2.1. Psycholinguistics

Psycholinguistics or psychology of language is the study of the psychological and neurobiological factors that enable humans to acquire, use, comprehend and produce language. Initial forays into psycholinguistics were largely philosophical or educational schools of thought, due mainly to their location in departments other than applied sciences (e.g., cohesive data on how the human brain functioned). Modern research makes use of biology, neuroscience, cognitive science, linguistics, and information science to study how the brain processes language, and less so the known processes of social sciences, human development, communication theories and infant development, among others. There are a number of sub disciplines with non-invasive techniques for studying the neurological workings of the brain; for example, neurolinguistics has become a field in its own right.

Psycholinguistics has roots in education and philosophy, and in 2013 covers the "cognitive processes" that make it possible to generate a grammatical and meaningful sentence out of vocabulary and grammatical structures, as well as the processes that make it possible to understand utterances, words, text, etc. Developmental psycholinguistics studies children’s ability to learn language.

Psycholinguistics is an interdisciplinary field. Hence, it is studied by researchers from a variety of different backgrounds, such as psychology, cognitive science, linguistics, and speech and language pathology. Psycholinguists study many
different topics, but these topics can generally be divided into answering the following questions:

(1) how do children acquire language? (language acquisition);
(2) how do people process and comprehend language? (language comprehension);
(3) how do people produce language? (language production) and
(4) how do people acquire a new language? (second language acquisition).

Subdivisions in psycholinguistics are also made based on the different components that make up human language.

Linguistics-related areas:

- Phonetics and phonology are concerned with the study of speech sounds. Within psycholinguistics, research focuses on how the brain processes and understands these sounds.
- Morphology is the study of word structures, especially the relationships between related words (such as dog and dogs) and the formation of words based on rules (such as plural formation).
- Syntax is the study of the patterns which dictate how words are combined to form sentences.
- Semantics deals with the meaning of words and sentences. Where syntax is concerned with the formal structure of sentences, semantics deals with the actual meaning of sentences.
- Pragmatics is concerned with the role of context in the interpretation of meaning.
2.2. Language Acquisition

There are essentially two schools of thought as to how children acquire or learn language, and there is still much debate as to which theory is the correct one. The first theory states that all language must be learned by the child. The second view states that the abstract system of language cannot be learned, but that humans possess an innate language faculty, or an access to what has been called universal grammar. The view that language must be learned was especially popular before 1960 and is well represented by the mentality theories of Jean Piaget and the empiricist Rudolf Carnap. Likewise, the school of psychology known as behaviorism (Verbal Behavior (1957) by B.F. Skinner) puts forth the point of view that language is a behavior shaped by conditioned response, hence it is learned.

The innate perspective began with Noam Chomsky's highly critical review of Skinner's book in 1959. This review helped to start what has been termed "the cognitive revolution" in psychology. Chomsky posited humans possess a special, innate ability for language and that complex syntactic features, such as recursion, are "hard-wired" in the brain. These abilities are thought to be beyond the grasp of the most intelligent and social non-humans. According to Chomsky, children acquiring a language have a vast search space to explore among all possible human grammars, yet at the time there was no evidence that children receive sufficient input to learn all the rules of their language. Hence, there must be some other innate mechanism that endows language ability to human. Such a language faculty is, according to the innateness hypothesis, what defines human language and makes it different from even the most sophisticated forms of animal communication.
The field of linguistics and psycholinguistics since then has been defined by reactions to Chomsky, pro and con. The pro view still holds that the human ability to use language (specifically the ability to use recursion) is qualitatively different from any sort of animal ability. This ability may have resulted from a favorable mutation or from an adaptation of skills evolved for other purposes. The view that language can be learned has had a recent resurgence inspired by emergentism. This view challenges the "innate" view as scientifically unfalsifiable; that is to say, it can't be tested. With the amount of computer power increasing since the 1980s, researchers have been able to simulate language acquisition using neural network models. These models provide evidence that there may, in fact, be sufficient information contained in the input to learn language, even syntax. If this is true, then an innate mechanism is no longer necessary to explain language acquisition.

2.3. Phonological Acquisition

Sound is at the beginning of language learning. Children have to learn to distinguish different sounds and to segment the speech stream they are exposed into meaningful units in order to acquire words and sentences. Here is one reason that speech segmentation is challenging: When you read, there are spaces between the words. No such spaces occur between spoken words. So, if an infant hears the sound sequence “this is a cup,” it has to learn to segment this stream into the distinct units “this”, “is”, “a”, and “cup.” Once the child is able to extract the sequence “cup” from the speech stream it has to assign a meaning to this word. Furthermore, the child has to be able to distinguish the sequence “cup” from “cub” in order to learn that these
are two distinct words with different meanings. Finally, the child has to learn to produce these words. The acquisition of native language phonology begins in the womb and isn’t completely adult-like until the teenage years. Perceptual abilities (such as being able to segment “this is a cup” into four individual word units) usually precede production and thus aid the development of speech production. There are some theories related to phonological acquisition:

2.3.1. Theory of Natural Phonology

This Natural Phonology Theory was introduced by Stampe in 1972 (Ingram, 1989). Cited in Lass (1984), Stampe believes that language actually does not need to be learned since children are born with a set of linguistic devices which make them able to use language naturally without learning it before. Thus, still according to Stampe, children’s phonological acquisition actually occurred naturally within their self.

Stampe cited in (Ingram, 1989), also stated that the child’s task in acquiring adult pronunciation is to revise all aspects of the system which separate his pronunciation from the standard. Standard here refers to the adult pronunciation in which the child is trying to reach in that form. By the fact of that statement, we can also interpret that actually in reaching his pronunciation like adult’s, child usually does some efforts to make his pronunciation at least similar with the adult’s.

Therefore, according to Stampe cited in Ingram (1989), child often reduces the application of phonological process in his own ways. Later on, it is divided into three possible ways: ordering, limitation, and suppression.
Ordering refers to imposing a restriction on the natural order of application of the phonological process. For instance, it orders the process of the elimination of some sounds. Child can order for when he wants to present or absent some words in their pronunciation.

Second mechanism of change is limitation, by which the child limits the range of segment or context in which a process applies. For example, the elimination process is limited only for stop sounds, while the other sounds are not occurred.

The last kind of change is suppression of a process, or sequence of processes. For a child who has been able to control and to master all of voiced stop sounds in every context, it means that he has succeeded suppressing the elimination process that might be occurred when the sounds come up within a word.

2.3.2. Theory of Word Simplification

Children, in the early years of their life, are limited by their biological growth in producing sounds. Often they are inconsistent in how they produce their words; make it far away from adult’s speech form (Ingram in Clark, 2003). Thus, in producing the words children usually simplify it based on their phonological acquisition ability. When they cannot pronounce some sounds which occur in a word, they sometimes avoid saying the word altogether. But, they often either drop the tough sounds (omission), or replace (substitute) it by the easier one (O'Grady, 2005). Still in the same book, he also said that 90 percent of the early words produced by the children are depicting the process of omission and/or substitution.
Based on the simplification made by the children, the experts characterized it into three characters. The first is Substitution; children tend to voice consonant sounds in initial position but find it difficult to voice them in final position. As a result, they often voice voiceless initial consonants, as in a [bai] instead of [pai] for ‘pie’; and they appear to devoice final ones as in [nop] instead of [nob] for ‘knob’ (Velten in Clark, 2003). The explanation of the examples given is that [b] sound substitutes the [p] sound for the word ‘pie’, and final voiceless sound [p] substitutes final voiced sound [b] in the word ‘knob’.

The second is assimilation. It refers to the effect of sounds on those preceding or following them within a word or across word boundaries. The most common assimilation in young children’s word production is probably reduplication, where children simply repeat the syllable they are articulating, as in [dada] instead of ‘daddy’ (Ingram in Clark, 2003). Another example of assimilation is at the production of [goggi] instead of ‘doggy’, here [d] sound becomes [g] because of its nearby sound [g] which following it (O’Grady, 2005).

And the third is omission; children often omit the final consonant or even final syllable if it is unstressed, in their early words. Examples are like in the pronunciations of [ba] instead of ‘ball’, and [bu:] for ‘boot’.

In other book, O’Grady (2005) also stated that omission is also very common when two or more consonants occur in a row within the same syllable. As in the production of [banket] for ‘blanket’, the process which is occurred is the omission of [l] consonant.
Children may continue to do this process as late as the age two and a half (2.5) or three years old (Leopold in Clark, 2003). By the age of three, they make fewer than 10% such omission in word final position (Winitz & Irwin in Clark, 2003).

2.3.3. Theory of Phonological Process

The Theory of Phonological Process was introduced by Ingram in 1979 then later on was developed more in 1989 (Ingram, 1989). According to him, children acquire adults’ phonological system by creating their own structure in which later on change that structure to the adults’ one if their phonological knowledge is getting better (Ingram in Chaer, 2003). The Theory of Phonological Process is divided into three parts:

2.3.3.1. Substitution Process

Substitution process happens when a segment in a word is replaced by another segment. According to Ingram in Fletcher and Garman (1986), this is the most common characteristic of the phonological process which is found in analyzing child’s word. The substitution process consists of:

2.3.3.1.1. Stopping

It is when fricatives are replaced with a stop consonant. For instance in the production of a word ‘sea’ becomes [ti:]. The process which is occurred is the replacement of initial fricative consonant [s] becomes a stop consonant [t].
2.3.3.1.2. **Fronting**

It is when velar and palatal consonants tend to be replaced with alveolar ones. The process that happened in the substitution of the sound [g] instead of ‘goose’ becomes [duːs] is the example of fronting.

2.3.3.1.3. **Gliding**

It is when a glide [w] or [j] is substituted for a liquid sound, i.e. [l] or [r]. The pronunciation of [wedi] instead of ‘ready’ is the example of it, since a glide [w] is replacing a liquid [r].

2.3.3.1.4. **Vocalization**

It is when a vowel replaces a syllabic consonant. This process is particularly a characteristic of English language (Fletcher and Garman, 1986), e.g. ‘apple’ becomes [apo] and ‘bottle’ becomes [babu].

2.3.3.1.5. **Vowel Neutralization**

This is the last process of substitution. It happens when nasal vowels tend to be changed into oral vowels and vowels in general are often centralized, i.e. [a] or [ʌ]. ‘Back’ which is pronounced as [bat], the low vowel [æ] turn into [a], is the example of vowel neutralization.

2.3.3.2. **Assimilatory Process**

Another general group of processes that is found in the production of child’s word is assimilation. It is a tendency to assimilate one segment in a word to another. Assimilatory process consists of:
2.3.3.2.1. Voicing

Consonants tend to be voiced when preceding a vowel, and devoiced at the end of a syllable. It is occurred in the pronunciation of [daini] instead of ‘tiny’, and the pronunciation of [bit] instead of ‘bird’. The first example shows that child tends to voice consonant when it precedes the vowel. While the second one shows that the consonant is pronounced voicelessly when it comes at the end of a syllable.

2.3.3.2.2. Consonant Harmony

Consonants tend to assimilate to each other in certain predictable ways. Below are the patterns which are commonly occurred:

(i) velar assimilation

Apical consonants tend to assimilate to a neighboring velar consonant. For example in the word ‘duck’ which is commonly pronounced as [gʌk].

(ii) labial assimilation

Apical consonants tend to assimilate to a neighboring labial consonant. It occurs in the pronunciation of [bʌb] and [beip] instead of ‘tub’ and ‘tape’.

2.3.3.2.3. Progressive Vowel Assimilation

An unstressed vowel will assimilate to a preceding (or following) stressed vowel. The pronunciation of [faː wa] for ‘flower’ and [haː ma] for ‘hammer’ is the example of this process, the stressed vowel [a] is assimilating the unstressed vowel [e].
2.3.3.3. **Syllable Structure Process**

Syllable structure process is a tendency of young children to simplify syllable structure. For most children, the pattern is toward a basic CV syllable.

Syllable structure process consists of:

2.3.3.3.1. **Cluster Reduction**

It is when a consonant cluster is reduced to a single consonant, i.e. [kaun] and [des] instead of ‘clown’ and ‘dress’. The processes is that a consonant cluster [kl] and [dr] are reduced into a single consonant [k] and [d] only.

2.3.3.3.2. **Deletion of Final Consonants**

It is when a CVC syllable is reduced to CV by deleting the final consonant. The deletion of a final consonant [k] in ‘bike’ into [bai] is the example of the deletion of final consonant process.

2.3.3.3.3. **Deletion of Unstressed Syllable**

It is when an unstressed syllable is deleted, especially when it precedes a stressed syllable. The pronunciation of the word ‘banana’ becomes [nænə] is the example of this process.

2.3.3.3.4. **Reduplication**

In a multisyllabic word, CV syllable tends to be repeated, e.g. ‘water’ turns into [wawa]. The process which happens on that word is the reduplication of CV [wa] into [wawa].
2.4. Phonemes in Languages

Phonemes are minimal units in that they cannot be broken up into smaller successive units: each phone is a string of phones which corresponds to exactly one phoneme on the underlying level (Griegerich, 1992). Below is the classification of phonemes which occur in Indonesian:

2.4.1. Consonants

In order to form consonants, the airstream through the vocal tract must be obstructed in some way (Ladefoged, 1975). Consonants furthermore can be classified, according to the theory of articulatory phonetics, into two classifications: the first one is the classification based on the place of articulation, and the second one is based on the manner of articulation. Both of those two classifications, then, are divided again in some sub classifications. The one which belongs to the place of articulation has nine types: bilabial [b, p, m], labiodentals [f, v], dental [ð, θ], alveolar [t, d, s, z, n, l], retroflex [ɾ], palato-alveolar [ʃ, _], palatal [j, h], velar [k, g, ƞ], and the last one is glottal [ʔ]. While the one which belongs to the manner of articulation has five types: stops; which consists of nasal stop [m, n, ƞ], and oral stop [p, t, k, b, d, g]; fricative [s, z, f, v, θ, ð, ʃ, _], approximant [w, r, j], lateral [l], and affricate. Yet, affricate sound does not occur in Indonesian.

Beside those two classifications, consonants in some ways also determined by the movement of vocal tract named: voiced [b, d, g, z, etc] and voiceless consonants [p, t, k, f, s, etc].
2.4.1.1. **Consonants in Indonesian**

Based on Moeliono (1992) in his book entitled ‘Tata Bahasa Baku Bahasa Indonesia’, Indonesian consonants are like shown in the table below:

<table>
<thead>
<tr>
<th>Manners of Articulation</th>
<th>Voiced (+)/Voiceless (-)</th>
<th>Places of Articulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bilabial</td>
<td>Labiodental</td>
</tr>
<tr>
<td>Stop</td>
<td>(-)</td>
<td>p</td>
</tr>
<tr>
<td></td>
<td>(+)</td>
<td>b</td>
</tr>
<tr>
<td>Fricative</td>
<td>(-)</td>
<td>f</td>
</tr>
<tr>
<td></td>
<td>(+)</td>
<td>z</td>
</tr>
<tr>
<td>Approximant</td>
<td>(+)</td>
<td>w</td>
</tr>
<tr>
<td>Lateral</td>
<td>(+)</td>
<td>l</td>
</tr>
<tr>
<td>Nasal</td>
<td>(+)</td>
<td>m</td>
</tr>
</tbody>
</table>

(Source. Moeliono, 1992)

From the table above, it can be seen clearly that Indonesian language has twenty two consonants. Meanwhile glottal, which is symbolized phonetically with [ʔ], actually is not too important. Its existence usually is just to give a stressed within a word (Marsono, 1989). Similar opinion is also stated by Moeliono (1992), he did not characterize it as a consonant. Moeliono just considers it as an allophone of stop velar sound [k] though its existence in Indonesian language is very common.
2.4.2. Vowels

In classifying the vowels, the experts mainly divided it into two parts: the one which is based on the position of the highest point of the tongue, and the other is based on the position of the lips (Ladefoged, 1975). Based on the highest point of the tongue, it consists of three characteristics: high vowels [i, u], mid vowels [ε, ǝ, o, ɔ], and low vowels [a, ɑ]. Meanwhile based on the position of the lips, it consists of three characteristics: front vowels [i, e, ɛ, a], central vowels [ǝ], and back vowels [u, o, ɔ, ɑ].

2.4.2.1. Vowels in Indonesian

Indonesian language has ten vowels (Soebardi in Marsono, 1989). Below is the table of the classification of Indonesian vowels:

<table>
<thead>
<tr>
<th>No.</th>
<th>Vowels</th>
<th>The highest point of the tongue</th>
<th>The position of the lips</th>
<th>Word example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>[i:]</td>
<td>High</td>
<td>Front</td>
<td>ibu, kita</td>
</tr>
<tr>
<td>2.</td>
<td>[i]</td>
<td>High</td>
<td>Front</td>
<td>kerikil, kelingking</td>
</tr>
<tr>
<td>3.</td>
<td>[e]</td>
<td>Mid</td>
<td>Front</td>
<td>Enak</td>
</tr>
<tr>
<td>4.</td>
<td>[ɛ]</td>
<td>Mid</td>
<td>Front</td>
<td>nenek, leher</td>
</tr>
<tr>
<td>5.</td>
<td>[a]</td>
<td>Low</td>
<td>Front</td>
<td>apa, pada</td>
</tr>
<tr>
<td>6.</td>
<td>[ǝ]</td>
<td>Mid</td>
<td>Central</td>
<td>elang, iseng</td>
</tr>
<tr>
<td>7.</td>
<td>[ɔ]</td>
<td>Mid</td>
<td>Back</td>
<td>otot, tokoh</td>
</tr>
<tr>
<td>8.</td>
<td>[o]</td>
<td>Mid</td>
<td>Back</td>
<td>toko, kado</td>
</tr>
<tr>
<td>9.</td>
<td>[u]</td>
<td>High</td>
<td>Back</td>
<td>ukur, urus</td>
</tr>
<tr>
<td>10.</td>
<td>[u:]</td>
<td>High</td>
<td>Back</td>
<td>udara, paku</td>
</tr>
</tbody>
</table>

(Source. Marsono, 1989)