

THESIS

AVOIDING MISPERCEPTION IN NAMING WAYPOINT: A LINGUISTIC PERSPECTIVE (MENGHINDARI KESALAHAN DALAM PENAMAAN WAYPOINT: PERSPEKTIF LINGUISTIK)



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2022**

THESIS

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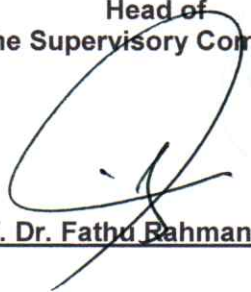
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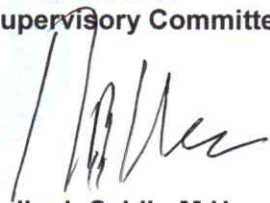
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ANDI MUHAMMAD ALVIAN

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ABSTRAK

ANDI MUHAMMAD ALVIAN. Pencegahan Kesalahan Dalam Penambahan Waypoint: Kajian Prespektif Linguistik (dibimbing oleh Fathu Rahman and Harlinah Sahib).

Penelitian ini bertujuan (1) menjelaskan kondisi komunikasi udara-darat antara pengendali lalu lintas udara dan pilot di Makassar Air Traffic Service Center yang dapat menimbulkan mispersepsi ucapan lantaran penamaan *waypoint*, dan 2) untuk memberikan solusi penamaan *waypoint* yang dapat menghindari potensi terjadinya kesalahan persepsi ucapan.

Metode penelitian yang digunakan adalah metode campuran antara kualitatif dan kuantitatif dengan teknik pengumpulan data yang digunakan adalah observasi, perekaman data, dan wawancara.

Hasil penelitian menunjukkan bahwa banyak masalah yang sering terjadi dalam salah komunikasi, yakni tanda panggilan serupa atau mirip dari *waypoint*. Penetapan *waypoint* penting dilakukan untuk memastikan keamanan penerbangan yang mungkin ditimbulkan karena terjadi miskonsep antara ATC dan pilot dalam sebuah penerbangan. Kesalahan komunikasi dapat menimbulkan kesalahan yang berakibat fatal dan itu harus diantisipasi.

Kata kunci: *waypoint*, komunikasi, mispersepsi, penerbangan, keamanan

ABSTRACT

ANDI MUHAMMAD ALVIAN. Avoiding Misperception in Naming Waypoint: A Linguistic Perspective (supervised by Fathu Rahman and Harlinah Sahib).

This study aims to (1) explain the condition of air-ground communication between air traffic controllers and pilots at the Makassar Air Traffic Service Center that can cause speech misperceptions due to waypoint naming, and 2) to provide waypoint naming solutions that can avoid potential speech misperceptions.

The research method used is a mixture of qualitative and quantitative methods with data collection techniques used are observation, data recording, data recording, and interviews.

The results of the study show that there are many problems that often occur in miscommunication, namely similar or similar call signs from waypoints. The determination of waypoints is important to ensure flight safety that may arise due to misunderstandings between ATC and the pilot on a flight. Errors in communication can lead to errors that can be fatal and must be anticipated.

Keywords: waypoint, communication, misperception, flight, safe

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CHAPTER I

INTRODUCTION

A. Background of The Research

Perception is one of the cognitive aspects that is very important every human being. This perception allows humans to know and understand the world around them. The term perception comes from the Latin "perceptio" which means to accept or to take. Meanwhile, according to Barroso (2013), perception is the brain's translation of information provided by all physical senses as well as everything that is in our minds, everything we want, desire, think, and need, past experiences, help determine perception. Based on this understanding, it can conclude that perception is a way of processing the knowledge that is already owned to obtain and interpret the stimulus received by the human sensory system.

One type of perceptions is speech perception. Speech perception is the process by which the sounds of language are heard, interpreted, and understood (Holt & Lotto, 2010). Speech perception tries to understand how humans hear and perceive sounds that contain words and use the information obtained to understand the meaning of what is spoken. The process of understanding this word or sentence starts from the sound level where the audio signal will be processed as in hearing. If the listener has difficulty in understanding the information from the speaker, the listener

will use visual information such as lip movements or gestures to get clues so as to avoid misunderstandings.

According to Poeppel in Brain Mapping (2015), Speech perception refers to the suite of (neural, computational, cognitive) operations that transform auditory input signals into representations that can make contact with internally stored information: the words are in a listener's mental lexicon. Speech perception is typically studied by using single speech sounds (e.g., vowels and syllables), spoken words, or connected speech. Based on neuroimaging, lesion, and electrophysiological data, dual stream neurocognitive models of speech perception have been proposed that identify ventral stream (mapping from sound to meaning) and dorsal stream functions (mapping from sound articulation). Major outstanding research questions include cerebral lateralization, the role of neuronal oscillations, and the contribution of top-down, abstract knowledge in perception.

Furthermore, Massaro (2015), suggested that speech perception has traditionally been viewed as a unimodal process, but in fact it appears to be a prototypical case of multimodal perception. This is best seen in face-to-face communication. Experiments have revealed conclusively that our perception and understanding are influenced by a speaker's face and accompanying gestures, as well as the actual sound of the speech (Massaro 1998). Consider a simple syllable identification task, synthetic visible speech and natural audible speech were used to generate the

consonant–vowel (CV) syllables /ba/, /va/, /a/, and /da/. Using an expanded factorial design, the four syllables were presented auditorily, visually, and bimodally. Each syllable was presented alone in each modality for $4 \times 2 = 8$ unimodal trials. For the bimodal presentation, each audible syllable was presented with each visible syllable for a total of 4×4 or 16 unique trials. Thus, there were 24 types of trials. Twelve of the bimodal syllables had inconsistent auditory and visual information. The 20 participants in the experiment were instructed to watch and listen to the talking head and to indicate the syllable that was spoken.

In aviation, misunderstandings of communication caused by speech perception often occur. This communication has difference with normal communication because the communication made by the Pilot and the Air Traffic Controller is only verbal communication. When the sound produced by radio communication, it is usually not very clear and sounds are vague, the listener cannot see the lips or gestures of the interlocutor to help to understand the meaning of the words or sentences spoken by the speaker. If we compare the communication between the pilot and the ATC with other communications, this type of air-ground communication has its own uniqueness and difficulties. ATC officers in an airspace provider air traffic services to all aircraft passing on a special radiofrequency. So in service, only one air traffic controller communicates with all pilots in the air space. This also makes it possible for variations in communication topics

to occur but it is still on the implementation of flight safety and security so that pilots and ATC are not allowed to communicate irrelevant things.

In this air-ground communication, there is its own uniqueness due to the communication tool used. When delivering a message, the speaker must press a button each time he wants to deliver the message and release it when finished otherwise the other speakers cannot deliver the message. This system is called Push To Talk (PTT). This condition gives us the idea that there is only one speaker at a certain time period. Each speaker must ensure the previous communication has been completed before commencing communication with the ATC. An overlapping conversation will lead to failure to understand the intent of the listener, which can lead to repeated communication or failure to understand.

At any given time, overcrowded water-ground communications can occur. As in bad weather, many pilots usually make multiple requests, such as requests for changes of direction, requests for changes in altitude, or even requests for flight information. On the other hand, ATC provides instructions, permits, or information needed to maintain smooth and safe air traffic flow. All messages given by ATC must be read-back and hear-back to confirm whether the message conveyed is correct or not.

International Civil Aviation Organization (ICAO) is an organization that regulates all aviation regulations, including one in the context of air-ground communication regulations. ICAO provides standard guidelines governing communication conducted by pilots and ATC in a limited form of

phrase, known as phraseology. This phraseology is used by pilots and ATC to exchange information, ask permission, and give permission or instructions. If something abnormal happens, or when the phraseology does not accommodate pilot and ATC communications, then the use of plain English language can be allowed.

In air-ground communication that occurs between pilots and ATC, there are many waypoints pronounced. Waypoint is a specified geographical location that is used to define an area navigation route or the flight path of an aircraft employing area navigation (Annex 11, 2018). In the ICAO document, Annex 11 (2018), the procedure for naming waypoints has been regulated. Each waypoint must consist of a unique five-letter name code, must be legible, and must not have the same name as any other waypoint within a radius of 1000km or 600nm. The naming of the waypoints is determined by the party who has been appointed, in this case, the flight designer procedure, so that the pilot and ATC have no difficulty or misunderstanding in mentioning it. Some examples of waypoint names on route of flight or airways in Indonesian airspace can be seen in Table 1.

Table 1. Airways and Waypoint Names

Airways	Waypoint Names
T1	PROGO, SEMPUR, KIDUL
T2	LASEM, LUNAS, JAMAK
T4	OKANG, WAWAN, FARIZ
T5	TELET, LUNAS, WAWAN, HEREN, OVINA
T6	TABIS, QOBAL, FARIZ, JAMAK, KURUS, GAPRI
M635	MASRI, RAVIS, TAVIP, SUMDI, RAMPI, UDONO, ATMAP
M774	KIKEM, POVOT, KEONG, KEVOK, TANUR, LAWIB, KADAR

From table above, we can see that from one route there are many waypoints that connect to another route. If pilots and/or ATC have difficulty in understanding each other when pronouncing the waypoint names, ICAO (International Civil Aviation Organization) requires both of them to spell the waypoint names using the flight alphabet. The flight alphabet list can be seen in Table 2.

Table 2. Aviation Phonetic Alphabets

CHARACTER	SPELLING	CHARACTER	SPELLING
A	ALPHA	K	KILO
B	BRAVO	L	LIMA
C	CHARLIE	M	MIKE
D	DELTA	N	NOVEMBER
E	ECHO	O	OSCAR
F	FOXTROT	P	PAPA
G	GOLF	Q	QUEBEC
H	HOTEL	R	ROMEO
I	INDIA	S	SIERA
J	JULIET	T	TANGGO
U	UNIFORM	2	TWO
V	VICTOR	3	THREE
W	WHISKEY	4	POWER
X	X-RAY	5	FIVE

Y	YANKIE	6	SIX
Z	ZOOLoo	7	SEVEN
0	ZERO	8	EIGHT
1	ONE	9	NINER

From table above, the flight alphabet is a guide to spelling in-flight communications to prevent misunderstandings that can occur. In fact, even though it has been regulated in such a way by ICAO regarding the naming of waypoints, there are still several potential hazards that can occur (Jones, 2003; Skaltsas, Rakas & Karlaftis, 2013). The name of the waypoint has been set not to have the same 5 letters but it is not regulated if it has almost the same sounding pronunciation in an air space. With the existence of several potential hazards that can occur, of course, it will increase the concentration of an ATC either when giving clearance/instruction or when doing hear-back of the instruction he gives.

The following is a transcript of the conversation between the pilot and the ATC on duty at the Makassar Air Traffic Center. The conversation took place between the ATC and the pilot who was departing from Yogyakarta to Balikpapan. From the following conversation, it can be seen how pronouncing a waypoint due to almost the same sounding name can increase the communication and workload of an ATC.

Tabel 3. The Communication and Workload of an ATC.

		Description
LNI 670	:	Ujung, Lion Inter 670, climbing to flight level 350.
Ujung ACC	:	Lion Inter 670, Ujung identified, for spacing traffic direct to LASEM, and continued climb to flight level 350.
LNI 670	:	Climb to flight level 350, and direct to LASER, Lion Inter 670.
Ujung ACC:	:	Negative, direct to LASEM
LNI 670:	:	Confirm, LASEM or LASER?
Ujung ACC	:	Direct to LASEM, lima alpha sierra echo mike.
Ujung ACC	:	Direct to LASEM, lima alpha sierra echo mike.
LNI 670	:	Roger direct to LASEM, LNI 670
Ujung	:	Ujung Control

(Source: Recording sector USBY, 1 April 2019, 05.23 UTC).

In that situation, the pronunciation of the waypoint names LASER and LASEM almost sounds the same at the frequency of logging because the names of the waypoints have almost the same character structure and only have a difference in the last letter. Some examples of other waypoint

names, which have the same letter structure, are causing almost the same reading style. The case can be seen in the following Table 4.

Tabel 4. Waypoint Names

No.	Waypoint Names	LOCATION
1	LASEM – LASER	ROUTE YOGYAKARTA TO BALIKPAPAN
2	KURUS - TIRUS – TIKUS	AROUND SURABAYA AND BALI
3	TAVIP – RAVIS	ROUTE M635
4	KADAR – KADAP	ROUTE SINGAPURE TO PAPUA NUGINI
5	HANKA – PANKA	IN SURABAYA

Seeing several incidents in the air space in Indonesia, especially in Makassar Air traffic services center (MATSC) due to listeners' misunderstanding in interpreting the waypoints meant by the speaker, MATSC has made several efforts to minimize these incidents, one of which is to conduct training in English so that they can facilitate and clarify how to read a waypoint. Another way, to propose a reading convention for each waypoint to ICAO so that it has a uniform reading method for all

pilots or ATCs, but this takes a long time and takes a long bureaucratic process considering that this is a world level proposal and there are number of waypoints available. Currently. Based on this incident, the authors see the need for a better and faster proposal to overcome this problem so that the potential for problems can be minimized.

Asking how to read from a waypoint is indeed a very good idea. However, this still has the potential for human error. Seeing events such as those that have been exemplified in how to read the words LASER and also LASEM is very clear, but we cannot minimize the potential for misunderstanding of the meaning of the listener. This is because the sound of the initial syllabi of the two words sounds the same plus the communication carried out via VHF Radio media which has the potential for communication can be interrupted or the message can sound imperfect.

Based on the description above, there is a high demand on better policy which may avoid human error. The present study, therefore, propose *linguistics theory (Sound Perception Theory)* in the waypoint naming to avoid misunderstanding in perceiving sounds. The main objective is to avoid possible similar waypoint sounds through syllables. This recommendation is expected to be considered by the Flight Designer Procedure in naming a new waypoint.

The schema of Sound Perception Theory (SPT) can be seen in the following figure.

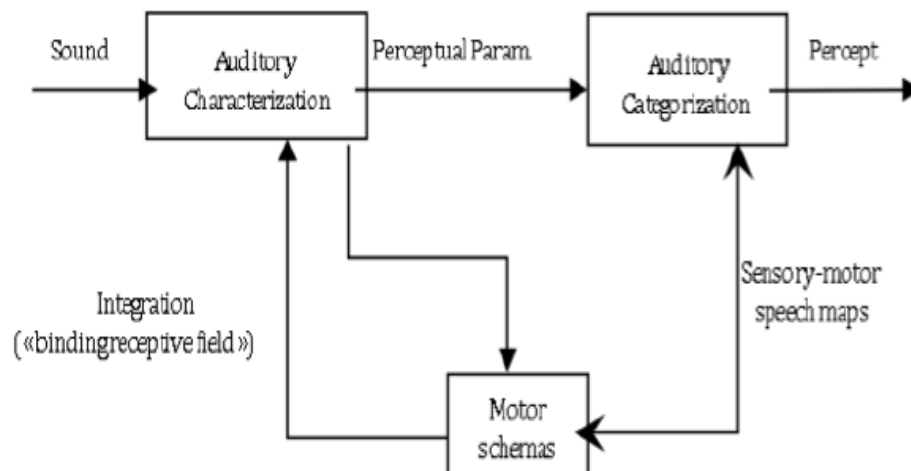


Figure 1. Sound Perception Theory

Perception for Action Control Theory (PACT): motor schemas are involved both in extracting relevant auditory information through binding, and in improving categorization through sensory-motor maps.

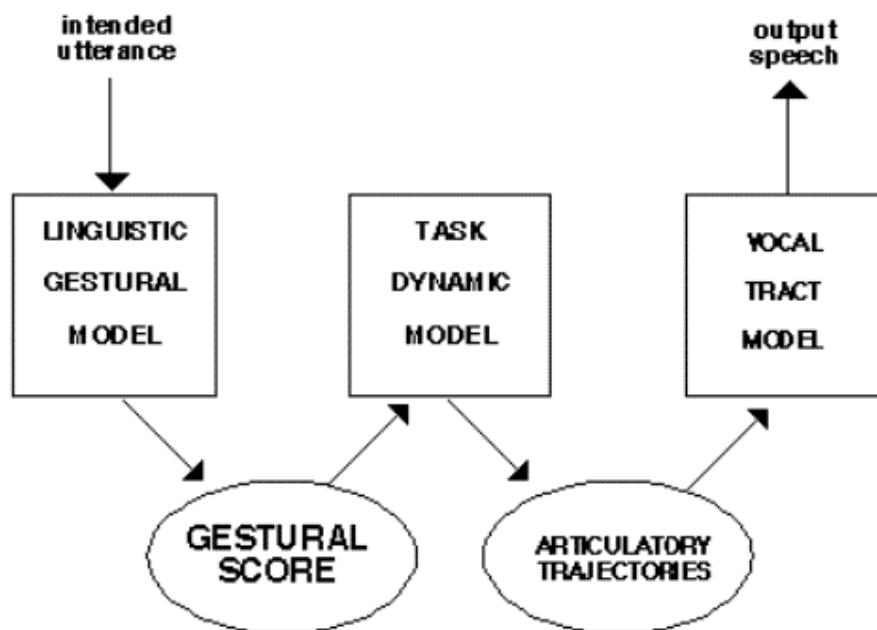


Figure 2. Gestural Computational Model

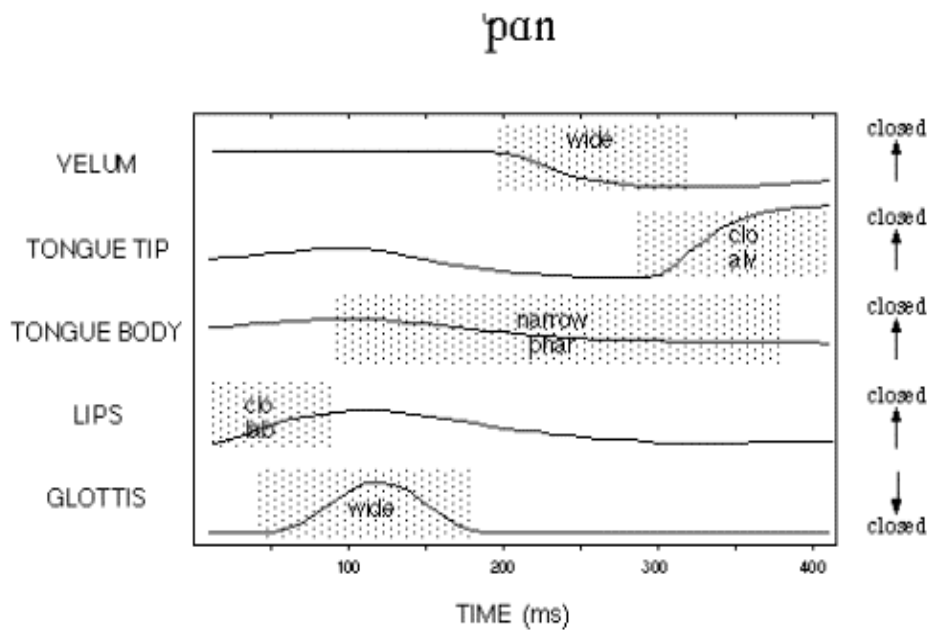


Figure 3. Gestural Score for The Utterance 'Pan'.

This figure tells us about two things. They are; a) Gestural computational model. b) Gestural score for the utterance 'pan'.

In line with the idea that the frames of speech communication are motor events, the Motor Theory of Speech Perception (Liberman and Mattingly, 1985) proposes that perceiving speech amounts to perceiving gestures. A main argument is coarticulation-driven signal variability, which makes the auditory content of a given phoneme dependent on the phonetic context (e.g. /d/ does not produce the same sound in /da/ vs. /du/), whereas the intended gesture is invariant.

B. Research Focus

This research focuses on sound perception on naming waypoint in Indonesian airspace when pilot and ATC communicate on frequency system. There are many interesting things about the topic of research

related to naming waypoints, but on this occasion, the researcher focuses only on this research with the title Avoiding Misperception in Naming Waypoints. The perspective of this research is Linguistics.

C. Research Question

Based on the phenomena which have been illustrated above including the focus of the research, this study aims to answer the questions as follows:

1. What does the conditions of communication between air traffic controller and pilots in Makassar Air Traffic Service Center speech misperception occur in waypoint name of Indonesian airspace?
2. How does flight designer procedure avoid possible speech misperception of waypoint name in Indonesian airspace?

D. Objective of the Research

Based on the previous description, this research, as already designed, it is expected that this research will be able to:

1. Elucidate the conditions of air-ground communication between air traffic controller and pilots in Makassar Air Traffic Service Center that might occur the speech misperception in waypoint naming.
2. Provide a solution to naming waypoint that can avoid potentiality to speech misperception happen.

The strategy to achieve the objectives above is, objective 1, to gather all the similar waypoint and presenting in the tables, while the

objective 2 is to elaborate the possible problem that may happen linguistically of misperception.

E. Significance of The Research

Both practical and theoretical the research is very significant to:

1. Flight Procedures Designer, as they may naming waypoints, consider the similarity with other waypoint names. This research will This research will give them more understanding about increasing attention when mentioning waypoint names so as not to cause misperceptions. This research will give them more understanding about increasing attention when mentioning waypoint names so as not to cause misperceptions.
2. Air Traffic Controller and Pilot, as they may encounter abundant of waypoints in everyday life. This research will give them more understanding about increasing attention when mentioning waypoint names so as not to cause misperceptions.
3. Theoretically, other researchers, as this research may be of their reference to do urther research on aviation or linguistic, especially to the study program of English Language Studies, Hasanuddin University, Indonesia, and
4. Another theoretical benefit will be for aviation training institutions, as this research may be of their reference to construct the syllabus.

CHAPTER II

REVIEW OF LITERATURE

A. Previous Studies

Research related to speech sound of waypoint name in aviation has revealed several important points.

A Study conducted by Prinzo et al (2010) in research with title Word Meaning and Pronunciation is to investigate the difficulties experienced by pilots in international operations. When it is related to how native English speaker of pilot in recognizing speech by traffic controller from non-English speaking country, words are somehow unknown when produced by nonnative speaker. It is found that there is a high frequency of incorrect pronunciation of waypoint name.

Another report of Prinzo et al. (2010) with title Language experiences in non-native English-speaking airspace/airports focuses on investigating how language international language experiences by pilots from non-English speaking countries. The study suggests that, it is somehow helpful for the growth of proficiency from country to country and individual to individual. However, “problems occur everywhere and Hearing multiple languages on the radio restricts situational awareness and diminishes pilots expectations as information derived from the party line decreases”.

Lange et al. (2003) entitled “*3D Visualization and 3D and Voice Interaction in Air Traffic Management*”. This study investigates the use of using a program developed by using the Microsoft Speech Application

Programming interface (SAPI) which provides facilities for the development of applications using discrete voice pattern recognition system and directly insert the flight plan to the airplane. However, factor like ATC pronunciation and similar waypoint name makes it hard for the software to recognize the speech sound.

Furthermore, Research by Hopkin (1995) entitled “*Human Factors in Air Traffic Control*”. The study investigates the causes of recognition failure of voice interaction between pilot and ATC. The study found that the misperception of speech can be overcome through the use of feedback, more abstract, and layers of interaction.

McRoberts (2008) claims that speech perception refers to the ability to perceive linguistic structure in the acoustic speech signal. During the course of acquiring a native language infants must discover several levels of language structure in the speech signal, including phonemes (speech sounds) which are the smallest units of speech. Although phonemes have no meaning in themselves, they are the building blocks of higher-level, meaningful linguistic units or structures, including morphemes, words, phrases, and sentences.

Furthermore, each of the higher-level units are composed of units at the next lower level using rules that are specific to each language (i.e., morphology, grammar, or syntax). Thus, sentences are made up of phrases, phrases are composed of words, and words are made up of morphemes. Again, McRoberts (2008) stated that each of the meaningful units is composed of one or more phonemes. In a very real sense, the

ability to perceive differences between and categorize phonemes provides the underlying capacity for the discovery of the higher levels of language structure in the speech signal. In this way, infants' speech perception abilities play a fundamental role in language acquisition. Although infant speech perception has traditionally focused on discrimination and categorization at the phoneme level, research over the past two decades has shown that infants are also beginning to become sensitive to a variety of higher-level linguistic structures in speech. This article outlines the current state of knowledge about how infants begin to perceive linguistic structure in speech during the first year of life, and the methods used to study infant speech perception.

For Mitterer and Cutler (2006), they remind that the goal of speech perception is understanding a speaker's message. To achieve this, listeners must recognize the words that comprise a spoken utterance. This in turn implies distinguishing these words from other minimally different words (e.g., word from bird, etc.), and this involves making phonemic distinctions. The article summarizes research on the perception of phonemic distinctions, on how listeners cope with the continuity and variability of speech signals, and on how phonemic information is mapped onto the representations of words. Particular attention is paid to theories of speech perception and word recognition.

The previous study has revealed factors that influence human error in speech recognition. Another study has also provided a solution to speech recognition through software program but found less efficient due

to talker factors. This study is very different from previous research. This research focuses on how to combine the waypoint naming policy with linguistic theory that explains speech perception. By explaining the theory of speech perception, this research will provide an understanding in avoiding speech misperception in naming waypoints.

B. Linguistic Theory

1. Speech Perception

Speech Perception refers to the process of how word/language heard, interpreted and understood (Liberman & Mattingly, 1985; Eimas et al, 1971; Massaro & Palmer, 1998). In linguistics, this study is linked to phonology and phonetics.

In speech perception, the listener familiarity to the talker is one key element to recognize the speech whether listening to common or novel words. Nygaard & Pisoni (1998) suggest that familiar talker results to better speech identification than unfamiliar talker, while the identification of novel words is better when uttered by familiar talker which involves talker contingent process (Nygaard, Sommers & Pisoni, 1994).

About the theory of speech perception, the relation between perceptual processing, perceptual decision, and perceived language events can be seen in the following figure.

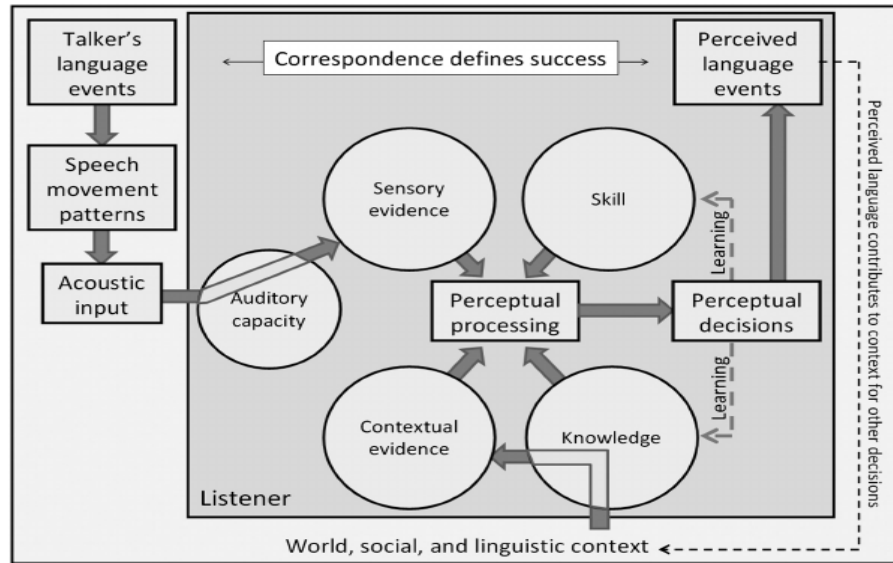


Figure 4. Theory of speech perception

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. Research in speech perception seeks to understand how human listeners recognize speech sounds and use this information to understand spoken language. Speech perception research has applications in building computer systems that can recognize speech, in improving speech recognition for hearing- and language-impaired listeners, and in foreign-language condition.

There are several elements that predispose human perception to speech sound. This includes acoustic cues, categorical perception, and Perceptual constancy.

a) Acoustic Cues

This refers to sensory signals contained in the speech sound signal which is used in speech perception to distinguish speech sounds related to different phonetic categories (Best, Morrongoiello & Robson, 1981; Francis, Baldwin & Nusbaum, 2000). For instance, Voice Onset Time (VOT) is cue signaling that distinguish between voiceless and voiced sounds, for example 'b' of voiced sound and 'p' of voiceless sound. *"At first glance, the solution to the problem of how we perceive speech seems deceptively simple. If one could identify stretches of the acoustic waveform that correspond to units of perception, then the path from sound to meaning would be clear. "However, this correspondence or mapping has proven extremely difficult to find, even after some forty-five years of research on the problem"* (Nygaard & Pisoni, 1995).

b) Categorical Perception

This refers to the process of perceptual differentiation. It is how human receives sound by different categories (phonemes) that within categories. The perceptual space between categories is warped, the center of categories working like sieve for incoming speech sounds (Trubetzkoy, 1969).

c) Perceptual constancy

It is believed that listeners perceive vowels and consonants as consonants category (Kuhl, 1979; Shankweiler et al, 1977;

Summer field, 1981; Tallal et al, 1980). for example, the word 'conditional'. Listener will receive the sounds focusing on the consonant of the sound which leads to listener perception. Broadbent, Ladefoged & Lawrence (1956) suggest that the identification of a particular sound depends on the acoustic structure of the neighbouring sounds.

2. Unit of Speech Perception and its Constrain

This study employs A Model of Speech Perception by Cole & Jakimik (1980). To be precise, the theory concerns phoneme and syllable effect in speech perception.

a) Phoneme

Phoneme is a unit of sound that distinguishes one word from another in a particular language (Jones, 1957). The sound Pattern 'pin' (pin) and 'piŋ' (ping) are two different words that are distinguished by one phoneme; 'n' and 'ŋ'. These are pairs of words or phrases that differ only in one phonological element, such as phoneme, toneme or chroneme and have distinct meaning. This language phenomenon is called minimal pair.

Cole & Jakimik (1980) suggest that a word will be predictable after the first two or three phoneme is heard. Furthermore, when a phoneme missing in the middle of a word, there is a possibility that the sound to be recognized if the word is familiar to the listener. It is also suggested that the prosodic

(rhythm, stress, intonation) structure of a word may determine the recognition of phoneme.

Phoneme is abstract. Phoneme is rather a psychological unit than perceptual or articulatory entities. Previously, Savin & Bever, (1970). adult tends to discriminate speech sounds according to the phonemic categories of their native language (Werker & Tees, 1984). Healy & Cutting (1976) suggest that the identification of both syllable and phoneme cannot be easily claimed as one is faster than the other. It is discovered that phoneme is likely to be detected quicker than syllable when the phonemes are typically easy to identify. Syllable is easier to identify when phonemes are relatively difficult to detect. Study conducted by Studdert-Kennedy & Shankweiler (1970) suggest that final consonant tends to be more right-ear advantaged while the vowel tends to be misheard.

b) Syllable

Syllable is organizational unit for a sequence of speech sounds. It consists of vowel with optional initial and final margins 'consonants'. Speech can be divided into a whole number of syllables. For instance, the word '*reason*' composed of two syllables; *rea* and *son*. A word that consists of a single syllable, such as *make*, is named a monosyllable. Disyllable (and *disyllabic*; also *bisyllable* and *bisyllabic*) is for a word of two syllables. trisyllable (and *trisyllabic*) for is a word of three

syllables. Polysyllable (and *polysyllabic*), which may refer either to a word of more than three syllables or to any word of more than one syllable (Fowler, Treiman & Gross, 1993).

Cole & Jakimik (1980) in their book of model of speech perception explain that words are accessed from the information of the first syllable and the second syllable is more predictable after the recognition of the first syllable. Their experiment suggest that if mispronounce occurs in the first syllable, then it is hard to predict the second syllable. When the first syllable are pronounced correctly then the first and second syllable will be as equally predictable. The number of the same sound syllable in a word also determines the recognition of the words.

c) Cross-language and second-language

A large amount of research has studied how users of a language perceive foreign speech (referred to as cross-language speech perception) or second-language speech (second-language speech perception). The latter falls within the domain of second language acquisition.

Languages differ in their phonemic inventories. Naturally, this creates difficulties when a foreign language is encountered. For example, if two foreign-language sounds are assimilated to a single mother-tongue category the difference between them will be very difficult to discern. A classic example of this situation is the observation that Japanese learners of English will have

problems with identifying or distinguishing English liquid consonants /l/ and /r/ (see Perception of English /r/ and /l/ by Japanese speakers).

Best (1995) proposed a Perceptual Assimilation Model which describes possible cross-language category assimilation patterns and predicts their consequences.[32] Flege (1995) formulated a Speech Learning Model which combines several hypotheses about second-language (L2) speech acquisition and which predicts, in simple words, that an L2 sound that is not too similar to a native-language (L1) sound will be easier to acquire than an L2 sound that is relatively similar to an L1 sound (because it will be perceived as more obviously "different" by the learner)

C. Waypoint

A waypoint is a set of coordinates that identifies a point on a map. Waypoints are used for terrestrial navigation purposes. These coordinates usually include longitude, latitude, and sometimes altitude for air navigation purposes.

Another definition of a Waypoint is a coordinate that relates to a place of interest and can be used as a place of public interest or a location related to something that has special meaning to you. In pre-GPS days you may rely on coordinates expressed as street addresses. Waypoint coordinates are formatted in a way that means something to your GPS (Global Positioning System) navigation device.

GPS stands for Global Positioning System. The main element of GPS is a set of satellites that transmit radio signals, with each signal reporting the time it was sent from the satellite. By comparing the signal times your device receives from each of the four (or more) satellites, your device calculates how far you are from each satellite. There is only one place on earth where distance people will all meet, so your device can report exactly where it is located. If you are in a place that is important to you, you can have your device store the coordinates of your current location as a waypoint (GPS coordinates).

A waypoint is a reference point/set of coordinates used for navigational purposes to identify a point on a map. Especially for navigation on land, which does not use humans as direction makers but robots, waypoints are used even though there is a clear path.

Waypoints are divided into two types, namely fly-by waypoints and fly-over waypoints. The fly-by waypoint does not pass through the location above the waypoint but still goes towards the destination, while the fly-over waypoint passes through the location above the waypoint. After one waypoint is passed, the pilot must determine the next waypoint which is called the active waypoint.

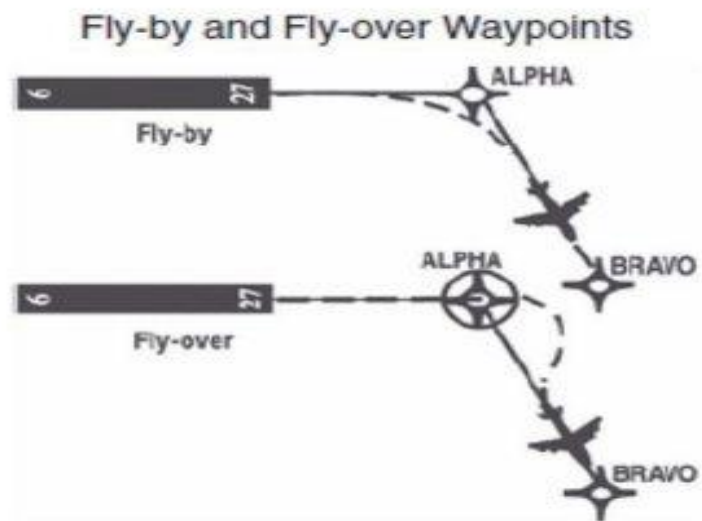


Figure 5. Fly-by and Fly-over Waypoint

Based on the figure above, it shows that the name of Waypoint ALPHA and BRAVO (comprises 5 letters, unique, and pronounceable)

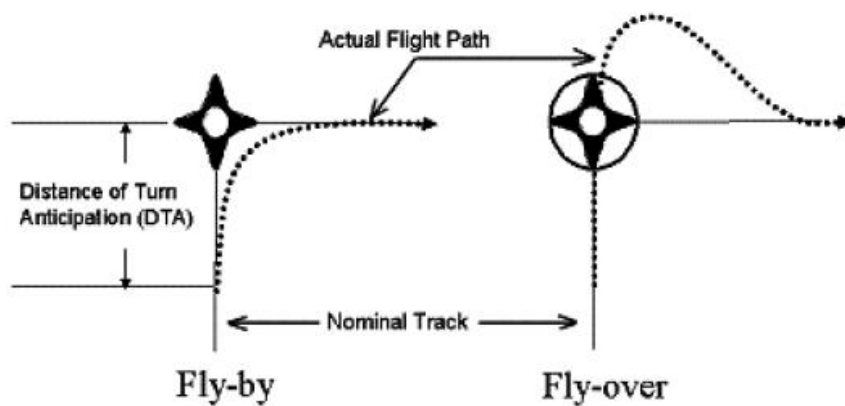


Figure 6. Actual Flight Path

D. Air Traffic Services

This section explains the requirements for creating a new waypoint that will be applied to flight procedures. These requirements are explained in several flight documents, including ANNEX 11 and Document 8168 (see appendix 7 and 8).

1. ANNEX 11

In Annex 11, appendix 2, explain rules when establishment a new waypoint. As for some of these rules are as follows:

- a. Waypoint should, whenever possible, be established with reference to ground-based or space-based radio navigation aids, preferably VHF or higher frequency aids
- b. Where a significant point is required at a position not marked by the site of a radio navigation aid, and is used for ATC purposes, it shall be designated by a unique five-letter pronounceable "name-code". This name-code designator then serves as the name as well as the coded designator of the significant point.
- c. Whenever practicable, waypoint shall be named with reference to an identifiable and preferably prominent geographical location
- d. The name should, if possible, form two syllables and preferably not more than three.
- e. Coded designators shall not be duplicated within 1 100 km (600 NM) of the location of the radio navigation aid concerned
- f. The name-code designator shall be selected so as to avoid any difficulties in pronunciation by pilots or ATS
- g. Personnel when speaking in the language used in ATS communications.
- h. States' requirements for unique five-letter pronounceable name-code designators shall be notified to the Regional Offices of ICAO for coordination.

2. Document 8168

In Document 8186, Chapter 1, Section 6, is talking about waypoint naming. In this section talk about waypoint used in support of procedures shall be designed by:

- a. Unique, it is mean name shall be having deference with another waypoint.
- b. Five letters (see the example in Table 8.
- c. Pronounceable, mean can be pronounced by ATC and Pilot.

E. Conceptual Framework

Based on the theories above, researcher has created a model of conceptual framework in naming waypoint. It is meant to show the steps where the researcher starts and to reach the destination of this research. So the discussion goes clear and is on the track. This conceptual framework is used to understand the step when naming waypoint using not only regulation from ICAO but also considering concept form linguistic theory.

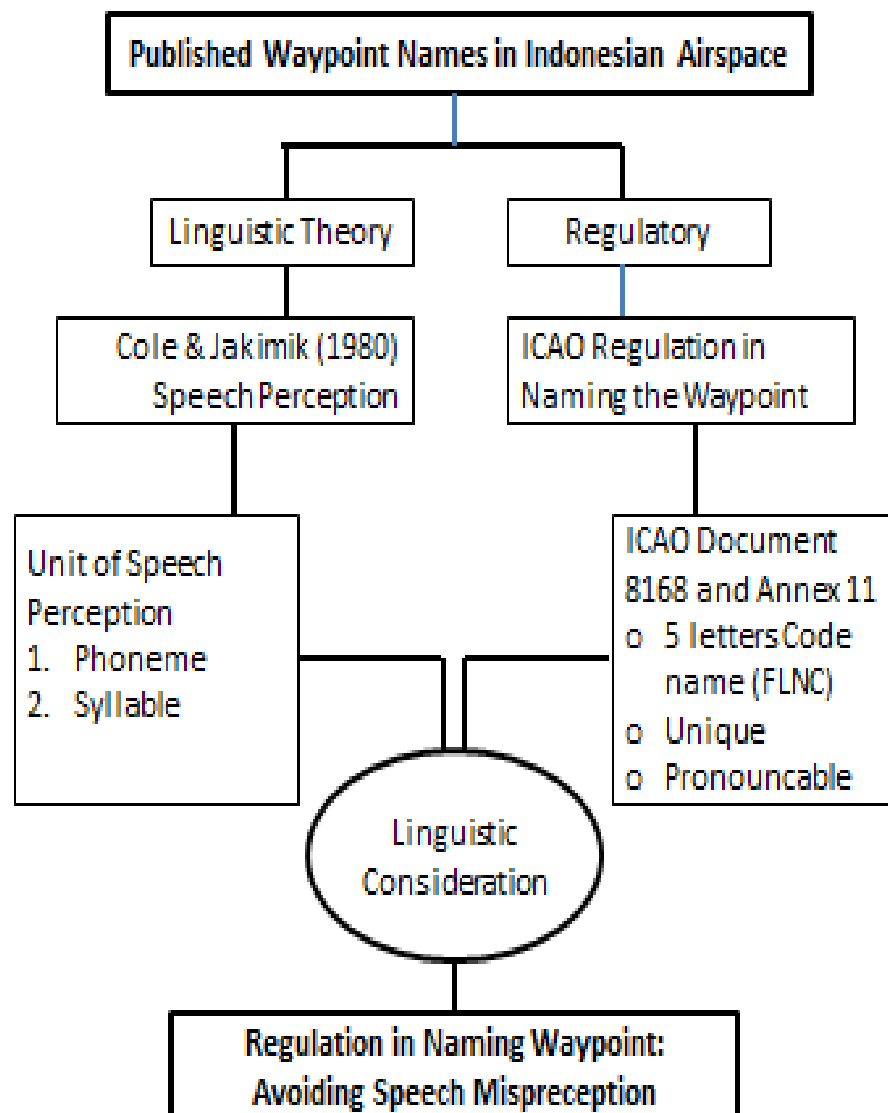


Figure 7. Conceptual Framework