The Origin of Universal Human Emotions

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The Evolution of Human Emotion

In the social sciences, feelings are referred to as "affect," and there are many confusions between the terms "emotions," "feelings," and "affect." One reason for this is that humans experience a wide range of feelings – such as being tired, bored, sleepy, excited, hungry, angry, afraid, sad, ashamed, proud, embarrassed, happy, or jealous, and much of it is called "emotion." Indeed, feelings are an important part of everyone's psychology because they are our private readouts of internal processes, informing us without words how we evaluate the world around us and events that happen to us, and what may be going on in our bodies. They are windows to our souls. And, feelings and emotion are aspects of mental life that all humans have a lifetime of access to, and a lifetime of contemplating the proper words to describe nuances of an inner physiological state or sensation. Thus it is not surprising that people lump "emotions" and "feelings" all together in one messy category.

But emotions are not just feelings. The universe of affective phenomena includes emotions, but also moods, some personality traits, some psychopathologies, and well-being. Emotion, therefore, is one class of affective phenomenon. To me, emotions are *transient, bio-psycho-social reactions designed to aid individuals in adapting to and coping with events that have implications for survival and well being.* They are biological because they involve physiological responses from the nervous systems, and prime skeletal muscle activities. They are psychological because they involve specific mental processes required for elicitation and regulation of response. And they are social because they are often elicited by social interactions, and have meaning to those interactions. (I use the word "social" here in the broadest sense in relation to our evolutionary history, which includes interactions not only with other humans, but also other living beings, such as snakes, bears, wild pigs, etc.)

The emotions humans experience today emerged (or were naturally selected) in our evolutionary history as rapid information processing systems that helped us deal with the environment and events that occurred. That is, emotions evolved to help us cope with events and situations that had consequences for our immediate welfare. If humans didn't have emotions, we wouldn't know when to attack, defend, flee, care for others, reject food, or approach something useful, all of which were helpful in our evolutionary histories (as they are today). If we didn't feel disgusted at spoilt food, we would eat it. If

we weren't outraged when rivals stole our food, resources, or mates, we wouldn't defend them strongly. If we didn't feel the joy in caring for a child, or the compassion in caring for a loved one, we wouldn't enjoy the social bonds that make human cultures and relationships unique.

In fact emotions-as-information-processing-systems are extremely adaptive because they allow us to take immediate action without thinking. There simply is not enough time to think through the consequences of every single event that elicits an emotion. Emotions evolved to allow us to rapidly, efficiently, automatically, and unconsciously react to the world without thinking, and prepare us to act (or react) appropriately. Thus emotions helped humans adapt to immediate needs in their environments, and were instrumental in our survival as a species. We cannot think of life today without emotions, and for good reason; without our emotions, we wouldn't be here!

Emotions aid in adaptation because they recruit programs that coordinate and orchestrate other evolved systems, such as perception, attention, inference, learning, memory, goal choice, motivational priorities, physiological reactions, motor behaviors, and behavioral decision making. Their engagement allows for the simultaneous activation of certain evolved systems and deactivation of others, in order to prevent the chaos of multiple, competing systems being activated at the same time when meaningful events occur that require a response. This allows for coordinated, orchestrated responses to environmental stimuli. Thus, anger prepares the body to fight, and fear prepares for flight. To be sure, not everyone who is angry actually does fight, nor does everyone who is afraid actually flee. In these cases, anger and fear *prepare* the individual to do so; engaging in such behaviors, however, depend on a host of other factors, both cultural and individual.

The emergence of the range and depth of human emotions is orchestrated with the evolution of the human brain, especially the cortical and language areas; the differentiation of the facial musculature and the neural pathways that innervate it; and the autonomic and central nervous systems. Animals much lower in the phylogenetic chain have much more primitive feeling states and reactions, such as pleasure and pain, which correspond to fight or flight responses. But just as the complexity of human speech evolved from grunts and howls, human emotions span a broad range, depth, and pitch in complexity and intensity, all of which evolved to allow humans to deal with the demands of their increasingly complex social lives, as groups became more differentiated and language evolved, producing greater social complexity. Emotions evolved in order to help humans deal with this complexity.

Basic Emotions

Humans experience many different types of emotions, including self-conscious emotions, positive emotions, prosocial emotions, and moral emotions. Research has

demonstrated that a class of emotions known as *basic emotions* has a unique set of characteristics that distinguish them from all other emotions. These characteristics include unique physiological signatures, distinctive changes in mental activities and attention, subjective experience, and reliable nonverbal signals. Moreover, these characteristics are universal to all people of all cultures. For now, the basic emotions include anger, contempt, disgust, fear, enjoyment, sadness, and surprise; future research may demonstrate that other emotions share the same characteristics as these emotions.

Basic emotions are called "basic" because research suggests that we share these emotions with our primate ancestors. That is, they appear to be emotional reactions that nonhuman primates have as well. It is not clear whether or not nonhuman animals have other more complex emotions such as love, hate, jealousy, shame, guilt, envy, compassion, and the like. It may have been the case that these latter emotions emerged later in evolution, and are truly unique to humans. This would make sense, given the increased cognitive abilities that seem to be prerequisite to having these emotions. Or, it could be that our nonhuman primate relatives have these emotions but we just can't tell yet because our current research technologies are not sophisticated enough to do so. Or, our primate relatives may have more primitive versions of these other emotions, related to dominance and submission, pleasure and pain Emotions such as shame, guilt, embarrassment, and pride, for instance, are also universal, discrete emotions that are parts of a system of social or moral emotions related to environmental contingencies of interaction. But there is no evidence yet to demonstrate their underlying physiology, or their expressive displays. Future research will certainly disentangle the interesting question of exactly what emotions we share with our primate relatives, which are uniquely human, and how nonhuman primate versions of emotions may be similar or different to human emotions. For now, it is clear that we share a class of emotions called basic emotions.

Some people wonder why there are only seven basic emotions. In actuality, each emotion term is a place-holder denoting a family of related emotions. For example, the anger family contains emotions denoted by the terms annoyed, irritated, frustrated, pissed off, angry, mad, hostile, exasperated, furious, and enraged. The fear family includes anxious, nervous, tense, worried, apprehensive, frightened, terrified, horrified, and mortified. Specific emotion labels often denote variations in intensity and/or the eliciting circumstances. Thus the basic emotions framework is not about "just" a small set of seven emotions; in fact basic emotions refer to a quite large and varied emotional world.

How are Emotions Triggered?

- You're driving on the freeway with a work colleague in the passenger seat, when all of a sudden, a car in the next lane over cuts in front of you dangerously close, forcing you to slam on the brakes.

- You've been starving all day, waiting to get a chance to get a bite to eat. Finally, you find some time to get a sandwich. Your stomach is growling as you open the bag, take out the sandwich, and take off the wrapper. Finally, you're able to sink your teeth into the bread, biting through, getting all of the meat, cheese, and vegetables when all of a sudden you hear a crunching sound. You take the sandwich out of your mouth and see a half-bitten insect sticking out.

These kinds of events trigger emotions in all of us. But how exactly are emotions triggered? Many authors have suggested the existence of a base processing system in the brain that describes how emotions are triggered. This base system evolved to deal with species-constant problems related to survival in a time-tested, predictable, and automatic fashion. These problems could occur in interactions with nature or with other humans. The system is hard-wired, fairly impermeable to modification by experience, and relatively unchanged throughout the lifespan.

Figure 1 is a graphical representation of the processes that occur in the base system. The first stage of this system is perception, in which the sensory information obtained as individuals scan their environment is converted to schemas – mental representations of the situations or events being perceived. These schemas may consist of two components – one referring to the physical characteristics of the sensory information associated with the perceived event trigger, the other referring to psychological meanings or themes associated with the event trigger. In other words, perceived schemas describe what the events are, and/or what they mean.

Then, the created schemas are evaluated in a process known as appraisal, which is immediate, unbidden, opaque, unconscious, and automatic. In that process, perceived schemas are compared to a known set of emotionally-relevant schemas, that is, schemas that when matched should initiate an emotional response. These schemas exist in an *emotion schema database* that stores such schema information. For example, the perception of a coiled, cylindrical object that is hissing may match the schema of a snake in the emotion schema database, triggering the emotion of fear. The perception of the smell of feces may match the schema of contamination in the emotion schema database, triggering the emotion of disgust.

If the perceived schemas do not match those in the emotion schema database, no emotion is elicited and the individual continues to scan the environment. A match, however, initiates a group of responses, including expressive behavior, physiology, cognitions, and subjective experience. The responses are coordinated, integrated, and organized, and constitute what is known as an emotion. Emotional responses, in turn, affect the scanning component of the system. In my view, "emotion" is a metaphor that refers to this group of coordinated responses.

So let's examine how this system worked in one of the examples above. Seeing the bug's half-body inside the sandwich was the perception. This perception was then

converted to a schema – a mental representation of the physical reality – and the schema was then appraised – evaluated and compared against the emotion schema database. The emotion schema database probably includes a schema for bugs as filthy, germ spreading objects, thus being associated with contamination and the emotion of disgust. This match of the perception to the schema in the existing database initiates a package of responses, including revulsion, nausea – in short, disgust. The emotion of disgust allows one to spit the food out of the mouth, avoid eating the rest of the sandwich, and to be very careful in the future before biting into something again. All of these actions are very adaptive in dealing with that event, and in the long run maximizes the potential for survival.

People all around the world universally have some prototypic schema in the emotion schema database when they are born. That is, there is a small number of events that bring about the same emotion in everyone, such as the bug in the sandwich above, coming into contact w feces or urine, seeing open and rotting body cavities, losing one's balance, seeing a large object approaching very quickly, hearing growling sounds at night, and the like. These events are universal triggers of emotion. But, the base emotion system is also very flexible, and can be adapted to be associated with any kind of event available in one's experience. Thus people can learn to have emotions to virtually anything. The ability to learn to have emotional reactions allows for large cultural and individual differences in the kinds of events that trigger emotions across groups and people, along with universal triggers that elicit emotion in everyone.

The Basic Emotion Response System

Physiological Reactions

When basic emotions are triggered, they initiate a unique physiological signature, which helps prepare individuals to respond to the eliciting stimulus immediately and effectively by initiating and maintaining whole body activity and priming the individual to engage in certain specific actions. Anger, for instance, produces vasodilation, pupil constriction, foaming, piloerection, and increased heart rate; blood flows disproportionately to the hands and arms, preparing people to fight. Fear, however, produces vasoconstriction, pupil dilation, bulging eyes, and increased heart rate, but the blood goes disproportionately to the feet, preparing people to run. These changes occur in people of all cultures, and thus are strongly suggestive of a biologically-innate, universal program for emotional responding that is unique for each emotion.

Cognitions

When emotions are aroused, they recruit a host of cognitive processes that support the action preparedness of the individual. Emotions turn on two types of cognitive processes. One is the perceptual/attentional system, which maximizes attention to the elicitor and minimizes attention to distractors. For example, when people are angry, they become hypervigilant to other people's anger. Has the following ever happened to you?

One person says or does something to anger another. The recipient responds angrily. The first person, perceiving the anger, responds with anger. The second person, perceiving the first person's anger, now responds more angrily and more quickly. This cycle continues as both respond to each other's anger signals rapidly, escalating their conflict. Soon, they are fighting. Yet when they stop to consider what they are fighting about, they realize that they are no longer fighting about the original issue. They have been responding hypervigilantly to each other's angry signals.

Emotions also gate higher mental processes. When angry, it's easier to think of aggressive acts and previous angry episodes; when afraid, it's easier to think of retreat, and previous fearful episodes. Emotion serves as mental glue, which connects memories and other knowledge stores that were encoded with similar emotions in the past. In fact, many people remember their emotional reactions to things but forget the specific content (e.g., remembering that you liked a movie or a particular part in a movie, but not remembering the specific details).

Feelings

When emotions are aroused they elicit feelings, which are one of the most important aspects of emotion. Feelings are the window to one's soul, and each specific emotion has a unique subjective feeling state and physiological sensations. They signal to the individual that an emotion is occurring or has occurred (or more precisely, that an event that requires a response has occurred). Feelings inform oneself about goals, motivational priorities, inferences, and decision-making. Despite what many people (and organizations) think, feelings are not a nuisance nor are they to be ignored; instead they are important read outs to our internal experiences, and tell us important things about our relationship to the environment.

Expressions

Darwin (1872/1998) suggested that expressive behaviors associated with emotion are the residual actions of more complete behavioral responses. Facial (and vocal) expressions are part of those actions, and occur in combination with other bodily responses. Thus, we express anger by furrowing the brow and tightening the lips with teeth displayed because these actions are part of an attack response; we express disgust with an open mouth, nose wrinkle, and tongue protrusion as part of a vomiting response. Facial expressions, then, are part of the coordinated response involving multiple systems.

Research has provided strong evidence for the universality of facial expressions of emotion. That is, each of the basic emotions are universally recognized and produced by people of all cultures, regardless of nationality, ethnicity, race, gender, age, or religion (Figure 2). That is impressive, given differences among researchers, laboratories, eliciting stimuli, and participant cultures.

Not only are facial expressions of each of the basic emotions universal; new evidence strongly suggests that they are resident in an evolved, biologically innate system. In one of the latest studies from my laboratory, for instance, we compared the spontaneous facial expressions of medal winners and losers from the judo competition at the 2004 Athens Paralympic Games with those from the 2004 Athens Olympic Games. There was an amazing degree of concordance – almost perfect– between the expressions of the blind and the sighted athletes. Humans have about 40 different, functionally anatomically separate movements that their faces can make, resulting in many possibilities for differences to have occurred. Despite that, however, exactly the same facial muscles fired in the blind as did the sighted when emotions were aroused spontaneously. The participants of the Paralympic Games were all blind, and could not possibly have learned to produce the expressions by seeing others do them, thus providing strong evidence that the ability to produce these faces must come from a biologically resident source (Figures 3a - 3c).

Other lines of research also indicate that facial expressions of emotion are biologically based. For example, the universal expressions have been observed in nonhuman primates. Although primates have less facial muscles than we do, the muscles they have all correspond to the same emotion signaling muscles that humans have. (The additional muscles humans have generally are in the lower face and probably exist for speech articulation and emotion referencing.) Individuals' facial expressions are more similar among kin than non-kin, even among blind individuals. And facial expressions of emotion are more concordant among monozygotic twin pairs than dizygotic twins. Collectively speaking, therefore, the evidence for the existence of universal and biologically innate facial expressions of emotions is overwhelming.

The Impact of Evolved Emotions Today

Emotions, and especially basic emotions, have been incredibly adaptive in our evolutionary history. They prepared individuals to respond to events in their environment immediately, automatically, and unconsciously. They are rapid information processing systems that helped us deal with threats from predators, problems of nature, and problems based in the social complexity of human life. We wouldn't be here today if it weren't for our emotions and the way they have evolved and were naturally selected.

But are emotions adaptive in today's world? After all, our emotional systems were built to help us deal with environmental challenges to our survival that faced us over the past 200,000 years or so. But human cultures – especially those in industrialized societies – have also evolved to the point where people today do not face many of the challenges of survival that faced us in our evolutionary history. Humans in many cultures today are conquering or controlling personal climate; the availability of food, water, and other resources; and even interactions among people and other animals. Moreover, the development of technologies related to transportation and communication have thrust people of very different cultures together today more than ever before to work, live, and

play. Thus, survival is in so many ways easier for many people in many cultures in today's world. Every day as we wake up and turn on the water, go to the grocery store and buy food, or turn on the lights at night, we conquer the environment and take survival for granted, just as we do flying around the world or communicating with strangers on the other side of the planet via email. In fact, one could make a good argument that human cultures have over-evolved to some degree.

But as human cultures have evolved, changing our world and the nature of our relationship to it, our emotional system has not (or is still in process). We still deal with today's world with yesterday's emotion system. Our emotions, which played such an important role dealing with predators and animals as we lived in small, isolated groups in our evolutionary history, is what fuels the basis of world wars, clashes of civilizations, and domestic violence. Our emotions, which ensured that we would derive pleasure from eating when food was scarce and difficult to obtain, today serves as the basis of obesity and health problems in many countries and cultures. Our emotions, which in our evolutionary history enabled family and community bonds to remain strong and for close relationships to flourish, today are stunted in their growth as computers and the internet replace actual interactions, and people are increasingly losing valuable social skills honed after many centuries of evolved human social life. For many, today's technology blurs the distinction between virtual reality and reality, and socioemotional development is based more on game technology than interacting with people. Thus the *hikikomori* problems in Japan, where youths shelter themselves in their rooms and interact with the world only through the internet yet cannot interact effectively with real people in real time, is a problem not only for Japan but for many countries and cultures of the world. Violent and primitive emotions fuel every day acts of road rage, conflicts between nation states, and global acts of terrorism. These are all based in an archaic emotion system that was clearly adaptive in the past, but more difficult to justify at times today.

Still, we cannot live without emotions. They allow for complex social networks and relationships, and enhance the meaning of normal, daily activities. They drive us to pursue happiness, and to be creative in music, art, drama, and work. They motivate us to seek recreation and to engage in sports and organize competitions, whether in the local community Little League or the Olympic Games. They inspire us to search the sea and space, to create mathematics, an achievement no other species can claim, as well as an educational system. They allow us to go to the moon, to create a research laboratory on Antarctica, and send probes to Mars and Jupiter.

Despite science fiction that depicts future beings as robot-like, emotion-less automatons, I do not believe that the key for the future is to eliminate emotions. We can't. Instead, we need to learn how to regulate our emotions to live in a civilized, new world. We need to tame the primitive instincts that we share with our animal relatives. We need to leverage emotion correctly, not suppress or ignore it. As cognitive intelligence is one of human's crowning abilities, we need to become more intelligent about emotion and its uses, directing its motivational energy to useful and constructive purposes.

References

Darwin, C. (1872/1998). *The expression of emotion in man and animals*. New York: Oxford University Press.

Figure 1

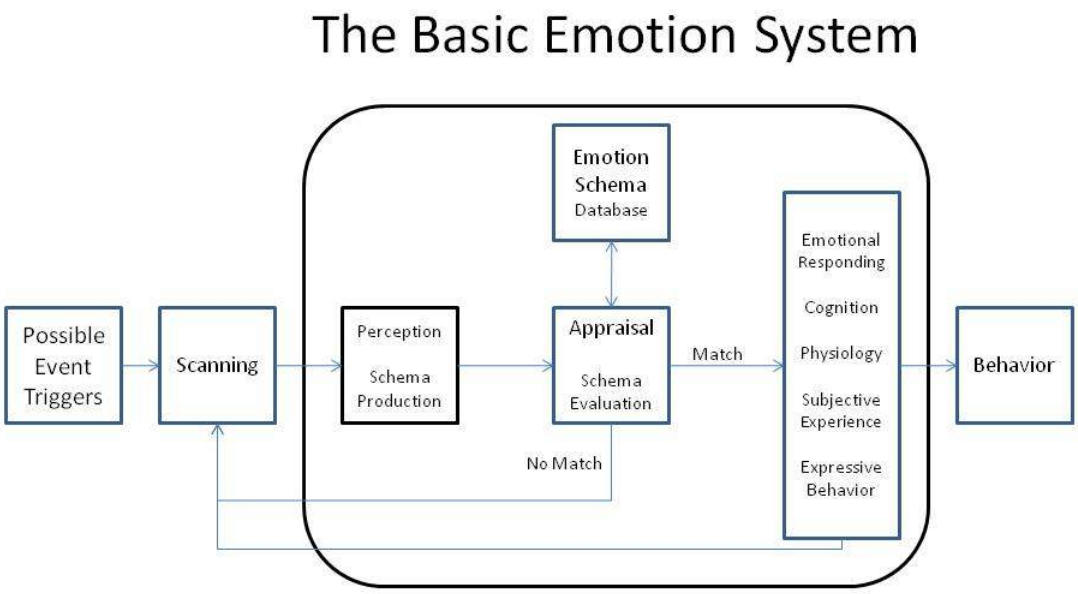
The Basic Emotion System
Emotion Schema Database
Possible Event Triggers
Scanning
Perception
Schema Production
Appraisal
Schema Evaluation
Match
No Match
Emotional Responding
Cognition
Physiology
Subjective Experience
Expressive Behavior
Behavior

Figure 2
The Seven Universal Facial Expressions of Emotion

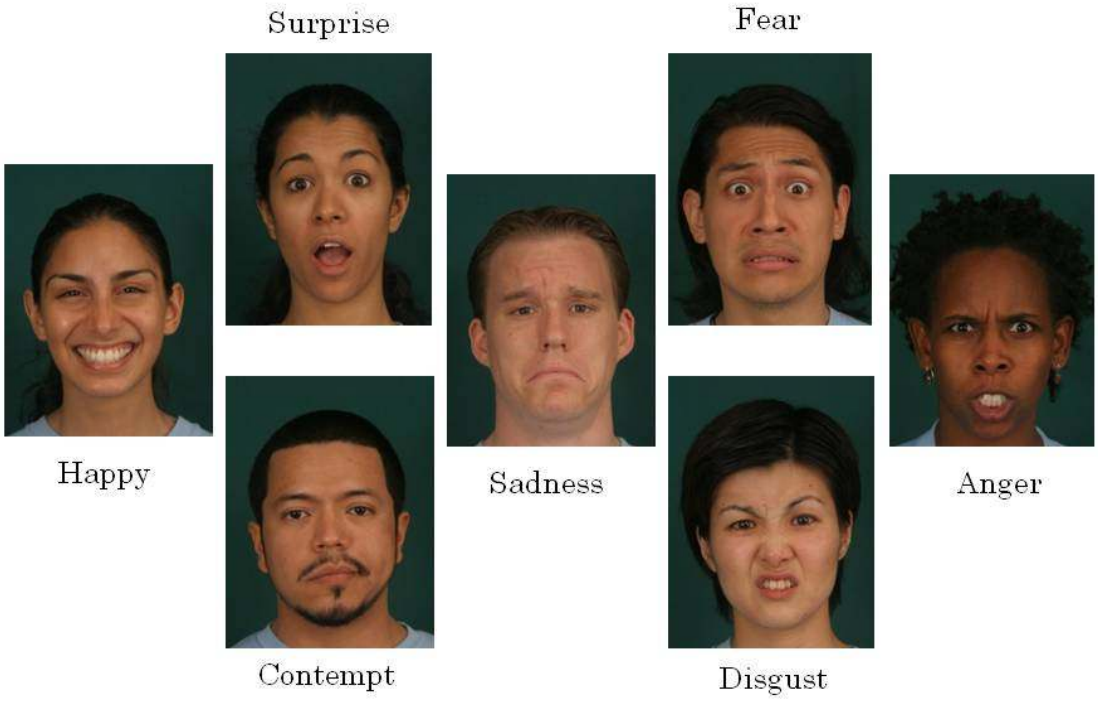

Figure 3a

Comparison of Blind and Sighted Athletes who Just Lost a Match for a Medal

Blind athlete

Sighted athlete

Figure 3b

Comparison of Blind and Sighted Athletes who Just Won a Match and was Overcome with Emotion

Blind athlete

Sighted athlete

Figure 3c

Comparison of Blind and Sighted Athletes who Just Won a Match

Blind athlete

Sighted athlete