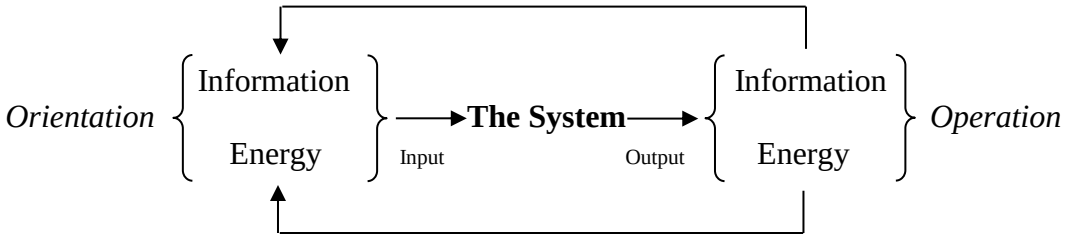
In general, the dynamics of an Open System allows for and requires Orientation and Operation:

The Dynamics of an Ideal Open System:



Orientation (Merkwelt): The Re-Organization of Physiological Components/Systems
Information: The Eidetic/Formal Aspect of Orientational Input
Energy: The Physical/Material Aspect of Orientational Input

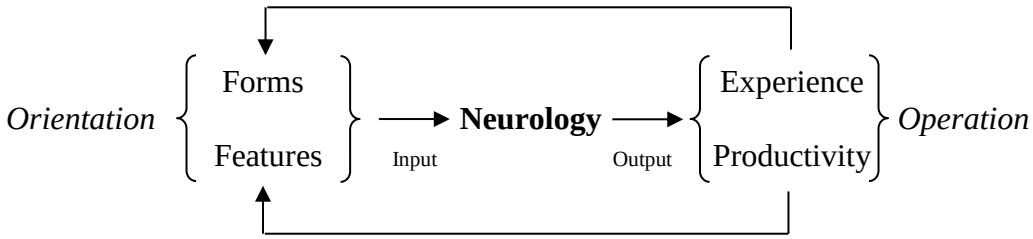
Orientation: {External Cause → [R/A-Effect]}

Operation (Werkwelt): The Re-Arrangement of Physical Components/Systems
Information: The Eidetic/Formal Aspect of Operational Output
Energy: The Physical/Material Aspect of Operational Ouput

Operation: {[M/E-Cause] → External Effect}

For a Neurological System, Orientation and Operation are mediated by the Neurology:

The Dynamics of an Ideal Nervous System:



Orientation and Operation in a Neurological System:

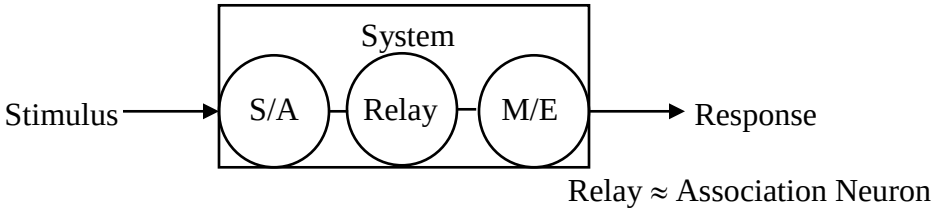
{External Cause → [R/A-Effect]}-{Relay Neurons}-{[M/E-Cause] → External Effect}
Sensory Affection — Central Processing — Motor Effection

Receptors and Reception:

Receptors: Receptor cells are Feature Detectors, a detected feature is called a Stimulus, and the change in the receiving system is called the Response. Sensory Receptors detect extrosomatic features while Somatic Receptors detect endosomatic features.

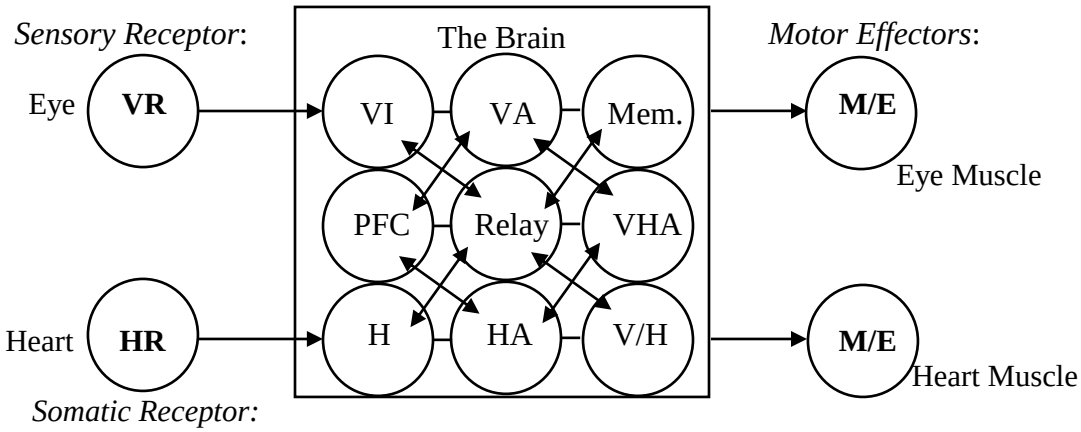
Analysis of Stimulus-Reception and Response-Transmission in variously complex systems:

Reflex Arc:



Legend: S = Sensory; A = Affector; M = Motor; E = Effector

Complex Nervous System:



Types of Reception (Systemic and Sensory Input):

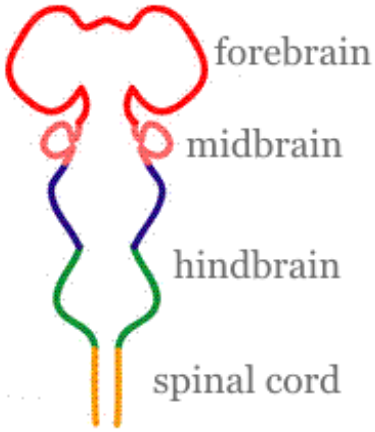
1) Interoception (Viscероception)
   a) Emotions: Pleasure and Pain, Comfort, Discomfort, etc.
   b) Bodliy Functioning: Chemical/Nutritive Levels, Organ Stress (Strain), etc.

2) Proprioception
   a) Orientation: Relative Position of Body Parts
   b) Operation: Relative Motion of Body Parts

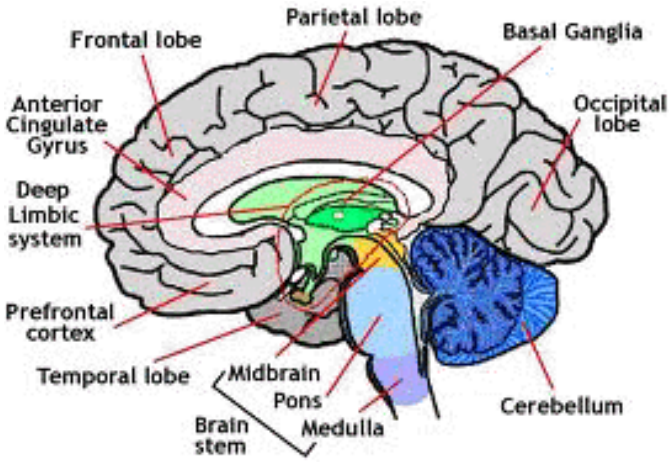
3) Exteroception
   a) Balance: The Inner Ear & the 3 Semicircular Canals
   b) Sensation: The Five Senses [Cf Nbi206: Olfactory, Auditory, and Visual]

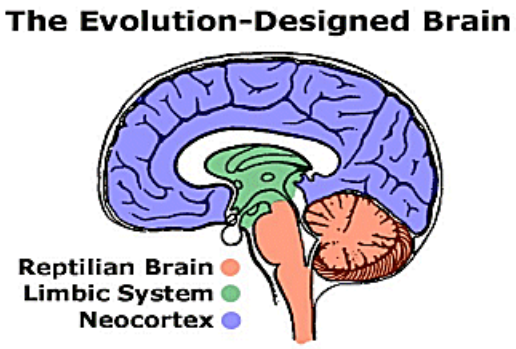
Schematic Representations of the Nerve Cell and the Brain

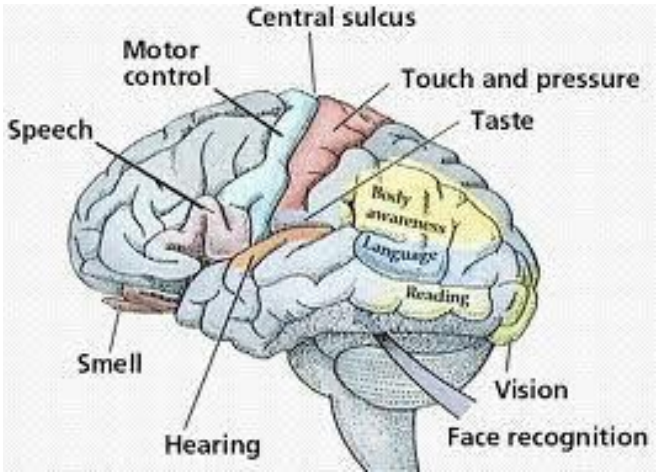
The Primitive Brain:



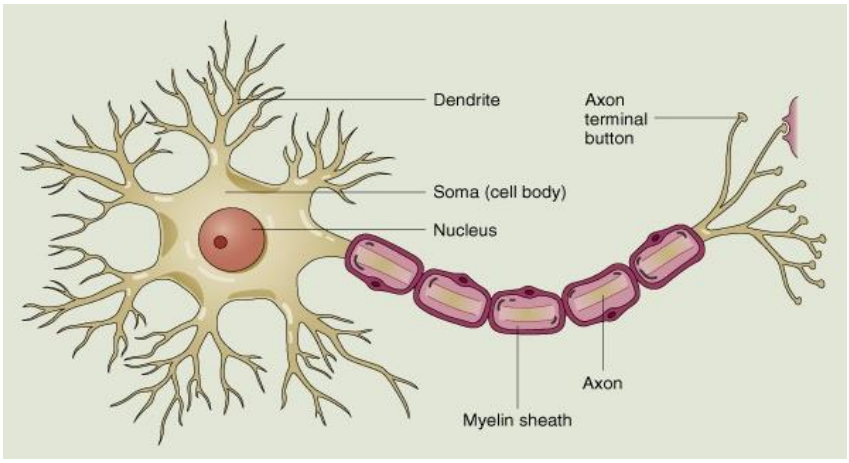
The Modern Human Brain:



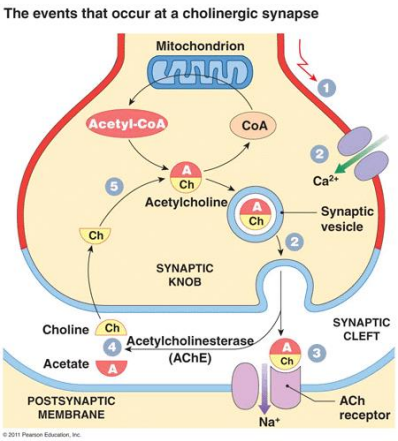




The Nerve Cell:



The Synapse:



Neurotransmitters (NTs):

Neurotransmitters are endogenous chemicals that transmitt Signals from a neuron (the Pre-Synaptic Neuron), across a gap (the Synaptic Cleft/Synapse) to another neuron (the Post-Synaptic Neuron).

Types of Neurotransmitters:

A*mino Acids*: Glutamate, D-Serine, GABA (γ-Amino Butyric Acid), Glycine
Mono-/Other-amines: Dopamine, Norepinephrine, Epinephrine, Histamine, Serotonin
Peptides: Somatostatin, Substance-P, Opioid Peptides
Others: Acetylcholine, Adenosine, Anandamide, Nitric Oxided, etc.

Functions of Neurotransmitters and their "Systems":

The Main Neurotransmitter Functions:

Neural Excitation: Glutamate
Most of the important Neuroreceptors for Glutamate have *excitatory effects*, and Glutamate is used at the majority of fast excitatory receptors in the Brain and Spinal Cord. It is used at most synapses that are "modifiable" (ie, capable of *increasing* or *decreasing* in strength). Modifiable synapses are thought to be the main memory-storage elements in the Brain. High levels of Glutamate are linked to *directed thinking*; low levels to *revery*.

Neural Inhibition: GABA and Glycine
Most of the important Neuroreceptors for GABA all have *inhibitory effects*, although there is evidence that GABA is *excitatory* during early Brain development. It is used at most of the inhibitory synapses in virtually every part of the Brain; but the main inhibitory Neurotransmitter in the Spinal Cord is Glycine.

The Main Neurotransmitter "Systems":

Acetylcholine: this Neurotransmitter is distinguished as the transmitter at the neuromuscular junction connecting Motoer nerves to Muscles. It also operates in many regions of the Brain, using different types of Neuroreceptors, including Nicotinic and Muscarinic receptors.

Dopamine: this NT has a number of important functions in the Brain, including the regulation of Motor behavior, Pleasures related to Motivation and Emotional *arousal*. It plays a critical role in the Reward System. Low levels can cause Parkinsons; high level are linked to Schizophrenia.

Serotonin: 90% of Serotonin is found in the intestines. It regulates Appetite, Sleep, Memory and Learning, Temperature, Mood, Behavior. It may have a role in Depression.

Norepinephrine: this NT and its "co-part", Epinephrine, are critical in Arousal (Excitement) and Reward (Feeling-Tone).

Substance-P: this NT is responsible for the transmission of Pain from certain Senory Neurons to the CNS. It also aids in controlling relaxation of the vasculature and lowering Blood Pressure through the release of Nitric Oxide.

Opioid Peptides: the NTs act within Pain pathways and the Emotional centers in the Brain; some are analgesics and elicit Pleasure or Euphoria.

Neuroreceptors (NRs):

Serotonin (5HT) Receptors:
(Tryptamines)

1A: Antianxiety, Pain-Killing
Overwhelming Love

1B: Social Reward (Vasoconstrictive)

1C: ?

1D: Anxiety (?) (Vasoconstrictive)

1E: } Memory?
1F: }

2A: Psychedelic (STP, etc.)

2B: Empathogens (Ecstacy, etc.)

2C: Enhances D metabolism (ie, Decrease)
OCD and Bingeing related
causes Erections, can Inhibit Opiates

3: Anxiety, Vomiting, ?Ecstacy Reward?

4: Nootropic (Enhances Cognitive Abilities)

5A: Lack of this Receptor causes reduced
Locomotor exploration on LSD

6: Widespread Brain inhibition thru GABA

Anitanxiety (≈ Alchohol, w/ Amnesia)

7: Circadian Rhythms, Thermo-regulation
Neuro-protection

Dopamine (D) Receptors:
(Phenethylamins)

D1: Working Memory, Spatial Awareness

D2: Orgasm, Effects of Tactile Reward
Perception of While Light, Tunnel Vision
Facial and Reaching-Hands Projections
Expansive Feelings, Schizo-style Thought
Disorder, Learning/Reward/Addiction,
decreases Proctactin (too much is bad),
makes Orgasm less freq. but stronger

D3: Craving/Motivation, w/ enhances Reward,
?Visual Beauty?, Antipsychotic towards
the 5HT2A Receptor

D4: Dopamine/Noradrenaline/Adrenaline Rec.
[?perhaps has a role in Focusing?]

D5: More similar to D1 that any other Receptor
(ie, D1-like, as opposed to D2-like, etc.)

Receptors hit by various drugs:

LSD: 5HT1A, 1B, 1D, 2A, 2B, 2C, 5A, 6, 7

Psilocon: 5HT1A, 1B, 1D, 1E, 1F, 2A, 2B, 2C,
5A, 6, 7

DMT: 5HT1A, 1B, 1C, 1D, 1E, 1F, 2A, 2B,
2C, 6, 7

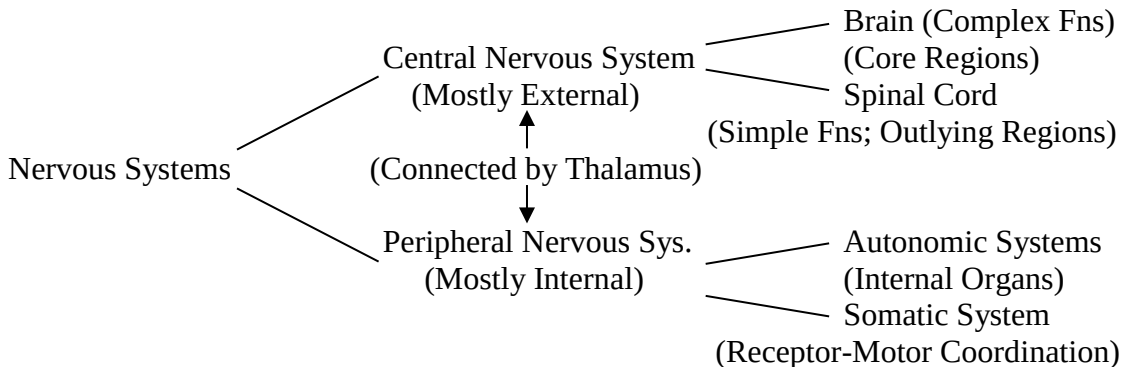
STP (DOM): 5HT2A, 2B, 2C

MDMA: 5HT2B

Higher #s are less well-known (ie, more recently discovered/investigated)
Similar #s imply similarity of the way Receptors are Coded (ie, similarity of Receptor Structure)

. . . PG-BRK

Organization of the Nervous System



Functions of the Major Components of the Nervous System

The Central Nervous System:
Mainly Externally Oriented; connected to the PNS by the Thalamus
Spinal Cord: Outlying Regions, Controls simple reflex arcs and other simple functions
The Brain: Core Regions, Initiates and Controls all complex functions
"The brain's main function is to keep the organism of which it is a part alive and reproducing."
1 mm^3 of the Brain contains more Neurons than the number of stars in the Milky Way

The Peripheral Nervous System:
Mainly Internally Oriented; connected to the CNS by the Thalamus
A) The Somatic System:
Involves Nerves connecting and coordinating Receptors and Muscles
Involved in Proprioception, Movement
B) The Autonomic System:
An *automatic regulatory system* for general life processes
Controls Assimilative-Metabolic-Elimative processes: Breathing, Digesting, Eliminating
Involves Nerves connecting and coordinating the Internal Organs
Involved in Organ Stress
a) The Parasympathetic System: *Routine* Situations, Interior Orientation
Homeostasis
b) The Sympathetic System: *Emergency* Situations, Exterior Orientation
Threat-Alarm and Reaction

The Basic Structure of the Brain

The Major Divisions of the Brain:
1) The Hindbrain — The *Rhombencephalon*: Contains the *Metencephalon* (the Cerebellum), the *Myencephalon* (Medulla Oblongata) and The Pons or Bridge between the Cerebellum and the higher parts of the Brain
2) The Midbrain — The *Mesencephalon*: Processes Reflexes
3) The Forebrain — The *Diencephalon*: Connects the Midbrain w/ the Cerebral Hemispheres
The *Telencephalon*: Contains the Cerebral Cortex and its parts

The Functions of the Major Components of the Human Brain

The Triune Brain:

1) *The Reptilian Complex*: (Hindbrain and Midbrain)
   Regulation of the animal's daily master routines and subroutines, and Behavioral manifestations of 4 types of prosemantic communication displays
2) *The Mammalian Complex*: (Posterior Forebrain/Medial Cortex.)
   Involved in the experience and expression of Emotion
   2 older subdivisions involved in Oral and Genital fns. of self-preservation and procreation.
      Closely assoc. w/ the Olfactory system
   The 3rd subdivision is involved in Parental Care, Audiovocal Communication, & Play
      No rudimentary Counterpart in Reptiles
3) *The Human Complex*: (Anterior Forebrain/Neocortex & Thalamus)
   Extensive connections with Visual, Auditory, and Somatic systems suggests it is primarily Externally oriented; increases capacity for problem solving, learning, and memory of details (with the Brainstem and Neocerebellar connections); in Humans it provides the neural substrate for the linguistic translation and communication of subjective states.

The Reptilian Complex [Appetite and Desire] ~ 300M YBP:

The Brain Stem:
   Regulates complex reflexes, eg Respiration, Heart, Body Fluids, Temperature, Appetite, etc. Neural connections are fixed and automatic. Automatic mechanisms here drive the Brain to constantly scan the environment for stimuli.

The Hindbrain:
   The *Myelencephalon* or Medulla Oblongata
      Controls Breathing, Digestion, and Upright Posture
      This is the site of the Left-Right Nerve Chiasmus
   The *Metencephalon* or Cerebellum:
         Coordinates Motor Functions, regulates Muscle Tone, and controls intricate Movements
         Learned, complex Movements are stored here
   The Pons: The Bridge between the Cerebellum and the higher parts of the Brain

The Reticular Activating System (RAS), the bodies Alarm System:
   Controls the state of Arousal or Awareness, eg sleep-to-waking or diffuse-awareness-to alertness. Constitutes a "consciousness switch". Anesthesia deactivates the RAS. Neuron-stimulus produces an electrical effect in the appropriate area, but the RAS inhibits consciousness of it. It is involved in Attention—some messages are toned down, other never reach higher centers. Attention involves the following:
      1) Arousal: the RAS releases brain-wide Adrenaline/Epinephrine
      2) Orientation: the Superior Colliculus & Parietal Cortex
         The SC orients to the new stimulus; the PC disengages from the current stimulus
         Dopamine & Noradrenaline affect the PC
      3) Focus: Lateral Pulvinar (part of the Thalamus) is like a spotlight, & shunts info

The Midbrain or *Mesencephalon*: Reflexes (Tectum, Superior/Inferior Collucula, S/I Olives)

All of the systems above conspire to affect Aggression, Territoriality, Ritual, and the establishment of Social Hierarchies. Also included are the Olfactostratum, Corpus Striatum, & the Globus Pallidus.

MacLean gives a detailed account of the behavioral aspetcs, as follows. In this analysis of reptilian behavior, there are two ranges (metaphorically speaking): 1) a range that includes behavior linked to daily *master routines and subroutines*; and 2) a range that includes *behavior patterns* used in four main forms of social communication displays: 1) *signature*, 2) *challenge*, 3) *submission*, and 4) *courtship*. Table 6-1 lists certain special forms of basic behavior that involves self-preservation or preservation of the species.

Table 6-1. Special Forms of Basic Behavior

Territorialization:
- Migration
- Trail Making
- Showing place preferences
- Marking of Territory
- Patrolling Territory

Domestication:
- Establishment of [home] territory
- Use of home range
- Selection and preparation of homesite

Ritualization:
- Ritualistic display in defense of territory, commonly involves using of coloration & adorment
- Formalized [i.e., ritualized] intraspecific fighting in defense of territory
- Triumphal display in successful defense of territory
- Assumption of distinctive [i.e., ritualized] postures and coloration in signaling surrender
- Use of defecation posts [?]

Subsitistence:
- Foraging
- Hunting
- Homing
- Hoarding

Ensocialization:
- Flocking
- Formation of social groups
- Establishment of social hierarchy by ritualistic display and other means
- Greeting
- Grooming

Reproduction:
- Courtship, with displays using coloration and adornments
- Mating
- Breeding and, in isolated instances, attending [to] offspring

The Mammalian Complex [Emotion] ~230M YBP:
The Forebrain:
The *Diencephalon* or Limbic System:
Affects Rage, Fear, Sentimentality, etc. Altruism may originate here.
— The Olfactory Complex: This is the oldest part of the Limbic System
— The Pituitary Gland: "Master Gland" of the Endocrine System; alters Mood
— The Amygdala: Regulates Aggression and Fear; sensitive to Threat
— With the Hippocampus, forms a crude Memory system
— *Right* Amygdalic Bulb: Processes Negative Emotional stimuli (Reaction [?Fight/Flight?])
— *Left* Amygdalic Bulb: Positive & Negative Emotional stimuli (Submission)
— The Hippocampus: Affects Memory and Recall
— The Thalamus:
Part is a relay station for information from receptors for the 5 Senses, allowing several senses to be used in concert; another part (the Limbic) plays a role in Sleep.
— The Hypothalamus: Connects Cerebro-Spinal System and Autonomic System
Regulates Eating, Drinking, Sex, Sleeping, & Temperature, as well as Endocrine activity. Maintains Homeostasis; detects changes in Body Systems and corrects imbalances. It is important for Emotion (electrical stimulus produces Pleasure & Pain). With the Pituitary, it controls reactions to Fear and Stress.
— Epithalamus; Pineal Gland; Substantia Nigra

The Human Complex [Reason] ~2.5M YBP:
The *Telencephalon* or Neo-Cortex:
The Frontal Region:
1 — Short Term Memory (with the Hippocampus)
— Orbital Frontal Region inhibits Aggression (larger in women)
— Deliberation and Regulation of Action; Motor & Cognitive Anticipation
2 — How we know what we are doing within our environment (Consciousness)
— How we initiate activity in response to our environment
— Makes judgements about what occurs in our daily activities
— Controls our emotional response and our expressive language
— Assigns meaning to the words we choose (involves word associations)
— Memory for habits and motor activities
The Temporal Region
1 — Complex Perceptual Tasks; Memory acquisition; Hearing ability
— Connecting Auditory and Visual stimuli; and some visual perceptions
— Left: Language; Right: Nonverbal Material (Perceptual Material)
2 — Catagorization of objects
The Parietal Region
1 — Spatial Perception and Symbolic Language
— Exchange of Information between the Brain and the rest of the Body
2 — Location for visual attention and touch perception
— Goal directed voluntary movements, manipulation of objects
— Integration of different senses that allows for understanding a single concept
The Occipital Region:
— Visual Perception: V1, V2 **. . . PG-BRK**

The Bilateral Asymmetry of the Cerebral Cortex:

Contiguity	*Isomorphism*
Left Hemisphere	Right Hemisphere
Analytic	Holistic
Sequential	Simultaneous
Rational	Emotional
Language	Nonverbal Ideation
Divergent (≈ Diversity)	Convergent (≈ Identity)
Literal Meaning	Figurative Meaning
Denotation	Connotation
Abstract	Concrete
Focal	Peripheral
Temporal	Atemporal
Discriminating	Generalizing
Names	Face Recognition
Rhyming	Music
Replies to Verbal Commands	Use of Expletives
Numbers	Geometric Shapes
Pretended and Complex Moves	Spatial Locations
Orchestrated Sequences of Moves	Dressing, Map Reading, Image Rotation
Pantomiming, Finger Naming	May Repeat Words
Feelings of loss from injury	Inappropriate emotional response
Being disturbed by the disability	Failure to recognize emotion in others
Recognize emotion/missing the meaning	Comprehend meaning/missing the emotion
Relations	Sets
Functors	Categories
Proof Theory	Model Theory
Algorithms	Data Structures

Due to the evolutionary development of the human nervous system, the only events that a Person can know immediately are those that are produced by the nervous system itself.

Sensation — The Components of Feature Detection (Cf von Euxkull's Tick)

The Four Primary Components of Feature Detection — Stimulus and Response:

1) Detection { 2) Magnitude / 3) Position } 4) Abstraction

1) Feature Detection:
The Behavior Threshold >/= the Receptor Threshold
Tantamount to the changes in the Receptor Physiology and Homeostasis

2) Magnitude:
The Amount of Reception is □ the Amount of Stimulation
Equivalent to the amount of change in the Receptor Physiology and Homeostasis

3)Position:
Spatial Discrimination by means of Sensory Fields
Visual: What? (Temporal Lobe), Where? (Parietal Lobe), and Hippocampus (3-D Space)

4) Feature Abstraction (Cf Nbi220):
A Feature is a set of Stimulus Properties
This involves Lateral Inhibition
It enhances Contrasts between Stimulated and Unstimulated Areas
Enhances Motion over Stasis
The Two Secondary Aspects:

The Two Secondary Aspects of Feature Detection:

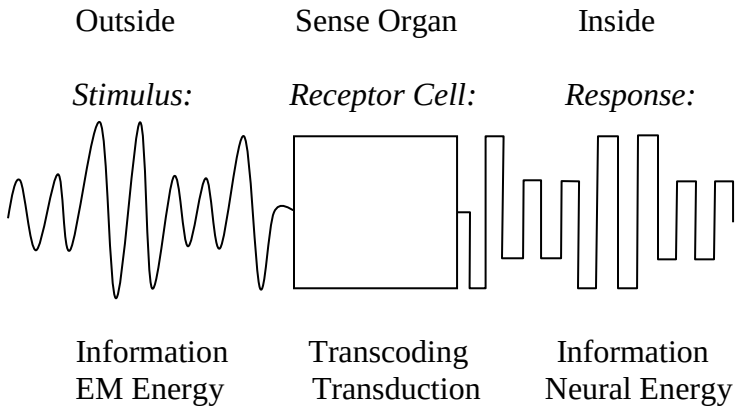
5) Feature Discriminability:
a) Analytic Discrimination
Eg, Taste: 4 Features combine but are still distinguishable
b) Synthetic Discrimination
Eg, Color: Colors combine and are not distinguishable

6) Pattern Recognition:
The Gestalt Principles of Organization — Simplicity through:
a) Regularity (Rule)
b) Order (Hierarchy)
c) Symmetry (Isomorphism)

The Principle of Isomorphism:
A Difference in Features is taken to indicate a Differentiation of Neural Structures

Human Sensation:

Sensation derives from Irritability (Exteroception), which involves a Transduction of Energy. In addition, *differences* (variations in constraints) in the *energy gradient* mean that the Energy is potentially carrying Information; thus, when irritaton occurs it conveys Information, and Sensation occurs. Thus, Sensation is the process by which the Brain receives Energy and Information from the Environment, by way of the Sense Organs (or Senses). Each Sense Organ is a collection of Receptors that, in concert, act as 1) a Transducer, a device that transforms Energy from the environment into Neural Energy (the electro-chemical energy of the Neurons); and 2) a Transcoder, a device that transforms Information from the environment into Information in the Brain. Thus the Energy from the environment does not get into the brain, but the Information from the environment does, and the internal Information must be Isomorphic to the external Information (otherwise there is no Knowledge of what is outside the Brain). Cf *Leviathon*



The Five Senses:

In terms of evolutionary development, the sense of Touch comes first, simply because of Contiguity, Irritability, and Proprioception. The sense of Smell very likely evolved next, due to the aquatic environment of the earliest sentient creatures and the Distal nature of Smell.

Mediated (Distal) and Unmediated (Proximal) Senses:

	Proximal:	*Distal:**	
Unmediated Contiguity:	Touch and Taste	(Smell)	Mass: Explicit Object
Mediated Contiguity:	[Smell]	Hearing and Vision	Energy: Implicit Object

*Teleceptors (per Nbi20b)

Distal Senses:	Medium:	Speed:	Taxis:	Energy:
Smell	Air Currents	1 – 25 mph	Chemotaxis	Chemical
Hearing	Sound Waves	800 mph	Phonotaxis	Mechanical
Vision	Light Waves	186,000 mps	Phototaxis	Electromagnetic

Tactility and Gustation — The Proximal Senses:

I. Touch (Tactile)
- A. Tacticity:
  - 1. Pressure: Force by Contiguity
  - 2. Texture: Variance in Pressure Details
- B. Temperature
  - 1. Hot: Does Not Readily Draw Off, or Radiates Heat
  - 2. Cold: Readily Draws off Heat
- C. Viscosity: Variations in Pressure produce Muscular Proprioception
- D. Pain: Intensity of Force by Contiguity

II. Taste (Gustatory)	Stimulants:
A. Sweet	Glucose & related organic compounds
B. Salty	NaCl & other natural Salts
C. Sour	Acids (Inorganic < H ion; Organic < Anion)
D. Bitter	Toxic Plant Substances
E. Savory	Carboxylate Anion of Glutamate
F. Starchy	Carbohydrates

Olfaction — The Mixed Sense (Proximal and Distal):

III. Smell (Olfactory)

A. Fruity B. Flowery C. Resinous		Living/Fresh Plants: Pleasant/Good
D. Burnt E. Foul	(Carbonic) Organic Rot	Dead/Decaying Organisms: Unpleasant/Bad
F. Spicy	Chemical — ?	

Taste and Smell use 5 Molecules: Carbon, Hydrogen, Oxygen, Sulphur, Nitrogen

Hearing and Vision — The Distal Senses:

IV. Hearing (Audial)

Features:	
Wave	A. Pitch: Frequency of Waves
	B. Amplitude: Height of Waves
	C. Timbre: Purity and Mixture; includes the difference b/w Noise and Info
Molar	D. Density: Quantity of Sound per Unit Volume
	E. Directional Reception: Locoreception or Source Direction

V. Vision (Visual)

Light	A. Luminosity: Rod Receptors detect Magnitude (Height) of Wave (6M Rods/Eye)
	B. Color: Cone Receptors detect Frequency (Number) of Wave (120M Cones/Eye)
	C. Polarization: Limited to Glare (for Humans) — Wave Orientation
Figure and Ground	D. Depth: Produced by Binocular Stereoscopy; Paralactic Perspective
	E. Contour: Contrasts between Edges, Boundaries, Borders, Surfaces, etc.
	F. Motion: Validates Figure & Ground Gestalt, validated by Predation

Gestalt Principles of Perception:

Biological entities are Directive and Purposeful with respect to exploration and Organization, and Perception is one result of this. Perception is the process by which the Brain *reifies* experience, integrating the various Features detected by the Senses into the experience of Objects in the World. The integrating principles that the Brain uses in order to produce the perception of complete or *whole* Objects are known as Gestalt Principles (from G. 'ge-stalt' $=_d$ 'a form'). The phenomenological diversity that results from the seveal sense-modalities (the five senses) and the numerous features detected by each of the senses (the sensory *capta*) is full of ambiguity. Accordingly, the brain must disambiquate its phenomenological experience, and it does so by means of Prägnanz (G. $=_d$ 'being terse but cogent'). Prägnanz derives from the need to focus on Threat/Nutrition Objects, and it involves Alarm and Motivation/Emotion. Biological entities are directive and purposeful with respect to exploration and organization, and Perception is one result of these characteristics.

Gestalt Principles of Organization:

A) Prägnanz: the Organization of Features in terms of Simplification
B) Reification: the Emergence of Objects from Features
C) Framing: the Setting of Objects in the World

A) Prägnanz (Concise but Cogent; Simple but Relevant) — Simplicity in the form of:
a) Regularity: occuring according to a Rule or Standard (ie, a *Paradigm*)
b) Orderliness: ocurring according to a Relational Hierarchy (ie, a *Gradient*)
c) Symmetry: occuring according to a Sensory Isomorphism (ie, an *Invariance*)

Techniques of Prägnanz:

1) Grouping: Creating Wholes from Discrete "Parts" (Reification)
a) Proximity: 00 00 00 00 ; we see four pairs rather than eight zeros; or: || || || ||
b) Similarity: OO00OO00OO00 ; we see three pairs of different circles / / | | / / | | / / | |
c) Closure:] [ ] [ ] [ ] [; we close this gap [ ] to make a square, rather then this gap] [
d) Common Fate: E.g. a string of lights, a swarm of bees, or a flock of birds
e) Common Region:
e) Unity:
f) Continuity/Contiguity: 0—0 0—0 0—0
g) Stability:

2) Fitness of Form: Creating Parts from Continuous Wholes (often involves Closure)
a) Continuation: the Brain wants to complete or finish any partial perception with the "best" perceptual results
b) Good Fit or Recognized Form:

3) Constancy of Features: Objective Regularities
   a) Size
   b) Shape
   c) Luminosity
   d) Color

B) Emergence: The Perception of *Objects* ("Foreground" Perceptual Forms/Eidoi)
   Objects and their Properties, Wholes-with-Parts
   Via Reification we tend to see a *Whole Object* rather than just a *Collection of Parts*
   And the Whole is greater than the Sum of its Parts (Systems Theory).
   Figure: Contiguous Features, Proximal Features, Moving Features

C) Framing: Objects *in the World* ("Background" Perceptual Forms/Eidoi)
   The World: the *largest* Whole (from the "farthest plane"), whose parts are Objects
   Ground: Distal Features, Stationary Features

1) Figure and Ground*:
   We tend to fix attention on a specific Counter-Structure (the Object, such as a Prey) as the main Figure, and we relinquish all else in our visual field to the Backgound. This is very likely motivated by subsistence pressure, and the result is an Object w/ Environs

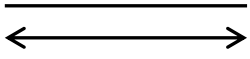
2) Context Effects*:
   The Context/Background/Frame of Reference influence how we percevie an Object
   Because Figure-Features experience interference from Ground-Features

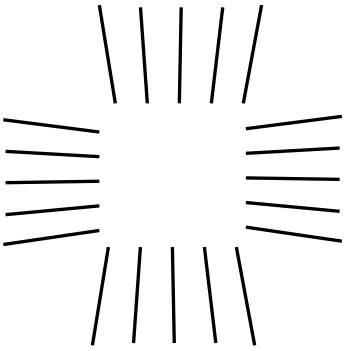
3) Frame of Reference (a Ground used for Orientation and Operation)
   Similar to Figure and Ground (because the Frame is a type of Background)
   Related to Context Effects (because the Frame = a Context [= a Ground])

4) Metaphors: Descriptive Phrases: Subject-Phrase and Predicate-Phrase
      Metonymy: Based on Contiguity
      Analogy: Based on Isomorphism

5) Categories: Dimensions of Understanding: Physical Dimension and Formal Dimension
      Force: Based on Contiguity
      Form: Based on Isomorphism

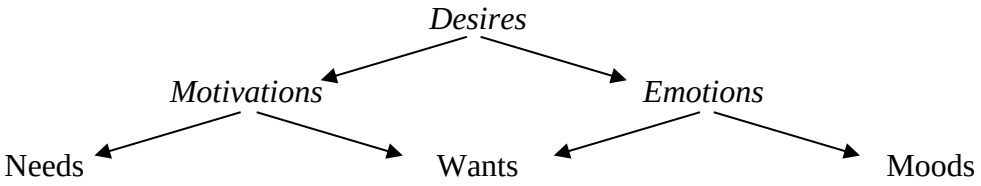
* Examples:





Emotion

All animals are driven to survive and even thrive, and in humans this *drive* is called *Desire*. Specific Desires, then, are survival mechanisms that have evolved to propel us toward perceived Benefits and repel us from perceived Dangers. Basic Benefits involve Pleasure, Basic Dangers involve Pain; and the Predator/Prey ecology, as well as the Parent/Child ecology, entails both. In contrast, Emotions are either Moods or Wants involving often intense physiological changes and sophisticated Cognitive Constructs. More specifically, Emotions are neurological events that we will call either Moods—neruological events that enter Consciousness but do not produce Motivation—and Wants—neurological events that do produce Motivation (that is, *thought* and *action* that result in movement). Emotions do not need Consciousness, and can produce Behavior unconsciously. But whether or not Emotions *are* conscious, their focus will be either the Self (felt Emotions or *Moods*—which are intrapersonal, and typically end in the Self); or some Other (Directed Emotions or *Wants*—which are extrapersonal, and typically do not end in the Self).



Motivations — Needs (Vital Necessities) and Wants (Directed Emotions):

Needs: a Desire caused by a *physiological deficit* that *must* be offset to avoid Pain/Death
1) Air: Needed to replenish and maintain the level of the aeration of the body (Autonomic)
2) Water: Needed to replenish and maintain the level of the hydration in the body
3) Food: Needed to replenish and maintain the physical structure of the body
4) Shelter: Needed to create/maintain protection of the body from environment elements

Needs start Physiologically
Needs allow for personal survivival
Needs require a fairly quick response

Emotions — Wants (Directed Emotions) and Moods (Felt Emotions):

Wants: a Desire caused by a (presumed) Psychological Deficit, w/ Emotions directed at an Other

Wants to be Obtained: Attraction for that which appears to promise Pleasure
1) Material Goods: House, Clothes
2) Psychological Goods: Respect, Praise
3) Social Goods: Family, Friends/Lovers

Wants to be Avoided: Repulsion from that which appears to threaten Pain
1) Material Evils: Alcohol, Drugs,
2) Psychological Evils: Disrespect, -repute
3) Social Evils: Family, Enemies/Haters

Wants are often wholly Psychological
Wants are critical for Psychological Well-Being
Wants can affect Physiological Well-Being

Mood: an intrapersonal emotional experience—Emotions *felt* but not directed at an Other
Moods are often the result of Satisfied or Frustrated Wants and/or Needs

Primary Emotions: Joy and Sorrow (Moods)

The satisfaction of both Needs and Wants produces feelings of Pleasure/Comfort/Joy
The frustration of both Needs and Wants produces feelings of Pain/Discomfort./Sorrow

General	Joy	*Moods*	Sorrow	—	*Psychological*	
Specific	Comfort / Pleasure	*Needs*	Discomfort	—	*Psycho-Physiological*	
			Pain	—	*Physiological*	

Motive:	Obtain Some Good	Avoid Some Evil
	Attraction: Absent Good	*Aversion: Absent Evil*
	Acceptance: Present Good	*Rejection: Present Evil*

Complex Emotions:

Complex Emotions involve several components, but require first and foremost a change in the level of Excitement of the nervous system (from Fr 'emouvoir" = 'to excite', from L 'cio' = 'to move'). This Excitement is associated with Pleasure and Pain (or Comfort and Discomfort), and this tends to Motivate or Drive the individual to maintain or change his or her physical or psychological situation (Attraction and Aversion). In addition, Cognitive development allows Cognitive aspects of Consciouness to become components of Complex Emotions. Accordingly, Complex Emotions are often said to have been "learned", which makes them "social" Emotions.

Seven Components of Complex Emotions:

1) Excitement — the level of stimulation & awareness of the PNS (Glutamate & GABA)
2) Feeling-Tone — the level and quality of pleasure/pain, comfort/discomfort (Dopa. & Dyno.)
3) Drive — refers to level and direction of acceptance/rejection, interest/disinterest
4) Thought — the level of Rational evaluation of the emotional situation (Acetylcholine)
5) Memory* — past-situations of Emotional and Cognitive evaluation (Norepinephine)
6) Control — refers to the level of effectiveness of volitional/deliberative thought
7) *Expression* — refers to the means by which we communicate our Emotions

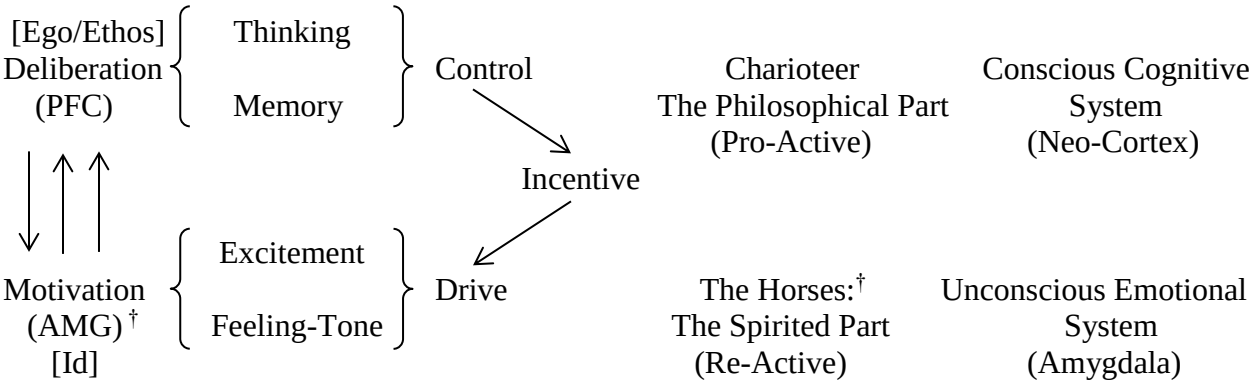
In Complex Emotion, the Incentive (Stimulus) starts the Drive "Systems" (Excitement and Feeling-Tone = Unconscious Response), whose effect, Motivation, eventually reaches Consciousness. There, Deliberation should start the Control "Systems" (Thought & Memory* = Conscious Response). This rational Deliberation can be applied to Emotions, and so Emotions can be "rational", at least in the sense that Feelings (e.g. autonomic and visceral sensations) are *rationed* over the field of perceptual experience. The rationing is such that, generally speaking, unpleasant or painful feelings are associated with threatening or dangerous experiences, and pleasant or enjoyable feelings are associated with beneficial experiences. In this sense, Emotion is superior to Sensation, being "internal" sensation plus a rationing process; that is, Emotions are values that can be manipulated according to logical rules, whereas Sensations are not. However,

Emotion is not rational in the same sense that Deliberation is rational. Rather, Deliberation attempts to rationalize Emotion as a means of Control.

**Emotional Memory*: Procedural, Unconscious (Amygdala), Implicit, Mulitple Systems
Involves the Medial PFC; high levels of Norepinephrine increase Emotional Mem. encoding

**Cognitive Memory*: Declarative, Conscious (Hippocampus), Explicit, Single System
Involves the Lateral PFC

Analysis of the Six Internal Components of Complex Emotions and Plato's Analogy:



†The two parts of the Amygdala (AMG) respond to different qualities of Emotional stimulus:
Right Bulb: processes Negative Emotional stimuli [Reaction]
Left Bulb: processes Positive and Negative Emotional stimuli [Submission]/(Reward center)

†Plato's two horses in the Analogy of the Chariot correspond to the two parts of the Amygdala:
Black Horse: Evil tendencies; this horse is impulsive and hard to control
White Horse: Good tendencies; this horse is deliberative and easily controlled

Situations of Competition/Cooperation: Personal (b/w Individuals) and Special (b/w Species)

Motivation:	Cooperation		Competition
Attitude:	*Submission:* (Felicity)		*Aggression:* (Anger)
Specific:	Love	*Wants*	Hate
	What we Love we call *Good*		What we Hate we call *Evil*:

Aristotle on the Objectives of Obtaining Goods and Avoiding Evils

Three Objects of Choice:	Three Objects of Avoidance:	
1) Honor/Beauty	1) Shame/Ugliness	[Optative]
2) Advantage	2) Disadvantage	[Utilitarian]
3) Pleasure	3) Pain	[Effectual]

Hobbes on the Three Types of Good and Three Types of Evil

The Three Types of Good:	The Three Types of Evil:	The Modes of Good/Evil
1) Honorable/Attractive	1) Vile/Foul	Promise
2) Profitable	2) Unprofitable	Means
3) Pleasant	3) Unpleasant	Effect

Human Emotional Development:

Newborn humans exhibit Comfort/Discomfort reactions

The earliest distinction/knowledge is between Pleasure and Pain, without distinction between "Me" and Not-Me" (ie, "it's all Me"). Soon, however, we distinguish between "that which *feels* pain/discomfort" (ie, Me) and "that which can/does *cause* pain/discomfort" (Not-Me). One's original "general comfort" goes unnoticed at first; but the eventual foreground of Pain/Dis-comfort forces the distinction into awareness. Consequently, the Me reacts to the Not-Me, even when the Not-Me is not now causing Pain/Discomfort, with Comfort/Discomfort reactons.

2 – 8 Weeks: True Smile (this expresses Comfort Satisfaction)

Hereditary factors probably sets the basic neural pathways for later Experience

Imprinting of + and - Reinforcement Behavior and Emotional Expression occurs

2 Years: the full set of Emotional Expressons is present

The Paths and Processes of Emotion:

The process of Emotion can be summarized in the 3 following steps:

Step 1) I think I something is going on. (Cortical Stimulation)

Step 2) I must do something. (Autonomic Arousal)

Step 3) I am Afraid. (Conscious Emotion)

This process takes about .24 seconds, at which time 2)s Feelings are *interpreted* as 3)

The path of the Emotions (ie, Desires) begins with the Thalamus, which sends crude Sensory Data to the Amygdala (in 0.012s). The stimulation of the Amygdala produces Aggression, desctruction of it causes Passivity, loss of Fear, and Hypersexuality

After affecting the Amygdala, the Emotion develops in 2 ways: 1) Reaction, 2) Deliberation

1) The Emotion-Stimulus is sent from the Amygdala directly to the Medial Pre-Frontal Cortex (Thought), for analysis (Awareness)

2) The Emotion-Stimulus is sent indirectly, to the Hypothalamus:

The Hypothalamus is involved in Expression and Motivation (Drive)

Posterior Hypothalamus & the Preoptic Region } Motivation; stimulation produces "stimulus reproduction security" (i.e., Pleasure)

a) The Hypothalamus sends hormonal messages to the body, causing physio. changes

— E.g. muscle contraction, blood pressure, heart rate, etc. (Excitement)

b) Reticular Activating System Arousal: Excitement and Attentiveness

3) The final step is to the is Awareness and Consciousness of the Emotion:

The Somatosensory Cortex registers/produces the changes in the body

— Without this feedback, Emotion is indistinguishable from Thought

The Pre-Frontal Cortex: Directed Emotional Expression

— The Frontal Cortex is then notified of the Emotional/Physiological changes

— And at this point the neural situation is interpreted as a *Conscious* Emotion

Systems of Attention and Arousal

Attention Systems:	*Attention:*
1) Amygdala	1) Arousal: 1 & 2
2) Hypothalamus	2) Orientation: 3 & 4
3) Posterior Hypothalamus & Preoptic Region	3) Focus: 4
4) Reticular Activating System & Cortex	

The many separate Perceptions that contribute to an Emotion are assembled into a Single, many-faceted Concept by the Pre-Frontal Cortex (PFC). But this is not enough for an Emotion, which requires the Medial Cortex. This evokes the appropriate Body changes (via the Hypothalamus): Heart rate, blood pressure, Hormones; and *Emotion occurs when the Hypothalamus alerts the Cortex of the changes that have occured*. Here, the Bodily-changes (which are standard) are interpreted (Thought).

However, there are many more neural connections running *from* the Medial Cortex *to* the Pre-Frontal Cortex than in the opposite direction, which means that Emotions influence Thought more than Thought influences Emotion.

Emotion and Memory (per TEB (J. LeDoux [to p15])

Cognitive Memory:	*Emotional Memory:*
Hippocampus	Amygdala
Declarative	Procedural
Explicit	Implicit
Conscious	Unconscious
Single System	Multiple Systems

Working-Memory Aspects:	*Emotional-Memory Aspects:*
Lateral PFC (only in Primates)	Medial PFC
General-Purpose	[?Special Purpose?]

A match between a current Emotional State and the Emotional State of a *stored* Explicit or Declarative *memory* facilitates the activation of the Explicit Memory

Learning involves the strengthening of Synaptic connections between Neurons
- This is Long-Term Potentiation (LTP), which is Experience-Specific
  - But a certain number of inputs (ie, > 1) are required (= Input Cooperativity)
  - Associativity $=_d$ LTP Cooperativity of Input pathways

The Hebbian Rule: Neruons that fire together wire together (Associativity)
- This occurs when NMDA receptors are open (ie, after Glutamate reception) while a second cell transmits Glutamate, which binds to the open NMDA receptor
- This allows for the Association of different aspects of Experience in Memory

When Protein synthesis is blocked, Long-Term (L-T) memories are not formed!
Hippocampal circuits (which have massive neocortical connections) are well suited to forming complex memories with many components bound together in space and time

Consciousness: (The Human Moment = 1/18 sec.; so 1 s = 18 Human Moments [Refresh Rate])

Working Memory (Conscious fn. + S-T Memory) is a limited capacity Serial Processor
1 main General Purpose temporary storage system & several specialized temporary storage systems (temporary Buffers)
Each storage system has one or more *buffers*, including Language buffers
The buffers work independently, in *parallel*
Working Memory depends upon L-T Memory
Memory influences Perception (top-down processing, whereas Perception is bottom-up)

The Lateral Pre-Frontal Cortex:

Visual Processing:
"Where?" pathways go to the Parietal Lobe; these Visual areas work with the Lateral PFC for *Object Location* in Working Memory
Pathways from the PFC to V1 prime the Visual system to affect the "Where" information

"What?" pathways go to the Temporal Lobe; these Visual areas work with the Lateral PFC for *Object Recognition* in Working Memory
Pathways from V1/V2 to the PFC tell it "What" is "Where"

Frontal Lobe Attention Network:

Includes Lateral PFC, Anterior Cingulate Cortex (ACC), etc.
Cognitive sytems are involved in Selective Attention, Mental Resource Location, as well as Decision Making and Voluntary Movement Control
The Anterior Cingulate Cortex is believed to be THE SEAT OF CONSCIOUSNESS

The Orbital Pre-Frontal Cortex:

Reward Information — What is "GOOD", and what is "BAD"
Working Memory allows us to know that the "Here" and "Now" ***Is*** "here and now"
Theory suggests that a LINK must be made, between our Mental Representations (ie, Memory) and our Mental Representation of the Self-As-Agent, for Consciousness
Consciousness = Contents of Working Memory (perhaps the Supervisory Function)
Consciousness seems to work Serially, Unconsciousness seems to work in Parallel
Dennet and others think Consciousness is a *Virtual* Serial Processor
This is a Parallel Processor that simulates a Serial Processor
Consciousness is only of Information that is represented *Symbolically*
Info processing at lower levels is "sub-symbolic" (which explains why we're conscious of Thoughts but not of the activity of our Neurons)

Consciousness works Symbolically and yeilds *introspectively acessible* content
Unconsciousness works sub-symbolically and is thus merely neural processing
Concsiousness is like a Computational System: it processes Information
But this does not explain Subjectivity

Consciousness of Emotions:

1st Ingredient: Direct Amygdalic influences on the Cortex
2nd Ingredient: Amygdala-Triggered Arousal (Amygdala and Hypothalamus)
3rd Ingredient: Bodily Feedback [into Consciousness] (RAS)

Visual Stimuli are 1st sent to the Thalamus, w/ sends crude Info to the Amygdala (.012 s)
Another part of the Thalamus sends detailed info to the Visual Cortex, which creates a
Detailed and accurrate representation; this is fed back to the Amygdala, which activates
Response-Control Networks (Bodily Feedback) which floods into Consciousness (.024 s)

Detailed Explanation:

1st Indgredient: Direct Amygdalic Influence on the Cortex (Danger-Stimuls Arousal)

For a visual stimulus to reach the Amygdala via the Cortex, the stimulus goes through the Primary Visual Cortex, to a Secondary Visual region in the Cortex, and through to a 3rd cortical area in the Temporal Lobe (a S-T Memory buffer). This 3rd area projects to the Amygdala.

But the Amygdala also projects back to these 3 cortical areas, which causes them to direct Attention to the Stimulus. The Amygdala also has projections to L-T Memory, such as the Hippocampus and L-T Memory systems that interact with the Hippocampus; and it also has strong connections with the Anterior Cingulate Cortex (ie, the Frontal Lobe Working-Memory Executive Circuits), as well as the Orbital Cortex (ie, the Working-Memory's Reward and Punishment System).

In sum: Connections from the Amygdala to the Cortex allow Defense Networks to influence Attention, Perception, and Memory (in terms of Good and Bad, but without Feelings.)

2nd Ingredient: Amygdala-Triggered Arousal (Bodily Responses)

When we are *alert and paying attention*, the Cortex is Aroused; when we are *drowsing and not focused*, the Cortex is un-Aroused. In Dreamless sleep there is not Cortical Arousal; but while Dreaming the Cortex is Aroused similarly to waking states, but without access to Exteranl Stimuli.

In Arousal, the Cortex and connected Thalamic Regions become more sensitive (ie, they go from slow, synchronized firing to active unsynchronized firing).

Arousal Systems in the Brain Stem:
Acetycholine (ACh) Group
Noradrenaline Group: [Arousal (Excitement) and Reward (Feeling-Tone)]
Dopamine Group: [Motor Sys., Reward (Feeling-Tone) Cognition, Nausea]
Serotonin Group: [Introversion, Mood, Satiety, Temperature, and Sleep]
Cortical Acetylcholine Group (in the Forebrain—Nucleus Basilis—near the Amygdala)

Without Arousal, we fail to notice what's going on, we pay no Attention. With too much Arousal, we become tense, anxious, and unproductive. Emotional reactions involve intense Cortical Arousal, which helps "lock in" the particular emotional Experience. Interactions between

the Amygdala and the ACh system in the Forebrain are particularly important. When the Amygdala detects Danger it activates the Nucleus Basilis (NB, mostly Cholinergic Neurons), which release ACh in the brain; as well as activating the other—Brain Stem—Arousal systems.

Arousal occurs for every Novel Stimulus (which typically does not invovle the Amygdala but rather the Sensory System to Arouse); but the Arousal is longer (ie, extended) for Emotional Stimuli (which does involve the Amygdala). The information provided by the Arousal system to the Cortex is weak; but a signal from the Amygdala to the Arousal system means "Something important is happening!". This non-specific cortical arousal and the specific information from the Amygdala-to-the-Cortex creates a "Working Memory" consciousness that "Something important is happening, and it's frightening (Fear)!". This stimulates L-T Memory (and S-T buffers), which re-stimulates the Amygdala. Cognitive Inference and Decision-Making processes focus on the Emotion-Arousing stimulus, to figure out what is happening and what to do about it.

3rd Ingredient: Bodily Feedback [The Conscious Feeling of Emotion]

The Amygdala activates Response Control Networks, which invovle:

Species-specific behaviors, ANS responses, and Hormonal responses, where the last two can be viewed as Visceral responses (involving the internal organs and glands). As a result, these responses create signals that return to the Brain. This process takes about 3 seconds, and so is too slow to be the source of Conscious Emotional Experience.

The Somatic system is much quicker, and likely produces [Feelings=Conscious Emotion]. Bodily Feedback is recorded by the brain system that first produced the bodily response. According to A. Damasio, "as if" loops reinforce the Bodily-Feedback theory of Feelings. So, these ingredients of Feeling are the Conscious Emotional Experience, and they involve:

- A specialized Emotion System (associated with the Amygdala) that gets Sensory Input and produces Behavioral, Autonomic, and Hormonal Responses
- Cortical Sensory Buffes that hold on to the Info of the currently-present Stimulus
- The Working-Memory Executive that monitors S-T Memory buffers, gets L-T Memory information, and *interprets* the S-T Memory content with respect to the L-T Memory information.
- Cortical Arousal
- Bodily Feedback: Somatic and Visceral information the returns to the Brain

Feelings involve Conscious content, but not necessarily access to the [Neural] processes that produce the Conscious content. These Emotions cause a Mobilization (Activation) and Synchronization of the Brains activities.

Step 1) The Amygdala Activates Cortical Areas

Step 2) Amygdala Initiates Bodily & Cortical Arousal

Step 3) Amygdala-Initiated Emotional Responses Feed Back to the Brain