CHAPTER II

LITERATURE REVIEW

2. 1 Theoretical Framework

2.1.1 Phonology

Phonology is one of the core fields that compose the discipline of linguistics (Odden, 2005). According to Poole (1999), Phonology is study sounds in the context of languages. It was in accordance with Clark and Yallop (1995), they said that phonology is concerned with speech with the ways in which human produce and hear speech. In other hand, phonology according to Ladefoged (1982, p. 23) is the description of the system and pattern of sounds that occurs in a language. In this case, Ladefoged said that it involves studying a language to determine its distinctive sound and to find out which sound convey a different in meaning. Based on the definitions above, it can be concluded that phonology is the study of the sound of a language.

In this case, there is one of important part of phonology like phonetics. Phonetics is the study of speech sound and their production. It was in accordance with MacMahon (2006, p. 360). He said that phonology focuses on the mechanics of sound production and transmission. In other hand, Aarts (2006, p. 359) Phonetics describes as the scientific study of speech

production. It concerned with articulatory phonetics, acoustic phonetics, and auditory phonetics.

Aarts (2006, p. 359) explain that Articulatory phonetics is The processes that generate an air-stream which carries linguistic content, acoustic phonetics is the physical characteristics of the resulting sound waves that pass between the speaker's vocal tract and the listener's ears, and auditory phonetics is the processes whereby the mechanical movements of the ear-drum, created by the action of the sound waves, are transmitted into the middle and inner ear and perceived at a cortical level as sound.

In this research, the writer concern with the acoustic phonetic, especially acoustic of vowel sound. So, it means that this research concern with the physical characteristics of the resulting sound waves of vowel that through between the speaker's vocal tract and the listener's ears. Because of this reason, it is known that the research has relationship with the acoustic analysis of the vowel. So, it is better to know about speech production at first. It happened because it is known from the explanation above that acoustic phonetics have relation with speech production. In other hand, it is also important to know about vowel, the articulation of the vowel sound, the sounds of the vowel and vowel quality as additional explanation to make it clear.

2.1.2 Speech Production

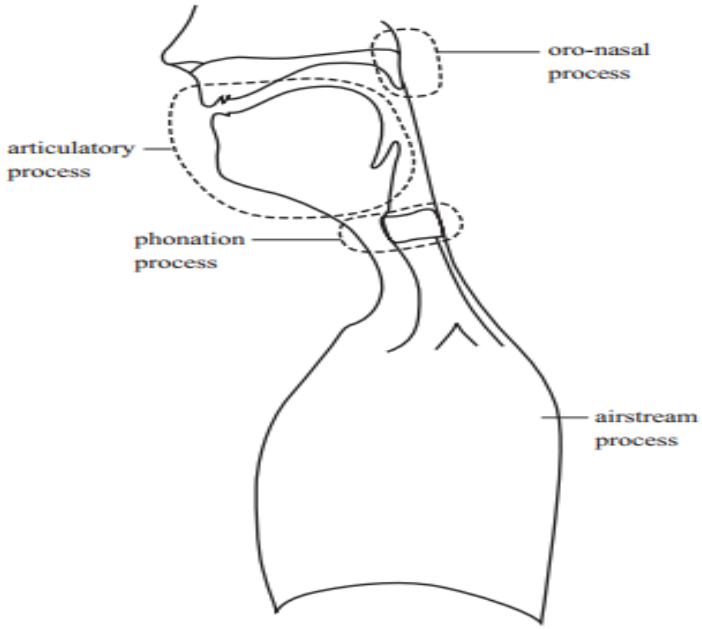
According to Ladefoged and Johnson (2011, p. 2), speech production is the result of the tongue and lips. He explains that the tongue and lips movements as gestures forming particular sound. It is possible to convey information by gestures of our hands that people can see, but in making speech that people can hear, humans have found a marvelously efficient way to give information. The gestures of the tongue and lips are made audible so that they can be heard and recognized.

Ladefoged and Johnson (2011, p. 2) also said that making speech gestures audible involves pushing air out of the lung while producing a noise in the throat or mouth. These basic noises are changed by the actions of the tongue and lips. So, it means that each sound is different because of the different of the tongue and lips' actions. Producing any sound requires energy. In nearly all speech sounds, the basic source of power is the respiratory system pushing air out of the lungs. It can be concluded that it is possible to produce sound or speak any language when we are breathing in.

In other hand, Ladefoged (2011, p. 5), explain that the speech production mechanism as a whole shows the four main component. They are the airstream process, the phonation process, the oro-nasal process, and the articulatory process. The airstream process includes all the ways of pushing air out that provide the power for speech. For the moment, we

have considered just the respiratory system, the lungs pushing out air, as the prime mover in this process. The phonation process is the name given to the actions of the vocal folds. Only two possibilities have been mentioned: voiced sounds in which the vocal folds are vibrating and voiceless sounds in which they are apart. The possibility of the airstream going out through the mouth, as in (v) or (z), or the nose, as in (m) and (n), is determined by the oro-nasal process. The movements of the tongue and lips interacting with the roof of the mouth and the pharynx are part of the articulatory process.

Figure. 1 The four main components of the speech mechanism.



2.1.3 Vowels

The term vowel refers to sound, not to letter. It was in accordance with Clark and Yallop (1990, p. 3). So, it can be concluded that when we talk about vowel, it means that we does not talk about vowel letter but vowel sound.

There is much kind of English vowel sounds. They are short vowel, long vowel and diphthong (Baker, 2006). It also was in accordance with Roach (1983).

Short vowel means that we make short sounds. The symbol for these short vowel are /i/ as in list, /e/ as in less, / æ/ as in lass, / ʌ/ as in cup, / ɔ/ as in lost, and /u/ as in look.

Long vowels are the vowels which tend to be longer than the short vowels in similar context (Roach, 1983). The symbol for these long vowels are /i:/ as in least, / ə:/ as in learn, / ɑ:/ as in last, / ɔ:/ as in lord, and /u:/ as in Luke.

Diphthong is two vowel sounds. The symbols for these diphthongs are /iə/ as in dear, here, near, hear, gear, etc, /ei/ as in day, take, cake, case, /ɛə/ as in care, there, where, /uə/ as in sure, tour, cure, /ou/ as in throw, grow, / ɔi/ as in toy, boy, joy, employ, noise, /ai/ as in tie, white, mind, time, find, right and /au/as in ground, town, snow, hound.

Although English has a large number of vowel sounds, the research focus on the short vowel especially /e/ and / æ/. Those vowels are chosen because the writer considers that most of Indonesian people pronounce it in the same way. So, because of the reason above the writer look for the formant value and its characteristics of vowel /e/ and / æ/.

Those vowels can be differentiated by the term of the position of the highest point of the tongue and the position of the lips. In this case, Ladefoged (2001, p. 12) states that there are three gestures that affect vowel sound. They are the height of the body tongue, the front and back position of the tongue, and the degree of the lip rounding. Johnson (2011, p. 211) called it as main aspects of vowel quality. Based on the previous explanation, it is important to know about the articulation of vowel sounds to know the gesture of vowel.

2.1.4 The Articulation of Vowel Sounds

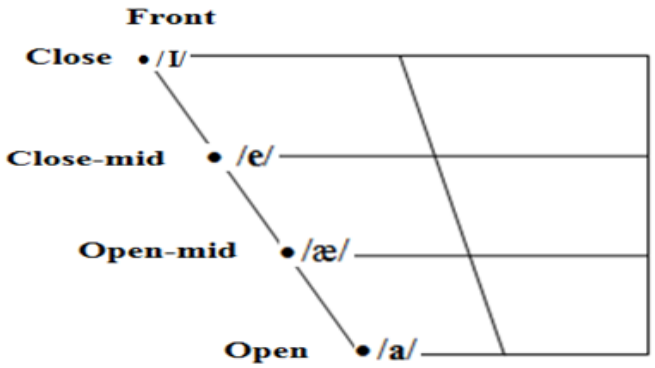
It is known that the passage of the airstream of vowel sounds is relatively unobstructed. It differentiated by their gestures (articulation). They are the height of the body tongue, the front and back position of the tongue, and the degree of the lip rounding.

Johnson (2011, p. 19) also said that vowel sound in heed, hid, head, had, father, good, food gestures, the tongue tip is down behind the lower front teeth, and the body of the tongue is domed upward. In the first four

vowels, the highest point of the tongue is in the front of the mouth. Accordingly, these vowels are called front vowels. The tongue is fairly close to the roof of the mouth for the vowel in heed, slightly less close for the vowel in hid, and lower still for the vowels in head and had. The vowel in heed is classified as a high front vowel, and the vowel in had as a low front vowel. The height of the tongue for the vowels in the other words is between these two extremes, and they are therefore called mid-front vowels. The vowel in hid is a mid-high vowel, and the vowel in head is a mid-low vowel.

Based on the explanation above, it can be concluded that /i/, /e/, /æ/, and /a/ are front vowels. /i/, is high front vowel or close front vowel, /e/ is mid-high vowel or close-mid vowel, /æ/ is mid-low vowel or open-mid vowel.

Figure. 2 The tongue shape of front vowel



In other hand, he also explains that the tongue position of vowel sounds in father, good, food is close to the back surface of the vocal tract.

These vowels are classified as back vowels. The body of the tongue is highest in the vowel in food and lowest in the first vowel in father. The vowel in good is a mid-high back vowel.

According to the explanation above, it can be concluded that /u:/ is called a high back vowel, /a:/ is called a low back vowel, and /u/ is mid-high back vowel.

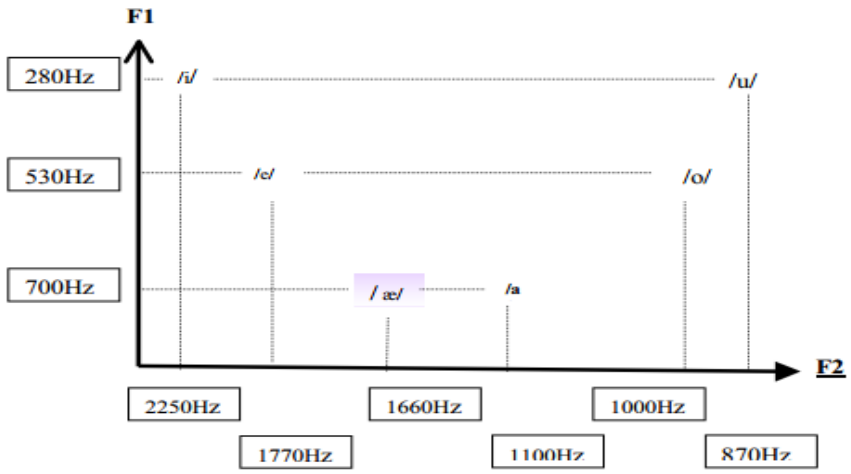
In this case, it is also known that lip gesture also have affect in the different vowels. According to Johnson (2011, p. 20) there is a movement of the lips in addition to the movement that occurs because of the lowering and rising of the jaw. This movement is called lip rounding. It is usually most noticeable in the inward movement of the corners of the lips. Vowels may be described as being rounded (as in who'd) or unrounded (as in heed).

2.1.5 Acoustic Analyses

It is known from Johnson (2011, p. 193) that it is possible to analyze physical of vowel sound because phonetic scientists like to describe vowels in terms of number. He said that it is possible to analyze sounds so that the researcher can measure the actual frequencies of the formant. It can represent graphically, as in figure. In this case, a linguist named Ladefoged (1925–2006) has contribution in this figure. This figure is the average of a

number of the frequencies of the first two formants in American English vowels.

Figure. 3 The frequencies of the first two formants in American English vowels.



Those values show the correlation between the first formant (F1) and second formant (F2) values and vowel height and frontness and backness. According to Kazuya Saito (2007, p. 24), the higher the F2 value is, the more front the tongue position, and the higher the F1 value is, the lower the tongue position.

Johnson (2011, p. 194) state that there are computer programs that can analyze sounds and show their components. The display produced is called a spectrogram. We have seen spectrograms in prior chapters without much discussion of how to interpret them. In spectrograms, time runs from left to right, the frequency of the components is shown on the vertical scale, and the intensity of each component is shown by the degree of

darkness. It is thus a display that shows, roughly speaking, dark bands for concentrations of energy at particular frequencies showing the source and filter characteristics of speech. There are several free computer programs on the Web that can be used to make spectrograms, such as Praat.

The praat program is designed by Paul Boersma and David Weenink of the Institute of Phonetics Sciences of the University of Amsterdam. Its home page is http://www.praat.org or http://www.fon.hum.uva.nl/praat /. The praat is one of Computer software that used for analyzing physical properties of speech and phonetics (acoustic), such as loudness, pitch, and quality. It can be operated in UNIX, Linux, Mac and Microsoft Windows. It has some versions, it is 5.4.01 until 5.4.08. The update version is PRAAT 5.4.08. Praat is the dutch word for “talk” or “speak”.

The first step to record sound using Praat software is click Objects, New, Record Mono and Press Record to record, and Stop to stop. After made a recording, the user has to name it and choose Save to list, and it will show up in the Praat objects window where it is ready for editing. In other hand, the user click Objects, Open, and Read from File if the user already have recording in their computer. The second step after the sound has been recorded or opened is select Objects, View & Edit to open a sound in the editor window. Finally, you will show the waveform of the sound that ready to analyze.

2.1.5.1 The Element of Acoustic

Sound consists of variation in air pressure due to small movements of the particles of air that differentiate each sound, such as loudness, pitch and quality in the wave. So, it can be concluded that those are element of acoustic that can differs sound.

In this case, Ladefoged (1996, p. 14) explained it clearly. He explained that If you listen to a number of musical notes, such as those made by tuning forks, pianos, or violins, you will find that they may differ from one another in three principal ways, firstly, one may be louder than another, if you strike two similar tuning forks, one gently and the other somewhat harder, almost the only difference between the two resulting sounds will be that one is soft and only just audible, whereas the other is loud and can be heard at a distance. The second possible difference between two musical sounds is that one may be higher in pitch than another. This is the main difference between two notes such as middle C and the C above it on a piano. It is possible to strike them so that they sound equally loud but differ as sounds because one is higher up the scale than the other. It is a number of vibrations per second of sound. Lastly, the third difference between musical sounds is that one may differ in quality from another. This is the difference between two

notes that are equal in pitch and loudness but have been produced by different instruments, such as piano and a violin.

These three factors loudness, pitch and quality provide the most convenient method of differentiating between all sounds. They can be regarded as three ways in which sounds can differ. Whenever you hear two sounds it is possible to describe the differences between them by comparing them in these three ways. For example, a tuning fork and an organ will produce sounds they produce may have the same pitch, but one sound is almost certain to be louder than the other, and each sound definitely has its own quality.

2.1.6 Vowel Quality

It is known from Johnson (2011, p. 187) that the quality of a vowel depends on its overtone structure. When discussing differences in quality, we noted that the quality of a vowel depends on its overtone structure. Putting another way, we can say that a vowel sound contains a number of different pitches simultaneously. There is the pitch at which it is actually spoken, and there are the various overtone pitches that give it its distinctive quality. We distinguish one vowel from another by the differences in these overtones. The overtones are called formants.

Based on the explanation above, it can be concluded that quality of vowels usually based on the frequencies of the vowel. So, because of this reason it is important to know the relationship between articulatory of the vowels and the frequencies of those vowel. In following explanation, explain about those relationships from some linguist.

Lindblom and Sundberg's work as cited on Clark and Yallop (1995, p. 266) suggests the following general relationships between articulatory and acoustic factors:

1. Jaw opening cause F1 to rise quite markedly, usually in the context controlling vowel height. It will cause F2 to rise if the tongue is retracted up towards the soft palate: this effect is strongest when the lips are spread, but minimal in other articulatory position. F3 may rise sharply at moderate jaw apertures when the tongue is raised towards the palate region.
2. Tongue body movement in a general anterior to posterior direction causes a modest rise in f1 if the jaw is kept at a fixed opening (but the jaw is not normally kept in one position). Movement from anterior to neutral position results in large drop in F2 in all cases. From neutral to posterior position, F2 will tend to rise with small jaw opening, but continue to fall with larger jaw openings.
3. Tongue body shape, which controls the degree of tract constriction (assuming a constant jaw position), has little effect on F1 except that it

results in a modest fall at maximum constriction if the tongue body is well forward. It has a strong effect on F2, causing it to fall substantially as constriction increases if the tongue body is in neutral or posterior position. An anterior tongue body position combined with maximum constriction results in a sharp rise in F2. F3 is little affected by tongue body shape except for a modest fall at neutral and maximum constriction with an anterior tongue position.

4. Lip rounding has the general effect of lowering all formant frequency, with the strongest effects observable on F2 and F3. The extent of the effect depends on what the tongue and jaw are doing at the same time.
5. Lowering of the larynx makes the vocal tract longer and tends to lower all formant frequency; the degree f lowering of each formant partly depends on the overall state of the vocal tract. In general, larynx height influences F2 and F4 more than F3.

In other hand, Ladefoged also said that there are two features of vowel quality. They are height and backness that are used to contrast one vowel with another in nearly every language, and there are other features that are used less frequently. In this case, the feature of vowel quality based on the explanation of Ladefoge can be concluded that formant frequency have some effect. Such as frequency of formant one affect height, frequency of formant two affect Backness, Frequency of formant three affect Rhotacization.

According to the explanation above, the writer can conclude that there are two features of vowel quality that are used to contrast one vowel with another in this research. They are height and backness. Both of them have relationship with the frequency of the first and second formant's frequencies. It was also in accordance with Kazuya Saito. He analyzed vowel æ and a based on the correlation between the first formant (F1) and second formant (F2) values and vowel height and frontness backness. He analyzed based on the first and second formant frequencies of æ and a.

1. 2 Related Study

Studies on acoustic phonetics have been done previously. For first example, Dini Ratna Sari Putri (2007) analyzed the sounds of Fricatives and affricates pronunciation by Sudanese literature 2010 generation of Padjadjaran University. Her research focused on the ability of the sounds of Fricatives and affricates (V, F, S, Z, ʃ, θ, ð, ʒ, t ʃ, and dʒ) pronunciation by Sudanese. She analyzed through praat Software and refers to the 7th Edition Oxford dictionary. The purpose of her research is to find out the accuracy of the sounds pronunciation of Sastra Sunda Students. She found that Sudanese are not pronouncing tʃ correctly. The results showed that the accuracy of the pronunciation of the respondents did not reach 70%.

Based on the explanation above, it is known that this research has similarity with previous study. Both of them measure quality of sound using

praat. In other hand, they also have difference. This research refers to the average formant of native English while the previous refers to the pronunciation in 7th Edition Oxford dictionary. This research more accurately than previous research that refers to pronunciation in 7th Edition Oxford dictionary. This is more accurately because we know that this research uses the average formant of native English. The average formant is chosen because the writer considered that it is difficult to compare acoustic data on the sounds of one individual with another. Even, it is known that Phoneticians do not really know how to compare acoustic data on the sounds of one individual with those of another (Ladefoged and Johnson, 2011). So, because of this reason, it is better refer to average formant of English than pronunciation in dictionary.

The second is Kazuya Saito (2007) in the linguistics journal that was edited by Paul Robertson and John Adamson. He analyzed the ability of The Influence of Explicit Phonetic Instruction on Pronunciation in EFL Settings: The Case of English Vowels and Japanese Learners of English. The vowel that was analyzed by Kazuya Saito are æ and a. this research involved six Japanese learners of English. He found that using praat software is very effective to analyze the ability of The Influence of Explicit Phonetic Instruction on Pronunciation in The Case of English Vowels and Japanese Learners of English.

This research also has similarity with the second previous study. Both of them are measure vowel quality using praat and refer to the average formant of native English and EFL setting. EFL (English as foreign language) means that

person who uses English after the first and second language. They usually do not use English in daily life of the society where they live (Rohmah, 2012). In other hand, it also has difference. The difference occurs because the previous study not only focuses on the vowel quality but also focus on the Influence of Explicit Phonetic Instruction on Pronunciation in EFL Settings.