KNOWLEDGE REPRESENTATION

Every cognitive enterprise involves some form of knowledge representation. Humans represent information about the external world and internal mental states, like beliefs and desires, and use this information to meet goals (e.g., classification or problem solving).

There are several main types of mental representation and corresponding processes that have been posited: spatial, feature, network, and structured. Each type has a particular structure and a set of processes that are capable of accessing and manipulating information within the representation. The structure and processes determine what information can be used during task performance and what information has not been represented at all. As such, the different types of representation are likely used to solve different kinds of tasks.

Semantics is the study of meaning. Any theory of Semantic memory must explain how people mentally represent concepts and ideas. • Semantic Memory stores knowledge of concepts and facts.

Three major themes of Representation • dual-coding (encoding and storage) • conceptual-propositional hypothesis •functional equivalence (e.g., in vision)

Dual Coding Hypothesis: 2 codes, 2 storage systems (Imaginal + verbal storage) • People show a memory recall advantage if information is processed both verbally and visually • This suggests an advantage for "dual-coding" • evidence: concreteness advantage in word recall • evidence: Brook's F task (w/ visual or auditory second task)

Conceptual-Propositional Hypothesis: Brandsford & Franks (from last week) • Semantic Integration • People store information as inter-related abstract mental concepts (propositional codes) • e.g., story sentence verbatim recall very poor (just content) • reject isomorphism • isomorphism: iso = same morph = shape; • "picture in the head"

Functional equivalence: imagery & perception are highly similar • consider mental rotation • Task • Theory • Data • Jolicoeur, Corballis.. Letter Rotation, Object Identification, top/bottom, left right facing.. • Shepard & Metzler cubes • Neurophysiology: Georgopolis (monkey motor cortex) • Mental Maps (Kosslyn) • further apart, longer time • Island, Speedboat, Ear comparison • Podgorny & Shepard (inside/outside) w/ real/imagined letter on grid

ANALOG REPRESENTATION

The notion of a "mental representation" is, arguably, in the first instance a theoretical construct of cognitive science. As such, it is a basic concept of the Computational Theory of Mind, according to which cognitive states and processes are constituted by the occurrence, transformation and storage (in the mind/brain) of information-bearing structures (representations) of one kind or another.

However, on the assumption that a representation is an object with semantic properties (content, reference, truth-conditions, truth-value, etc.), a mental representation may be more broadly construed as a mental object with semantic properties. As such, mental representations (and the states and processes that involve them) need not be understood only in cognitive/computational terms. On this broader construal, mental representation is a philosophical topic with roots in antiquity and a rich history and literature predating the recent "cognitive revolution," and which continues to be of interest in pure philosophy. Though most contemporary philosophers of mind acknowledge the relevance and importance of cognitive science, they vary in their degree of engagement with its literature, methods and results; and there remain, for many, issues concerning the representational properties of the mind that can be addressed independently of the computational hypothesis.

Analog code is an internal representation is a *copy* of the external stimulus

- mental picture. It is stored like a bitmap and is binary code in memory: they are pictures in the head.
- similar mechanisms in the visual system are activated when objects or events are imagined as when they are the same objects or events are actively perceived

BASIC PRINCIPLES OF SPEECH AND WORD RECOGNITION

Speech perception is the process by which the sounds of language are heard, interpreted and understood. The study of speech perception is closely linked to the fields of phonology and phonetics in linguistics and cognitive psychology and perception in psychology. The process of perceiving speech begins at the level of the sound signal and the process of audition. After processing the initial auditory signal, speech sounds are further processed to extract acoustic cues and phonetic information. This speech information can then be used for higher-level language processes, such as word recognition.

The basic principle of voice recognition involves the fact that speech or words spoken by any human being cause vibrations in air, known as sound waves. These continuous or analog waves are digitized and processed and then decoded to appropriate words and then appropriate sentences.

Factors on which Speech Recognition System depends

The speech recognition system depends on the following factors:

- **Isolated Words**: There needs to be a pause between the consecutive words spoken because continuous words can overlap making it difficult for the system to understand when a word starts or ends. Thus there needs to be a silence between consecutive words.
- **Single Speaker**: Many speakers trying to give speech input at the same time can cause overlapping of the signals and interruptions. Most of the speech recognition systems used are speaker dependant systems.
- **Vocabulary size**: Languages with large vocabulary are difficult to be considered for pattern matching than those with small vocabulary as chances of having ambiguous words are lesser in the latter.

PHONOLOGY AND MORPHOLOGY

Phonology is the study of sounds and their parts. It focuses on how sounds are made using mouth shape, tongue placement, vocal cord use, etc. For example, it can look at the difference between fricative sounds like [f] (a f sound like in fish) and [ʃ] (this is a "sh" sound) and all other possible sounds.

Morphology is the study of the smallest meaningful units of words. It looks at words and breaks them into their simplest parts to analyze meaning. For example, the word unbelievable can be broken into the basic parts of "un-" meaning "not", "believe", and "able" meaning "to be able to". Together it means "not able to be believed."

Syntax focuses on the structure of language regarding how it is orally and literarily presented. It breaks down sentences by tense, noun phrases, verb phrases and other various parts that make up a sentence.

The five main components of language are **phonemes**, **morphemes**, **lexemes**, syntax, and context. Along with **grammar**, **semantics**, and pragmatics, these components work together to create meaningful communication among individuals.

- A phoneme is the smallest unit of sound that may cause a change of meaning within a language but that doesn't have meaning by itself.
- A morpheme is the smallest unit of a word that provides a specific meaning to a string of letters (which is called a phoneme). There are two main types of morpheme: free morphemes and bound morphemes.
- A lexeme is the **set** of all the inflected forms of a single word.
- Syntax is the set of rules by which a person constructs full sentences.
- Context is how everything within language works together to convey a particular meaning.

VISUAL WORD RECOGNITION

Words are the building blocks of language, and visual word recognition is a crucial prerequisite for skilled reading. Before we can pronounce a word or understand what it means, we have to first recognize it (i.e., the visually presented word makes contact with its underlying mental representation). Although several tasks have been developed to tap word recognition performance, researchers have primarily relied on lexical decision (classifying letter strings as words or nonwords), speeded pronunciation (reading a word or nonword aloud), and semantic classification (e.g., classifying a word as animate or inanimate).

Word recognition was typically thought of as the process of going from a printed letter string to the selection of a single item stored in lexical memory. Lexical memory, or the "lexicon," is a mental dictionary containing entries for all the words a reader knows. Thus, word recognition was essentially synonymous with the terms "lexical access" or "lexical selection."

The main criteria for inclusion are replicability and the likelihood that the phenomenon reflects the basic architecture of the word recognition system. This second criterion appears to be especially challenging.

The word superiority effect. Based on its historical import, an obvious phenomenon to include would be the word superiority effect (Reicher, 1969; Wheeler, 1970). It should be noted, however, that some researchers have recently argued that this effect may actually have more to do with phonology than with lexical processing (e.g., Hooper & Paap, 1997; Maris, 2002). Unlike the word superiority effect, the next three effects all arise in speeded response tasks, that is, tasks in which participants are instructed to respond as rapidly and accurately as possible, and response latency is the main dependent variable. The two standard tasks of this sort are naming, where participants simply have to pronounce a presented word, and lexical decision, where subjects have to decide whether a letter string is a word in the language (e.g., CAT vs. SLINT). The word frequency effect.

The second phenomenon is the word frequency effect (Becker, 1976; Forster & Chambers, 1973; Monsell, 1991; Monsell, Doyle, & Haggard, 1989). Words that are seen more often are responded to more rapidly. Once again, however, this effect is controversial. Balota and Chumbley (1984) have argued that this is a decision phenomenon and, hence, may have little to do with the word recognition system. Further, some researchers (e.g., Morrison & Ellis, 1995) have suggested that observed frequency effects are at least partly due to confounding frequency with age-of-acquisition – that words learned at younger ages are more rapidly processed and, due to the fact that higherfrequency words are typically learned at younger ages, frequency effects may be, to some degree, age-of-acquisition effects.

The semantic priming effect. The third phenomenon is the semantic priming effect (Meyer & Schvaneveldt, 1971; see Neely, 1991, for a review). The experimental task involves the presentation of two words. The first, the "prime," establishes a context. Typically, no response is required to the prime. The second word, the "target," requires either a naming or lexical-decision response. Targets (e.g., DOG) that are related to the semantic context provided by the prime (e.g., CAT) are responded to more rapidly than targets that are not (e.g., NURSE) although there is some controversy as to whether all types of semantic context (e.g., category, antonym) produce priming effects (Lupker, 1984; Shelton & Martin, 1992; Williams, 1996). It should also be noted that there is general agreement that at least some of the observed priming effects are due to processes outside the word recognition system (although see Plaut & Booth, 2000, for an attempt to explain semantic priming solely in terms of lexical processing).

The masked repetition priming effect. The fourth and final phenomenon is the masked repetition priming effect (Evett & Humphreys, 1981; Forster & Davis, 1984). In the masked priming technique, a prime word is briefly presented followed immediately in the same physical position on the computer screen by the target. The presentation of the prime and target in this way means that the target masks the prime such that participants typically report that no stimulus other than the target had been presented. The prime and target are in different cases so that there is very little figural overlap between them (e.g., dog-DOG). Targets are responded to more rapidly if the prime and target are the same word.

MODELS OF VISUAL WORD RECOGNITION

INTERACTIVE ACTIVATION & COMPETION MODEL OF WORD RECOGNITION (IAC Model)

Given by-Mc Clelland & Rumelhart (1981) & Rumelhart & Mc Clelland (1982)

The original purpose of this model was to account for word content effects on letter identification.Reicher (1969) &Wheeler(1970) Showed in tachiostopic recognition ,letters are easier to recognize in words than when seen as isolated letters.This phenomenon is known as **word superiority effects.**

The IAC model consists of many simple processing units arranged in three levels.There is an input level of visual feature units,a second level where units correspond to individual letters,and an output level where each unit corresponds to a word.Each unit is connected to each unit in the level before and after it.Each of these connections is either excitatory if appropriate or inhibitory if inappropriate.Eg,the letter ‘T’ would excite the word units TAKE and TASK in the level above it and would inhibit CAKE or CASK.Excitatory connectionist make them less active.Each unit is connected to each other unit within the same level by an inhibitory connection .This introduces the element of competion.

When a unit becomes activated,it sends activation in parallel along the connections to al the other units to which it is connected.If it is connected by a facilitatory connection it will have the effect of increasing activation at the unit of tha other end of the connection ,where as if it is a connected by an inhibitory connection it will have the effect of decreasing the activation at the other end.Hence if the unit corresponding to the letter' T' in the initial letter position becomes activated,it will increase the activation level of the word unit corresponding to 'TAKE' and 'TASK',but decreases the activation level of 'CAKE'.But because units are connected to all other units at the same level by inhibitory connections as soon as a unit (eg.a word) becomes activated ,it starts inhibiting all the other units at that level.Hence if the system recognizes a 'T'.the 'TAKE','CAKE' and 'TIME' will become activated .and immediately start inhibiting words with out a 'T' in them .like 'CAKE','COKE' and 'CASK'.As activation is also sent back down to lower levels ,all letters in words beginning with 'T'will become a liitle bit activated and hence a faster recognition takes place.Furthermre,as letters in the context of a word receive activation from the word units above them,they are easier on the context of a word than when presented a isolation ,when they receive no supporting down activation-hence the word superiority effect.

Suppose the letter to be presented is an 'A',this will activate TAKE and TASK but inhibit TIME,which will also then also be inhibited in turn by within-levell inhibition from TASK and TIME.The 'A'will also activate CASK and CAKE ,but these will already be someway behind the two words starting with a 'T'.If the next letter is a 'K'.then 'TAKE' will be the clear leader.Time is divided into a number of slices called processing cycles.Over time,the pattern of activation settles down or relaxes into a stable configuration so that only 'TAKE'remains activated,and hence is the word is recognized.

Criticisms for the model

- Context plays a major role in recognition according to this model.
- The scope of the model is limited ,and gives no account of the roles of meaning and visual word processing.
- Connection strengths have to be coded by hand.

HYBRID MODEL

These models combine parallel processing and serial processing models.In Becker's Verification model (1976,1980), A bottom up stimulus driven perceptual process can not recognize a word on their own.A process of top down verification plays a major role instead .Perceptual processing generates a candidate or sensory set of possible lexical items .This sensory set is ordered by frequency .Context generates a contextual or semantic set of candidate items.Both the sensory and semantic set are compared and verified by detailed analysis against visual characteristics of the word.The semantic set is verified first and this verification is serial.If a match is not found ,then the matching process proceeds to the sensory set.This process will generate a clear advantage for words presented in an appropriate context .The less specific the context ,the larger the semantic set ,and slower the verification process.As the context procedes the target word,the semantic set is ready before the sensory set is ready.Paap,Newsome,McDonald and Schvaneveldt(1982) also presented a version of the verification model.

Verificaion models can be extended to any model where there is verification or checking that the output of the bottom-up lexical access process is correct.Norris (1986) argued that post –acess checking mechanism
checks the output of lexical acess as against context and resolves ambiguity.

CONNECTIONIST MODEL

Given by-Seidenberg & McCelland(1989)
This was developed to account for lexical decision tasks and word naming tasks .There is no lexicon .It has distributed representations that do not have a single representations like a lexicon with lexemes that represents single words ,for eg.dog.There is no dog node;the word is recognized by it is unique pattern of orthographic activation distributed in the network.

The model is largely determined by the characteristics of orthography .The model tries to show how a lexical processing system develops when influenced by a spelling to sound learning reigme.Regular and irregular words learned through experience with spelling- sound correspondence .There is no mechanisms which looks words ,no lexicon and no set of phonological rules.The key feature is that there is a single procedure for computing phonological representations from orthographic representations that works for regular words,exceptional words,and non words.

The Seidenberg and McCelland model has a set of input units that translate the orthography of the stimulus along with a set of output units that represent the stimulus phonology.The input units are connected to a group of hidden units .The hidden units only inputs and out puts are within the system being modeled and they are not connectd by external systems.The hidden units are connected to the phonological output units .The weights(strength of association)connecting input and output are adjusted according to a back –propagation rule that is adjusted to reduce the difference between output units and correct pronounciation.Feedback (correction)adjusts the association between the out put and correct target .There are no priority weights between the output and input units before learing begin.The weights are established by the feedback in the back propagation process.In the training phase of the model’s development,The Seidenberg and McClelland fed the model 2897 monosyllabic English words at a rate that reflected their frequency of usage in the language .The model produced phonology that corresponded to regular words high frequency exception words(eg.have)and novel non words.

In an important way this model captures the frequency-by-regularity interaction in lexical research.This interaction indicates that for high-frequency words,the correspondence between orthography and phonology is of little importance .However ,for low frequency words ,the impact of spelling –to-sound correspondence is large.The dual route model of lexical access accomodates this interaction as summing that the direct part rather than indirect part accesses high frequency words(Andrews,1982.Monsell,Patterson,Graham,Hughes,and Milroy,1992;Paap and Noel 1991).That the word is not pronounced according to regular phonological rules over rides inconsistent correspondence between orthography and sound .For eg.’have’has such a high frequency of use that lexical access is achieved before incorrect pronunciation information (should it sound like gave or wave?)is overridden.Conversely ,a low frequency word shows up the lexical path and allows for interference from phonological mediation.The critical point for the dual route model is that the output of low frequency mediated responses can be overridden by the availability of phonological information produced by the indirect route.

In comparison ,the Seidenberg and McClelland model does not assume separate (dual)paths to a lexicon or even the existence of a lexicon to account for the frequency -by-regularity interaction.The frequency –regularity is produced by the correspondences between frequencies and spelling to sound correspondence in the alphabetic system.With continued practice ,the difference between target activation (right pronunciation) and the actual activation computed by the network get smaller and smaller.The activation of chronological units approximates the target values more and more,regadless of whether the word has regular correspondence,(eg.gave)or exceptional correspondence (eg.have).For high frequency words ,the magnitude of erroe between the target and the activated units is larger than it is for low frequency regular words.

This model also accounts for some neighborhood effects on pronunciation.The consistency of spelling –to-sound correspondence in English is influenced by word neighborhood,words that differ by one letter or one phoneme .Jared ,Mc Rae and Seidenberg

(1990) demonstrated that regular words show consisteny effects ,especially when high frequency neighbors have consistent spelling-to-sound pattern (eg.lint)more so than when neighbors have inconsistent spelling-to-sound patterns(eg.pint).The neighborhood frequency effects are handled well by connectionist models which predicts pronunciation on the basis of lexical frequency and correspondence.

DIVISION OF LABOR

Visual word recognition (VWR)research has been driven by various theoretical models such as functional architecture model and computational model .

Functional architecture model specifies components of the lexical processing system & the transition between them.These models are difficult to be disproved.But they lack specificity with regard to knowledge representations and processing mechanisms.Eg.Dual route model by Patterson,Marshall&Coltheart(1985)

Computational models use computer stimulation to explain VWR process but in deals with only parts of word recognition process and apply to limited vocabularies.They are also easy to be disproved.These models are however acutely detailed.
Another way of explaining VWR in terms of connectionist model Vs lexical access model.

Lexical access model-In this recognizing a word involves successfully accessing its entry in the mental dictionary.But it doesn’t take into account the change in meaning of word with context.

Connectionist model-It explains VWR through distributed representations.It allows entities such as meanings or spellings or pronunciations to be encoded.In contrast to lexical access model ,there are no units dedicated to representing individual words ;rather ,the units represent sub-lexical features(graphemes,phonems)each of which participates in many different words.

DIVISION OF LABOR

The models explained above are alike in assuming that different types of information can be used in determining the meaning or pronunciation of a word from print.The DOL issue concerns how the resource that are available in such system are allocated.The main question in the VWR research –how the people pronounce words and non words ,the effect of brain injury on performance ,the role of phonological and morphological in word recognition ,the effects of difference among orthographies,the use of different decoding strategies ,and the role of contextual information-are different realization of DOL issue.DOL may vary across words,individuals,or writing systems;it may be something that an individual can strategically alter;it may be the cause of different patterns of impairment following brain injury.

Core principles

- Orthography,phonology and semantics are inter conneted.
- Semantics and phonological representaions are distributed features which are computed (as opposed to accessing stored representations).
- Activation is spread between representatios in a smooth and gradual manner.
- Information is summed from different sources.
- The same computational principles apply to all mechanisms of the model.
- Hence ,difference in the strength of different pathways are a function of experience and item characteristics ,not a priori architectural decision.

The principal lexical access model is the dual-route model introduced in a landmark paper by Marshall and Newcombe(1973) and subsequently Colthert et al(1978,1987,1993).Allport and Mc Celland,1989 model entails a general theory of word processing in reading,but has been worked out in most detail with regard to the task of reading aloud.The two routes in the the name originally referred to lexical and non lexical mechanisms for pronouncing words and non words.The non lexical mechanisms involves the application of rules governing spelling-sound correspondence .The rules are non lexical in the sense that they are general rather than word specific;they are sub word level insofar as they apply to parts of words such as graphemes rather than entire words.The rules will generate correct pronunciation for rule governed (regular)words such as ‘gave’ and non words such as ‘mave’,but not exception words such as ‘have’.The lexical mechanisms involves pronunciation of individual words stored in memory.Irregular nonwords can be pronounced only by accessing these stored representations;nonwords can never be pronounced in this way because their pronunciation are never not stored;regular words can be pronounced this way although the rules make this unnecessary.Thus,the DOL in the dual-route model follows the assumption that spelling sound knowledge is encoded in terms of rules and the fact that English has minimal pair such as ‘gave’-‘have’ and ‘leaf’-‘deaf’.The rules can not correctly specify both pronunciation ;hence some words will have to be pronounced by looking up pronunciation stored in memory.That there are such rules in further suggested by the ability to pronounce nonwords.

For many years the dual-route model assumed a rule based mechanism without identifying what the rules are .Coltheart et al,1993,have recently described an algorithm for inducing grapheme-phoneme correspondence (GPC)rules.Applied to the 2897 words corpus described by Seidenberg and Mc Clelland,1989,the algorithm induces 144 rules .The rules produce correct output for about 78% of the 2897 words in the corpus.The others are considered exceptions.The rules also generate plausible pronunciations for nonwords such as’nust mave’,’jinje’.

Most versions of dual-route model assume a third mechanism for pronouncing words.The lexical naming route involves accessing the pronunciations of individual words stored in memory.There are two suggestions for how this can be achieved.One involve accessing the meaning of a word from orthography and then accessing the phonological code from semantics ,as in speech production.A lexical but non semantic pronunciation mechanisms has also been proposed utilizing direct association between orthographic and phonological codes for words.The evidence for this third mechanism (orthography to phonology-word level)is provided by brain injured patients who are able to read some words aloud despite severe semantic impairment but are unable to pronounce nonwords.

The DOL issue is realized differently in the connectionist models.First,these models do not have parallel,independent processing routes.Second ,they do not utilize domain-specific types of knowledge representaions such as grapheme-phoneme correspondence rules;the same type of knowledge representations (weighted connections between units)and process (activation-based parallel constraint satisfaction)are used for all types of information.Third,a lexical code(eg.the meaning of a word)is a pattern that builds up over time based on input from different parts of lexical system and from context.

DUAL ROUTE MODEL

Our ability to read non words on the one hand and irregular words on the other suggests the possibility of dual route model of naming.the classical dual route model has 2 routes for turning word into sounds.

There is a direct access or lexical route ,which is needed for irregular words.This must atleast in some way involve reading via meaning.That is lexical route takes us directly to a word's meaning in the lexicon and we are then able to retrieve the sound of a word.There is also a grapheme to phoneme conversion route(also called the indirect ornon- direct or sub-lexical),which is used for reading nonwords.This route carries out what is called phonological recording.It does not involve lexical access at all.The nonlexical route was first proposed in the early 1970s(eg.Gough ,1972;Rubenstien,Lewis,Rubenstien,1971).Another important justification for a grapheme-to –phoneme conversion route is that is useful for children learning to read by sounding out words letter by letter.

NONWORD NAMING

Non words are sequences of letters(and some times digits and other characters)that do not form words.

A pseudo word is a unit of speech or text that appears to be an actual word in a certain language(at least superficially),while in fact it is not part of the lexicon.Within linguistics ,a pseudoword is defined specifically as respecting the phonotactic restrictions of a language.That is it does not include sounds or series of sounds that do not exist in that language;it is easily pronounceable for speakers of the language.Also when written down ,a pseudoword doesnot include characters of strings of characters that are not permissible in the spelling of the target language.'Ployer' is a pseudoword in English,while 'dfhnxd'is not.The latter is an eg.of a nonword.Nonwords are contrasted with pseudowords in that they are not pronounceable and by their spelling ,which could not be the spelling of a real word.

LANGUAGE PRODUCTION

Language production is a concept in psycholinguistics that describes the stages of speech from the initial mental concept to the spoken or written linguistic result. Simply put, it is the process of communicating through language. **Language production** is the production of spoken or written language. In psycholinguistics, it describes all of the stages between having a concept to express and translating that concept into linguistic form. These stages have been described in two types of processing models: the lexical access models and the serial models.

Stages of Language Production:

Language production consists of several interdependent processes which transform a nonlinguistic message into a spoken, signed, or written linguistic signal. Though the following steps proceed in this approximate order, there is plenty of interaction and communication between them. The process of message planning is an active area of psycholinguistic research, but researchers have found that it is an ongoing process throughout language production. Research suggests that messages are planned in roughly the same order that they are in an utterance. But, there is also evidence that suggests the verbs that give case may be planned earlier than objects, even when the object is said first. After identifying a message, or part of a message, to be linguistically encoded, a speaker must select the individual words—also known as lexical items—to represent that message. This process is called lexical selection. The words are selected based on their meaning, which in linguistics is called semantic information. Lexical selection activates the word's lemma, which contains both semantic and grammatical information about the word.

The basic loop occurring in the creation of language consists of the following stages:

- Intended message
- Encode message into linguistic form
- Encode linguistic form into speech motor system
- Sound goes from speaker's mouth to hearer's ear auditory system
- Speech is decoded into linguistic form
- Linguistic form is decoded into meaning

There are three broad areas of speech production processes which are **conceptualization**, **formulation** and **encoding**.

Conceptualization

The processes of conceptualization (also known as message level processes of representation) involve determining what to say. Speakers construct a preverbal message through conceiving an intention and selecting relevant information from memory or the environment in order to prepare for the construction of an utterance.

Conceptualization processes involve macroplanning and microplanning. In macroplanning, a communicative goal is elaborated into a series of subgoals and the retrieval of appropriate information. Microplanning, on the other hand, assigns the right propositional shape to these chunks of approapriate information and involves decisions on matters such as what the topic or focus of the utterance will be.

Formulation

The processes of formulation involve translating the conceptual representation into a linguistic form. There are two major components of formulation which are lexicalization and syntactic planning. In lexicalization, speakers select the words that they want to say and in syntactic planning, they put the words together to form a sentence.

Encoding/Execution

The processes of phonological encoding/execution involve detailed phonetic and articulatory planning.These processes involve turning words into sounds. The sounds are produced in the correct sequence and specify how the muscles of the articulatory system must be moved.

LANGUAGE IN NON HUMANS

Language is considered to be a very complex form of communication that occurs among the human race. It is a set of verbal and non-verbal conventions that humans use to express their ideas and wants. Humans use words while talking to express their needs and wants and they cry, slouch and make faces when they want to express feelings. Animals, or in other words non-humans also show signs of communication such as a dog wagging its tail when excited or a bird singing a song to attract the opposite sex. However do animals have their language? Scientists are still unsure about this question.

Researchers say that animals, non-humans, do not have a true language like humans. However they do communicate with each other through sounds and gestures. Animals have a number of in-born qualities they use to signal their feelings, but these are not like the formed words we see in the human language. Human children show these same forms of communication as babies when crying and gesturing. But they slowly learn the words of the language and use this as form of communication.

There is no doubt that animals communicate with each other to one degree or another in response to different stimuli such as hunger or fear. Human language is creative and consists of unique characteristics that give us the ability to engage in abstract and analytical ways. So can it be said animals do not have a true language like us humans, since we use language for a variety of things other than just communicating simple needs? It is a matter of opinion and extensive research in the area.

Animal languages are forms of non-human animal communication that show similarities to human language. Animals communicate by using a variety of signs such as sounds or movements. Such signing may be considered complex enough to be called a form of language if the inventory of signs is large, the signs are relatively arbitrary, and the animals seem to produce them with a degree of volition (as opposed to relatively automatic conditioned behaviors or unconditioned instincts, usually including facial expressions). In experimental tests, animal communication may also be evidenced through the use of lexigrams (as used by chimpanzees and bonobos).

The following properties of human language have been argued to separate it from animal communication:

- **Arbitrariness**: there is usually no rational relationship between a sound or sign and its meaning. For example, there is nothing intrinsically house-like about the word "house".
- **Discreteness:** language is composed of small, repeatable parts (discrete units) that are used in combination to create meaning.
- **Displacement:** languages can be used to communicate ideas about things that are not in the immediate vicinity either spatially or temporally.
- **Duality of patterning:** the smallest meaningful units (words, morphemes) consist of sequences of units without meaning. This is also referred to as **double articulation**.
- **Productivity:** users can understand and create an indefinitely large number of utterances.
- **Semanticity**: specific signals have specific meanings

Communication in both animals and humans consists of signals. Signals are sounds or gestures that have meaning to those using them.

- Human communication consists of both signals and symbols. Symbols are sounds, gestures, material objects, or written words that have specific meaning to a group of people.
- Key differences between human communication and that of other primates are that (1) humans have an open vocal system while other primates have a closed vocal system, and (2) humans have a larger bank of symbols to use in communication.

All animals use some form of communication, although some animal communication is more complex than others. Animal language is any form of communication that shows similarities to human language; however, there are significant differences. Some animals use signs, signals, or sounds to communicate. Lexigrams, or figures and symbols that represent words, are commonly used by chimpanzees and baboons, while animals such as birds and whales use song to communicate among one another. Bees uses complex “dances” to convey information about location. Other animals use odors or body movements to communicate.

Communication in both animals and humans consists of signals. Signals are sounds or gestures that have some meaning to those using them. The meaning is often self-evident based on context: for example, many animals roar, growl, or groan in response to threats of danger; similarly, humans may wave their arms or scream in the event of something dangerous. These signals in these situations are designed to let others in the species know that something is wrong and the animal or human needs help.

Human communication consists of both signals *and* symbols. Symbols are sounds or gestures that have a specific meaning to a group of people. This meaning could be cultural, group-related, or even related between two specific people. For example, two people may create a “secret” handshake, or a group may develop a passcode that only members are aware of. Symbols, unlike signals, must be taught and learned; they are not instinctual or self-evident.

Nonhuman primates communicate in ways that are very similar to those used by humans; however, there are important differences as well. First and foremost, humans use a larger repertoire of symbols, and these symbols are substantially more complex. Second, and more importantly, nonhuman primates (and other animals who communicate with one another) have what is known as a closed vocal system: this means different sounds cannot be combined together to produce new symbols with different meanings. Humans, by contrast, have open vocal systems, which allow for combinations of symbols to create new symbols with a totally new meaning and therefore allows for an infinite number of ideas to be expressed.

Human language is also the only kind that is modality-independent; that is, it can be used across multiple channels. Verbal language is auditory, but other forms of language—writing and sign language (visual), Braille (tactile)—are possible in more complex human language systems.