations they face (Frijda 1993b), and their attributions of why good and bad outcomes occurred (Weiner 1986). Also, emotional experiences are embedded deeply within language (Shaver et al. 1987), and can be socially constructed ways of acting (Averill 1980) or social roles and identities (Heise 1989).

3.1.3 Social and cultural aspects of emotion

Researchers from a number of disciplines including psychology, sociology, and anthropology, have argued that an over emphasis on biology can lead to the formation of a partial picture of emotion. Instead, they contend that emotions are as much cultural as they are biological and must be considered alongside the

social interaction and cultural context from which they originate (Averill 1980; Kemper 1987; Manstead 1991; Rime 2009; Stets & Turner 2008).

At the crux of the argument is that if you change the culture you live in, your emotional repertoire changes too (Mascolo et al. 2003). For instance, Chinese infants are less emotionally reactive and expressive than American infants, probably because Chinese parents emphasise and expect emotional restraint whereas Americans expect expression. Additionally, in China, love is not a positive emotion, but often tinged with melancholy, and romantic love as understood in western cultures can be seen as undesirable in Chinese culture (Potter 1988; Russell & Yik 1996).

Additionally, a number of anthropological studies have found discrepancies between the emotion words used in different languages. Some emotion words that appear in other languages do not seem to correlate closely with those used in English. Given that individuals experience emotions that they have terms for, this suggests that people in different cultures experience different emotions. For instance, the people of Ifaluk, a small island in the Pacific, have an emotion that they refer to as *Fago.* Lutz (1988) translates this as "compassion/love/sadness" and claims that it is unlike any western emotion. Additionally, the Japanese use the emotion word *amae* to describe the feeling of a child-like dependency upon another's love experienced by adults (Morsbach & Tyler 1988). There are also several cultures where anger and sadness are not distinguished as separate discrete emotions (Rosaldo 1980; Rosaldo 1984).

This cultural specificity is a product of emotions occurring in social settings and during interpersonal interactions. People provide the primary source of daily interaction (Oatley & Duncan 1994), so it should not be surprising that we experience a greater number of emotions when interacting with others than when we are alone. Emotions are central to interpersonal relationships, playing a key role in creating, maintaining, and dissolving interpersonal relationships (Levenson et al. 1994). For this reason, emotions must be seen as much as the product of interactions between two people are they are products of biological systems (Parkinson 1996). If you change the nature of the interpersonal encounter, or the cultural context in which it takes place, you also change the emotional response.

As such, Harré (1986; 1995) has argued that culture, including language and social practices play a key role in the formation of an individual's emotional repertoire. Emotions develop based on the social environment that individuals are exposed to and experience, either directly or indirectly. This can be seen in the medieval emotion of *Accidie*, which depended upon the religious beliefs and the norms of the time. *Accidie* was a negative emotion of "boredom, dejection, or even disgust with fulfilling one's religious duty" (Harre & Finlay-Jones 1986, p.221). Specifically, this emotion was "the major spiritual failing to which those who should have been dutiful succumbed" and "to feel it at all was a sin" (221). In many parts of society, this emotion no longer exists, because our emotions are "defined against the background of a different moral order" (222). However, it is possible to imagine a similar category of emotional experience emerging from similar appraisals being applied to different stimuli in changing social environment.

In this sense, emotions and their expression are influenced by social norms and expectations. These norms influence what the appropriate stimuli of emotion are and how emotions should be expressed. One particularly influential theory that has developed along these lines is Averill's (1980; 1986; 1990) conception of emotions as "transitory social roles" that are both generated by and in turn generate social norms and expectations.

Transitory social roles are socially mediated programmes stipulating the correct behaviour in a given situation. For example, a grief response may be appropriate at a funeral, but a different response may be expected from a close relative and an acquaintance. In order to behave in a way consistent with social norms and expectations, it is necessary for the individual to understand what role should be adopted and the context in which it should be used. Transitory social roles help individuals to navigate the social world, by explaining how emotional responses relate to society as well as specific social contexts.

The intricate relationship between social interactions and emotion is further seen in emotion contagion: the "tendency to automatically mimic and synchronise expressions, vocalisations, postures, and movements with those of another person and, consequently, to converge emotionally" (Hatfield et al. 1993). Individuals have a tendency to mimic the facial expressions (Dimberg 1982;

Strayer 1993), speech style (Hatfield et al. 1995), and posture (Bernieri & Rosenthal 1991) of those whom they are in contact with.

In addition, conversation provides a context to relive past emotions: "the social sharing of emotions" (Rime et al. 1991). Usually this takes place later in the day when in the company of close friends or relatives. Much of this time is spent recounting full emotion episodes, including what happened, what it meant, and how the person felt (Rime et al. 1991). An empathetic listener can offer support or assistance, strengthen coping response, help make sense of experience, and reconfirm self-concept (Lehman et al. 1986). This is significant, as times of sharing our emotions help build and maintain relationships that are central to our lives (Edwards et al. 1984).

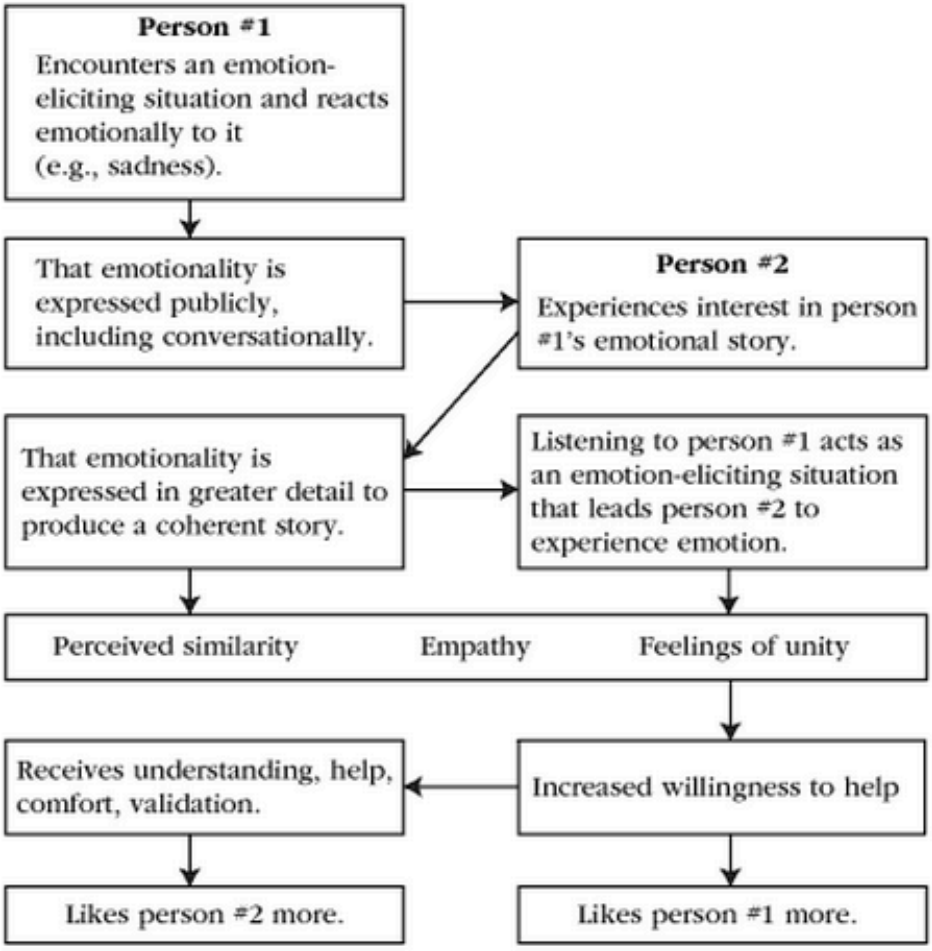


Figure 3.6: Rimes et al (1991) Model of interpersonal dynamics (Reeve 2014, Fig 13.4.)

Rime et al (1991) present a particularly complete account of the intricate relationship between personal emotional experiences and the role of a second individual (Figure 3.6). In this account, person 2 is recruited into the process by expressing an interest in person one's expression of emotion. Person 1 then gives a fuller account of that experience, with person 2 empathetically experiencing the emotion through the story. The shared emotion experience that results has beneficial effects on the relationship for both individuals. Person 1 feels affirmed from being heard and can benefit from advice and comfort. While person 2 may benefit in the future by building the relationship and making it more likely that person 1 will reciprocate.

3.1.4 The emotion process as multidimensional

As outlined above, emotion is a heuristic processes made up of the four component processes, so seeking to understand any in isolation will give only a partial account fo the full complexity of emotion. In order to build the multi-componential whole of emotion, phenomenological, bodily, cognitive, and socio-cultural approaches must be brought together. Some researchers have attempted to so this, emphasising the interconnectedness of all elements of the emotion heuristic.

3.1.4.1 The Feedback Loop

Plutchik (1985) has also emphasised the interconnectedness of the component processes of emotion, including biology and cognition (Figure 3.7). From this perspective, emotion should be considered neither wholly biological nor wholly cognitive.. Rather, emotion is seen to be a series of interconnected events that together operate as a feedback loop giving rise to emotional experiences. The cycle is elicited by a stimulus and the result is an emotional response, however, the nature of the process through which this is achieved is variable. The process by which stimulus gives rise to responses is a complex interactive chain of processes, comparable to the component processes of emotion outlined above; including bodily arousal, motivation to act, subjective feelings, expressions,

cognition, and behavioural responses. When emotion is imagined in this way, neither cognitions nor biological events directly cause emotion. Rather, all the elements cause, influence and regulate emotion. The point at which the cycle starts, whether it is an autonomic bodily response, a cognitive appraisal or something else, is variable, but will always start the cycle, with other processes recruited into the emotion experience.

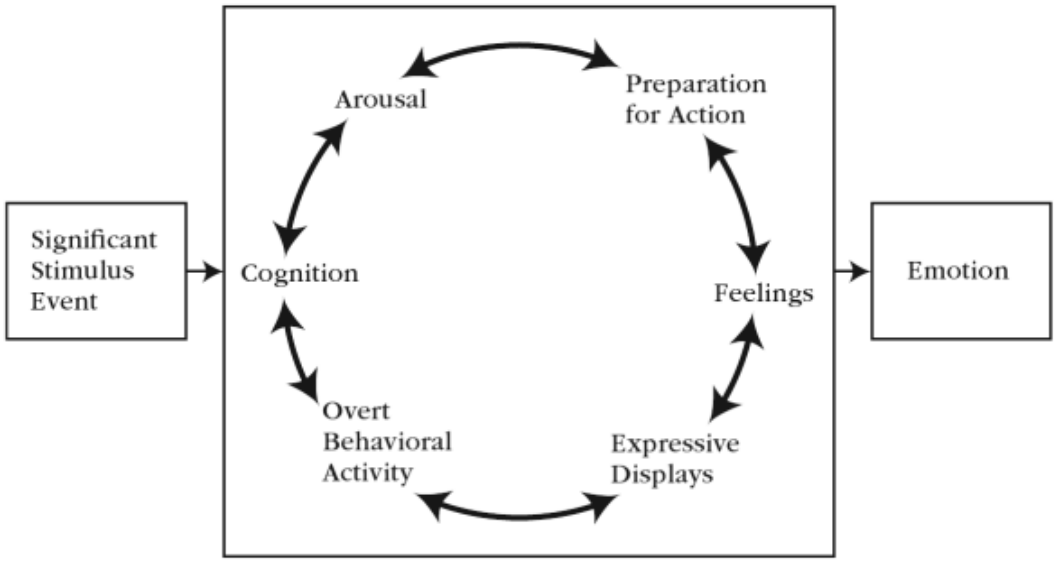


Figure 3.7: Plutchik's (1985) Feedback Loop of Emotion with arrows indicating the interconnectedness of components (Reeve 2014, Fig 11.5.)

This feedback loop is similar to Scherer's (1994; 2009) component processing model. He proposes five elements of emotion: cognitive appraisal, bodily responses, action tendencies, expression, and feelings. An emotion episode occurs when all elements become coordinated and synchronised for a short period. The component process model differs slightly in Scherer's assertion that it is cognitive appraisals that drive the process.

3.1.4.2 Two systems approach

An alternative to the feedback loop is to imagine emotions as two synchronous systems: one is biological, managing instinctive reactions to stimuli; the other is a cognitive system draws on experience to assess and interpret

information to ascertain the personal relevance of an emotional stimuli (Figure 3.8). According to Buck (1984), the biological system, mediating physiological response, came first in human evolution, promoting the rapid interpretation of sensory information for adaptive purposes. The cognitive emotions system came later as human beings became increasing cerebral and social.

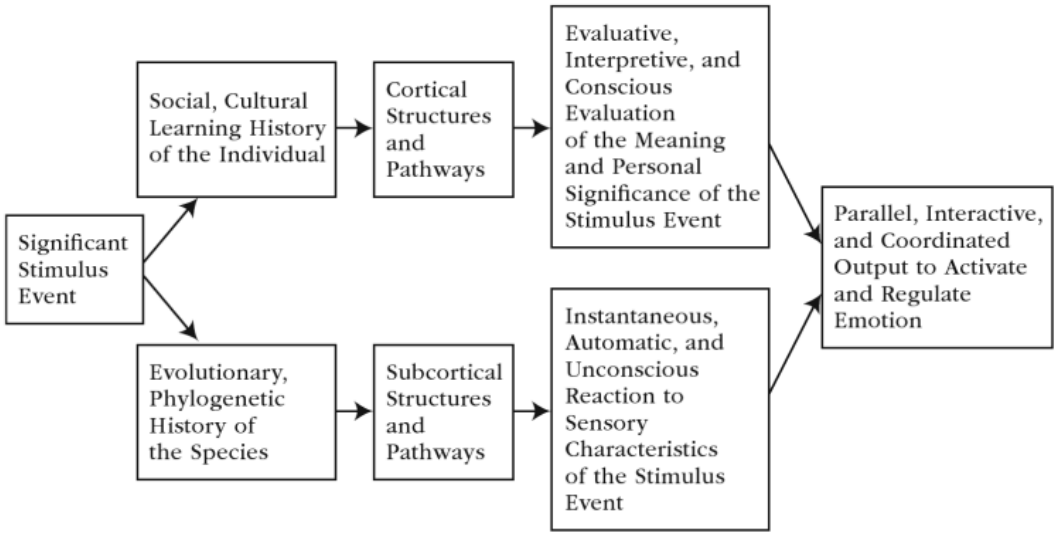


Figure 3.8: Buck's (1984) two system view of emotion (Reeve 2014, Fig 11.4.)

Levenson (1994) suggests that the biological system solves basic problems by quickly and reliably generating emotional responses to stimuli that serve an adaptive function to preserve the organism, while the cognitive system can provide more nuanced, situation specific responses based on learning and personal experience (Levenson 1999). As such, the two systems act in synergy, both providing important and valuable functions. Parallels can be found in the work of Panksepp (1994; 1998; 2011b), who argues that basic emotions arise primarily from subcortical biological systems and act as autonomic responses to stimuli, while others, such as gratitude, hope, and resentment, arise primarily from personal experience, social modelling, and cultural contexts. These emotions arise primarily from the cognitive systems in the cerebral cortex, mediating appraisals, expectancies, and attributions.

3.2 How do emotions work? Putting the pieces together

The running theme throughout the above has been the multidimensional nature of emotion. It is difficult to consider the varying characteristics of emotion separately; instead, a comprehensive definition of emotion as a heuristic is needed to include all the aspects of emotion. In the above discussion, there are allusions to ways in which the component processes of emotion could have changed during deep time. The hierarchical complexity of appraisal and attribution suggests the interaction of neocortical cognition with subcortical emotion circuits to produce increasingly complex emotional experience.

A second important point, is that, given the complexity of cognitive appraisals and socio-cultural factors impacting on bodily and phenomenological feelings, it is difficult to classify emotions with any precision. This is because emotional experiences are not natural kinds, but are constructed at the confluence of the four component processes. Recognising that emotion categories are merely descriptive rather than biologically privileged, allows the conceptualisation of emotions as the subjective experience of broader cognitive, bodily, and socio-cultural processes. It is acknowledged that shared neuroanatomy is at the core of the bodily experience of emotion, but, the focus is on the processes that lead to the division of emotions into ever more specific discrete categories of subjective experience. Cognitive appraisal theorists have described many of these mechanisms, with their emphasis on attribution and emotion knowledge as outlined above.

This leads to a view of emotion as a psychological construction. Emotion words, like “fear,” “happiness,” and “sorrow” are taken to be folk psychological categories referring to the phenomenological experience of emotion. These words do not, however, refer to the basic, underlying building blocks of emotion. Rather, categories of emotional experience “emerge from the interaction of more basic psychological ingredients that are not themselves specific to emotion” (Barrett, Gendron, & Huang 2009, 431).

Whilst there are a variety of explanations for the psychological construction of emotion (see papers in Barrett and Russell 2015 for a range of approaches), there is agreement over general principles. In essence, it is argued

that emotional experiences occur when bodily sensations (affect) and external stimuli are made meaningful by a process of categorisation informed by acquired emotion knowledge (Barrett, Gendron, & Huang 2009, 431). Different combinations of these ingredients give rise to a variety of mental states that coordinate an individuals subjective emotional experience with pre-existing concepts represented by emotion words. The process of categorisation serves to render the experience meaningful so as to make it easier to understand, process, and communicate. This allows the construction of a "remembered present" (Edelman 1987), where past experiences are stored knowledge is used to make sense of the world. Dissolving the dichotomy that has so often been drawn between evolutionary and social forces, the psychological constructionist approach sees the processes of affect and categorisation as a natural endowment.

One leading advocate of the psychological constructionist approach has been Russell (1980). Russell proposed that emotion words could be distributed spatially based on a scaling analysis. This produced an emotion "circumplex", with 28 emotion words distributed in a circle across a matrix using valance (pleasure-displeasure) and arousal (activation-depression) dimensions. Since the initial publication of his circumplex model (fig 3.9), Russell (2015) has continued to develop and clarify the theoretical and empirical basis of his ideas. The two dimensions, valance and arousal, which started out as hypothesised dimensions in a uni-dimensional scaling analysis, have become a concept of core affect, the biological basis for emotion made up of generalised valance and arousal systems in the brain. That emotion words can be distributed across the twin dimensions of core affect, is not an indication that discrete emotions exist, but a product of the construction of emotion meta-experience corresponding to particular states of core affect.

Russell's core affect is a byword for the biological underpinnings of emotion meta-experience. It is, in his own words (2003, 147) "a neurophysiological state that is consciously accessible as a simple, non-reflective feeling that is an integral blend of hedonic (pleasure-displease) and arousal (sleepy-activated) values".

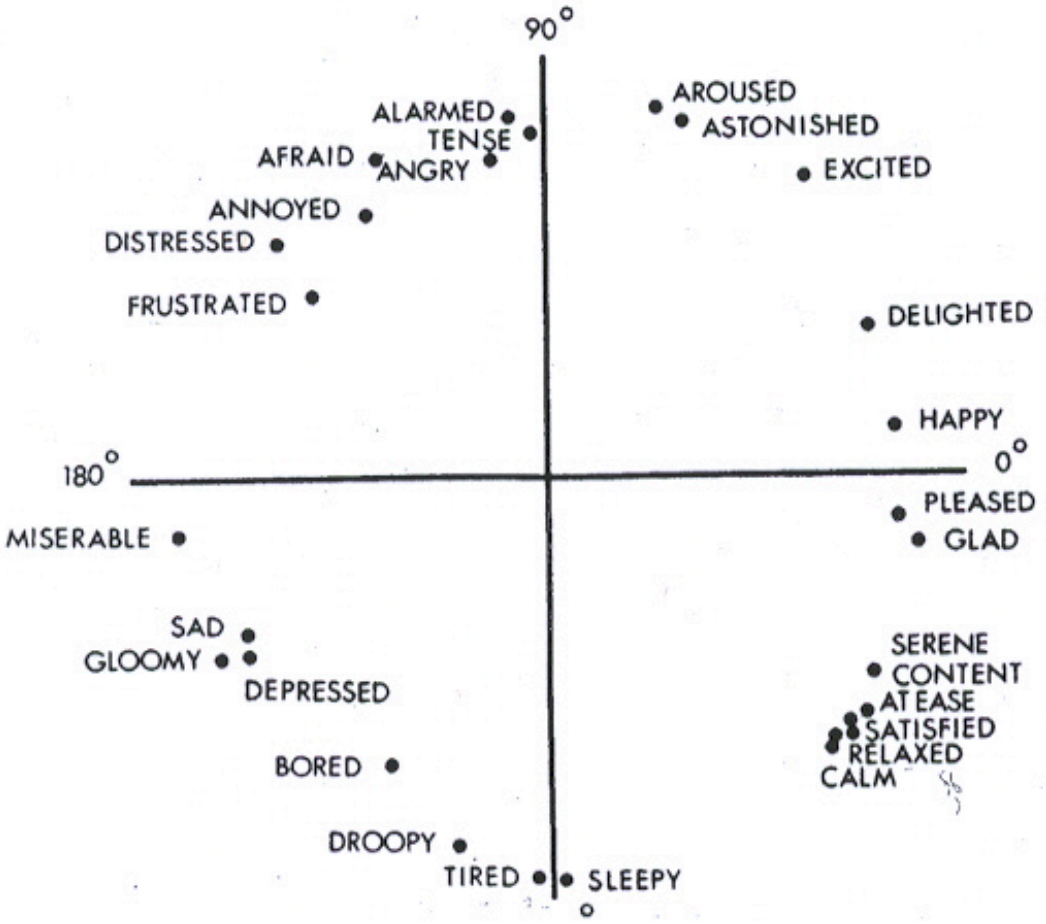


Figure 3.9: Circumplex Model of emotion (Russell 1980, Fig 4.)

Organisms are always in a state of core affect, unlike emotion episodes, which understood to be directed and to imply and involve relationships with a particular object (Frijda 1994). In many ways, core affect is more like moods, which can be free-floating, and often direction-less experience, similar in many ways to moods (Frijda 1993a). However, whilst moods last longer than emotions and are generally more mild (Davidson 1993) lacking the motivational impulse, this is not necessarily true of core affect. Also like moods, core affect operates like moods to bias cognitive processes, meaning that stimuli encountered whilst in a positive mood will likely be responded to, and remembered, more positive than those faced in a negative mood (Schwarz and Clore 1983).

When attended to, core affect is experienced as a simple, nonreflective feeling that is an integral blend of hedonic (pleasure-displeasure) and arousal (sleepy-activated) values. It cannot be broken down into smaller units of analysis.

Core affect is a preconceptual primitive with many aspects of modularity: fast, mandatory, unique output, an evolutionary explanation, dedicated brain circuitry, and encapsulation (Russell 2006).

Core affect can be caused by a single salient event, or can be multi-determined as a bottom up assessment of current situation (Ochsner et al 2009). The state of core affect elicited by an event is not an intrinsic part of the stimuli, but a product of the person's experience of it. Through this process, objects and events that we perceive in the world are coded with affective quality, and have the ability to alter our state of core affect. Russell sees this as a routine aspect of perceiving the world. As we do not have access to all the multitude of influences impacting on our state of core affect, we can misattribute causation (Neumann 2000).

By Russell's own admission (2015, 196) neurophysiological basis of core affect remains hypothetical, with researchers working to clarify the details (e.g. Gerber et al 2008). However, here it is argued that much of the recent from affective neuroscience can be seen as contributing to a broader understanding of core affect. In many ways, the constant activation of Panksepp' (1994) SEEKING system can be seen as a component of a core affect that is always tracking environmental changes and updating attitudes towards it. Additionally, the multitude of neurological mechanisms that have been posited to play a role generating emotion, seem either to be appraisal systems or those that produce hedonic tone. Whilst affective brain circuitry may not be organised neatly into two valance and activation systems as Russell suggests, they general concept remains a valuable heuristic for understanding the basic building blocks of affective experience.

Core affect is of the ingredients of "emotional meta-experience" (Russell 2015), a term that refers to the conscious experience of emotion. Emotional meta-experiences occur within the subjective reality of an individual, guided by their interpretation, or appraisal, of stimuli. These interpretations can be top-down, based on acquired knowledge and socio-cultural influences, or bottom-up, emerging from bodily, physiological experience and influences from the external world. Experiences can be assigned to categories of experience. These categories are the folk psychological categories that lie behind emotion words. They are

socially negotiated categories, constructed from acquired, cultural, knowledge, about what to feel or how to react in a given situation. As such, meta-experience is a representational mental state, in that it includes a representation of something: what one is angry about. Linguistic labels to facilitate the communication of internal mental states. By this definition, an emotion is not the recurrence of a simple pattern of neurological activity or behaviour, as argued by basic emotion theories, but is a form of self-perception dependant on other aspects of experience (Russell 2015, 195).

Russell would expect to find core affect in all mammals as an ancient system to allow flexible behavioural responses based on appraisal, rather than bioprogamming. However, the same may not be true of emotional meta-experience. This is because emotional meta-experience "serves to categorise oneself with respect to important social norms and roles attached to culture specific categories of emotion" (Russell 2015, 202), the construction of which seems to be beyond most non-human animals.

From an evolutionary perspective the upshot of adopting a psychological constructivist view of emotion is to focus on the ingredients that contribute to the construction of meta-emotional experience, rather than the nature of the meta-experience itself. Only once the requirements for the creation of a psychological construct have been identified can we begin to ask whether other species have these abilities and ultimately generate the same kinds of meta-experience as humans.

4 Raising an Emotion

Above, it was argued that emotion can only be explained through a model of dynamic change. Emotion is a component process, consisting of subjective feelings, bodily responses, sociocultural factors, and appraisals. Whilst many researchers have attempted to understand these components separately, they cannot be fully understood when divorced from each other. However, the discrete emotion approach, so prevalent in evolutionary and archaeological approaches to emotion, does just that. By attempting to establish the ontogeny of discrete, specific emotion, researchers are in fact seeking an evolutionary scenario for categories of subjective experience pertinent to the modern human experience of emotional life, but without any definite natural origins.

Instead, it is argued that emotions are best understood in terms of meta-experience, with discrete emotions existing as ontologically subjective categories establishing statistical regularity between the affective experience of social partners. Emotional meta-experiences contain within them appraisal processes, with the emotional experience dependant on subjective evaluations of situations encountered. Models of appraisal outlined above often imply a hierarchical nature of cognitive complexity, moving from initially simplistic appraisals regarding the significance of the event for the individual, to complex considerations of attribution and emotion knowledge. However, the nature of this change, and the ingredients that contribute to the appraisal processes are rarely considered explicitly (c.f. Feldman Barrett and Gendron 2009: Fugate 2015).

Whilst the development of basic emotions is fairly well covered, there is considerably less work looking at the development of self-conscious emotions. Whilst Darwin (1872) was aware of the importance of cognitive elicitors relating to self, he was not able to distinguish among the various types of emotion and elicitor (see also Tomkins 1963; for similar problems Izard 1977). However, in recent years, researchers specialising in child development have done much to clarify the specific aspects of self that are involved in non-basic emotions. Here, it will be seen how this can help understand the ingredients contributing to the appraisal processes and the construction of emotional meta-experience.

4.1 Growing emotions: children's experience of emotion

During their development, children pass through a series of stages with differing social and emotional emphasis (fig 4.1). These stages are intricately related to the development of broader, generalised cognitive abilities, such as the emergence of consciousness, reflective self-awareness, language, and theory of mind. There are also similarities with appraisal theories outlined above.

Through an exploration of infant development, it will be seen how emerging psychological ingredients contribute to the continued development and complexity of affective appraisal and the construction of subjective experience. Neurological systems are transformed from programmatic responses to homeostatic urges into vastly complicated cognitive appraisals recruiting other cognitive capacities and learnt knowledge. Differences in emotion behaviour are explained because of the enculturation of children during the first two decades of their life.

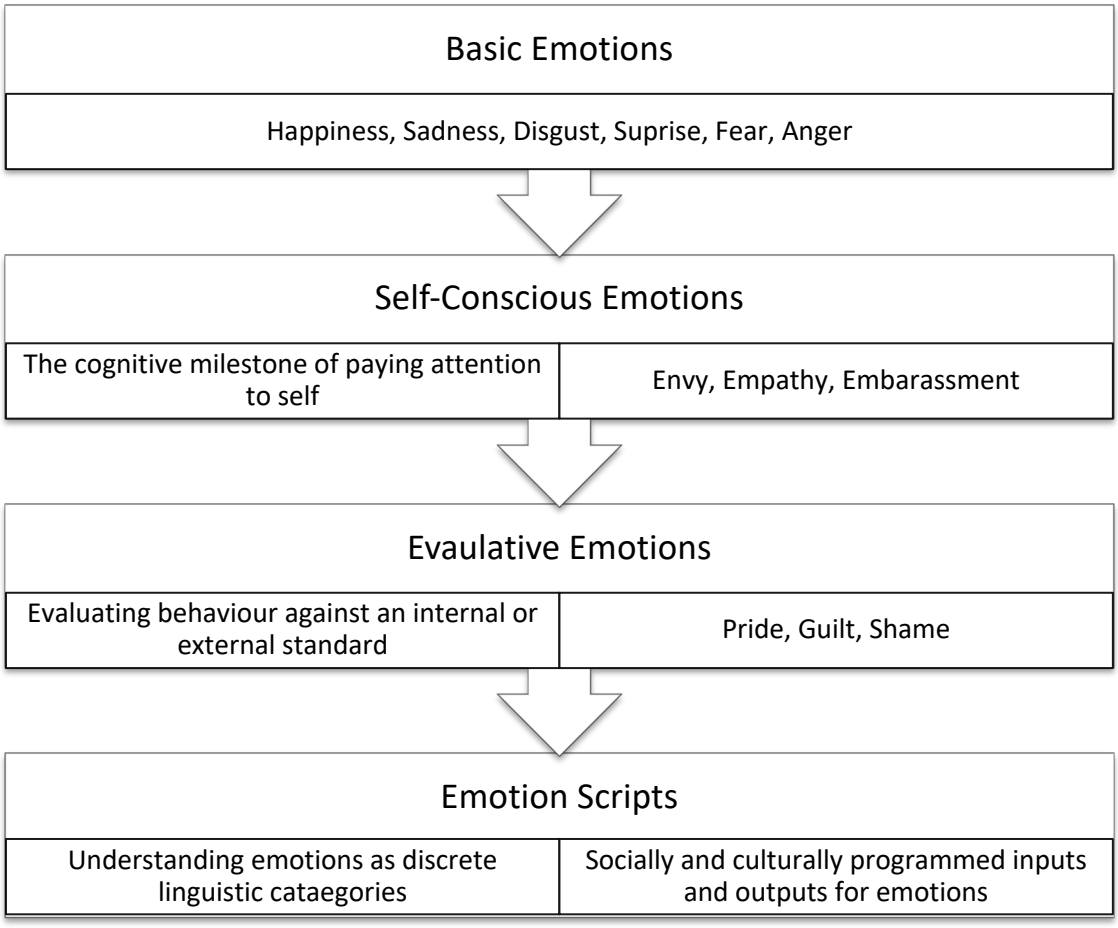


Figure 4.1: the developmental model of emotion

4.1.1 From core affect to basic emotions: birth to 9 months

For the first few months following birth, children's emotional life can be described in terms of valance and arousal (Bridges 1932), the basic ingredients of core affect. Initially, newborn's experience only a generalized sense of excitation, however, this quickly branches into equally generalized senses of distress, marked by crying and irritability, and pleasure, causing satiation, and drawing attention and responsiveness to the environment (Lewis 2010b, 315).

By six months, a child's experience of emotion is further refined. At about three months, joy emerges from positive valance responses to positive stimuli and familiar situations. Around the same time, sadness also emerges as a negative valance response to positive stimuli being withdrawn. Excitation develops into surprise, in response to discovery or the violation of expectations (Brooks & Lewis 1976; Lewis et al. 1984), and disgust, when mixed with negative valance as a response to distasteful objects (Lewis 2010b).

Anger appears to emerge slightly later, between four and six months (Stenberg et al. 1983), as frustration in response to objectives being thwarted. This is particularly significant, as it requires the ability to track activity towards a goal and recognize its frustration, which has been seen as a unique cognitive capacity (Lewis 1991). Some studies have claimed to show anger as early as 2 months (Lewis et al. 1990).

Also appearing in the first six or eight months is fear. Generally, fearfulness is seen as the final piece of this formal stage of development (Lewis 2010, 315). This is because, like anger, it requires special cognitive development. Schaffer (1974) has argued that in order to generate fear it is necessary to compare a novel stimulus with a familiar event; fear being caused when the current situation does not match with previous situations known to be safe.

It can be said, then, that in the first nine months or so a child develops emotional experiences comparable to the basic emotions suggested by some theorists (e.g. Ekman 1992). This may be taken as supporting evidence for basic emotion theorists, however, this is not the case. The developmental picture presented here does not represent the emergence of discrete "basic" emotion circuits hardwired into the brain. Infants respond behaviourally and emotionally

to a variety of vocal, tactile and visual displays, including adult emotional displays (Witherington et al. 2001), which attract their attention (Widen & Russell 2010b), alter their affective state (Owren et al. 2003) and regulate their behaviour (Campos et al. 2003). However, the affective content is understood only in terms of valance (Widen & Russell 2010b). Bridges (1932) sees this as a branching of increasingly specific types of emotion experience from preceding more generalized ones. Each emotion does not describe a new experience per se, but a more refined and specific experience of a pre-existing one. Anger, for instance, is negative valance directed at the frustration of intentions. This is not a new emotion, but a new experience of negative valance. As Lewis and Granic (2010, 186) have argued: "even at this young age, [children's] emotions derive from their cognitive activities".

Over the subsequent years, children experience a continued refinement of their emotional experience with the ingredients of generalized interest, contentment, and distress, being applied to new experiences and situations in increasingly complex ways.

4.1.2 Social referencing and the emerging self: 9 months to 18 months

From a very early stage, perhaps around 2 months, infants are aware of being the subject of an other's attention, and respond with a variety of emotional reactions (Reddy 2003). Face to face interactions draw positive valance responses, including smiling, with less responses when adults look away (Muir & Hains 1999). Distress responses are caused by being unable to break away from another's gaze (Brazelton 1986) or when another facial expression is not positive (Nadel & Tremblay-Leveau 1999). Children can also display "coy" responses when attention is directed to them, an expressive action often associated with self consciousness (Reddy 2003).

This period of interpersonal attention (Lewis and Granic 2010), is marked by the initiation of "reciprocal exchange" (Sander 1975) as infants turn their attention towards others and engage in often prolonged two way interactions. The experience of being noticed becomes an important source of positive affect for infants (Stern 1985). Trevarthen & Hubley (1978) have described these

"intersubjective" interaction as the sharing of a world which both infant and parent inhabit. At this stage, however, these interactions do not progress from moment to moment, because "infants are not keeping track of what to expect… this is a period of dawning interpersonal excitement, affection, and sharing, but without the sense of "what comes next" that is such a fundamental platform for most human interactions" (Lewis & Granic 2010, 188).

It is not long before, infants begin to make active attempts to attract other's attention through 'calling vocalisations' at about 4 months of age (Reddy 2003). This marks the emergence of interpersonal expectancy (Lewis and Granic 2010), an understanding of self as an agent that can act on the world. Back and forth interactions now occur. After about 6 months, infants respond to other's attention directed not just at themselves, but at aspects of the self, such as their actions (Reddy 2003). This can include showing off to gain attention (Trevarthen & Hubley 1978), repeating acts to elicit praise; clowning to elicit laughter; and teasing (Reddy 2003). In all cases, infants are aware of their own actions as eliciting responses from others (Reddy 2003). This newfound ability to associate an action with an outcome is a fundamental ingredient of intentional behaviour, acting with the *intention* of producing change (Case 1991).

Lewis and Granic (2010, 193) have suggested that this is the culmination of bifocal coordination, that is the ability to represent two perceptual observations concurrently. Prior to this, infants have only been able to represent one sensorimotor coordination at a time, limiting them to experiencing personal action, or the actions of others, but not both. However, bifocal coordination allows infants to coordinate representations of their intention and their parent's expected response. This allows infants to begin to enlist their parents help in achieving their objectives through communicative exchange. This is a fundamental difference, as others cease to be simply an effective means of achieving ones objectives, and become partners working together to achieve a shared goal (Lewis & Granic 2010, 194).

This is the first flourishing of joint attention, an understanding that both you and your social partner are attending to the same thing. Joint attention is an ingredient of theory of mind (Tomasello 1995). Once it is possible to understand where another person's attention is directed it is possible to begin to make

inferences about what their intentions may be. According to Tomasello, the process is only rudimentary at this stage and does not become more objective and accurate until about two years of age.

Joint attention is, however, sufficient for children to begin engaging in social referencing at about nine months of age, allowing the emotional responses of others to guide their reaction to events or objects, and learning whether to approach or avoid based on this example (Feinman & Lewis 1983; Sorce et al. 1985; Klinnert et al. 1986; Moses et al. 2001). Social referencing has been shown most affectively with the visual cliff experiment (first conducted by Campos & Stenberg 1981) where children are encouraged to crawl across a transparent surface placed over a drop of several feet, giving the illusion of a cliff. Up until about nine months of age, infants will not hesitate to crawl "off" the cliff, however, around nine months, infants will generally begin looking to their caregiver for guidance. A positive response from the mother will encourage the infant to continue, a negative response dissuades the infant from proceeding. As such, infant's actions appear to be guided by affective social cues from caregivers (Case 1991).

As age increases, children engage in social referencing more reliably and more quickly (Walden & Kim 2005). However, the precise nature of the meaning they derive from other's emotional displays is unclear. For instance, there is still no evidence that infants understand discrete categories of emotions (Widen & Russell 2010b). Whilst children begin to use emotion words around eighteen months, they do so only infrequently (Bretherton et al. 1986; Dunn et al. 1987) and mostly only one emotion word, "good", in their vocabulary (Ridgeway et al. 1985). At this stage, it seems that infants are receiving social cues in terms of valance only.

It is clear, that during this period, infants are coming to understand that they occupy a shared world. They go from attending only to themselves, to understanding that they are the object of others attention, and end up able to represent others' representation and act upon them (Reddy 2003). Paradoxically, whilst other is understood to be an active participant in the world of self, this begins the separation of self and other. It is at this stage that separation distress spikes (Emde, Gaensbauer & Harmon 1976), as infants begin to understand that

other is missing from the world of self. As such, it is necessary to consolidate the sense of shared world. Attending jointly to situations, as in social referencing, and objects, which is well documented by one year of age (Carpenter et al 1998) including active attempts to direct other's attention to things in the world (Butterworth & Jarrett 1991), tethers minds together. In the first half of the second year of life, this is amplified further by the use of single word utterances (Lewis and Granic 2010). Whilst most nouns are used to express simple ideas, the act of communicating even on such a basic level creates a sense that self and other are paying attention to the same thing: "Baby shouts "Up!" and Dad picks her up. That confirms, with utter certainty, that Dad knows what you want, knows what you are thinking about, and knows what you intend" (Lewis & Granic 2010, 197). At this stage, the world that Dad inhabits is not considered, but the interaction irrefutably confirms the world of self.

4.1.3 Self consciousness: 18 months to 30 months

During the second half of the second year of life, children acquire consciousness or objective self-awareness. Whilst such behaviours are inherently difficult to evaluate, particularly when methods are necessarily non-linguistic, mirror self-recognition has served as a tried and tested method for placing the emergence of self-awareness at around 18 months (Lewis & Brooks-Gunn 1979). The rise of self-awareness lead to self-referential behaviour and the new class of self-conscious exposed emotions, including embarrassment, empathy and envy (Lewis 2010b). Whilst little attention has been given to the development of these emotions, Lewis et al (1989) have shown that the conceptualisation of embarrassment is dependant on the pre-existence of consciousness or self-recognition, and Bischof-Kohler (1991) has done the same for empathy.

At around 18 months, children begin to represent self as an object to the self (Reddy 2003). This "cognitive milestone of paying attention to the self" (Lewis 2010b, p.317; Lewis 2010a) changes the way that infants interpret actions and attention. Previously, being the subject of attention could provoke withdrawal or coy responses from infants as a reflection of whether the attention was welcome or not. With the emergence of objective self-awareness, infants come to

understand the self as the object of others' attention, rather than attention simply being directed at self.

Take embarrassment as an example. There are two distinct types of embarrassment: exposure embarrassment and evaluative embarrassment. The first is associated with self-recognition (Lewis et al. 1989), and is elicited by being made the centre of attention (Lewis 2003). Being singled out, either for praise or by simply being asked to perform, are effective elicitors of exposure embarrassment, and results in the embarrassed individual breaking gaze and adjusting their body position, attempting to retreat from the limelight (Lewis et al. 1989; Lewis et al. 1991). At this stage, infants can only recognise themselves as the centre of others' attention, and react accordingly. Later, evaluative embarrassment appears and is specifically related to the evaluation of an individual's performance against a standard. If an individual fails to meet their own standards, or they perceive that they have failed to meet the standards held by others, they may experience embarrassment related to their performance. Thus, evaluative emotions require that children have not only a sense of self, but also the ability to evaluate their performance against others' expectations (Lewis 2003; Lewis 2010a). This sort of behaviour comes later.

Similar results have been found for empathy, another non-evaluative emotion (Bischof-Kohler 1991; Hoffman 2010). From birth, newborn infants respond to others' distress by feeling distressed themselves (Simner 1971; Sagi & Hoffman 1976). Slowly, this reaction becomes more restrained and thoughtful (Hay et al. 1981; Radke-Yarrow & Zahn-Waxler 1984), and some attempt to intervene, but their actions seem designed only to reduce their own distress, rather than because of truly altruistic motivations. Hoffman (2010) calls this 'egocentric empathetic distress'. It is not until the emergence of self-consciousness, around 18 months, that infants begin making more differentiated helpful advances towards the victim (e.g. Radke-Yarrow & Zahn-Waxler 1984), actions clearly designed to help another in distress (Hoffman 2010). Thus, whilst this is difficult to test, there is strong evidence that self-other differentiation predates sympathetic distress and helping (Zahn-Waxler et al. 1979; Bischof-Kohler 1991; Johnson 1992). Whilst these actions show that children now realize that others are physical entities independent of themselves, they do not yet form complex

representations of others' minds. It is only after this, later, with increasing awareness that others have mental states of their own that children begin to behave in a way approaching mature empathy, with interventions that truly reflect understanding of another unique perspective (Hoffman 2010).

At this stage then, the implications of other's attention and actions are considered only in relation to one's representation of self. Action can be taken to reduce or eliminate the causes of negative affect when caused by others, either because of attention directed at self or distress calls. However, at this stage the response remain egocentric, and do not include representations of other's minds or truly empathic actions.

Up until this point, the emotional responses correspond closely to particular facial expressions (Ekman 1973), however, self-conscious emotions require the observation of other bodily and vocal behaviours. For example, embarrassment has no clear facial expression and is best recognised through the observation of nervous touching, smiling, gaze aversion, and return behaviours (Lewis 2010b). This is because self-conscious exposed emotions are a step further removed from the valance responses generated by core affect.

According to Case (1991; Case et al 1988), between the ages of 18 and 24 months, children transition from understanding the world primarily in terms of sensorimotor schemes to primarily in terms of interrelational schemes. As such, actions and sensory information cease to be the main source of information. Instead, encountered stimuli are understood in terms of the relationships between agents, actions, objects, and goals (Lewis and Granic 2010).

More advance language allows a predicate to be appended to an object or subject, allowing the communication of intentions rather than ideas. When other act upon these instructions there is a confirmation of shared world beyond joint attention. In the words of Lewis and Granic (2010, 199): "Instead of just looking to where the child is and pointing, the parent is showing that her thoughts and goals are accessible and incontrovertibly linked with the child's thoughts and goals." As such, infants now begin to truly become part of a social being, part of a shared world of meanings and actions.

With the ability to represent self to self, infants are now able to hold in mind both their own objectives and those of others. This allows the goals of self

and other to be seen as competing. No longer are other's intentions clouded with only an implicit and intuitive understanding (Tomasello 1995). When the goals of self and other are congruent positive valance is experienced. Where goals compete negative valance can manifest as anger or rejection, and there is the possibility of withdrawal of parent affection (Lewis and Granic 2010). An infant will not simply abandon their own goals, however. Instead, this stage sees extensive negotiation as infants attempt to figure out how much they must comply in order to maintain positive responses from caregivers.

4.1.4 Social comparison: 30 months to 36 months

Some time between the ages of 2½ years and three years, infants acquire the ability to evaluate their behaviour against a standard; the standard can be either external, as in the case of parental or teacher sanction or praise, or internal as in the case of children developing their own standards (Lewis 1992b; Stipek et al. 1992; Lewis 2010b). The resulting range of emotions can be referred to as "self-conscious evaluative" and include pride, shame, and guilt, among others. These emotions require that children have a sense of self and be capable of comparing their own behaviour against external standards. If children fail against the standard, they are likely to feel shame, guilt, or regret. If they succeed, they are likely to feel pride (Lewis 1992a).

Self-conscious evaluative emotions are the product of interactions with others that are based on predictions of how one's behaviour affects them (Lewis and Granic 2010, 203). This requires that children have not only a sense of self, but also the ability to compare their own behaviour against a set of standards, rules or goals (SRGs) (Lewis 2003; Lewis 2010a). These SRGs are the product of the culture in which the child grows up, and are dependent on the infants learning of, and willingness to consider these SRGs as their own (Lewis 2010a), a process that seems to start early in life (Stipek et al. 1992). Certainly, by one year of age, children are beginning to attune their behaviour to cultural SRGs (Lewis 2010a), and by the second year of life, are coming into an understanding of behaviour that violates these expectations (Heckhausen 1984). By the beginning of the third year of life, children already have SRGs and seem to show distress when they violate

them (Stipek 1983; Lewis et al. 1992). The acquisition continues across the lifespan (Lewis 2010a).

So, by three years of age, a child can understand how accepting or breaking rules affects the goals and emotional states of her parents. The process by which these evaluations are made is complex, but broadly, there are two distinct outcomes; we can evaluate our behaviour and hold ourselves responsible for the action that is being evaluated, or we can hold ourselves not responsible (Lewis 2003). This distinction has also been called internal or external attribution (Weiner 1986). If we conclude that we are not responsible, then evaluation ceases, but if we evaluate ourselves as responsible, we then go on to evaluate our behaviour as successful or unsuccessful against the standard (Lewis 2003).

The exact emotion experienced seems to be dependent on the nature of the final self-attribution. This can be either global or specific (Weiner 1986; Dweck & Leggett 1988), sometimes called performance or task specific (Dweck 1996), terms that were originally used clinically to specify the tendency of individuals to make specific evaluations about themselves (Beck 1967, 1979; Seligman 1975). Global evaluations are focused on the individual's performance, rather than the action itself (Janoff-Bulman 1979). Thus, a behaviour violation leads to self-focused evaluations such as "because I did this, I am bad (or good)" (Lewis 2003). Specific evaluation, in contrast, focus on specific actions of the self and of the task. It is not the total self that has done something wrong or good, but upon a specific instance of the self's behaviour within its context that is judged (Janoff-Bulman 1979; Lewis 2003). This leads to evaluative phrases such as: "my behaviour was wrong, I mustn't do it again" (Lewis 2003).

It seems that global self-attributions lead individuals to experience a generally more negative emotion, whereas specific self-attribution produces a generally more positive emotion. For example, Tracy and Robins (2007) have identified two distinct types of pride: authentic and hubristic. They suggest that authentic pride is achievement based and occurs when the subject feels they have earned recognition in a situation when success was uncertain. Conversely, hubristic pride is self-focused and occurs when pride is taken in something that is outside the individual's control and where the outcome was never in doubt. It is clear that authentic pride is the product of a specific, task focused, self-attribution,

whereas hubristic pride results from global, self-focused self-attribution. In this model, authentic pride is a pro-social emotion related to good self-esteem, whereas hubristic pride is more closely associated with narcissism. A similar division can be seen between guilt and shame (Tangney et al. 1992; Cohen et al. 2011). Guilt appears to be experienced fleetingly and focused on specific events, with a negative evaluation causing an individual to seek reparation for the consequences of their actions. Shame, on the other hand, can linger and causes an individual to reflect on themselves as bad, without necessitating a specific inciting incident. This can lead to negative behaviours, such as becoming angry or blaming the other. Again, the more positive, pro-social emotion of guilt is the product of specific, task focused self-attribution, and the more negative emotion of shame is caused by global, self-focused self-attribution. This attribution process is essentially the same as that posited by appraisal theorists.

Wrapped up in the cognitive requirements for evaluation of behaviour against a standard is causal reasoning; an understanding of the causes of emotion, distinct from the emotions themselves (Wellman et al. 1995). Additionally, infants begin to refer to emotions and events experienced in the past (O'Neill 1996; Adams & Bakeman 1991).

Thus, by three years of age, the emotional life of a child has become highly differentiated. From initial experience of core affect in terms of valance and arousal, the child comes within three years to possess an elaborate and complex emotional system. Family rules are now incorporated into a complex appraisal system that allows children to understand themselves as social beings occupying active worlds. It is during this period that children begin to deviate increasingly from the "norm" developing their own idiosyncratic responses to dynamic situations. Towards the end of this stage, there is also an increasing emphasis on imagined worlds, with animals and dolls often taking the place of adults (Lewis and Granic 2010).

4.1.5 Building meta-experience: 36 months to 5 years and beyond

Despite the advance in the emotional repertoire of infants by 3 years of age, children still do not understand emotions on the same terms as do adults. Infants

at this age are beginning to describe others as the subjects of subjective experiences (Huttenlocher & Smiley 1990) and are able to respond correctly most of the time when asked what a subject is feeling (Widen & Russell 2008). But rather than referring to specific discrete emotions, infants use emotional categories much more broadly with much of their understanding still predicated on the broad dimensions of valance and arousal (Widen & Russell 2010b). Anger, for instance, is used to refer to a full spectrum of negative emotions (Bullock & Russell 1984; Denham & Couchoud 1990; Russell & Widen 2002a). Emotional vocabulary is limited with the addition of only five words "good", "happy", "sad", "angry", and "scared" (Ridgeway et al. 1985; Wellman et al. 1995). This perspective is consistent with arguments that 2 year olds lack a mature Theory of Mind (Wellman & Woolley 1990). Infants are able to attribute desire to others, and understand that fulfilment or frustration can affect emotional valance, but fail to understand that others can have different beliefs to themselves (Ortony et al. 1987).

It is only around three or four years of age that children begin to show evidence of fuller understanding of beliefs (Wellman 1995). Positive and negative valence remains important (Bullock & Russell 1984; 1985; Widen & Russell 2003), but labels for specific emotions begin to enter into children's vocabulary in a systematic order, with labels for the "basic" emotions coming into use earlier than those for self-conscious and self-conscious evaluative emotions (Harris et al. 1987; Russell & Paris 1994; Wintre & Vallance 1994; Widen & Russell 2010b). Thus, it appears that, emotion categories are refined over time, with children initially understating emotions very broadly before learning to distinguish between subtle differences; anger, for instance, starts broadly encompassing all negative emotions before becoming a specific term for a single emotion (Russell & Widen 2002a; Widen & Russell 2003; Russell & Paris 1994).

As such, subjective experience begins to become governed by "emotion scripts". Each emotion label is associated with its own script, which is essentially a narrative sequence for the expression of an emotion, including an eliciting event, conscious feeling, facial expression, action, label, and so on, aligned in a causal and temporal order (Tomkins 1987; Harris 1989; Izard 1994; Widen & Russell 2010a; 2010b; 2011). In fear, typically, a danger occurs; the person orients to it, freezes

or flees, and feels unhappy; physiological arousal increases; face and voice change. The concept of fear is thus a script in which sub-events unfold in a temporal and causal order (Widen & Russell 2010b). Emotion scripts, then, tell an individual what emotion to feel in a certain situation, or how to react when experiencing a particular emotion, and what emotion others are feeling based on their behaviour.

Whilst scripts are not prescriptive and are always subservient to an individual's appraisal of a situation (Harris 2000), they contain important social and cultural information about emotion. Scripts are not innate, the label and all corresponding information must be acquired. This allows considerable cultural influence to be exercised over how certain emotions function. For instance, if a child is brought up to believe that they must be brave, or that cowardice is bad, they are more likely to confront a situation which is causing them fear. In this instance, bravery is the culturally scripted response to fear. Scripts are particularly important for defining self-conscious emotions. In the absence of any fixed neural wiring, emotions such embarrassment, shame and guilt are better recognised from short narratives of an emotion experience than a facial expression (Heerey et al. 2003; Seidner et al. 1988; Shamay-Tsoory et al. 2008). Thus, causes and consequences of emotions help children learn the script for these emotions. Certainly, from the age of three children seem to best understand emotions based on their narrative structure as opposed to facial expressions (e.g. Balconi & Carrera 2007; Camras & Allison 1985; Reichenbach & Masters 1983; Russell & Widen 2002b), especially for fear and disgust (Camras & Allison 1985; Russell & Widen 2002a; 2002b; 2004).

This emphasises the significance of language in the formation of emotion scripts. Indeed, almost three-quarters of the variation in the level of emotion understanding in children is accounted for by the children's age and level of language ability (Pons et al. 2003; also Cutting & Dunn 1999; DeRosnay & Harris 2002). The exact nature of the relationship between language and emotion has not yet been established (Cutting & Dunn 1999; Eisenmajer & Prior 1991; Harris 1999); however Pons et al (2003) have suggested two possible explanations. First, language may be considered as an instrument of cognitive representation: Emotions are simply one more thing for language to represent, along with the physical world and other abstract thought. Therefore, the more readily children

are able to form linguistic representations, the better their understanding. Second, language is an instrument of social communication. Children with superior language skills are able to communicate more easily with other people and partake in more conversations. Children with greater language ability, then, have more opportunities for using that ability, and thereby come to represent mental states, including emotions, more intensively. This is certainly consistent with the assertion by anthropologists that humans only experience the emotions that they have words for (e.g. Lutz 1988).

The two-step explanation proposed by Pons et al is consistent with findings from research into the role of family interaction. The more a family communicates coherently about emotions, the better the child will be able to understand emotion (see Harris 1999; 2000). However, the relative contribution of children's language abilities, and of family interaction, to children's emotion understanding remains an open question.

It is no coincidence that as emotion scripts come to dominate at around 3 ½ to 4 years of age, children start passing false-belief tasks, the final ingredient of a mature Theory of Mind (Wellman et al. 2001). ToM is closely tied to the understanding of others' speech, goals, social action, and social reasoning (Happe 1993), and, of particular interest, is also involved in the appreciation of social norms and awareness of others' evaluations (Tager-Flusberg 1999). It has been suggested that children's understanding of emotions and belief develop during similar timeframes (Harris et al. 1989). It is certainly likely that they are related abilities, given that ToM and emotion understanding both involve an understanding of mental states (Dunn 1995).

False-belief tasks are similar to emotion understanding tasks in that both require children to set aside their own mental states and reason about a character's perspective. In a false belief task, children's set aside their knowledge of reality to consider the character's thoughts, whereas in an emotional understanding task, children set aside their own emotions to consider how another person might be feeling. Thus, there seems to be common underlying factors promoting the development of both false belief knowledge and emotion understanding.

Unfortunately, work connecting ToM and emotion tends to be conflicting. In particular, there are contradictions between false belief understanding and 3- to 5-year-olds' ability to recognize and label basic emotions. Some researchers found that affective perspective taking (Cassidy et al. 2003) and affective labelling were not correlated with false belief, whilst others found positive correlations (Hughes & Dunn 1998). Regarding children's understanding of the causes of emotions, research has indicated that 3- to 5-year-old children's ability to understand the external causes of emotions is positively related to false belief knowledge (Guajardo et al. 2009), even independent of age and vocabulary ability (Weimer & Guajardo 2005). Harris and colleagues (1986) used a ToM task that directly assessed emotion understanding, with children asked to distinguish between an apparent and a real emotion. They found that some 4-year-olds and the majority of 6- and 10-year-olds were able to successfully distinguish between real and apparent emotions, suggesting that around the time children learn to distinguish reality from appearance in the physical domain, they also apply this understanding to emotions and recognize that outward expressions are not always what they seem.

The classic Smarties task (Bartsch & Wellman 1989) has also been altered to incorporate emotions. Harris et al. (1989) conducted a series of studies to assess 3- to 7-year-olds' understanding of the relationship between beliefs, desires, and emotions. They found that by ages 4 and 6, although inconsistently for the former, children were able to predict a character's emotional reaction upon learning that an undesirable food item was in a box labelled as containing a desirable food item. Although there were no measures of children's other emotional abilities or overall emotion comprehension, these studies imply that by age 4 children begin to understand that emotions are related to desires and false-belief knowledge.

Most significantly, empirical evidence reveals reliable links between individual differences in children's ToM test scores and their exposure to rich and varied conversations about thoughts and feelings with family members and friends (Dunn 1996; Harris 2005). The frequency with which mothers talk about mental states correlated with children's greater ToM understanding (Dunn 1996; Peterson et al. 2007). Additionally, young children with restricted access to family

conversations about mental states (e.g. deaf children growing in hearing families) are often delayed in ToM development (e.g. Peterson & Siegal 1996; 1999; see Peterson 2009 for review). Yet, similarly, the later growth of pragmatic conversational skills is apt also to be prompted by a child's earlier success in the ToM domain. It transforms children's close relationship and they strive to influence others (Hughes & Leekam 2004). Certainly, a sharing of minds is necessary for emotion scripts to be communicated and incorporated into the behavioural repertoire.

There is, however, an additional consequence to the blossoming understanding that other people have minds of their own. Previously, there was no reason to have doubts that others see things in the same way that you do. Now other people have minds of their own and you cannot see what is inside them. In this sense, Lewis and Granic (2010) have argued that false-belief is a gateway to a whole new realm of insecurities. Minds closed to you may think badly of you, opening the possibility for "an anxiety that reflects self-consciousness, embarrassment, and even intense shame" (Lewis and Granic 2010, 209). This provides the foundation of truly moral behaviour. In order to be motivated to conform, a child must not only feel shame at violating other's expectations, but must be self-conscious enough to make amends. False-belief makes this possible.

4.2 Learning from Experience

Based on a synthesis of the developmental literature it seems that children's experience of emotion passes through five key stages. **First** is the branching of core affect into response that seem broadly analogous with the "basic" emotions suggested by some theorists. Quite apart from implying the manifestation of hardwired emotion, these responses are a result of the interaction between core affect and developing executive functions providing nuanced valance responses to specific situations. **Second**, children begin to understand themselves as the subjects of others attention. This brings with it socially significant meaning, providing social cues that children use to guide their behaviour. A developing sense of self is vulnerable to the valance of others' attention, with infants acting to attract positive attention and withdraw from

negative attention. **Third**, self crystallises, coming to exist as a representation in the mind, rather than simply as the subject of others attention. As such, the implications of others' attention come to acquire new meanings. New relational schemes for understanding the world and infants begin to share their world with others, although do not yet fully appreciate divergent world views. **Fourth**, more complex evaluations and causal reasoning begin to provide insights into the fuller implications of one's actions on others. This brings with it a complicated negotiation of social obligations as self attempts to establish its position relative to other. **Fifth** and finally, meta-experience comes to dominate in the form of scripts. As concerns with the inner worlds of others comes to dominate, categories of affective experience emerge as tools to mediate social interactions. The experience and knowledge children having gained from growing up and acting in a social world reaches a critical mass and comes to inform the construction of nuanced and often idiosyncratic ontologically subjective categories.

This can be taken as the first steps in understanding the complex mix of ingredients that make up appraisal processes and emotional meta-experience. From an evolutionary perspective, we may begin to ask whether it is possible to draw from this any conclusions about the changes in emotion process that occurred during human evolution. Certainly, many of the ingredients suggested here, including theory of mind, language, and objective self-awareness, are present in only modern humans today.

By understanding emotion in terms of the underlying psychological ingredients we may be able to glean a better understanding of the changes that occurred during human evolution. The following section will present a model suggesting the evolutionary trajectory that led to the attrition of psychological ingredients that caused emotional meta-experience to emerge from core affect.

5 Seeking the difference

The child development model provides a coherent theoretical framework for conceptualising dynamic change in emotion cognition during deep history. However, it is necessary to establish how this model intersects with hominin evolution. To do this we may seek to undertake a comparative analysis to establish the key differences between the human brain and that of chimpanzees, our closest living relative.

The primary goal of a deep history of emotion is to explain the difference between the limited emotion-like behaviours seen in non-human animals and the complex subjective experience of emotions seen in modern humans. The most commonly used comparative measure for quantifying the cognitive differences between humans and non-human animals is brain size. However, brain size may not be a suitable measure for comparison of emotion (e.g. Derner et al. 2007). Many late Pleistocene hominins, for example, have a brain size that would not disgrace a modern human; indeed Neanderthals and some early modern Homo sapiens often have larger brains, yet may lack some of the higher cognitive functions seen in modern humans, such as advanced synaptic language. This suggests that brain size is an imperfect measure of cognitive complexity and speaks of significant differences between hominin brains that are not accounted for by absolute size. In order to resolve this problem, a solution must be found that allows cognitive complexity to be inferred in spite of the limitations of the palaeoanthropological data.

In studies of evolution, relationships of size are critical for understanding how adaptation actually works. If a part of an organism gets bigger at the same rate as the organism as a whole the relationship is said to be isometric (Lewin & Foley 2003). The organism is simply getting bigger as a whole. However, sometimes this is not the case, and certain characteristics change at a different pace to the organism as a whole. For example, as body mass increases, the energy required for metabolism increases at only three quarters of the rate; the amount of energy required decreases per kilogramme as overall size increases. This is an allometric relationship and it is deemed that there are different factors effecting the divergent rates of change. These are the most interesting relationships of size,

and explanation of the different factors promises to illuminate the pressures effecting the unique evolutionary history of the organism.

One of the most important relationships of size in palaeoanthropology is that between brain size and body size. The brain is an expensive organ (Aiello & Wheeler 1995), and accounting for its substantial increase in size throughout human evolution is a significant concern. However, in order to understand fully the implications, increases in brain size must be expressed in relation to body size to establish whether the change is isometric or allometric. Perhaps the most established measure for brain expansion in relation to body mass is encephalisation quotient (EQ). For this measure, the observed brain mass of an organism is expressed in relation to the brain mass that would be expected based on the organism's body mass. The resulting number calculates how encephalised, or how relatively big, the organism's brain is compared to its body. The benefit of this measure is that it factors body mass into the analysis. For instance, whilst the whale has an exceptionally large brain, it is not proportionally more intelligent than humans because the organism as a whole is also significantly larger. The whale has a big brain, but not substantially bigger than it needs. This is not the case for modern humans, who have a brain far bigger than would be expected for an organism of comparable body mass.

There are, however, a number of problems with encephalisation quotient as a measure for cognitive complexity (Derner et al. 2007). While some have used EQ to justify arguments that one species may be more intelligent than another based on a relative measure of brain mass, it does not explain *how* or *why* this is the case. Simply stating that a species has a relatively larger brain than another by one, two, or more EQ points tells us nothing. The value of an EQ point is arbitrary and unquantifiable, as evidenced by the several EQ formulas, each producing different values from the same data (Martin 1983; McHenry & Berger 1998). For EQ to be meaningful, there must be a way of establishing the difference in real terms between species.

To fully establish the differences between the human and chimpanzee brain, we must go deeper; we must look beyond calculations of absolute size and focus instead on the neuronal structures that make up the inner workings of the brain.

5.1 Chimpanzee Neurones

On a neuronal level, it would appear, initially at least, that quantity is the main difference between the human and chimpanzee brain. Herculano-Houzel (2007; 2012) has shown that mammalian brains differ in their ratio of neuronal to non-neuronal cells, or grey to white matter. Rodents, for example, have a ratio 1:50 in their cerebral cortex, compared with a ratio of 1:1 in chimpanzees. This suggests that primates have evolved a much more efficient system of neuronal organization than other species, allowing them to house a larger number of neurones for every non-neuronal cell. This is important, as non-neuronal cells are the connective tissue that facilitates connections between neurones; more non-neuronal cells means more connections which is vital for high cognitive abilities, such as language and emotion processing in humans. Humans also have a ratio of 1:1, with 85 billion neurones and 86 billion non-neuronal cells. Thus, according to Herculano-Houzel, there is no difference in the neuronal organisation of humans and chimpanzees; humans just have more neuronal and non-neuronal cells. The human brain is a scaled up version of a chimpanzee brain.

This, however, is not the whole story. A significant body of neuroscientific research is showing differences between the human and chimpanzee brain that would not be picked up just by counting the number of cells. Whilst there is a general pattern of primate cortical expansion, large brains do not appear to be scaled up versions of smaller ones (Chaplin et al. 2013). These differences lie in the way that brains mature and develop, from gestation into adulthood, profoundly effecting the way the brain is wired.

Sakai and colleagues (2011; 2012; 2013) tracked the development of cerebral tissues in growing chimpanzees during infancy and the juvenile stages (fig, 5.1). The cerebral cortex of both chimpanzees and humans showed less maturity at birth, and developed over a more protracted course of development, than macaques. However, chimpanzees do not experience the rapid increase in total volume of the cerebral cortex and proportional dynamic change in the brain tissue that occurred in humans during early infancy. The difference in developmental patterns appears to be caused by differences in the developmental patterns of brain tissues and greatly influences the total adult brain

volume. Based on this, the researchers concluded that: "a dynamic reorganization of cerebral tissues of the brain during early infancy, driven mainly by expansion of white matter is likely to have emerged in the human lineage after the split between humans and chimpanzees and to have promoted the increase in brain volume in humans" (Sakai et al. 2013, 1). Moreover, the enhancement of neuronal connectivity may also explain why experiences during the first few years of life can greatly affect children's long-term behavioural and cognitive development.

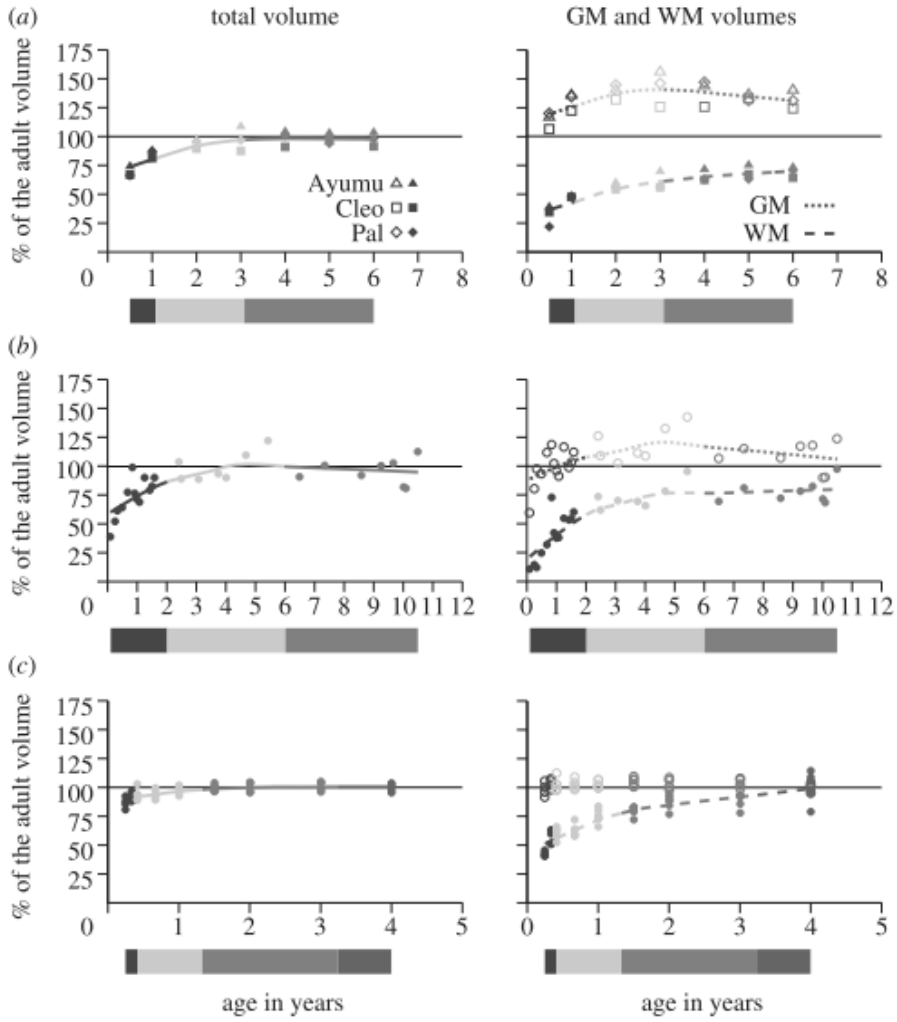


Figure 5.1: Total volumes and grey and white matter volumes of chimpanzees, humans, and macaques during the developmental period expressed as a percentage of adult volume (Sakai et al. 2013 Fig 3)

The proportional dynamic change that Sakai refers to includes the processes of synaptogenesis (the creation of synaptic connections between neurones) and myelination (an increase in the fatty sheath that surrounds axons

and increases the speed of information transmission) (see fig. 5.2). Additional research provides supporting evidence that these processes work differently in humans and chimpanzees. Liu et al (2012; also Bianchi et al. 2013) argue that the development of synaptic connections is relatively more protracted in chimpanzees than humans. Humans had more time to form synaptic connections, which caused them to behave differently. They found that the number of synapses in chimpanzees and macaques increased exponentially shortly after birth, but did not peak in humans until about 4 years of age (see Huttenlocher & Dabholkar 1997; Webb et al. 2001; de Graaf-Peters & Hadders-Algra 2006; Chugani et al. 1987 for synaptogenesis in humans). This resulted in 702 genes in the human prefrontal cortex having unique patterns of expression, as opposed to only 55 in chimpanzees and macaques (Liu et al. 2012).

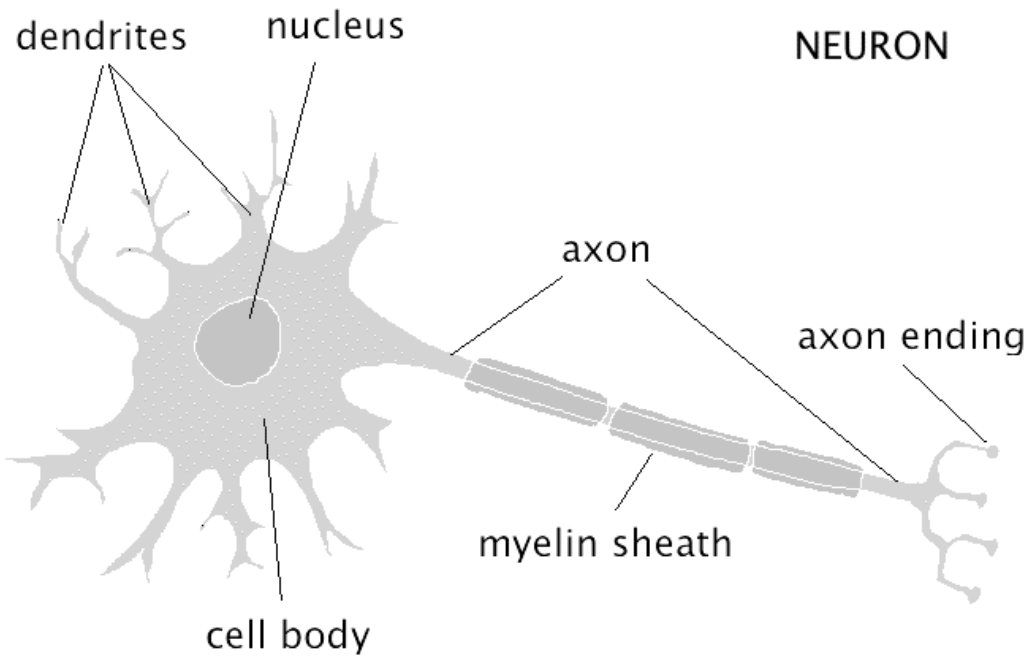


Figure 5.2: Neurones consist of three basic features - a cell body, dendrites that receive information, and axons that send information. In this diagram, the axon is myelinated to speed up the conduction time (Ward 2010, p.18)

Myelination is also more protracted in humans than chimpanzees. In humans, myelin develops slowly during childhood followed by a delayed period of maturity beyond adolescence (Jakovcevski et al. 2009; Yakovlev & Lecourse 1967;

Giedd et al. 1999; de Graaf-Peters & Hadders-Algra 2006; Kinney et al. 1988). In chimpanzees, however, the development of myelin starts at a relatively more mature level after birth and ceases development long before puberty (Miller et al. 2012). This suggests that the developmental timing of synaptogenesis and myelination is different between chimpanzees and humans.

The case of the SRGAP2 gene is a particularly interesting example (Charrier et al. 2012; Dennis et al. 2012; Guerrier et al. 2009). The SRGAP2 gene is responsible for the production of SsrGAP2 proteins, which control the growth of the dendritic spines and axon branches of neurones during infancy, structures that facilitate the formation of synaptic connection. In other words, the SRGAP2 gene controls the way in which neurones are wired together.

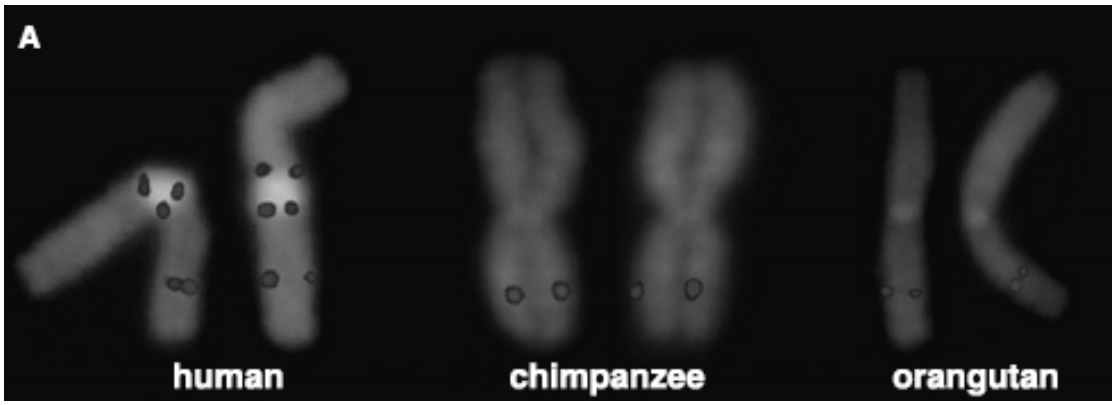


Figure 5.3: Chromosome 1 with the location of SRGAP2 copies highlighted in red (Charrier et al 2012)

This gene is one of 23 that are duplicated in humans, but not in primates (Sudmant et al. 2010). Humans have four copies, the original SRGAP2-A gene and three duplications (B, C, and D) (figure 4.5), whilst chimpanzees only have one. Dennis et al (2012) were able to reconstruct the sequence in which the duplications happened. It seems that SRGAP2-A duplicated into B, which in turn duplicated into both C and D. As duplicates mutate faster than the original gene, it was also possible to approximate when the duplications of the gene occurred. It has been suggested that the first duplication happened around 3.4 ma, the second around 2.4 ma, and the third around 1 ma (Dennis et al. 2012). All four SRGAP2 genes are present in the Neanderthal genome (Dennis et al 2012; Charrier et al 2012).

Significantly, the duplications are incomplete, meaning that a protein created by one of the duplications will not function correctly. This causes dendritic spines to grow for longer than they ordinarily would, making them denser and able to receive more information, which in turn allows them to form connections with more neurones, enhancing brain connectivity. Additionally, fewer axon branches are formed, allowing neurones to move into position faster and start forming synaptic connections sooner. Thus, the broken duplications of the SRGAP2 gene allow humans to form synaptic connections faster than chimpanzees, to have more of them, and allows them to grow and develop for longer. The implications of this for human brain development, and particularly the development of emotions and other higher cognitive functions cannot be underestimated.

5.2 Human Neurones

During human infancy, the brain goes though significant changes, not least a three-fold expansion in size. However, as the vast majority of neurones are formed before birth, the postnatal expansion is due not to an increase in the number of cells, but to an increase in cortical white matter, the non-neuronal cells that form connections between neurones (Markant & Thomas 2013). This is driven by a suite of intricately related developmental processes including synaptogenesis, the growth of dendrites and axon bundles, and the myelination of nerve fibres (Ward 2010, p.369).

More synaptic connections, however, do not necessarily make for efficient brain functioning. After the initial glut of synaptogenesis, the brain goes through a process of fine-tuning, the trimming of superfluous connections (Ward 2010, p.369). Processes of synapse stabilisation and elimination occur throughout childhood and well into adolescence (Goldman-Rakic 1987; Huttenlocher & Dabholkar 1997). Although concurrent synapse formation and elimination may seem inefficient, it is a vital part of the formation of the human brain. The pruning of redundant synapses is an experience dependent process, allowing the remaining connections to be tuned to individual engagement with and experience of the world (Markant & Thomas 2013). This allows the generation of complex

and individualistic neuronal systems through the combination of biological processes operating within the context of environmental and experiential influences (Markant & Thomas 2013). Neuronal connections are continuously fine-tuned by experience dependant mechanism throughout life, ensuring that neural systems remain plastic and malleable to a changing environment.

The significance of these developments in humans is played out by clinical studies. A number of researchers have reported that autistic children experience abnormal brain overgrowth, beginning around the second year of life and continuing until around four years of age (Courchesne et al. 2001; Sparks et al. 2002; Hazlett et al. 2005; Schumann et al. 2010; Redcay & Courchesne 2005; Stanfield et al. 2008; Courchesne et al. 2003; Dementieva et al. 2005; Dissanayke et al. 2006; Dawson et al. 2007; Mraz et al. 2007; Webb et al. 2007; Elder et al. 2008; Fukumoto et al. 2008). This overgrowth is greatest in the frontal and temporal cortices (Courchesne et al. 2007; Schumann et al. 2010), areas vital to higher cognition, and Sparks et al (2002) have found overgrowth in the amygdala, a structure vital to emotional processing. This overgrowth seems to be caused by the formation of an excess number of neurons (Courchesne et al. 2011) and synapses (Stoner et al. 2014). It appears that, in autistic individuals, developmental processes are occurring too quickly. The accelerated rate of early growth and premature arrest of growth in the autistic brain indicates abnormalities in cortical organization and connectivity, which prevents the brain from reacting to experience and learning based activity (Courchesne et al. 2011), precluding the refinement of neural organization and connectivity seen in normal brains. This causes the behavioural differences seen in autistic individuals with social and emotional cognition not reaching normal adult levels of understanding. Thus, the correct developmental timing for processes such as synaptogenesis and myelination appears vital for the development of higher cognitive function.

5.3 Seeking the difference

The conclusions to be drawn from neuroscientific investigations into human and chimpanzee brain development are significant. Whilst chimpanzee brain development might be protracted in comparison to other primates, human

development is more protracted still. Processes of synaptogenesis and myelination maintain prenatal rates of growth for longer after birth, continue further into childhood, and more connections are able to form. This allows the subsequent pruning of synaptic connections, fine-tuning neuronal circuitry to individual experiences. Overall, this allows human brain development to remain plastic for much longer than chimpanzees, allowing development to be highly complex and individualistic. The unique human developmental trajectory allows the human brain to be wired to experience, a vital characteristic for the computation of higher cognitive function, including elaborate emotional capacities and social cognition.

It seems likely that the duplication of the SRGAP2 gene during human evolution played a role in bringing about the modern human course of brain development, by speeding up initial synapse formation, allowing more to form early in life, and ultimately improving brain connectivity. The evolutionary timeframe presented for the duplication of this gene provides the beginnings of a bridge between the neuroscientific evidence for brain development and the implications of this for the emotional capacities of hominins. However, in order to complete this bridge, we must establish how the unique pattern of human brain development effects the emotional capacities of modern humans.

Thus, the difference between human and chimpanzee brains, and indeed process of change that took place during human evolution, is not restricted to size alone. Rather, there is a fundamental rewiring of the brain, related to complex developmental processes, which allows humans to develop highly complex and individualised neuronal circuitry, facilitating the computation of advanced higher cognitive functioning. If this is the case, it should be expected that significant behavioural changes occur during human infancy, as neuronal circuitry is refined. This is indeed the case.

The evolutionary change in developmental trajectory provides a coherent way of conceptualising the model of dynamic emotion change within the context of hominin evolution. If life history patterns changed throughout human evolution, with the period of child development lengthening, it would lay the ground work for the processes that led to sophisticated higher social cognition, and complex emotion, in modern humans.

5.4 Hominin life history patterns

The evidence outlined above suggests that human life history varies from that of other primates in a number of ways. In particular, humans have a longer period of gestation, earlier age at weaning, slower postnatal maturation, older reproductive age, and longer post-reproductive period (Bogin 1990). Of especial relevance is the slower post-natal maturation during which developmental processes of synaptogenesis and myelination permit the fine-tuning of neuronal wiring to experiences. By examining the life history patterns of early human ancestors it may be possible to establish the extent to which such developmental process were present in human evolution.

Many primate life history variables correlate strongly with the development of the brain and dentition, and can be inferred in fossil species from tooth eruption ages, and body and brain mass (Smith 1989; Godfrey 2001; Kelley & Smith 2003; Dirks & Bowman 2007; DeSilva & Lesnik 2008). For example, the age at weaning broadly correlates with the eruption of the first molar across primate species (Smith 1989; Smith 1994; Kelley & Smith 2003). Also, adult brain size is correlated with age at reproductive maturation (Leigh & Blomquist 2007; Robson & Wood 2008). However, the lack of information on neonatal and juvenile brain size is the main obstacle to studying patterns of infant brain growth evolution (Leutenegger 1987; Hausler & Schmid 1995; DeSilva & Lesnik 2008). Nevertheless, recently several studies have examined brain development in juvenile hominins (Coqueugniot et al. 2004; Alemseged et al. 2006; Coqueugniot & Hublin 2007; Poncé de Leon 2008; Gunz et al. 2010). This work has thrown up two very different results.

On the one hand, Coqueugniot et al (2004) argues that *Homo erectus* had a developmental sequence closer to apes than modern humans. In their study, they determined that the Mojokerto *Homo erectus* individual was about one year old at death and had an endocranial volume of 72-84% of an average adult. This, they argued, is closer to the percentage of brain growth expected from a one-year-old ape than a one-year-old human, implying major differences in the development of cognitive capabilities between *Homo erectus* and anatomically modern humans. This theory is supported by Dean et al (2001); whose research on tooth enamel

growth suggests that neither australopithecine nor early Homo fossils show the slow dental development seen in modern humans but resemble ape patterns. Robson and Wood (2008, 394), sum up this perspective on life history, arguing that prior to *Homo heidelbergensis* and *Homo neandethalensis* "there is no evidence of any hominin taxon possessing a body size, brain size or aspects of dental development much different from that of apes." This leads to the logical conclusion, that modern human life history patterns evolved quite recently, perhaps even as late as 500ka (Dean 2006; Hublin & Coqueugniot 2006).

Conversely, Alemseged et al. (2006) suggested that brain growth in *Australopithecus afarensis* did indeed differ slightly from extant apes. Both DIK-1-1 and A.L. 333-105 (juvenile A. *afarensis*) fall below the average endocranial volume of African apes of the same age, and are more similar to modern human ratios. Alemseged et al. (2006) interpreted this as evidence of a slower developmental pattern that would have been more prolonged than in apes. Additionally, Leigh (2004; 2006) argues that the proportional brain size of the Mojokerto individual is consistent with that of *H. sapiens* children as young as 10 months of age. Directly contradicting Coqueugniot et al (2004), this suggests that a modern human developmental trajectory may have begun to emerge quite early in human evolutionary history.

Initially, it seems hard to reconcile the two perspectives; however, the similarities lie in the detail. Neither Alemseged nor Coqueugniot et al. found evidence for a wholly ape or wholly human life history pattern. Their differing interpretations rest in their choice to cast hominin life history patterns as 'more human-like' or 'more ape-like' based on the variables they studied. This speaks of a general problem in hominin life history research. In most cases, modern humans and apes have been used to model the evolution of human development (Conroy & Vannier 1991; Smith & Tompkins 1995). This proceeds from the assumption that extinct hominins followed a developmental trajectory equivalent to a modern species. However, recent studies show that fossil taxa do not appear to fit either group (DeSilva & Lesnik 2008; Dean & Smith 2009), underscoring the fact that the use of humans or chimpanzees as a model is not ideal. DeSilva and Lesnik (2008) argued that using humans or chimpanzees as a baseline for hominin developmental patterns is not warranted, as there seems to be a gradual change

from the chimpanzee to the human pattern during hominin evolution. Specifically, O'Connell and DeSilva (2013) note that the Mojokerto individual falls almost directly between the average growth expected in humans and chimpanzees, and well within the range of both. More recently, Coufran and DeSilva (2015) have argued that the Mojokerto individual sits on a developmental trajectory intermediate between modern humans and primates. Alemseged et al (2006) also noted this in their analysis of the Dikika child. Ultimately, O'Connell and DeSilva (2013) argued that the developmental trajectory of *Homo erectus* cannot be dichotomized as either ape-like or human-like; "it was *Homo erectus*-like." Thus, *Homo erectus* should be seen as having a unique developmental pattern unlike those of primate species living today; that was an important step from primate to modern human patterns in its own right.

5.5 Meeting in the Middle

Taken together, the evidence for primate, hominin, and modern human developmental trajectories and life history patterns suggests that changing patterns of brain development in infancy may have played a significant role in the emergence of new types of cognition. The evidence for changes in hominin life history patterns suggests that the extension of the developmental period was a significant factor in the evolution of modern humans. This would justify the use of a developmental model of emotion cognition being used as the basis for a model of hominin emotion cognition.

6 Three hypothetical mindstates

In chapters 2 and 3, it was seen that discrete emotions, as posited by evolutionary and basic emotion theorists, did not evolve. This is because they do not exist as natural kinds, or entitative biological systems, but are instead categories of meta experience, folk psychological concepts based on subjective experience assigned to linguistic labels with social negotiated meanings. Thus, if we are to seek that evolutionary ontogeny of emotion we must look beneath meta-experience to the component processes which converge during emotional episodes.

In chapter 5, it was seen that the difference between the human brain and that of our last common ancestor with chimpanzees is more than a matter of size. During the 8 million years since our lineages split, humans have acquired a unique developmental trajectory. None of the processes are different, chimpanzee brains experience synaptogenesis and myelination as well, but they occur differently in humans. Initially the processes are faster, equalling foetal growth rates, and they continue for longer allowing more connections to form. Then, the synaptic connections are pruned; fine-tuned to experience with and engagement of the environment in which the individual is raised. This allows human neural circuitry to remain plastic, providing highly complex and individualistic brains.

In chapter 4, it was seen that a unique developmental trajectory allows humans to generate a vast array of emotions and put them into words. Through infancy and into childhood, we pass through a series of cognitive thresholds, which, whilst not furnishing us with new discrete emotional circuits, allows us to generate increasingly complex emotional computations. First, we become the subject of our own emotional mind as we begin to pay attention to our own place in the world. Then, our attention turns to our conspecifics as we begin to understand the implications of their emotional display for ourselves, and evaluate our own actions against their perceived standards or expectations of us. Finally, our emotions become more complex and nuanced as our cultural and social upbringing starts to stipulate the emotions and behaviours expected of us in certain situations.

Unfortunately, it is impossible to reconstruct the developmental trajectory of hominin species. It is also impossible to quantify the relationship between an increasingly protracted course of development, and a faster rate of synaptogenesis, to the cognitive milestones for the development of emotion cognition. In lieu of this, a theoretical framework must be used as a bridge to begin conceptualising the possible emotional experience of early human ancestors. To begin this process, we must first establish the basic psychological ingredients that underpin the construction to emotional meta-experience.

6.1 The Ingredients of Psychological Construction

The nature of the meaning making process that leads to the construction of emotional experience from core affect is the subject of on-going research (Feldman Barrett & Russell 2015). As outlined above, it is generally agreed, however, that the ingredients of meta-experience include: the biological processes of core affect, an appraisal processes for making sense of stimuli, and influences from socio-cultural factors. It is assumed that at least all mammals share the basic systems for core affect (Russell 2003), and can therefore experience the full circumplex of affective tone. The difference lies in the nature of appraisal and the role of socio-cultural forces in generating emotional meta-experience from core affect.

In the discussion of child development in Chapter 4, it was seen that human infants pass through three main phases of emotional development: self-conscious emotions, evaluative emotions, and emotional meta-experience. Each of these phases contributes to the construction of emotional meta-experience by adding a layer of complexity to the process of meaning making. Each of these phases is also associated with the emergence of a suite of cognitive traits that facilitate the conceptualisation of emotion experience (Fig 6.1).

Self-conscious emotions are associated with the emergence of **objective self-awareness**. These emotions are concerned with the subjects ability to recognises itself as an individual acting in and engaging with the world. Subjects are also able to recognise themselves as the subjects of others attention and to

allow this to guide their behaviour. This occurs through the processes of **joint attention** and **social referencing**.

Evaluative emotions emerge as individuals begin to perceive the intentions or motivations of others. Behaviour is mediated by internal or external standards with failure to match resulting in a presumed social sanction. In order to conceptualise these standards, individuals require the capacity for **causal inference**, the ability to understand that their actions may induce certain responses in others. Additionally, subjects will be able to **infer the intentions** of others actions and make **predictions** relating to their likely social behaviour.

Emotional meta-experience is the construction of emotion experience based on social and cultural scripts. This allows emotional experience to be guided imagined, socially negotiated concepts. **Analogical reasoning** allows individuals to think through these **abstract concepts. Language** is also an essential component of emotional meta-experience providing a discrete linguistic categories that anchor socially negotiated concepts.

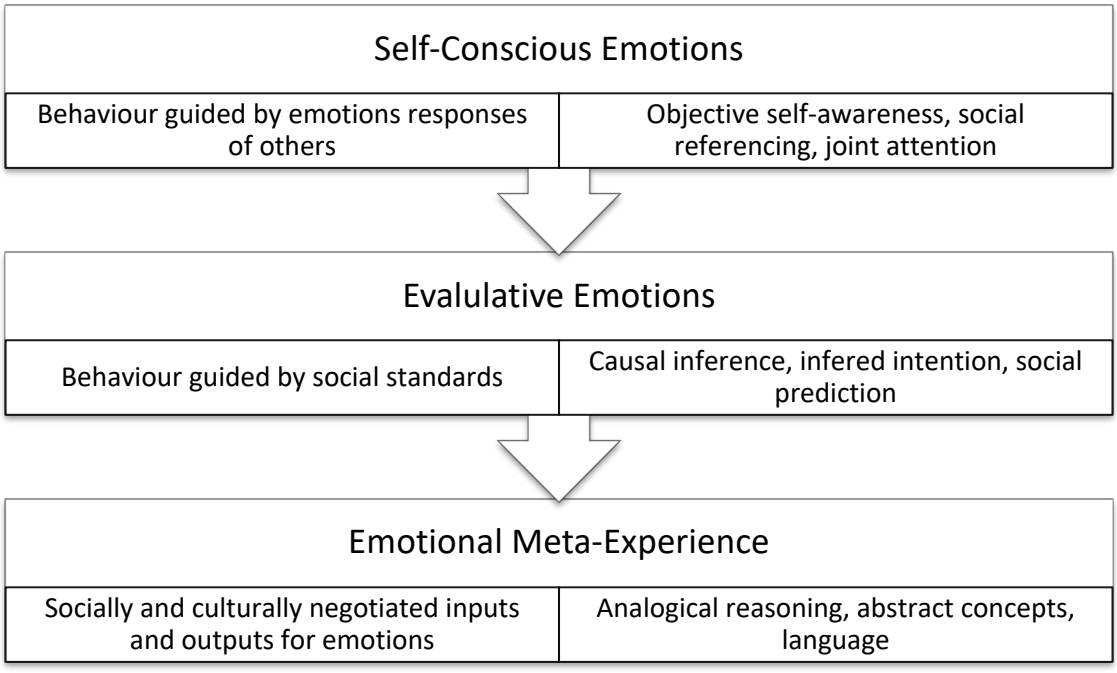


Figure 6.1: The psychological ingredients of emotional meta-experience

Whilst they are not primarily affective systems, there psychological ingredients provide the collective building blocks upon which emotional

experiences are built. Moreover, grouped together in this way, they constitute distinct and logical stopping points as the processes of meaning making become more complex. From these collections of psychological ingredients, it is possible to conceptualise three 'hypothetical mindstates' to articulate potential nature of emotional experience for a hominin possessing the requisite psychological ingredients.

6.2 Three Hypothetical Mindstates

The three hypothetical mindstates will be described briefly first and then in more detail below. Fig 6.2 provides an outline and Fig 6.3 illustrates the expected emotional repertoire of each mindstate on a circumplex diagram.

The first hypothetical mindstate, associated with the emergence of objective self-awareness, focuses on the self-aware subjects **interaction** with the world it inhabits. Initially, subjects are only capable of egocentric emotions. That is, individuals could respond to the affective behaviours of others, but not their mental state, with self- interested action. As such, individuals may be embarrassed at being the centre of attention, envious of another 's possessions, or act 'empathetically' to stop a conspecific from causing them distress (crying) (fig 6.3a). This is the mindstate of **Interaction (egocentric)**. When, **objective self-awareness** is extended through **social referencing** and **joint attention**, a subject may begin to experience **relational** emotions and affective responses to the perceived thoughts of others. As such, individuals may be embarrassed by the way they think others perceive them, jealous because of their perception of others, or act empathetically on behalf of others they perceive as being in distress (fig 6.3b). This is the mindstate of **Interaction (relational)**.

The third mindstates seeks to explain the **extension** of the subject's world to incorporate the emotional states and behaviours of conspecifics through the processes of prediction and extrapolation. This occurs when objective self-awareness matures to a fully reflexive self-awareness. This allows behaviour to be evaluated against a social negotiated standard, with the perceived expectations of others guiding emotional responses. If the individual is deemed to meet expectations they may feel pride, but if they fail, they may feel shame or guilt (fig

6.3c). This may be understood as the basis of an emotionally mediated moral code. This is the mindstate of **Extension**.

The fourth and final mindstate sees emotion states mediated by social and cultural categories through a process of **abstraction**, allowing the formation of emotion scripts. Scripts allow the causes and behavioural responses of emotion to be guided by social expectations and cultural norms. This gives rise to the vast array of culturally and situationally specific emotions observed ethnographically and historically, including accidie (a medieval sin of religious boredom), amae (a Japanese form of dependent love), and western romantic love (fig 6.3d). This is the mindstate of **abstraction**

Each mindstate brings with it new opportunities for engagement, both with others and things. It will also be seen that the mindstates are closely linked to the developmental trajectory of emerging emotional experience seen in children and outlined in the previous chapter. Each mindstate is accompanied by a circumplex diagram illustrating the proposed emotion vocabulary for a hominin at said stage of development.

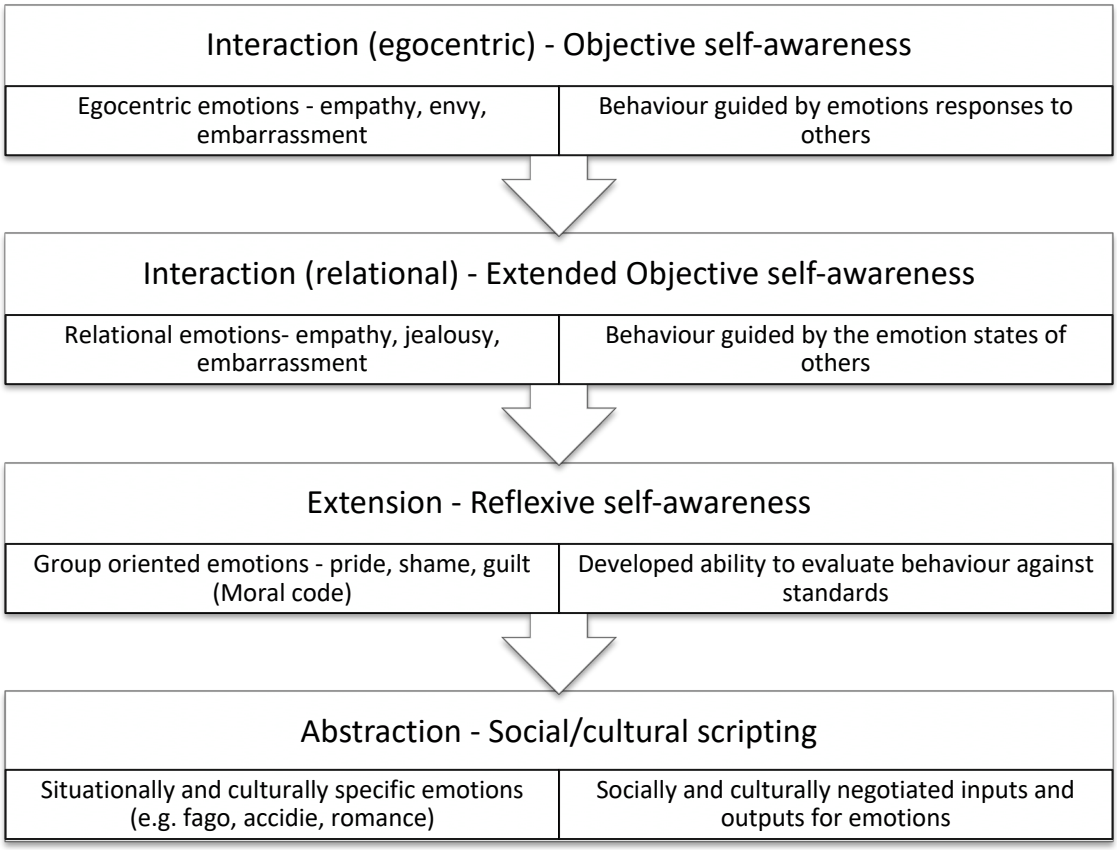
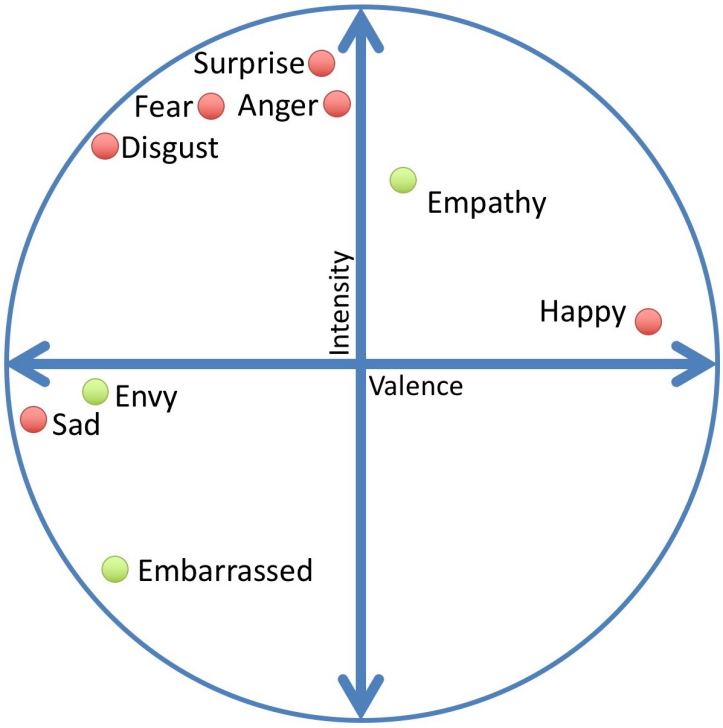


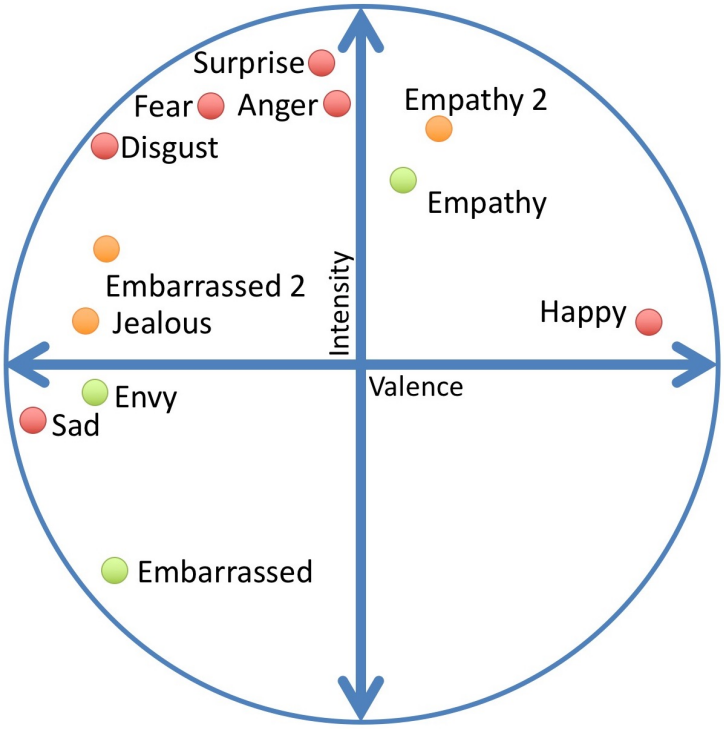
Figure 6.2: The Three Hypothetical Mindstates

Figure 6.3: The Three Hypothetical Mindstates displayed as circumplex diagrams

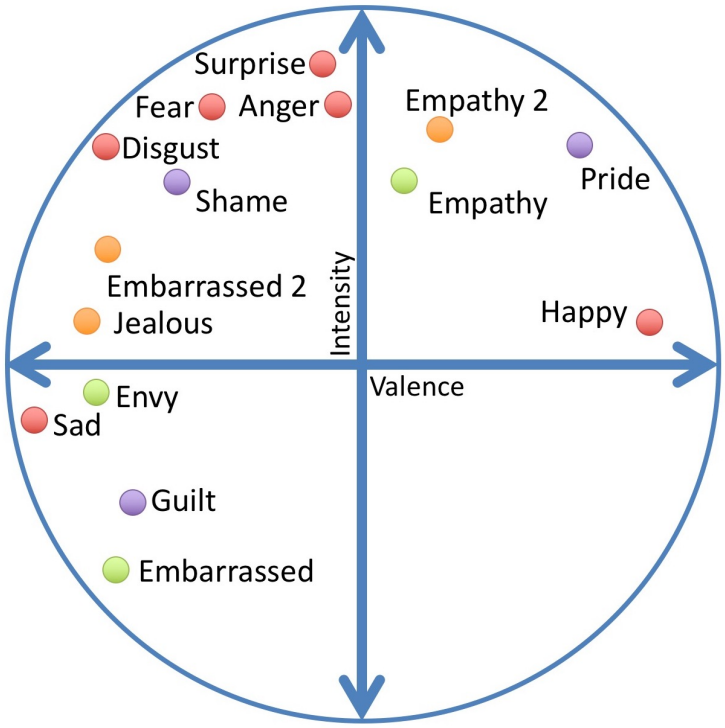
a. Interaction (egocentric)



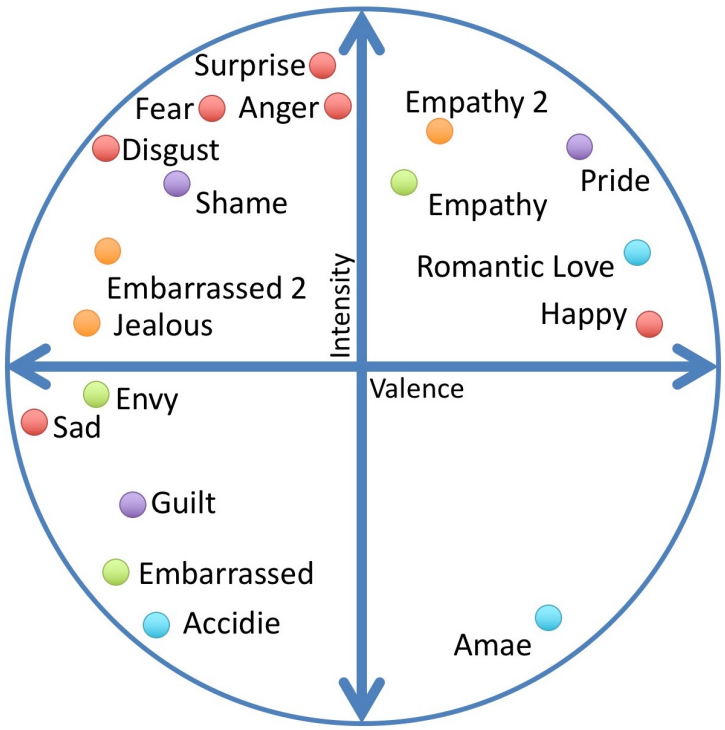
b. Interaction (relational)



c. Extension



d. Abstraction



6.3 Hypothetical Mindstate One – Interaction

In this first hypothetical mindstate, the individual has an egocentric, solipsistic conception of the world. Objects and agents are perceived only in relation to self, with the emphasis on personal relevance and individual experience. Other individuals are a source of affective significance, but are not afforded their own agency.

As such, in the hypothetical mindstate of interaction, others are experienced as sources of positive or negative valence. In the first phase of this mindstate, a self-aware subject will be capable of egocentric emotions. That is, individuals could respond to the affective behaviours of others, but not their mental state, with self- interested action. As such, individuals may be embarrassed at being the centre of attention, envious of another 's possessions, or act 'empathetically' to stop a conspecific from causing them distress (crying).

A more complex form of this first mindstate sees emotional responses guided by the inferred mental states of others. This allows for relational rather than egocentric emotions, with affective responses tailored to the perceived thoughts of others. As such, individuals may be embarrassed by the way they think others perceive them, jealous because of their perception of others, or act empathetically on behalf of others they perceive as being in distress.

The distinction between the two is subtle, but significant. Egocentric interaction sees subjects as passive receivers of valance, reacting to but detached from their conspecifics. Individuals are recognising that they are the focus of attention and reacting accordingly. Relational interaction, on the other hand, sees subjects form an appraisal of self against a perceived expectation. This is not yet a socially negotiated standard, but is a appraisal of expectations based on the specific nature of the interaction. So, for instance, in egocentric interaction, embarrassment may be experienced when negative valence towards self. In relational interaction, embarrassment may be experienced when an individual perceives negative valance as a failure of self.

These processes are both underpinned by the emergence of objective self-awareness. As described above, the emotional life of children changes profoundly as they come to understand themselves as the focus of other's attention. This

formative sense of self as the subject of other's attention, I-you self (Reddy 2003), allows individuals to understand that emotion is not always experienced as passive perception, but can be directed at self. As such, a fear no longer simply exists in the world, but can be understood as directed explicitly at self.

Others are now distinct from objects in that it is understood that the emotion is not passively experienced, but actively directed at the individual and may be changed through a process of interaction. Individuals can then enter into a process of interactive negotiation with others in order to maximise their experience of positive affect and minimise their experience of negative affect. In infants, this is associated with the acquisition of a theory of attention. This makes it possible for individuals to perceive not just the emotional expressions of other agents, but also to understand that these agents are directing particular emotions at them.

This allows individuals to react more complexly to these *agentive* emotions. It is understood that emotion directed at self can be changed by actions of the self. For instance, attention may be withdrawn and directed elsewhere, thus alleviating negative affect. Alternatively, attention may be attracted in order to experience positive tone directed at self. As such, agents are understood to exist within the world and can be interacted with, starting a process of negotiation in order to maximise the positive valance, and minimise the negative valance, received from conspecifics.

Additionally, joint attention is associated with the more complex form of the first hypothetical mind state. Here agent's attention is understood to be directed at an object in the world. The affective tone of a particular meaning carrier can then change based on the nature of the others' engagement, altering the meaning. This will allow others to begin to act together where goals coincide, or act in opposition when they do not as evidenced by the emergence of social referencing in children.

As such, when objective self- awareness interacts with an I-you self, emotional responses can be guided by inferred mental states of others. This allows for relational emotions, affective responses to the perceived thoughts of other. However, the conception of agents remains egocentric, as the perception of emotion remains a reflection on self. Intersubjectivity exists only in as much as

other agents are understood to direct emotion at self, and this emotion can be withdrawn from or directed in such a way as to benefit self. Individuals are yet to have a concept of other that allows them to understand anything outside of that which is immediately observable, such as beliefs or desires.

An individual in the hypothetical mindstate of interaction understands that self shares the world with other and that actions can have consequences on the emotional responses of other. Where goals coincide, two individuals can act together to maximise positive affect. The implications of others' engagement within the intersubjective lifeworld can also have significant for self through the process of social referencing. However, this process of affective negotiation is limited. Individuals can only understand others on the basis of what they can observe directly, body language and emotion expression for instance; they cannot go beyond the bounds of that which is immediately perceived. As such, interactions remains egocentric, focused on maximising positive affect for self. No consideration is given to the subjective experience of other. In many ways other is little more than a special object, one which can be engaged with but is not understood as an agent, with beliefs desires and goals.

6.4 Hypothetical Mindstate Two – Extension

The first hypothetical minds state saw the emergence of intersubjective interaction, the understanding that one is not alone in the world, that others perceive you and that you can affect the emotion tone they give off. In the second, these interactions are extended beyond the immediately perceived. This can include **predictions** made about the **intentions of others**, an understanding of the affect of behaviour on others, **causal inference**, and the integration of objects and memories. The key here, is that information may be incorporated that is not immediately accessible.

Perhaps the most significant change here is the use of sophisticated problem solving abilities to make predictions about the behaviour of interactants. Predictions may be made about others' intentions based on what can be observed in the intersubjective lifeworld, with connections being drawn between actions or events, and the emotions that they provoke. Thus, the second hypothetical mind

state sees the emergence of social influence and manipulation. Individuals come to understand the implications that their actions have on other, and how they can influence the emotional responses of social partners. As such, intense negotiation will occur as individuals attempt to pursue their own goals whist seeking to maximise their own exposure to positive valance. This will be guided by the development of social standards, rules and goals that influence the behaviours that are expected in particular situations.

Where the first hypothetical mind state remains egocentric in its focus on personal relevance, the second is truly social. Individuals will pursue their own objectives and may not always act altruistically, but they will be aware of the needs of their social partner, the affect their actions will have on others, and their own needs to receive positive affective valance. This allows socially negotiated moral codes to emerge, as others come to understand with more clarity the relationship between their behaviour and the likely behavioural responses of others, the emotional responses that their behaviour may provoke. With others now valid repositories for emotion, individuals will begin to feel shame, guilt, or pride about their actions based on the likely emotional response of others.

In one sense, the hypothetical mindstate of extension is concerned with chaining together separate instances of engagement. Relationships have historicity; individual dyadic interactions occur within the context of an ongoing relationship, with a history of previous interactions informing the nature of the subsequent interactions (Boiger & Mesquita 2015). Over the course of a developing relationship numerous interactions are chained together in the minds of the interacting agents in order to sustain a dynamic affective current running though the relationship.

A further characteristic if the hypothetical mindstate of extension is the extension emotionally salient relationships across distances. With an interactive mind, relationships are only emotionally salient during the process of a n interaction. However, the hypothetical mindstate of extension brings with it the psychological ingredients to extend relationships beyond the immediately observable. Transitional objects (Winnicott 1953, Litt 1986) provide a source for emotional attachment to be offset onto a surrogate object in order to manage the emotional stress of a separation. This is a particularly common tool for managing

the separation of a mother and her child, and is observed frequent in human infants coinciding with the appearance of evaluative emotions. Within the context of human evolution, it is possible to postulate that transitional objects may underpin the recruitment of material culture for non utilitarian purposes by hominins of the mindstate.

This is not just the extension of the intersubjective, but the extension beyond the intersubjective and may be called offline social reasoning (Bering 2006). This is the understanding that an individual can remain active even when they do not a part of intersubjective engagement. Without offline social reasoning, relationships become deactivated when social partners separate, when relationships go online. The ability to continue reasoning about a relationship when an individual is absent allows for others to influence behaviour from a geographical and temporal distance. At this point, it is likely that OSR only operates as a function of socially mediated moral codes, providing a face for the standards by which one is judging their behaviour. Later, absent individuals may take on abstract or symbolic forms. Where objects are used to mediate this process, they should not be understood as symbols. Their meaning is derived from the direct associations that they have acquired, they do not stand for the things that they represent, they are those things existing in the world (e.g. Armstrong 1971). In this sense, it may be possible to imagine these psychological ingredient providing the formative underpinnings of Clark and Chalmers (1998) Extended Mind.

Thus, the hypothetical mindstate of extension is concerned with the chaining stances of engagement together, both those experienced in the past and those imagined, predicted futures. Through this process individuals come to understand the causes of others' behaviour, that it can be influenced by the actions of individuals in the present. Whist others are still not understood to have their own minds, they are increasingly idiosyncratic and afforded more individuality in their actions. This process lead to in increasing distance between minds, and self comes to understand that it cannot always control other. As minds become increasingly severed from each other, with the understanding that others may not be taken at face value alone, individuals come to need mechanisms to tie minds together. Things, as transitional objects, may fill this space.

6.5 Hypothetical Mindstate Three – Abstraction

Once interactions have been extended beyond the immediately perceived it becomes possible for abstract categories to begin to guide behaviour. As such, the hypothetical mindstate of abstraction will see the dominance of emotional meta-experience and ontological subjective categories as the framework though which the world is perceived and understood. These categories are socially constructed and mediated, and individuals understand that others have minds and their own subjective experience of the world, and groups come together to find ways to share this experience.

In order for ontologically subjective categories and meta experience to attain significance, they must be anchored in the real world, either through communication or material culture. In this sense, they are by their very nature symbolic, as a single word or objects can become a socially negotiated repository for emotion. The hypothetical mindstate of abstraction, then will see the emergence of increasingly complex ontologically subjective categories as more and more information comes to be invested in symbols.

Perhaps one of the key processes that occurs during abstraction is the understanding that others have full and complex minds. An understanding that others may have a completely different world view to self practically destroys the intersubjective lifeworld as a valid concept. Now anything can be a valid motivator for the behaviour of others, this does not have to be based on the observable so long as it can be imagined. This puts an immense cognitive load on interacts as they are put under pressure to imagine the multitude of possible things affecting a social partner's behaviour. This creates a requirement for a mechanism of quickly parsing information in a manageable way. Ontologically subjective categories (Searle 1995) provide such a mechanism as large quantities of information can be offloaded into categories used to understand other. It becomes easier to understand other in terms of social roles, such as parent, friend, or enemy, than to imagine their historicity complexly.

In the first instance, ontologically subjective categories will be underpinned by the construction of emotion scripts based on direct or

communicated experience of the world shared and agreed upon by members of a social group. Ultimately, this will lead to increasingly abstract categories as individuals come to be understood in terms of the ontologically subjective categories with which they identify, be that their profession, nationality, religion, or sports team. Once these categories are created individuals can invest affectively in them, creating strong affective bonds to socially constructed groups. Once an ontologically subjective category has been invested in, individually may chose to display their affiliation. This may be done through the use of personal ornamentation.

As already mentioned, the construction of ontologically subjective categories and meta experience requires the communication of internal mental states to create consilience. As such, the hypothetical mindstate of abstraction will require language to facilitate the construction of ontologically subjective categories and the sharing of subjective mindstates.

It has been seen that the hypothetical mindstate of abstraction marks the dominance of abstract concepts as a framework for understanding the world. Others are understood as separate minds that have their own subjective perception of reality. These subjective perceptions are shared to create a socially mediate experience of the world to which interactants conform or deviate. This includes emotional meta-experience and the formation of increasingly complex and culturally significant emotional experiences relevant to the unique experiences and environment of the group. This experience becomes guided by increasingly complex abstractions formed to provide easily proceed heuristics. Rather than being understood as complex individuals, others come to be parsed in terms of the ontologically subjective categories to which they conform and identify. These categories become loaded with affective meaning as the imagined world, at is core, is fundamentally an affective one.

Ontologically affective categories based on emotion scripts allow the causes and behavioural responses of emotion to be guided by social expectations and cultural norms. This gives rise to the vast array of culturally and situationally specific emotions observed ethnographically and historically, including *accidie* (a medieval sin of religious boredom), *amae* (a Japanese form of dependent love), and western romantic love.

6.6 Conclusion

Above, it was shown that the psychological ingredients of emotional meta-experience coalesce into three coherent hypothetical mindstates. These provide broad heuristics that can be used to predict the emotional repertoire and behaviour of organisms that exhibit the underlying psychological ingredients.

Interaction – in the first instance, emotional experience is dominated by objective self-awareness. That is, individuals could respond to the affective behaviours of others with self- interested action. They are not able to conceptualise the mental state of others', however, the may be able to make some basic inferences based on their behaviour and respond appropriately. This produces a repertoire of self-conscious emotions including embarrassment, empathy, and jealously, which are reinforced by social referencing and joint attention.

Extension – in the second mindstate, individuals are able to reason more complexly about the minds of conspecifics. Causal inferences and behavioural predictions allow the construction of social negotiated standards by which an individual's own behaviour can be guided. This produce a formative moral code reinforced by social emotions like pride, shame, and guilt. This extension of reasoning allows individuals to imagine the likely responses of conspecifics who are not present, thereby reasoning about their offline relationships. This may be scaffolded by the use of transitional objects to reinforce offline relationships.

Abstraction – in the third mindstate, emotions become influenced by abstract concepts that are mediated through social and cultural processes. These abstract concepts are reliant on analogical reasoning and language to provide a basis for others to understand and share in them. This produces an increasingly diverse array of emotions that are culturally specific and will reflect the unique circumstance of the society in which it develops.

These three hypothetical mindstates represent a conceptual framework which can be used as a heuristics from which to construct interpretations of the archaeological record. However, before this can happen, we must seek to establish a rough timeframe for the emergence of these mindstates during human evolution.

This can be done by seeking archaeological evidence for the phycological ingredients that make up the hypothetical mindstates.

7 Seeking the Ingredients of Emotional Meta-Experience

In this chapter, evidence for the psychosocial ingredients that underpin the processes of emotional experience will be sought in the archaeological and paleoanthropological record. Whilst they are not primarily affective systems, by their nature they change the types of emotional experiences that organisms can generate. As such, if there is evidence that the ingredients for emotional meta-experience emerged in a systematic fashion during human evolution coinciding with changes to the developmental trajectory of hominins, it may be presumed that the emotional experience of hominins developed in a corresponding fashion. As such, it may be posited that if the psychological ingredients are present, then the hominins may be placed within the corresponding hypothetical mindstate.

7.1 The Psychological Ingredients of Self-Conscious Emotions

The primary ingredient for the construction of the hypothetical mindstate of Interaction is an understanding of self as the subject of attention, or **objective self-awareness**. Reddy (2003) has referred to this as an I-You self, a conception of self emerging from being the subject of attention from others. Understanding one's self as the subject of others attention is the foundation for **joint attention**,. This allows individuals to understand the personal relevance of other's emotional expressions and to experience positive and negative affect from interactions with other agents. They may also begin to negotiate in order to maximise positive affect and minimise negative affects. It also makes **social referencing** possible, the ability to derive affectively salient information from the emotional behaviours of others. By engaging in joint attention, conspecifics are able to work together to achieve goals, behaviour which will underpin the establishment of truly social relationships.

The classic test for objective self-awareness is the mirror recognition test (Gallup Jr 1970; Povinelli et al. 2003). Conceived by Gallup, these experiments place a red dot, or other visual marking, on the face or forehead of an animal that

has been acclimatised to a mirror. If the animal responds to their changed reflection in the mirror, by touching the marking or some other behavioural cue, it is taken as an indication that they can connect what they are seeing in the mirror with changes to their own body. Chimpanzees and orang-utans seem to be able to do this whilst evidence is unclear for gorillas. Monkeys tend not to pass the mirror recognition test, but Hauser (2000, 108-9) argues that this is because the changes are too subtle, and has demonstrated positive results with more significant changes to the subject's appearance when studying cotton-top tamarins.

As such, the evidence seems to indicate that chimpanzees at the very least are able to direct attention towards their own body and understand that there is a connection between that attention and changes to the body (Gardenfors 2003, 116). It is important to note, that this should not be taken as an indication that chimpanzees are self conscious, there is not evidence that they are capable of the sort of introspection this would imply. Rather, it is an indication that they are self-aware, aware that they exist as an entity separate from others.

Like human infants, chimpanzees enjoy being the subject of attention from an early age, smiling at familiar stimuli, laughing when tickled, and imitating facial expressions (e.g. Bard 2003, 2005, 2007). Chimpanzees also have gaze following skills equivalent to an 18 month old child. At the age of 6 months children can follow their mother's gaze if her head is also oriented in the direction of the gaze, at 12 months only pupils need to be directed, and at 18 months children can follow gaze even if it is located outside of their field of vision. (Butterworth and Jarrett 1991). Chimpanzees can follow an experimenter's gaze, even if it is directed outside their field of vision, and will even attempt to located a point if it is hidden behind a screen (Povinelli and Eddy 1996).

This indicates that chimpanzees are able to coordinate joint attention based on gaze following. Indeed, joint attention has been observed in chimpanzees at 5 months of age (Bard et al 2014), and older chimpanzees are capable of many behaviours requiring joint attention such as intentional communication, pointing, cooperation, and social referencing (Bard et al. 2014; Boesch 2012; Leavens & Racine 2009). This shows that primates are capable of understanding what others see. Joint attention is slightly more complex, requiring an understanding that both subject and interactant can understand what each other see. Again, it is not

necessary to understanding how others see the world, simply what they are looking at.

Of particular relevance is social referencing, that is the ability to understand the implications of others' emotional responses for oneself and to adjust ones actions based on this information (Feinman & Lewis 1983; Klinnert et al. 1986; Moses et al. 2001; Sorce et al. 1985; Widen & Russell 2010b). Young chimpanzees do seek emotional messages about objects from caregivers in a way comparable to social referencing in human infants (Russell et al 1997). This is particularly true of young chimpanzee infants raised in socially rich environments (Russell, Bard, and Adamson 1997), but has also been observed in the wild as well leading Boesch (2012, 149-50) to argue that the chimpanzees' world is "being 'transformed' by the social culture to which an infant belongs".

Assessing the cognitive abilities of non-human animals is a complex business. Many of the tests used to assess humans require responses in written or spoken language and so cannot be used. The difficulties in communication prevent researchers from knowing with any degree of certainty what their subjects are actually experiencing. However, researchers have managed to narrow the field, and whilst there remains much disagreement, it is possible to say something of relevance here.

There is evidence that chimpanzees have a sense of self and are able to understand that others can direct their attention at, or away from, self. They are able to enjoy, or dislike, the attention that is focused on them and can recruit this into their decision making process, whether this is attempts to maximise positive affect or in instances of deception. There is also some evidence that chimpanzees raised in socially rich nursery environments are capable of more complex types of joint attention, such as social referencing. This presents a somewhat confused picture. Considering the evidence for primate social cognition, it seems that chimpanzees are capable of displaying all the behaviour that is associated with the self-conscious emotions at least some of the time, but most of the time they only show some of the behaviours. Given that the more complex behaviours are generally only displayed consistently in social rich environments, it may be reasonable to infer that, whilst chimpanzees are on the road to a fully objective

self-awareness this faculty is not yet fully integrated into broader cognitive processes.

A similarly complex picture may be seen for the earliest hominins. It may be presumed that as australopithecines had a cranial capacity about the same size as that of modern chimpanzees (Robson and Wood 2008) they also had similar cognitive abilities. However, the archaeological record suggests that the picture may be more complex.

Even the earliest Lomekwian stone tools, dating to 3.3 mya, indicate a developing understanding of the technological aspects of stone tool making, including stone fracture mechanics and the processes of core reduction (Harmand et al 2015). Certainly, the Oldowan tools from Lokalalei 2C, dating to 2.3 mya, indicate that hominins were operating at a technological level in advance of that which could be expected of extant chimpanzees (Delagnes and Roche 2005). Indeed, Oldwan industries would have required social arrangements to provide sufficient opportunity for participation by learners (Stout et al 2015). At a bare minimum, this requires social tolerance among conspecifics: the simple opportunity to share activity space without conflict. In fact, varying degrees of social tolerance do seem to influence the distribution of tool use across modern ape populations (van Schaik et al. 1999). Even in the nut-cracking chimpanzees of Bossou, Guinea, a lack of adult tolerance for juveniles may inhibit skill learning beyond infancy because only infants are afforded 'opportunities to freely access stones and nuts' (Inoue-Nakamura & Matsuzawa 1997). A relatively high degree of social tolerance would have been important prerequisite for the development of increasingly diverse and skill-intensive tool behaviours during hominin evolution.

Thus, it may be inferred that joint attention and social referencing would been required to provide a rudimentary imitative learning mechanism for early hominins to begin to grasp the basic methods for manufacturing simple tools, in addition to more general resource acquisition strategies. Indeed, it has been suggested that an overreliance on imitation and emulation may have prevented Oldowan tool technology from developing until language based teaching made Acheulean technology possible (Morgan et al 2015).

As such, whilst early hominins may not have been able to understand complex discrete categories of emotion, it is possible that they were able to learn

from observing the positive or negative emotional responses of others. These opportunities for engagement suggest that even the earliest hominins were in possession of at least some of the psychological ingredients required for the construction of self-conscious emotions.

This ties in with the observations by Alemseged et al (2006) and DeSilva and Lesnik (2008) that the *Australopithecines'* developmental trajectory would have differed slightly from chimpanzees. Whilst not large, the prolongation of infant development, driven by a need for bigger brains in the context of obstetric constraints, may have been a significant first step, particularly if coupled with a corresponding prolongation of foetal growth (Bogin & Smith 1996). Whilst not substantially changing overall life history patterns or the need to share infant costs (Lee 2012), *Australopithecine* females would have experienced a longer period of gestation and infant dependency.

An intensification of the mother-infant bond is the logical result of this, and would seem to be supported by anecdotal accounts of mother-infant grief in a series of social mammals and non-human primates. Carrying dead infants has been observed in chimpanzees (Biro et al. 2010) and Yunnan snub-nosed monkeys (Li et al. 2012); Others have suggested that chimpanzee reactions to dead individuals reveal that they experience 'grief' (Anderson et al. 2010). African elephants have evolved a suite of behaviours that are exhibited upon the death of a conspecific, including standing close to the carcass and investigating the carcass using feet, trunk and tusks (Poole & Granli 2011), agitated and possibly compassionate displays (Douglas-Hamilton et al. 2006). Additionally, recent evidence suggests that giraffe also react to their dead with vigilant guarding (Muller 2010) and carcass inspection (Carter 2011; Bercovitch 2012). Because of this, it has been suggested that giraffe have closer family ties than often assumed (Muller 2010). All attested instances of grief have focused primarily on the mother's response to the death of her infant, with conspecifics responding to this. It is possible to see this the co-option of the Panksepp's (1998; 2012) separation distress mechanism, which ensure mothers are attentive to dependant offspring. The extension of this response to separation caused by death can be seen as a function of the increasing intensity of mother-infant and group bonds in social

species. If this can be seen in extant primate and other mammals, a more complex form of grief or separation distress should be expected in Australopithecines.

7.2 The Psychological Ingredients of Evaluative Emotions

The construction of the hypothetical mindstate of Extension requires an ability to incorporate predictions about the future and memories of the past into the cognitive appraisals one makes of the present. **Predictions** will arise from drawing **causal inferences** between two seemingly disparate observations, which may be experienced intersubjectively or remembered from past instances of engagement. This allows individuals to begin to deduce what may be motivating the other's behaviour. Thought of in this way, **intentions** are understood as special cases of causes; they are the "hidden variables in the minds of other agents that can be used to explain their behaviour" (Gardenfors 2003, 89). There is no need to understand the minds of other abstractly, rather deductions are made based on what can be observed concretely. The ability to infer causation is also a key building block for the ontologically subjective categories that will come to form emotional meta-experience (Fugate 2014).

Primates seem able to foresee the effects of theirs and others actions, however, there is some doubt as to whether they can grasp the causes of physical events or others actions (Gardenfors 2003, 89). From a very young age children are able distinguish between effects caused by physical forces and those caused by agents (Premack 1996), but monkeys and apes struggle to understand the effects of physical causes (Povinelli 2000). In a series of experiments testing the abilities of apes to understand different types of causation, Povinelli (2000, 207) concluded that: "the principles of chimpanzee folk physics are founded upon things that can be directly perceived, including action sequences that can be generated from imagination or held in memory as visual imagery". This would seem to suggest that chimpanzees do not possess the cognitive ingredient of causal inference, with their interactions taking place intersubjectively and not extended beyond it. Tomasello (1999, 19) would seem to agree, suggesting that chimpanzees "do not view the world in terms of intermediate and often hidden

'forces', the underlying causes and intentional/mental states, that are so important in human thinking" (see also Povinelli 2000, 298).

It is not just, however, that chimpanzees remain within the intersubjective world. They also appear only to understand the world in terms of its personal relevance to self. Gopnick (1998, 104) argues that: "Other animals primarily understand causality in terms of the effects on their own actions on the world. In contrast, human beings combine that understanding with a view that equates the causal power of their own actions and those of objects independent of them."

Primates certainly understand third party relationships, this providing the basis of the understanding of kinship and dominance hierarchies (Tomasello and Call 1997). However, this does not mean that chimpanzees are capable of understanding intentions – simply actions that have causes that can be attributed to representations of third party relationships (Gardenfors 2006, 90). In other words, chimpanzees are very good at making predictions based on what they can observe intersubjectively, but cannot extend their reasoning beyond this.

Tomasello and Call (1997, 387) have argued that: "If they [chimpanzees] understood others' intentionality, they should be able to develop novel strategies that take into account the intentions or beliefs of others, learn novel strategies by observing others' behaviour in communicative and other problem solving situations, …". This contrasts with 18 month old children who are able to understand the intention of an action that was interrupted and remains incomplete with sufficient clarity to perform the action successfully themselves (Meltzoff 1996). This is not a representation of mind, simply a representation of the goal. The distinction is significant as an understand of mind implies the construction of other as a subject, whereas understanding only goals leave other an agent. As such then, primates seem able to understand "antecedent-consequent relations in the behaviour of others," but they seem to have no conception of "a psychological component in terms of the intentional and mental states of other that mediate their interactions with their environments" (Tomasello and Call 1997, 387).

If chimpanzees do not show signs of possessing the psychological ingredients for evaluative emotions, we must look to early human ancestors in order to establish when these ingredients emerge.

The appearance of Acheulean tools in the archaeological record about 1.7 mya (Lepre et al 2011; Beyene et al 2013) may have been caused by the emergence of more effective transmission of technological knowledge (Morgan et al 2015). As outlined above, Oldowan tools appear to be beyond the technological capacities of chimpanzees, but still only require imitation or transmission, reinforced by imitation and emulation to transmit. (Morgan et al 2015). Stout et al (2015), for instance, found that predictive abilities did not have a strong influence on the ability of modern knappers completing Oldowan flaking tasks. However, the abilities to make success technological choices based on prediction was consistently associated with success in handaxe making (Stout et al 2015). This is because the techniques required for the manufacture of a handaxe, that is bifacial flaking, are more difficult to replicate consistently (Stout 2011). It seems likely that Acheulean technologies would require a process allowing the effective and reliable transmission of knapping techniques and sub-goals in order to consistently replicate the distinctive and regular shapes (Gowlett 2006).

This argument fits with evidence from neuroimaging studies suggesting that Acheulean toolmaking is associated with increased responses in the prefrontal cortex (Stout et al 2008, 2011), thus meaning that handaxe manufacture requires a higher level of cognitive facility that the Oldowan. This lead Stout et al (2015) to conclude that "explicit prediction and evaluation of toolmaking action outcomes may be unnecessary for effective Oldowan flaking but is a normal part of Acheulean handaxe- making skill."

As such, it is argued that the predictive abilities required for the production of Acheulean handaxes indicates that early human ancestors had by this point acquired the psychological ingredients associated with evaluative emotions. Handaxe makers are able to extend their mind beyond the immediately intersubjective to understand the consequences of their actions.

This would appear to suggest that the emergence of evaluative emotions may have corresponded with the emergence of the more complex Acheulean technologies. Indeed, this would correspond with the first major shift in life history patterns observed with the Mojokerto individual, c, 1.4 mya, with O'Connell and DeSilva (2013) describing life history patterns at this time as neither ape nor human.

Martin (1983) has argued that 850cc is a tipping point in the development of hominin brain growth. One of the main constraints limiting brain size at birth is the size of the birth canal. Based on an analysis of pelvic dimensions across a range of mammals and primate including fossil taxa, he suggests that an 850cc adult brain may have been achieved by all fossil hominins by lengthening the foetal growth stage. However, the pelvic inlet of fossil hominins and living humans does not allow for sufficient foetal growth in order for an adult brain to exceed 850cc. Thus, a period of rapid and extended postnatal brain growth and slow body growth is needed, as seen in modern humans. Australopithecines could have achieved their adult brain size largely through extension of the foetal period and a slightly increased period of infant dependency, as discussed above. This pattern would, however, place severe demographic constraints on early hominins, with the foetal period almost prohibitively long (Bogin & Smith 1996). The addition of a childhood stage, a longer period of postnatal brain growth, along with new resource acquisition strategies, would have circumvented the demographic constraints. The hiatus of relative brain expansion in Homo ergaster may well represent a stage in the transition from mainly foetal to mainly post-natal brain growth. Homo erectus would have seen a longer childhood still, but benefited from a shorter infancy.

An increased period of infant dependency would have necessitated the recruitment of additional help for the mother. Frequently, it is proposed that this resulted in the establishment of paternal investment in childcare (e.g. Lee 2012). However, Bogin et al (2014) have convincingly argued that allocation of childcare in humans is defined culturally rather than biologically. Thus, it may be incorrect to describe humans as kin-based 'cooperative breeders' in a strictly biological sense. The term 'biocultural reproduction' may be better suited, where additional care is sourced from the group as a whole. The development of a 'biocultural' reproductive strategy in Acheulean making hominins would allow for the existence of a suitably enriched social environment to allow infants to develop group specific standards and a context for the evaluation of their behaviour. It should be expected that hominins, like human infants, acquired this ability gradually, perhaps with the earliest manifestations being seen in modern day chimpanzees and therefore in *Australopithecus* as well. However, it would not

have been until some point during the Acheulean that they became the dominant force in emotion processing.

A knock on effect of the psychological ingredient of this mindstate is the emergence of offline social reasoning (OSR). This is the ability to imagine a conspecific as having agency despite not being in direct contact with them (Bering 2006, pp.455–6). This is an essential process for the formulation of standards, rules, and goals, allowing them to remain an influence on decision making even when an individual is not in the presence of conspecifics. A contrast here to the hypothetical mindstate of interaction where individual only influence behaviour when they are presence. The consequence of off-line social reasoning is the development of something akin to a formative moral code, with behaviour constantly measured up against the socially negotiated standards. An ability to formulate such mentalization would also seem to be required for sophisticated, organised resource acquisition strategies, which require individuals to work together when all members of a group may not be in visual contact, as well as supporting sociality in increasingly large groups. OSR may have had several knock-on effects. First, it can cause relationships to remain emotionally salient when individuals are apart, resulting in grief experiences being extended in intensity and longevity. Second, OSR may provide a further opportunity for material culture, in the form of transitional objects, to become an alternative stimulus for absent individuals and begin to play a role in mediating extended networks.

7.3 The Psychological Ingredients of Emotional Meta-Experience

The ability to construct emotional meta-experience and the hypothetical mindstate of Abstraction requires imagined concepts to be recruited into the appraisal processes. Much of this is achieved through the construction of ontologically subjective categories, which allow individuals to understand the thoughts and feelings of others through socially negotiated categories of meaning. In order to construct ontologically subjective categories, individuals must have a theory of mind, causal inference, analogical reasoning, and language (Fugate 2015). A Theory of Mind allows individuals to understand that other has a

mindstate and begin to reason about what they may think, believe, or intend. Causal inference, as outlined above, allows ontologically subjective categories to be incorporated into the appraisal process as causes of others actions. Analogical reasoning allows associations to be made between two otherwise desperate observations under the rubric of an ontologically subjective category. Language is necessary for the communication and negotiation of ontologically subjective categories.

In order for ontologically subjective categories to exist, people must collectively agree and make a declaration about its existence (Searle 1996). A key part of making such a declaration is that those involved in its inception must be able to share and understand their own and others' mental states. The cognitive ability to attribute mental states to others and understand that these motivate their behaviour is known as Theory of Mind.

Traditionally, studies of Theory of Mind have concentrated on the representational ability to assign mental states to others. However, there is some debate as to whether this truly constitutes a Theory of Mind. Much of the information necessary to understand another's emotional state is provided by feedback through facial expressions and behaviour. As such, it is not necessary to abstractly represent the mind state of another, as in classic Theory of Mind, rather behaviour can be guided by observed phenomenon. Instances where an other's intentions can be deduced from that which is observable intersubjetively are a part of the hypothetical mindstate of intention as outlined above.

In the case of meta-experience, observed behaviour is not enough. It is required that one understand that others share an ontologically subjective category and conform to it. Thus, interpretations are made about the mental state of others based on the ontologically subjective category. The concept of meta-experience implies more than deduction of mental state from observable phenomena. Rather, a level of abstraction is required in order to see beyond the immediately visible.

Whether non-human animals have a Theory of Mind remains somewhat open to debate with much controversy (Povinelli and Vonk 2003). Those who have raised encultured primates generally are unequivocal in assigning a theory of mind to their charges (e.g. the language trained Bonobo Kanzi, see Savage-

Rumbaugh 1994). One of the most commonly cited examples of theory of mind in primates are displays of deception, where primates use behaviour cues from others to preform complex behaviour feats taking into account the likely thoughts of conspecifics (Baboons: de Waal 1995, 105-6; Chimps: Woodruff and Premack 1979, Povinelli and DuBois 1992).

However, often these types of behaviour can be accounted for as complex simulation based on what is immediately observable intersubjectively. Penn et al (2008) have argued that many Theory of Mind tests used on chimpanzees yield false positives, where complex reasoning is all that is required. In these instances complex problem solving abilities produce results that appear require a Theory of Mind, but in fact can be accounted for within the hypothetical mindstate of extension. For this reason, it would be dangerous to assume that *Homo habilis* was capable of forming meta-emotional experiences, despite the suggestion that it may have possessed a Theory of Mind (Dunbar 2007).

Language, however, is more difficult to fake. Part of the process of emotional meta-experience is the assigning of the subjective experience of core affect to socially and culturally negotiated categories. These ontological subjective categories (Searle 1996), have no entitative meaning beyond that which is negotiated between members of a social group. As such, the experience of shame is not simply a knowledge that one feels shameful, but an understanding that one's shame corresponds to other's experience of the same emotion. This requires the construction of a concept of shame external to the subjective experience of social partners, but to which individual experience conforms. Many things contribute to this concept, but it can include: an understanding of causation, a phenomenological experience, an expression and display rules, and a behaviour response, but generally all these components are brought together into a cohesive whole under the auspices of a single word or phrase.

Words, like objects, anchor abstract categories: coordinating behaviour, physiology and brain activity into meaningful categories (Fugate 2015). They do this by highlighting commonalities between objects or events that share few perceptual or structural characteristics (Ferry, Hespos & Waxman 2010; Fulkerson & Waxman 2007). In many ways, words are a kind of "conceptual glue", and serve to create an almost statistical regularity between the subjective

experience of individuals (Barrett 2006a, 2006b; Barret et al 2007; Lindquist & Gendron 2013).

This can be seen in the role that words play in the accuracy of emotion self reporting. Several studies have looked at the impact of restricting or limiting access to emotion words on the level of agreement between multiple correspondent's recognition of facial expressions (Gendron et al 2012; Lindquist et al 2006). It was found that without words there is generally less agreement over the observed expressions. Allowing people to use words, however, improves the accuracy of reporting (Fugate et al 2017).

Ultimately, it can be seen that language plays a key role in the types of ontologically subjective categories that a person recognises. In many ways the words in a person's vocabulary affects the way they think about the world (Whorf 1956). This can explain why several studies have found that emotion words play such a vital role in construction emotional experience (e.g. Lutz 1988). Cultures create words, and by extension ontologically subjective categories, for the types of experience that seem important to them. This creates a coalescence of subjective experience, with individuals experience the emotions they have words for, with this experience perpetuated over time with the survival of the word. This is not to say that without a word, a particular type of emotion episode cannot be experienced, simply that it will not be so affectively communicated and therefore will not become part of the socially negotiated emotional meta-experience.

Fugate (2015) has asked whether language is necessary for the construction of ontologically subjective categories, or whether the cognitive skills required for language are enough. As has been seen, words serve as symbols that anchor perceptually ill-defined categories. In the absence of words, an organism would need some other way to anchor categories, which must serve as a relational device for processing information according to the perceptual categories. Having and using such relation devices is the key to forming analogies, a skill called analogical reasoning.

In animals, analogical reasoning is tested with relational or same difference tasks. The only compelling evidence comes from language trained chimpanzees (Premack 1988). There is limited empirical evidence that any non-human animals are capable of analogical reasoning. This suggests that, in the absence of language

(or symbolic training) or extensive training, an individual is capable of understanding relationships in terms of categories that are not grounded concretely in perceptual reality (Fugate 2015, 408).

Indeed, the ability to transcend objective reality may be a watershed in cognitive evolution. Penn et al (2008, 127) proposed the relational reinterpretation hypothesis in which they say that non-human and human minds differ in their ability to reinterpret relationships into rule governed relationships. Consistent with this view, it seems that learning a language allows subjects to respond using an abstract code (see also Premark 1983b). Deacon (1997) suggests that symbolic learning allows for a 'freeing' or 'unlinking' of relationships between otherwise obvious relationships.

Here, then, it is argued that at least some form of basic language is required for the construction of the ontologically subjective categories that form a part of emotional meta-experience. Without language, these abstract categories cannot exist, and socially meaningful emotions must be negotiated afresh for each new interaction on the basis of empathetic experience. However, it may be possible for something of meta-experience to exist in the absence of ontologically subjective categories.

There has been much speculation about the language capacities of early human ancestors. The discovery of the Kebara 2 hyoid bone suggests that Neanderthals may have been anatomically capable of producing sounds similar to modern humans (Arensburg et al 1990; D'Anastasio et al 2013). Additionally, based on the position of the larynx, not even Neanderthals had the anatomy necessary to produce the full range of sounds modern humans make (Fitch 2000). Indeed, it would appear that even the complex Levallois toolmaking technology of Neanderthal could have been learnt without language (Ohuma, et al 1997). Normally, such arguments cite what is seen to be relatively simple material culture, particularly stone tool technology, as an indication that early human ancestors were not as behaviourally sophisticated.

Here, however, it is not argued that language necessarily leads to more complex material culture. Instead, linguistic complexity is seen as scaffolding the construction of ontologically subjective categories that guide perceptual experience. These categories may not leave a material trace, but they would help

to structure increasingly complex social groups. Indeed, it is suggested that the language abilities necessary for the construction of ontologically subjective categories may have begun to emerge as early as 500,000 years ago. Mithen (2006) has argued that Homo ergaster was the first hominin species to make controlled vocalisation, and that heidelbergensis may have developed the first "symbolic' language.

Certainly, by about 500 kya, hominin brain size reached a level comparable to that of modern humans. So, for later *Homo erectus*, *Homo heidelbergensis*, *Homo neaderthalensis*, and early *Homo sapiens*, absolute brain size would have been a less important determinant of behaviour than the provision of a suitable social environment, including continued interaction with conspecifics and culture, for the increasing refinement and tweaking of higher cognitive abilities like emotion.

The prolongation of the developmental period through the evolution of these species is generally agreed upon by life history reserachers (DeSilva & Lesnik 2008; O'Connell & DeSilva 2013; Lee 2012; Bogin & Smith 1996). In conjunction with the preceeding cognitive advances, this would have led to the rich social environment allowing infants to begin to form emotion scripts. The ability to develop scripts, which would inevitably have a group-specific character, provides a social, rather than material, foundation for culture. This feeds group cohesion and allows groups to adapt socially to their environment; learning to respond to environmental pressures in a certain way by fine-tuning basic approach aversion responses. In modern humans this leads to a highly sophisticated, individualistic, and changeable emotional landscape, variable across culture. For hominins, we should expect to see an equally big difference in the emotion landscape of groups capable of emotion scripts, and a significant behavioural difference to species that could not form them or whose script were less complex. Thus, from the appearance of early *Homo erectus* it is likely that hominins will have been acquiring increasingly complex emotion scripts, consituting group specific emotional responses to particular stimuli. This can be seen as a precursor to later cultural acquisition, coming to a head only with the acquisition of fully human brain sizes and increasingly complex behaviours, including language, with *Homo heidelbergensis*.

Indeed, as mentioned above, the main limiting factor for the development of emotion scripts in children is language. This is not to say that all emotion scripts are wholly reliant on language, many have non-linguistic elements, however, they do imply an ability to conceptualise a rudimentary narrative structure complete with causation and consequence, possible long before language itself develops. It is possible, that, in the absence of language, material culture was vital for the formative development of emotion scripts. Nevertheless, the ability to communicate and mentalize emotions linguistically would certainly have considerably altered the way in which emotion scripts could be formed and acquired. Language, after all, provides a means for both the cognitive representation of complex emotions and a way to communicate information about one's emotional state (Pons et al 2003).

It should, then, be of no surprise that hominins appear to reach the cognitive threshold for emotion scripts at around the same time that it has been conjectured language first occurs. As with children, we should expect that the complexity of emotion scripts that hominins were able to form was closely correlated with their linguistic ability (Pons et al. 2003; Cutting & Dunn 1999; DeRosnay & Harris 2002). Certainly, the more a family communicates coherently about emotions, the better the child is able to understand them (see Harris 2000). Logically, children, and hominins, with greater language ability have more opportunities for using that ability, and thereby come to represent mental states, including emotions, more intensively.

Equally, the length of brain development remains important. Whilst the developmental trajectories of later hominins were moving closer to that of modern humans, they were not as yet the same. Weaver and Hublin (2009) have noted that Neanderthal obstetrics appears to be different to modern humans, and Bogin and Smith (1996) suggest that adolescence was only present in *Homo sapiens*. This suggests that the developmental period of later hominins was slightly curtailed when compared to modern humans. The human brain continues to change well into adolescence (Widen & Russell 2010b), and this period sees significant turbulence in individual emotional repertoire, which leads ultimately towards obtaining a fully adult suite of emotional responses. That this life history stage appears not to have been present in Neanderthals and *Homo heidelbergensis*

may suggest that they were less emotionally complex, or were not able to obtain such sophisticated scripts, as contemporary *Homo sapiens*, explaining at least some of the behavioural differences.

There are significant differences between the material record of Neanderthals and that of modern humans. Use of ochre and manganese to mark objects or skin may date back as far as 350,000 years (Roebroeks 2012). Burials with symbolic objects may date back 100,000 years (Pettitt 2010). The first evidence for personal ornamentation and jewellery also appears around 100,000 years ago (Abadía & Nowell 2015). Evidence for analogical reasoning is easier to come by. Collectively, this should be taken as firm evidence that modern humans had the capacity for analogical reasoning since the emergence of the species.

However, recent discoveries of Neanderthal material culture suggest that the diving line may be blurred. Evidence for the use of ochre and other pigments, as well as perforated shells have been used to suggest personal adornment (e.g. Henshilwood et al 2001; d'Errico et al 2001). Incised lines on bones and shell may suggests primitive art (Parkington et al 2005; Rigaud et al 2006). Bird bones may indicate that feathers were worn as personal adornment (Finlayson 2012). Arrangements of stalagmites around structures in Bruniquel Cave suggest something more than the functional use of the cave for habitation (Jaubert et al 2016).

However, much of this evidence remains controversial (e.g. Higham et al 2010). Engraved bone objects are often suggested to be among the first art objects, however, none of the markings show anything approaching the degree of clarity, regularity or obvious intentionality that would be expected from consciously symbolic engravings (Mellars 1996, 374). The same accusations could be levelled at the 'anthropomorphic' rocks, slightly modified to exaggerate the human form (Pettitt 2010, 333). Chase and Dibble (1992) see the bone engravings as analogous with butchery marks common across many sites of later periods. For a pattern of behaviour to be symbolic, it must be shared and serve as a medium for communication (Mellars 1996, 375). It is difficult to accept symbolism with occurrences so rare and isolated, thus it is unlikely that it served a significant role in Neanderthal life. It may be then, that, the key difference between human and

Neanderthal emotional cognition rests in the utility of material culture for the abstraction of meta emotion experience

Certainly, Neanderthals would appear to have had the ability to form emotion scripts. However, their developmental trajectory may be slightly curtailed, with brain development ceasing before the teenage period. This may have direct ramifications for the emergence of certain scripts. In modern humans, the brain remains plastic well into early adulthood, around 25 years of age, allowing the continued fine-tuning of neural wiring to experience. This process may have ceased some ten years earlier in Neanderthals, fixing emotion knowledge in place at an earlier phase of life history. In modern humans, this would prevent some key emotion scripts from developing. It is difficult to see, for instance, how western romantic love, or Japanese *Amae*, could develop if brain circuits came to be fixed in place at 15 years of age. As such, it is possible that Neanderthal emotional life was stunted by a shorter period of neural plasticity, limiting the types of emotion scripts that could develop.

For this reason, it seems likely that Neanderthals lack the modern human ability for abstraction. The emotional life of modern humans is replete with investment in abstract entities with no tangible reality. Groups like nation states and sports teams are frequently the source of affective bonding, whilst individuals have no hesitation about investing emotionally in material objects or with others through social networking. It is this ability to form bonds with, and become attached to, things that do not exist, that allow many institutions on which we depend to function. If Neanderthals were not able to invest emotionally in such abstractions, their societies would have been limited to the immediate and the tangible. Material culture may have been used as a proxy for individuals not currently present; however, they may have lacked the ability to invest emotionally in material culture in the way that children become emotionally attached to toys. Equally, this would have prevented Neanderthals from conceiving, and becoming invested in, supernatural deities, or assuming membership of a cultural group beyond the bonds of their conspecifics and extended network. As such, the social emotions of Neanderthals would have been significantly more restricted than in modern humans, limiting the focus of their emotions to their immediate surroundings and conspecifics.

By definition, the ontologically subjective categories of emotional meta-experience function as explanatory mechanism that fit a group's folk psychology of how the world works (Searle 1995). However, in the case of emotional meta experience perceptual categories explain the actions of people and things based on more than their physical properties. As such, a category becomes a "stand in" for observable forces when making causal inferences: "The result is that the category itself takes on the process and a causal mechanism is either revealed or inferred by those engaged in the use of the category" (Fugate 2015, 406).This allows abstract or imagined forces to assumed the role of causal mechanisms when observable, physical forces are absent or insufficient.

Humans seem to be unique in that we also prioritise causal information over perceptual content or physical forces in forming categories (Fugate 2015, 406). People also reason about unseen forces, invent their own theories about how the world works, distinguish between real and spurious causes, reason diagnostically, and intuit theories (e.g. Bering & Parker 2006). They are also the basis for our superstitions and religion and scientific thinking (Bering 2006). Although a great many species show a great ability to learn and navigate their environments, learn contingencies, and perhaps even possess a rudimentary understanding of cause and effect, there is little evidence that other species besides our own make such elaborate inferences about causation or hypothetical forces. It may be this capacity for causal reasoning that underlies emotional differences between humans and Neanderthals, with modern humans able to construct emotional responses to imagined motivations, with Neanderthals restricted to that which is immediately observable.

This provides the groundwork to consider the differences in emotion cognition between Neanderthals and modern humans. Neanderthals appear to have been able to form emotion scripts with group specific inputs and outputs for self-aware, evaluative cognitions. However, their curtailed period of development likely limited the scope of potential emotion knowledge, preventing the development of some emotions observed ethnographically in modern humans today. Additionally, Neanderthals may have been unable to form abstract conceptions of an intangible world, limiting their affective engagement to their immediate surroundings.

7.4 A Deep History of Emotion

Through a consideration of the archaeological evidence for the psychological ingredients of emotional experiences it has been possible see the emergence of cognitive traits associated with emotional meta-experience. This has provided an extra contextual layer to evolutionary theories of emotion that usually stop short of suggesting the emotion experiences lived by ancestral hominins. It has been seen that the three hypothetical outlined in chapter 6 are broadly represented by the systematic emergence of the same cognitive traits in hominins (fig 7.1).

Hypothetical mindstate of interaction – The data suggests that chimpanzees and early hominins likely possess the psychological ingredients associated with self-conscious emotions. They seem to have possessed a rudimentary capacity for self-recognition allowing the conceptualisation of some basic self-conscious emotions, which would have been bolstered by social referencing and joint attention in Oldowan tool makers. This would have been supported by the slight extension of post-natal development, although at this stage it would not have necessitated the recruitment of additional help.

Hypothetical mindstate of extension – The data suggests that emotional experiences began to incorporate more complex evaluations during the Acheulean . The development of the genus *Homo* was characterised by a shift from mainly foetal to mainly post-natal brain growth. Ultimately, gestation would have been prohibitively long, leading to the emergence of a brief childhood period, which would go on to become extended to allow the enlarged brain of *Homo erectus*. With a longer childhood, assistance would have been sought from conspecifics for the raising of children. This provided both the required social environment and developmental parameters for the emergence of behavioural evaluation and standards.

Hypothetical mindstate of abstraction – By the evolution of *Homo heidelbergensis* all of the major thresholds for emotion cognition have been achieved. All that is left is for the existing cognitions to become further elaborated as new cognitive developments allow emotions to become more nuanced and

individual. The development of emotion scripts in *Homo Heidelbergensis* and *Homo Neanderthalensis* will have afforded the emergence of group specific emotions contributing to group cohesion providing the groundwork for culture.

The emergence of modern humans brought with it the extension of brain plasticity into early adulthood. This allowed for the continued fine-tuning of emotion cognition to experience, and the subsequent development of an array of exclusively *Homo sapiens* emotion, like romantic love and *Amae*, that constitute the vast variability in cultural emotions seen today. Additionally, modern humans appear to be the only species able to invest emotionally in an intangible world, affectively bonding with objects beyond their use as a proxy for an existing individual, and forming social and cultural groups that extend beyond immediate conspecifics to shared ideology.

Table 7.1: model for emotional mindstates during deep history

Australopithecus	
Some evidence for self-conscious behaviour, underlying affective interaction. Associated emotions include empathy, envy, and embarrassment	Prolongation of infant dependency beyond chimpanzee level but not requiring assistance from conspecifics. Intensification of mother-infant bond.
The Emergence of *Homo*	
Developed sense of self-recognition with *Homo erectus*. Staged acquisition of evaluative abilities, developed by late *Homo erectus*. Associated with extension of emotion to include pride, shame, and guilt.	Shift from mainly foetal to mainly post-natal brain growth leading to development of childhood period. Assistance in child raising sourced from conspecifics intensifying social environment.
The Neanderthals	
Developed ability to evaluate behaviour against standards. Acquisition of emotion scripts improving understanding of emotion, increasing the nuance of experience, and giving highly differentiated cultural characteristics.	Significant group investment in childrearing provides rich social environment for the development of complex emotions. Modern humans differentiated by presence of adolescence for further fine-tuning of scripts.
Modern Humans	
Development of ontologically subjective categories due to extended period for the development of emotion knowledge. The development of an intangible world and investment in abstract concepts through material culture and groups based on ideology.	Neuronal plasticity extended into early adulthood, allowing cognition to continuing being fine-tuned to experience.

8 Making an example of burial

The preceding chapters have sought to construct a conceptual framework through which to address the topic of hominin emotions. By breaking down emotion experience into its constituent psychological ingredients it was possible to do two things. First, the psychological ingredients could be reconstituted into a three hypothetical mindstates describing the potential emotional repertoire and behaviours associated with the ingredients. Second, it was possible to seek evidence for the ingredients directly from the archaeological and palaeoanthropological record. This provided a bridge by which it was possible to begin to suggest the sorts of emotion experiences that early humans ancestors were capable of constructing.

Whilst these inferences may be of some interest, the success of the project will depend on the ability to use the conceptual framework as a heuristic to generate fresh interpretations of the archaeological record. This chapter will seek to describe on such application of the conceptual framework.

To do this, it is necessary to select a dataset that is amenable to such a study. Ideally, such a dataset should extend over the full arc of human evolution, the data should be rich enough, and have a broad geographical and temporal spread to facilitate a full understanding of the process by which behaviour changes as hominins move from one mindstate to the next. Some of the most obviously suitable data would be that for early art, however, the relatively limited data for early periods would preclude a full appreciation of the process of change.

For the purposes of this chapter, the evidence for burial and mortuary practices will be used. This gives the full sweep of human evolution, as even the earliest hominins had to deal the their dead one way or another. It is also a rich dataset with much discussion in which to embed a new interpretation. As was seen above some of the earliest attempts to tackle emotions in archaeology have focused on burial for these reasons, and on account of the intensely emotional nature of the subject matter. It seems likely that some of the earliest developments in emotion cognition may have occurred around mediating separation deceased individuals.

Perhaps the most important reason for choosing burial and mortuary data is that there is a strong biological basis for emotional behaviours relating to mediating separation from individual. It is with this biological basis for grief responses that the analysis will start. Then we can consider how the psychological ingredients combine to construct emotional experiences according to the hypothetical mindstates.

8.1 Separation distress

Traditionally, anecdotal accounts of animals expressing *grief* at the death of conspecific have been considered anomalous. However, in recent years, the sheer number of such accounts has begun to reach a critical mass. The degree of investigation of carcasses, or carrying of carcasses, has led some to infer that chimpanzees, *Pan troglodytes* (Anderson et al. 2010; Biro et al. 2010), African elephants, *Loxodonta Africana* (Douglas-Hamilton et al. 2006; McComb et al. 2006), and giraffe, *Giraffa camelopardalis* (Bercovitch 2012; Carter 2011), have a mental concept of death. Below is a brief overview of the evidence, as presented by observers.

Moss (1976; 2000) first reported that elephants attend to dying comrades and stroke the bones of deceased relatives. More recently, Douglas-Hamilton et al (2006) have described elephants' responses to a dying matriarch called Eleanor. On several occasions before her death, Eleanor collapsed, prompting another matriarch called Grace to lend her assistance. Over the course of a week following Eleanor's death, females from five families showed interest in the body, some appearing *upset*, touching the body with trunk or feet or rocking back and forth whilst standing over it. This prompted Douglas-Hamilton et al (2006) to conclude that elephants show a generalised response to death, grieving the loss of individuals in other families, as well as close kin, suggesting that elephants show compassion, as in people. Other instances of 'body guarding', standing close to the carcass, and 'explore-touch', investigating the carcass using feet, trunk and tusks, have been observed in African elephants (Poole & Granli 2011), with displays of apparent agitation noted (McComb et al. 2006).

Ritter (2007) has described a generalised grief response in dolphins. A mother was seen pushing and retrieving her dead calf's body. At times she was accompanied by two male escorts, and on one occasion a group of at least 15 altered their pace of travel to include the mother and dead infant. Particularly noteworthy was the mother's persistence, and when it began to wane after five hours, the escorts began to support the infant on their own backs.

Giraffe also appear to react to their dead with vigilant guarding (Muller 2010) and carcass inspection (Carter 2011; Bercovitch 2012) in ways similar to, if more fleeting than, elephants. Following the death of a four-week-old infant born with a deformed foot, conspecifics paid particular attention to the body, approaching and retreating, and in some cases touching the carcass with their muzzles. At its peak, some 23 females and four juveniles were involved on the first day. On the third day following death, the mother was seen attending to the infant's body some 50 meters from the original location where it had been dragged and half devoured by hyenas. Muller (2010) does not use the terms "grief" or "mourning" in her account of this event, but suggests that it indicates giraffe have closer family ties than often assumed. King (2013), however, is unequivocal in her assertion that grief is likely involved in such responses.

Mark Bekoff (2007) has linked grief responses to love responses in animals. For instance, he recounts an episode where a coyote called Mom left her group at Wyoming's Grand Teton National Park. After short absences, her pack would *rejoice* at her return, licking her and rolling at her feet. When Mom left for good, some in her pack paced back and forth, whilst others searched for her.

If these accounts of grief-like displays in nonhuman animals can be believed, we must presume that there is a biological imperative driving these responses. Panksepp has proposed a PANIC/GRIEF system as the neurological under pinning of separation distress (Panksepp 1998; Panksepp & Biven 2012). Infants of all mammalian species experience a period of parental dependence following birth. Thus, they must have a powerful means of signalling distress to solicit and maintain parental care. Isolation calls, or distress vocalisations, are the most efficient method and all animals probably share the underlying mechanisms governing them (Panksepp 1998). Experiments starting in the mid 1970s monitored social distress through the frequency of distress vocalisations exhibited

by young animals (young dogs, guinea pigs and chickens) that were separated from their normal social environments, usually mothers, for short periods of time (Herman & Panksepp 1978; Panksepp et al. 1978). This research began to illuminate the neuroanatomy controlling behavioural responses, first in guinea pigs (Herman & Panksepp 1981) and then in an evolutionarily very distinct species, the domestic chick (Panksepp et al. 1988). Later similar results were produced by experiments on *Octadon degu* (Colonnello et al. 2011). These effects were subsequently replicated and extended to rodents and primates (Kalin et al. 1988; Kehoe & Blass 1986; Keverne et al. 1997; Newman 1988; Jurgens 2002). Birds also express socially induced separation distress arising from very similar brain regions as mammals and regulated by the same neurochemistries (Panksepp et al. 1980; Panksepp et al. 1988). This strongly suggests that the circuitry for separation distress is a universal property of all mammals, and possibly other animals (Panksepp & Biven 2012, p.223).

Imaging of higher brain mechanisms that are recruited during grief and sadness in humans (Freed et al. 2009) often fail to do justice to the ancient subcortical mechanisms for separation distress (Panksepp et al. 1980). However, recent brain imaging using PET scans has shown that the same brain mechanisms that control separation distress in animals mediate human sadness and related social processes (Damasio et al. 2000; Swain et al. 2007; Kennedy et al. 2006; Zubieta et al. 2003). Thus, the general anatomy of human grief seems to be the same as the system that mediates separation distress calls, as mapped in animals. This strongly suggests that all mammals, and possibly other animals, share the social cohesions that mediate separation distress (Panksepp & Biven 2012, p.314).

Thus, within the framework of *Affective Neuroscience*, a PANIC/GRIEF system provides a biological substrate causing a separation distress response especially when death curtails the mother infant bond. That this system recruits the same brain circuitry associated with sadness is humans should not be surprising. As such , we can consider complex grief displays in modern humans to be emotional meta-experience built on the biological substrate underlying separation distress in nonhuman animals. The focus then turns to how these meta-experiences were constructed from the psychological ingredients of emotion.

8.2 Grief and the hypothetical mindstate of interaction

If Pankepp's argument can be accepted, then we should expect to see grief-like responses caused by a triggering of the separation distress mechanism in even the earliest hominins. The nature of these responses, however, will be constrained by the limited number of cognitive ingredients available with which to construct emotional meta-experience. In the first instance, separation distress responses are expected to be egocentric. The purpose of the PANIC/GRIEF system is to motivate the reunion of mother and infant, as such it is the mother infant dyad that will provide the initial source of grief-like responses.

Based on the evidence seen in chapter 7, chimpanzees and the earliest ancestral hominins would be in possession of the hypothetical mindstate of interaction. As such, their experiences of grief would be egocentric, limited to the individuals experience, with as yet no social element to displays. However, as a moves are made towards the second hypothetical mindstate, social referencing would allow individual to understand the grief responses of other, recognising they are directed, and perhaps even acting in an attempt to minimise the negative valence of conspecifics. However, in this mindstate this will remain primarily concerned with individual responses.

Indeed, corresponding *grief-like* responses have been observed in primates. Perhaps, the best example is that of Jokro a two and a half year old infant (Matsuzawa 2003). When Jokro finally succumbed to illness and died, her mother, Jire, did not simply abandon the corpse, but continued to carry Jokro for a month. Whilst this could be seen as simply habit on the part of the mother (W. McGrew pers. Comm. to Pettitt 2010) , this seems unlikely. It is true that Jire seems to continue to treat Jokro as if she was alive, carrying and grooming her, but the intellectual curiosity of other chimpanzees investigating her body indicates that there was meaning behind the actions (Pettitt 2010, p.24). Furthermore, Goodall (1986, p.101) has recognised that the death of a mother can lead to significant prolonged, behavioural disturbance in her infant. She observed a decrease in play, whimpering, delayed sexual interest, rocking, hair pulling, hanging upside down, and deterioration of social responses. Additionally, physiological symptoms can

include lethargy, growing a pot belly, sunken eyes, or loss of appetite. All these are signs we would recognise as grief among modern humans.

The death of Bambou (Boesch & Boesch-Achermann 2000, p.250) also has strong undertones of a detachment process. After Bambou's death, caused by falling from a tree, his mother, Bijou, carried him for 10 minutes making alarm calls. The following day, as the group made to move on, Bijou hesitated looking at Bambou's body. A few members of the group returned to the corpse, made soft calls then moved on. A short time later Bijou left, met with some members of the group who were waiting for her, returned to Bambou, and then finally left the corpse. Such instances of portage of dead infants by chimpanzees have been reasoned to be a 'poignant testament to the close mother-infant bond' (Biro et al. 2010). This is also seen in Yunnan snub-nosed monkeys, *Rhinopithecus bieti*, who vary the length of time that they carry dead infants as a function of the age of the infant (Li et al. 2012). Others have suggested that chimpanzee reactions to dead individuals reveal that they experience 'grief' (Anderson et al. 2010).

It has also been suggested that cannibalism plays a role in grief behaviour. Boesch and Boesch-Achermann (2000, pp.248–9) recount of the death of Tina, a 10-year-old female chimpanzee who was attacked by a leopard. The standout features here are; unusual calls, attendance of the corpse, dragging the corpse over short distances, aggressive displays by males, and the inspection of the corpse and the wounds. This bears some striking resemblances to cannibalistic behaviours. Goodall (Goodall 1977, p.279) has observed abnormal behaviours during cannibalism, such as repeated charging at the body, usually only practiced during the capture and killing of prey not after its death, and a tendency for the body to be abandoned after little has been consumed, suggesting that cannibalism in chimpanzees is not simply nutritional. Bygott (1 972, p.410) provides an example of cannibalism where eating only took place for several minutes before the corpse was examined, sniffed and poked, groomed and often shaken by its leg or tapped on its chest. Pettitt (Pettitt 2010, p.22) sees cannibalism in chimpanzees as conforming to a larger behavioural set he refers to as morbidity, possibly deriving from a desire to understand the nature or cause of death of an individual.

In all cases, these responses are limited to individual experiences of separation distress. In the cases of Jokro and Bamou, this is initially the mother's

response to the loss of a child, the very definition of Panksepp's PANIC/GRIEF response. The performative nature of the grief displays suggest that morbidity practices help to process the unexplained absence. Others are often recruited, but only if they observe the body or the mother's distress. As such, it is unclear at this stage whether triggering of the PANIC/GRIEF system is extended beyond the mother infant dyad. It could be explained by curiosity regarding a novel stimulus and an empathetic response to the mother's grief displays caused by social referencing. It is argued then that whilst the evidence shows emotional disruption at death, particularly of the mother infant dyad, grief in chimpanzees corresponds to the first hypothetical mindstate as it is not extended beyond this.

The archaeological evidence for grief responses in Australopiths also seems to conform to this analysis. Fossils representing an MNI of 13 individuals assigned to *Australopithecus afarensis* dating to 3myr to 3.5myr have been recovered from the site of Hadar, Ethiopia (Johnson et al 1982). Whilst some scavenging did occur, suggested by the general disarticulation of remains and their scatter across 7m, this must have been minor and Pettitt (2010, 44) argues that carnivores were not the agents of deposition. The accumulation of remains due to catastrophic events can be disregarded. A flash flood (White and Johnson 1989, 98) seems to be unlikely, based on sedimentology (Johnson et al 1982) and the group getting 'bogged down' (Aronson and Taied 1981, 187) can be rejected due to the lack of evidence that a similar fate befell any prospective scavengers (Pettitt 2010, 44). Equally, deposition over a long period (Lewin 1987, 170) can be rejected as it fails to account for the taxonomic composition of the sample. This has led Pettitt (2010, 45) to conclude that there is no reason to suggest that the reasons 'why 13 hominids came to rest at the site were out of the control of the hominids themselves.' He sees this as 'structured abandonment', the deliberate placement of a corpse at a certain point in the landscape, but implying no more than a desire to protect remains from scavengers.

This description would appear to conform to the notion of morbidity practices easing a separation distress response. Based on the evidence from nonhuman animals and chimpanzees, it should be expected that Australopiths would experience emotional distress at the death of a conspecific. If the mother was present, this could easily have resulted in a performative morbidity practice

in order to ease the separation distress response. With a more acute ability for social referencing which may be expected from Australopiths, this could have led to the recruitment of others in an attempt to alleviate grief response of the mother. Whilst some doubt may remain of the material evidence, it should not be doubted that Australopiths were capable of performative morbidity displays to alleviate separation distress.

8.3 Grief and the hypothetical mindstate of extension

With the second hypothetical mindstate, the egocentric responses of the first mindstate will be extended to a more authentically social response. It may be expected that the PANIC/GRIEF system would become emotionally salient beyond the mother infant dyad making it easier to recruit the help of conspecifics for more authentic morbidity displays. In addition to this, at this hypothetical mindstate the emotional salience of relationships will become extended offline (Bering 2006). As such more complex morbidity practices would be expected as deceased individuals continue to influence behaviour long after the initial interaction with the body and grieving individuals.

An important, early, and somewhat controversial example is Sima de los Huesos, Atapuerca. The pit contains the bones of at least 28 individual hominid fossils and is now firmly dates to 430 kya, making it the largest and oldest assemblage of human remains currently known (Dabney et al 2013). The bone pit lies at the very bottom of the vertical shaft, approximately 13m deeps and lies a short distance into the entrance of the Cueva Mayor (Arsuaga et al 1997a). The assemble of bones is made up mostly of animals: cave bears, lion, wildcat, grey wolf, red fox, and Pardel lynx (Garcia et al 1997). However, in amongst the animal assemblage is 6500 fragments of human bone. Stratigraphic analysis suggests that the human remains were deposited in the pit prior to the other animals (Bischoff et al 1997).

Upon initially analysis of the human remains, Arsuaga et al (1997b) concluded that the bones would be best categorised as *Homo Heidelbergensis* a close evolutionary relative to Neanderthals. More recently, Dabney et al (2013) were able to conduct an analysis of mitochondrial DNA recovered from the

remains. They proposed that the individual at Sima de los Huesos share some DNA with Denisovans. Further study by Arsuara et al (2014) suggested that whilst there were enough similarities in skeletal morphology with Neanderthals to preclude the assignation as *Homo Heidelbergensis*, the remains still bears some significant differences to other known Neanderthal populations. With the date at 430 kya, the remains are close to the postulated evolutionary divergence of Neanderthals and Denisovans, meaning that Sima de los Huesos may prove to be a key site in understanding the relationship between the two species.

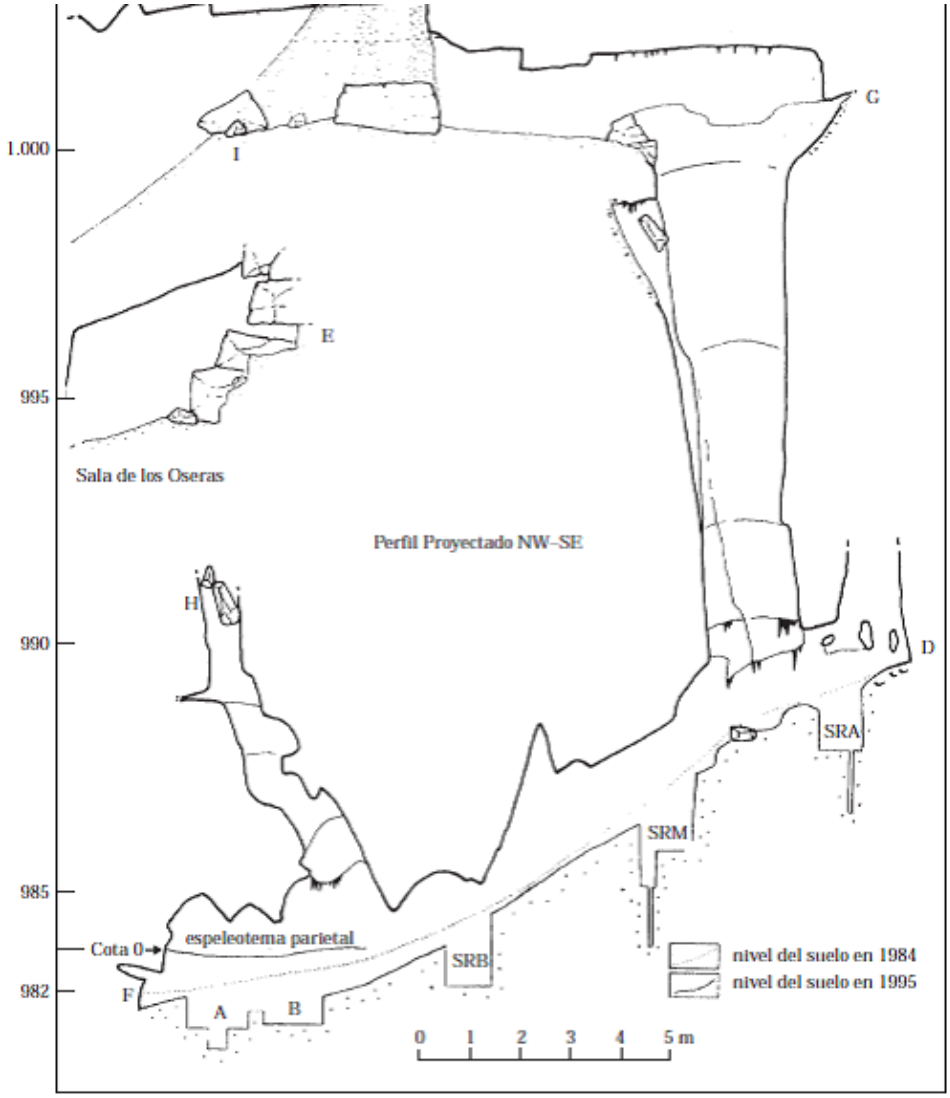


Figure 8.1: Drawing of Sima del los Huesos showing the vertical shaft to the bone pit (Arsuaga et al. 1997).

By far the most common interpretation of the causes of the deposits is that the humans and animals fell into the it from the chamber above, became trapped,

and could not escape. However, some have suggested the collection of human bone may have been the product of deliberate deposition. Mortality profiles of the human remains (Bermudez de Castro et al 2004) indicate a high number of adolescents and young adults, with an unusually low number of adults between 20-40 years old, only one child under the age of 10, and none over 40. This is a mortality profiles that would be assumed to represent natural attrition. In addition to this, the only artefact to be recovered from Sima de los Huesos is an Acheulean handaxe made of quartzite. Carbonell and Mosquera (2006) have suggested that, given the absence of any artefactual traces of habitation, the presence of this handaxe may be indicative of deliberate deposition.

Sala et al (2015) found that at least one cranium had evidence of multiple impact fractures which occurred near to the time of death. This indicates then that at least one of the individual died as a result of interpersonal trauma. For Sala et al, the deliberate deposition of corpses into the pit can be seen as evidence of a social mortuary practice. This is what Pettitt (2011a, 49) terms 'funerary caching', the structured deposition of remains in a chosen place, but without modification of that place, for example the back of a cave, a natural fissure or a pit not intended for other purposes. This would be more complex for of structured deposition (Pettitt 2011a, 49).

Whilst the lack of stone tools recovered indicates that the site was not a camp or feeding site (Arsuaga et al 1997a), it is unclear how the remains accumulated, but taphanomic investigation suggests that, despite their fragmentary nature, the remains were not simply thrown down the 13m deep shaft (Andrews and Fernandez-Jalvo 1997, 215). It is, however, generally agreed that the remains accumulated anthropogenically over a long period (Arsuaga et al 1997, Andrews and Fernandez-Jalvo 1997). The most plausible interpretation would seem to be that the remains were brought to the cave and left in, or near, the shaft where they were scavenged by carnivores (Pettitt 2010, 53). The remains would then have been dragged, or fallen, further into the cave system, helped by mudflows, resulting in the disarticulated and disordered assemblage (Fernandez-Jalvo and Andrews 2001, 232).

To Pettitt (2010, 55) the repeated deposition of hominin remains in the cave over a prolonged period indicates the creation of a place of the dead. He

argues that the hominins the used Sima de los Huesos were aware that the cave was a natural trap, a place of animal death, and came to associate it with a place of hominin death, of decay and disease. This would seem entirely plausible.

With the individuals falling at an interesting meeting point between Denisovans and Neanderthals, Sima de los Huesos could represent a key development in the emotional responses of hominin to death. Whilst earlier hominins were almost certainly not capable of the abstract thought required for religious thought, that death was emotionally salient cannot be doubted. However, with Neanderthals moving towards a more complex mindstate of extension, this could be a first indication of the emotional salience of bodies being extended beyond life. The caching of remains, then, would be an example of a more complex, extended, morbidity practice, likely socially mediated by a community looking to process grief. With offline relationships remaining salient long after death a return to the same place is also highly likely.

Indeed, discussions of the Neanderthal funerary record have been dominated by a debate over whether Neanderthals intentionally buried their dead. The main critique of this position comes from Gargett (1989, 1999) who believes that, in many cases, it is simply assumed that human remains discovered in archaeological contexts will have been deposited with purpose, without sufficient evidence. The thrust of Gargett's argument focuses on a reassessment of stratigraphic and taphanomic data concluding that deliberate protection was not required to account for the preservation of articulated skeletal remains. Whilst Gargett makes valid points in some instances, it seems reductive to suggest that there is no evidence for Neanderthal burial. The remains of an adult Neanderthal excavated at Kebara, Israel was undoubtedly buried in a deliberate grave cut. The cut was observable during excavation; the fill distinctive and most anatomical connections were still intact with the body decomposing after interment (Bar-Yosef et al 1992, 527). The remains from La Chapelle-aux-Saints, France, are found in a rectangular, straight walled, flat-bottomed pit, which, as Frayer and Montet-White (comment to Gargett 1989, 180) argue, is unlikely to have occurred naturally. Also, the presence of deliberate burial at La Ferrasie surely cannot be disputed. The preservation of burials 1 and 2, both near complete skeletons, is 'too extraordinary to be accepted as accidental' (Ossa, comment to Gargett 1989, 183).

Burials 3 and 4, a 10-year-old child and a neonate, were found in close association, leading Pettitt (2010, 134) to question the likelihood the remains would have been interred in two parallel cut marks purely by chance.

It seems likely that whilst intentional burial is not a universal or pervasive Neanderthal behaviour, there is some convincing evidence to suggest it was in use. Care should be taken, however, not to imply anything more than this. Whilst evidence for intentional burial is strong, evidence for ritual or symbolic offerings is weak (Mellars 1996, 377). The tentative suggestions for grave goods are now generally refuted. Whilst there is clear evidence for deliberate burial at Shanidar, the interpretation of pollen recovered from burial IV as the intentional inclusion of flowers (Solecki 1972, 174) is generally discounted. Sommer (1999) has argued strongly that the pollen can be explained as a later intrusion, caused by the burrowing activity of rodents. There is also little need to see grave inclusions as deliberate. Faunal and lithic remains from the burial at La Ferrassie can be seen as accidental inclusion in the fill, from other strata (Gargett 1989, 162), as can similar inclusions at Kebara (Bar-Yosef et al 1992, 529). Certainly, suggestions of food offerings to provide sustenance for 'the journey' (Shackley 1980, 86) seem highly unlikely.

For this reason, it is argued that Neanderthals' responses to death remain extended and have not yet been abstracted. The possibility of deliberate burial among some Neanderthal groups strongly suggests the development of scripts mediating social responses to death. However, in no cases does burial seem to indicate anything other than a response to an emotionally salient death. There is no evidence of symbolic or abstract components that would constitute an ontologically subjective category for a pseudo-religious grief emotion. As such, it is argued that Neanderthals were more concerned with the 'after person' than the 'after life' (Gamble 2014). Indeed, increasingly complex morbidity practices would suggest that the emotional significance of key social relationships seems to have been extended to be salient in death, motivating complex negotiations with offline line relationships.

8.4 Grief and the hypothetical mindstate of abstraction

It is only with the final hypothetical mindstate of abstraction that symbolic or religious funerary practices would be expected to emerge. The introduction of analogical reasoning will allow the construction of increasingly complex and idiosyncratic responses to the death of conspecifics. As such, it would be expected that regional differences in mortuary practices should increase.

The first convincing evidence of symbolic practices are from the sites of Skhul and Qafzeh, both attributed to *Homo sapiens*. Of the ten individuals dating to between 100,000 and 130,000 BP found at Skhul, Israel, at least four were deliberately buried and there is nothing to suggest that this could not apply to the remaining six. The inclusion of a large wild boar mandible in burial V is highly likely to be deliberate, due to its location under the left radius and ulna (Pettitt 2010, 62). At the site of Qafzeh, Israel, the remains of a further 13 *Homo Sapiens* were found dating to 90,000 – 100,000 BP (Schwarcz et al 1988). Perhaps the most interesting burial is number 11, a child found with an antler and frontal bone of a red deer positioned by the head and hands as if it were clasped to the chest (Belfer-Cohen and Hovers 1992). Considering the defined grave cut, deliberate placing of stones as an architectural element and the lack of other items in the fill, it seems likely that the red deer antler and bones, as well as some red ochre fragments, were deliberate inclusions (Pettitt 2010, 68). The significance of these two sites should not be overlooked. Considering the relative scarcity of convincing symbolic activity from Neanderthal sites, Skhul and Qafzeh can been seen to represent an important change in behaviour.

There has, however, been some debate regarding the meaning of symbolic practices related to mortuary behaviour during the Upper Palaeolithic. Zilhão (2005) has argued that the rare burial of non-adults indicates that age-related social status had come into being by the Mid Upper Palaeolithic. He notes that, unlike the preceding Middle Palaeolithic where infants are represented in burials in approximately the same proportions as in life, in the Mid Upper Palaeolithic their number drops to less than 10 per cent of known burials. Given this, he argues that the relatively well-provisioned burial of the Lagar Velho child, Portugal, must indicate that social standing was accorded to the child. In this burial, a 4-5 year old boy was found in a shallow pit under the overhang of an unoccupied rock shelter (Duarte et al 1999) dating to 24-25,000 BP (Pettitt et al 2002). A burnt branch of

scots pine was placed into the pit before the body, which was probably wrapped in an ochre-stained shroud. Grave goods include a perforated shell pendant, four ochre-stained red deer canines, probably part of a headdress, two red deer pelvises, and a juvenile rabbit was placed on top of the legs. Zilhao hypothesises that the lack of burials of children under 5 years suggests infants were not regarded as independent and thus not afforded burial implying age-related social status.

It has also been noted that a relatively high proportion of Upper Palaeolithic burials show signs of pathology. The association of a pathological individual with otherwise 'normal' individuals in the Donli Vestonice triple burial and in the Sungir double burial has been stressed by Formicola et al (2001) and Formicola and Buzhilova (2004, 196), who suggest that these associations 'reassert the possibility of ideological connections between "abnormality" and extraordinary funerary patterns'. This raises the possibility that the practice of burial may have been determined by unusual events rather than by the status of the individuals concerned.

A particularly interesting example is that of the triple burial at Dolni Vestonice, site II, in the Czech Republic. This burial, dating to about 30 kya (Vlcek et al 1991) has proved a headache for archaeologists, mostly on account of the difficulty in determining the sex of the individuals involved. Whilst the two individual on the sides of the burial were established to be teenage boys some time ago (Sladek et al 2000), the individual in the centre of the burial has evaded concrete categorisation, having been identified as both male (Jelinek 1992, Bruzek et al 2006) and female (Klima 1988, Vlcek et al 1991). This individual shows signs of pathological conditions, possibly some form of congenital deformity distorting the skeletal morphology (Novotny 1992, Cerny 1992).

The relationship between the three individual is particularly interesting on account of their positioning (Klima 1988). Two males lay either side of a central figure, the right hand male is lying face down looking away from the group, whilst the left hand male is looking at the central figure with his hand on its groin and he himself is pegged to the ground with a wooden stake through his pelvis. Red ochre was placed on all three skulls as were perforated teeth of fox and wolf, and ivory beads, which could be the remains of headdresses. The burial is covered with

burnt spruce logs and branches, which Svoboda (2008, 30) believes could be the remains of a wooden structure.

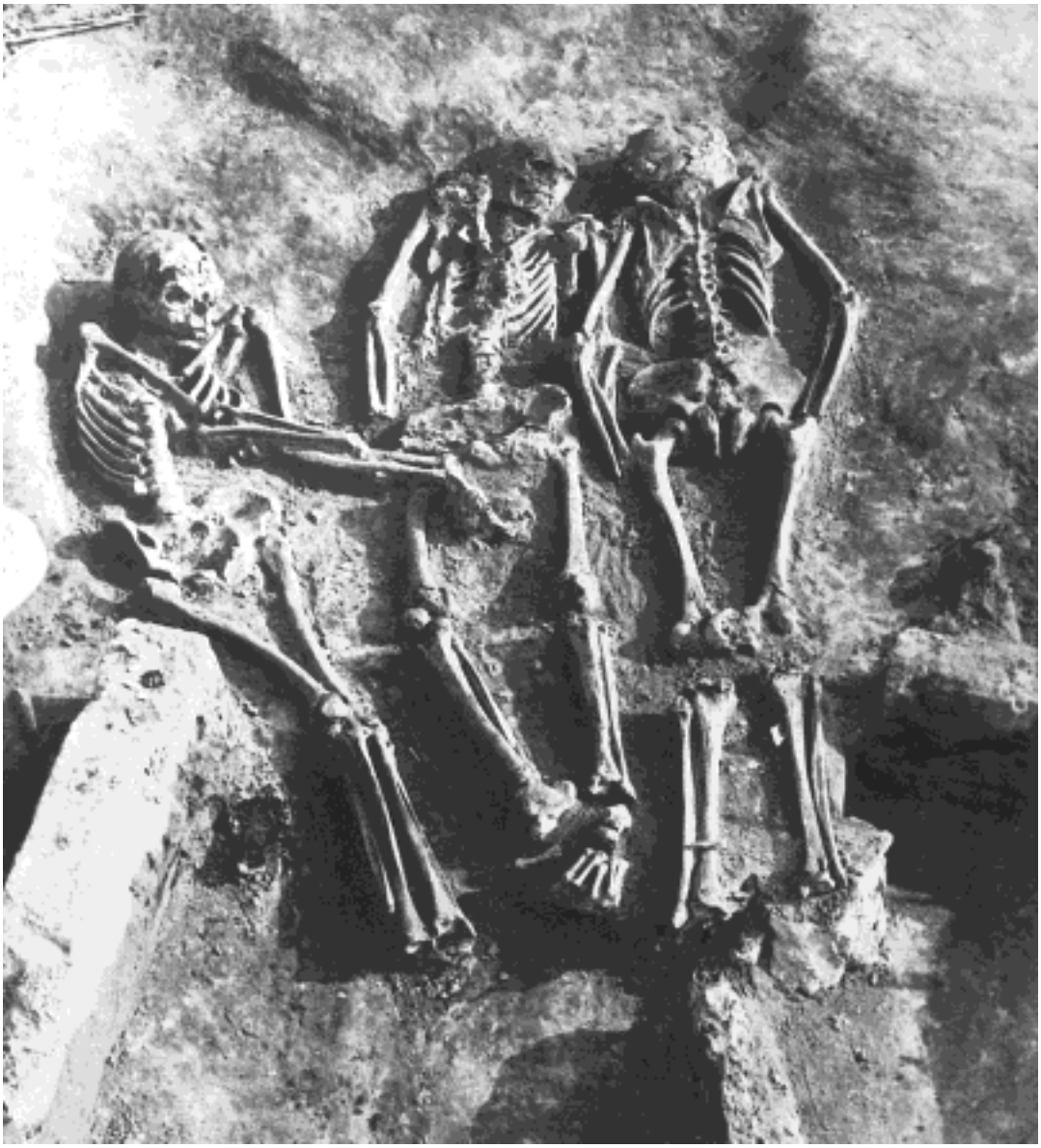


Figure 8.2: The Dolni Vestonice triple burial (Formicola et al 2001, fig 1)

There have been several suggestions as to the significance of the central figure. Formicola et al (2001) suggest that it was a severely disabled female suffering from upper limb osteoarthritis and a high level of hypertrophy in the limbs indicating sustained use, perhaps dragging heavy loads. The circumstances of this burial have stimulated wide-ranging speculation, including concepts of the eternal triangle and sexual misdemeanour. Pettitt (2010, 291) suggests that,

whilst nothing can be proved, it seems possible that the physical impairment of the central individual may have accorded her some form of social status.

However, recent studies seem to rule out some of the more salacious rumours. Mittnik et al (2016) have shown using mtDNA analysis that the central individual is also a male. The established maternal kinship and close ages of the left and right individual have lead the authors to suggests that they may be brothers (Fu et al 2013), whilst the third individual may be a more distant relation (Alt 1997). This would seem to rule out suggestions that the central figure died during child birth (Klima 1988), although the pathological condition may have caused his early death. Whilst it is still possible that a burial like Dolni Vestonice, site II, may represent the attribution of social statues, the close familial relationships between the three individual suggests something more personal. A social status acquired though close familial bonds, rather than though social or political capital.

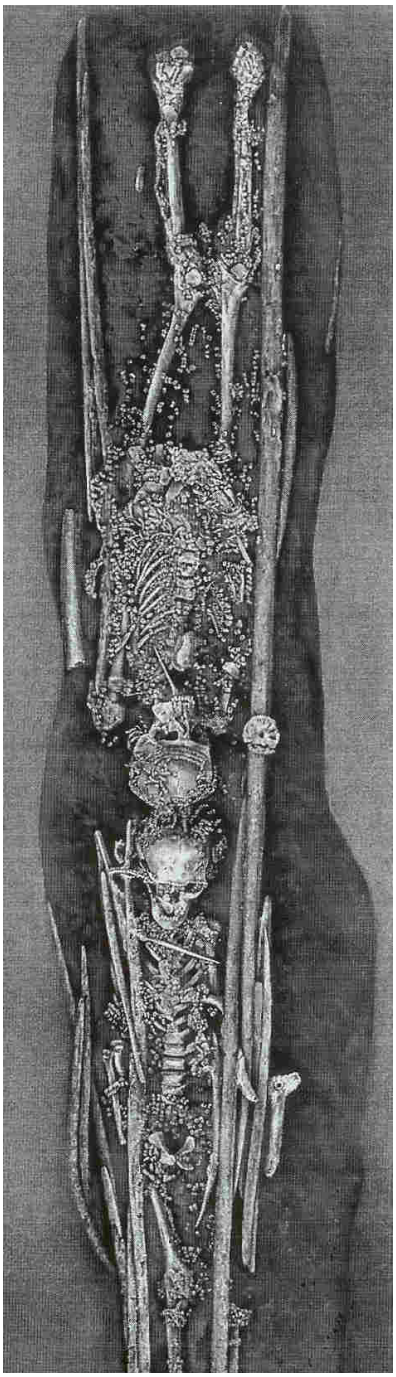


Figure 8.3: Sungir double burial (Bader and Mikhajlova 1998)

Three burials are of note at Sungir, Russia. Burial 1, an adult male, is accompanied by 2,936 mammoth ivory beads, which were probably strung onto clothing (Bader and Mikhajova 1998). Perforated fox teeth, 25 ivory bracelets, a painted pendant of schist and an ivory carving of a horse were also found in the grave. This is one of the richest Upper Palaeolithic graves, however, the double burial at Sungir is even more spectacular. Two children, a boy of 11-13 years and a girl 9-10, were found laid head to head (Bader 1978). They are associated with thousands of ivory beads (the boy has 4,903, the girl 5,274) sewn onto caps and clothing, hundred of perforated artic fox teeth,

ivory pins, disc shaped pendants, ivory carvings and spears. Soffer (1985, 456) has suggested that the beads alone represent over 2,500 hours of labour. Interestingly, the beads are of the same form as those from Sungir 1, but are 30 per cent smaller (White 1995), seeming to support the idea of aged based social distinctions centred on strictly governed production of personal ornamentation in a way observed some 10,000 years later in the Magdalenian (Vanhaeren and d'Errico 2005). Again, evidence for physical impairment is present, Formicola and Buzhilova (2004) found that the girl had pathological abnormalities suggestive of a congenital disease perhaps connected with a diabetic mother. Whether or not the girl's condition afforded her social status, it is difficult to see the richness of this burial as suggestive of anything other than social status differences from an early life.

The possibility that those with physical impairment were singled out for special treatment in death, could reflect a growing fear reflected in burial. Zilhão (2005) argues that the spatial data for infant burials suggests a policy of avoidance. All multiple burials of the period associate adults with adults or adolescents, but not with other children. Children, on the other hand, are only associated with adolescents. Indeed, child burials do seem to be an isolated phenomena, suggesting that 'a special place (was) required for the ritual disposal of the body of such a young child' (Ibid 235). This may reflect a more general fear of the dead and a desire for permanent separation. Gamble (2007) suggests that burial represents a symbolic containment of the body. He argues that this is present in Neanderthals as evidenced by the double containment at Chapelle aux Saints where an arthritic and toothless man barely 40 years old is buried in a pit inside a cave (Stringer and Gamble 1993, 94-5). In the Upper Palaeolithic, when a cave is not used, he suggests that the dressing of the corpse represents the symbolic second containment (Gamble 2007, 197). Evidence for clothing comes from many of the sites discussed not least Dolni Vestoice, Sungir and Il Principe. Binding is another practice suggestive of containment as evidenced at Kostenki 14, Russia. Here, a male dating to at least 29,000 BP was found in a shallow pit covered in red Ochre (Sinitsyn 1996). With the legs tightly flexed, it appears that the man was bound before burial. His head is also facing the ground and the fists are clenched,

which has led Pettitt (2010, 201) to suggest that he might have died while experiencing considerable pain, another indication that his death may not have been simple and required a more elaborate ritual to mediate.

It should not be surprising to see infants and the infirm apparently being singled out for special treatment in death. The biological imperative for Panksepp's PANIC/GREIF system is to ensure that children are not isolated from caregivers. As such, it should be expected that the most affectively charged deaths are those of children. Additionally, the presence of an infirmity in an individual may have required active support from other members of a social group (Dettwyler 1991). With more members of the community invested in the welfare of an individual in life, it is likely that the experience of separation distress will have been more widely shared in death. For this reason, under the rubric of the hypothetical mindstate of abstraction, there is no need to posit notions of social status, hereditary or otherwise. The individuals represent in the funerary record for the Upper Palaeolithic would appear to be those most likely to have provoked a strong separation distress response form the individual invested in their welfare in life.

Additionally, it is not necessary, at this stage, to posit the emergence of specific afterlife beliefs that extend beyond the affective significance of the dead, much less a shared continent wide set of beliefs as argued by Pettitt (2010, 207). Rather, the mortuary practices of the Upper Palaeolithic would appear to be highly variable, idiosyncratic attempts to manage the disruptions of emotional salient relationships. The nature of meta-experience instead seems to be concerned with the notions of divestment, managing separation with material culture to offset the affective disruption of separation with individuals (Miller 2009). It is this abstraction of the meta-experience of grief onto material culture practices that seems to set modern humans apart from other hominins within the context of the third hypothetical mindstate.

8.5 Conclusion

The three hypothetical mindstates have provided an alternative way of viewing the evidence for mortuary behaviour of ancestral hominin (table 8.1).

Working from the assumption that all hominins will possess a biological mechanism for separation distress producing a grief-like response at the disruption of a mother infant relationship, the scepticism of positing afterlife beliefs in mitigated. The suggestion that even Australopiths engaged in simple morbidity practices such as 'funerary caching' is entirely consistent with the first hypothetic mindstate. Interacting with the dead and with grieving individuals could easily have led to the structured disposition of remains.

The extension of this practice to included places of repeated deposition can be seen as evidence that relationships are continuing to be emotionally salient, for more individuals, beyond that which would be expected in the first hypothetical mindstate. With relationships maintained once they have gone offline, the deceased can continue to act and guide behaviour in death. Additionally, the possible emergence of burial in isolated instances, may indicate a move towards nuanced, idiosyncratic, script based responses.

Finally, the increasing use of material culture to mediate the loss of affectively significant relationships suggests the emergence of ontologically subjective categories relating to the performative nature of grief. Practices are still idiosyncratic and do not yet represent fully consistent belief systems, but there is clearly a socially mediated understanding among certain groups as to the acceptable behaviours in times of intense grief.

Table 8.1: Hominins, mindstates, and grief

Mindstate	Type of grief	Material Culture	Hominin
1st mindstate	Interaction with the deceased and grieving individuals	Morbidity and funerary caching	Primates and Australopiths
2nd mindstate	Extension of grief beyond the absence of body	Structured deposition and burial	Neanderthals Possibly *Homo Heidelbergensis*
3rd mindstate	Abstraction of grief into material culture practices	Grave goods and geographically specific practices	Modern Humans

9 Conclusions

The objective of this thesis was to propose an interpretative framework for the prediction and analysis of hominin emotions. I have attempted to do this by constructing a model for hypothetical hominin mindstates informed by the theoretical requirements of the archaeological study of emotion, the interdisciplinary study, and the evidence of child development. This model was then bolstered by the paleoanthropological evidence for life history patterns and tested against the archaeological record to anchor the hypothetical mindstates to specific hominins and material culture. I shall conclude by summarising the argument, outlining key conclusions, and considering directions for future research.

9.1 Summary

In chapter 1 it was seen that a complicated intellectual history has prevented emotion from being a viable topic of research within the study of archaeology and human origins. An overt materialism within archaeology, and an overbearing desire to be 'scientific' has led to the rejecting of topics including emotion as spurious to the archaeological exercise. Instead, a preference has been for functional, deterministic interpretations that are held to stay closer to the "objective reality" of the material record. Within human origins, the same materialism can be found. Additionally, changing perspectives on what it means to be human has caused emotion to be sectioned off as both a primitive animal instant and a higher cognitive ability in what is splendid cognitive dissonance. Recently, some have attempted to incorporate emotion into the study of archaeology, however, these attempts have been held back by disagreements over what should be studied. Ultimately, it was necessary for the "archaeology of emotion" to return to the central issues of interdisciplinary study of emotion in order to find a new definition of emotion with which to move forward.

In chapter 2 it was seen that the evolutionary study of emotion has often taken the wrong track. **Evolutionary psychologists** have sought explanations for emotions that are observed today, proceeding with the assumption that they must have developed as a solution to an adaptive problem in our evolutionary past. As such, emotions are presumed to be discrete neurological mechanisms, on which natural selection could act to convey an adaptive advantage. This evolutionary approach is closely related to the "**basic emotion**" position advocated by some psychologists and neuroscientists. They argue that certain emotions are universal to all humans, and some animals, being biologically hardwired brain mechanisms acquired during evolution. These theories have always been controversial, with **constructivists** often arguing for the role of social and cultural processes in the construction of emotional experience, and greater cross-cultural variability. Evolutionary and basic emotion theorists will often cite research from **neuroscience** to support their claims that biologically discrete neural mechanisms for emotions to exist. However, the evidence provided by this research is often not as clear cut as many presume. Whilst it is clear that emotional experiences are generated by certain mechanisms within the brain, activity is far more diffuse that would be expected if emotions were discrete, evolved mechanisms. Rather, it appears that many brain regions are recruited to the generation of emotional experience, and it is difficult to label any single region as responsible for a specific "emotion". At best, it can be said that there are a small number of brain mechanisms that generate a **broad** affective experience best described in **general** terms of valance. This leads to the conclusion that folk psychological categories are not the correct unit for the scientific analysis of emotion. Discrete emotions, as posited by evolutionary and basic emotion theorists, do not seem to exist in any entitative sense.

In chapter 3 it was seen that emotion is best understood as a complex **multicomponent process.** As such, an emotion episode must be understood as the confluence of subjective feelings, bodily responses, cognitive appraisal, and social-cultural influence. Emotions cannot be adequately understood by recourse to only one of these factors. Phenomenological studies have done much to explore the highly individualised nature of subjective affective experience. Bodily responses have a hormonal basis and is closely related to neurological systems.

Cognitive theories begin to explain how different types of emotional experience can be distinguished through the appraisal process, including the attribution of events, understanding personal relevance, the influence of emotion knowledge, and provide the impulse to act. Cultural and social factors influence the types of emotions that are experienced and the way they are experienced within dynamic social networks. It is argued that the multicomponential nature of emotion can be considered in an evolutionary context under the rubric of the Russell's circumplex model. The underlying biological systems are termed 'core affect' and are taken to be the generalised neurological systems described by neuroscientists. An emotion episode occurs when an individual becomes aware of their state of core affect. In humans, this can be termed the self-aware experience of core affect can be termed emotional meta experience. The task for an evolutionary study of emotion is to understand processes that lead to the construction of emotional meta experience.

In chapter 4 it was seen that the processes that lead to the psychological construction of emotion can be observed during the development of human children. From an affective life experienced only in the broad terms of valance and arousal that make up core affect, children come to construct vastly complex and idiosyncratic emotional meta-experiences. This is the result of a shift away from sensory perceptions towards relational schema that involve conceptions of self, other, and the causes and effects of action. As such, the focus of study shifts from the underlying neural processes to the cognitive elicitors that are incorporating aspects of self into affective appraisals. Ultimately, the developmental process is presented as a vital stage in the emergence of social cognition. It is during this period that children acquire the knowledge that they require to become active participants in shared social worlds, choosing whether or not to conform to the obligations their role brings. Here, it is argued that evolutionary changes in the psychological ingredients of appraisal caused an expansion of the emotional vocabulary of early human ancestors.

In chapter 5, it was seen that it is there is a period of infant brain development that is behind divergence in the cognitive abilities of primates and modern humans. Looking beyond the significance afford to brain size, it will be argued that the pace at which the brain develops in infancy is the major factor in determining cognitive complexity. Human brain development is more protracted

than that of chimpanzees, with the processes of synaptogenesis and myelination maintain prenatal rates of growth for longer after birth, continue further into childhood. This allows the human brain to be wired to experience, a vital characteristic for the computation of higher cognitive function including elaborate emotional capacities and social cognition. It was also seen that evidence for life history patterns from Hominin fossil remains indicates that this shift in developmental patterns occurred during the evolution of ancestral hominins.

In chapter 6 it was seen that the affective lives of hominins can be described by three broad heuristics: interaction, extension, and abstraction. These heuristics build on the evidence for dynamic changing in the emotion process seen during childhood, to provide generalized hypothetical mind states to be used as conceptual frameworks for understanding the behaviour of early human ancestors. It will be argued that all animals inhabit an inherently affective world, perceiving and experiencing the environment in terms of affective tones. Evolutionary changes to psychological ingredients alter the ways in which environmental stimuli are perceived and thus their affective significance. Interaction speaks for intersubjective affective engagement. An emerging sense of self allows consideration of the personal relevance of affective valance, with people, things, and places serving only as sources of affective tone. Extension begins to incorporate people, place, and things into the world of self in more complex way. The addition of certain psychological ingredients allows the intentions and desires of others to be considered and incorporated into behaviour decisions, however, these conclusions are drawn only from the evidence immediately observable during intersubjective engagement. Abstract interaction allows the imagined worlds of other to being to play an active role in the decision-making process. Ontologically subjective categories come to dominate affective life. These heuristics are not seen to have evolved teleologically, but are coexistant and over lapping potentials. As the new psychological ingredients are added, additional layers of affective complexity become possible and may be exercised given an amenable social and material environment.

In Chapter 7, it was seen that an understanding of the ingredients of the psychological construction of emotion can provide insights into the evolutionary ontogeny of emotion. There is evidence that many of the cognitive prerequisites

for emotional meta-experience antedate the emergence of modern humans. This implies that some early human ancestors may have been able to construct the emotional experiences predicted by the hypothetical mindstates. It will be seen that these cognitive abilities develop over the course of childhood, with implications for the way emotions are understood. During infancy, children are highly susceptible to social and cultural factors, which play a significant role in the emergence of brain circuitry necessary for the psychological construction of emotion. Changes in growth rates and developmental processes scaffold these developments. It is suggested that hominin emotional repertoires could be hypothesised based on this data. The proposed hypothetical mindstates also provide predictions about the sorts of behaviour that may be expected and thus suggests new ways to interpret the archaeological record.

In Chapter 8, the archaeological evidence for burial was used as an example to show how the three hypothetical mindstates can be used to make sense of complex, non-functional behaviour. It was seen that the concepts of religion and symbolism are not required in order to understand burial behaviour. Rather, by recognising the emotional disturbance of a broken relationship, particularly the mother-infant dyad, burial practices can be understood as individual and social attempts to processes separation distress. Initially this occurs through morbidity practices as seen in primates, and develops to fully fledged burial practices with a high degree of variation and the underpinnings required for symbolic and religious elaboration.

9.2 Conclusions

By presenting the three hypothetical mindstates for predicting hominin emotional capacities, I have attempted to show that emotions are not wholly off limits for archaeological discussion. The hypothetical mindstates offer a way of thinking about emotions that is amenable to archaeological study, breaking discrete emotions down into psychological ingredients for which archaeological evidence can be sought directly. When a hypothetical mindstate can be related to a hominin it provides a heuristic though which to think about the possible emotional motivations that were a driving force for behaviour. This provides a

discursive framework for proposing new ways of thinking about hominin material culture.

It has also been seen that there is more to cognitive complexity than brain size. The latter has been the default for those attempting to assess the cognitive ability of hominins, mostly due to the lack of any other reliable evidence. Whilst good progress has been mad using EQ, it is now time to consider other factors affecting development of hominin minds. The most important factor for modern human and chimpanzee cognition is the process of brain development in infancy. As discussed in chapter 5, exposure to stimuli during this period has a profound affect on the development of cognitive traits, especially those associated with sociality. If we are to fully understand the nature of hominin cognition and emergence of modern cognitive traits during human evolution we must come to grips with life history patterns and the way that hominin brains matured in their unique social environments.

Chapter 8 has attempted to demonstrate the potential of the three hypothetical mindstates for generating new ways of view data. It was seen that it is possible to understand complicated non-functional behaviour by shifting the emphasis away from abstract notions such as symbolism, afterlife beliefs, and religion. Emotional motivations are entirely consistent with the biological and psychological endowment of hominins without overreaching the interpretive remit. Indeed, interpretations of behaviour based on emotion motivations would seem more authentic than postulated and unsubstituted symbols and belief systems.

That said, the hypothetical mindstates are less rooted in empirical data than other models for cognitive evolution. For this reason, it must be considered as a theoretical framework, not a data driven model. The hope, is that such a framework will provoke discussion and stimulate new interpretations influenced by a broadened appreciation of the possibilities factors affecting hominin decision making. We cannot continue to consider hominins as rational actors optimised for survival. If this is true for any animal, it is certainly not true for primates in general, let alone the human animal. If we are to fully understand the non-functional decision making of hominins we must understand the emotions

motivating their actions. This is not an easy task, and the proposals here are not definitive, but more focussed and detailed analysis may start to make headway.

9.3 Future research

The objective of this thesis was to propose a model by which archaeologists could begin to ask questions about the emotional repertoire and behaviour of early human ancestors. The proposed hypothetical mindstates and provisional interpretations can only be taken as a suggestion as to the way forward. In order for archaeology to make a significant contribution to the interdisciplinary literature on emotion, a much greater research effort will be required.

First, much closer attention should be paid to the life history patterns of ancestral hominins. With the scant evidence available from the fossil record this will prove difficult, although one should always have hope for new discoveries that could shed further light on the changes that occurred to developmental processes during human evolution. The work on the SRGAP2 gene suggests that genomic research may be able to make a contribution to understanding the biological processes underpinning infant brain growth. However, it should not be assumed that the anthropological record is silent on life history. As suggested in chapter 7, the extension of the period of infant dependency will have an effect on nature of child rearing practices. The longer the period of post-natal brain growth, the more investment will be required in order to rear the child. As such, group structures and division of labour within communities of ancestral hominins will have been in no small part decided by the increased requirement for child rearing. It should not be assumed that this additional work will fall on the parents, but is likely to be shared across the extended family and group. As such, future studies should look at the nature of childhood in the Palaeolithic so as to improve our knowledge of the social environment in which children are raised. Brain size and EQ alone can no longer be considered enough to explain cognitive complexity in hominins. We must consider the social processes that fine tune cognition in the sensitive developmental years after birth.

Second, extended and more detailed analyses of the material culture record will be required to full explore the potential of the model. The hypothetical mindstates are not intended to be monolithic, but rather to provide workable predictions and suggestions for the study of hominin cognitive abilities and behaviour. Those working within the rubric of cognitive archaeology may be able to offer further consideration of the psychological ingredients of emotion. Certainly, more empirical evidence is needed to establish the capacity for objective self-awareness, causal inference, and joint attention present in ancestral hominins. It would also be interesting to see social referencing considered as a component of the teaching process for stone tool manufacture and other technical skills. Those working under and interpretive rubric may be able to offer a more detailed consideration of way the hypothetical mindstates interact with material culture. Certainly, the investment of emotional capital in objects connected to emotion scripts is likely to have fundamentally changed hominin interaction with material culture. Emotion scripts provide a way to understanding a non-symbolic process of meaning making through emotional investment that may have potential for understanding nonfunctional decision, particularly with regards to the debates surrounding early art and religion.

Of particular interest should be the study of hominin subsistence patterns. Many of the psychological ingredients of emotional meta-experience would have a bearing on prosocial behaviour at large, including alloparenting, cooperative hunting, and division of labour. A thorough analysis of the subsistence patterns of hominins would be able to provided further indications as to the presence of psychological ingredients. It would also help to illuminate the social and emotional processes that underpin extended sociality. As hominins become more mobile, the extension of social networks over longer distance will have a significant bearing on the emotional salience of offline relationships. It will be the psychological ingredients of emotional meta-experience that keep social relationships intact and emotionally salient and keep diffuse social groups intact.

Additionally, an analysis of tool production strategies may be a fruitful area of study. Whilst simple stone tools, such as those at Lomekwi, may be the product of a single instance of activity, more complex tools will require time investment and a longer Chaîne opératoire. As investment in material culture grows objects

will begin to be retained in a way not previously seen. When objects stick around, they have a better chance of becoming transitional objects, or acquiring unique object biographies and their own social life (Appadurai 1986). Through this process objects may be able to acquire emotional meaning through association with people, places, and things. Ultimately, retained objects may begin to acquire their own social agency (Dobres and Robb 2000) and act reinforce the relationships that hold social networks together (Gamble 2007). Through these processes emotional investment in material culture may begin to contribute to the construction of ontologically subjective categories, with objects taking a key role in the performance of socio-cultural emotions.

Significant emphasis should also be placed on the role of process in studies of hominin cognition. This thesis has shown that attempting to understand cognition and behaviour in terms of discrete categories is likely to be unsuccessful. The component processes that make up complex cognition and behaviour are so interconnected, so interdependent, that attempting to separate them out will likely cause important factors to be overlooked. It is best to consider cognition not as a single instance, but a complex process, a process that generates thoughts and behaviour in the moment as well as an evolutionary process. At a time when academic archaeology is becoming increasingly specialised, large scale works seeking to explain the processes of long term change are more important than ever.

Finally, the deep history of emotion should not be presumed to stop with the Upper Palaeolithic. The process of the construction of complex emotions continues into the present with new emotions emerging at regular intervals. For instance, cyberchondria – "anxiety about 'symptoms' of an 'illness' fuelled by internet 'research' (Watt Smith 2015, 67). As such, the search for emotional meta-experience should be extended to the ancient societies of the Mesolithic, Neolithic, archaic states, and beyond. With more material culture evidence available for these time periods it may be possible to reconstruct very specific, culturally specific, emotions describing the hopes and anxieties of people of the past. The emotions that we experiences and created by the society that we live and to understand what someone feels is to understand the society in which they live. If

we can begin to delve into the emotion vocabulary of the past we can begin to unveil some real truths about the people who lived there.

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