The Use of Malaysian Phonology in Developing a Malaysian Mouth-chart for the Animation Industry

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Referring to previous studies, it has been found that mouth-charts refer to the mother tongue and the spoken language of a place and environment. In animation, a country's mouth-charts are different because of the language, the way it is spoken and the way it expresses symbols and objects in the form of speaking. According to pilot studies and observations on animation studios, this paper found that references to mouth-charts are widely used from western and other Asian countries by doing a little bit of improvising on these animated characters. This paper, concerns of this phenomenon and proposes a study of the mouth-chart for Malaysian animation as a reference. Phonology theory and viseme are integrated to recapitulate how the correct pronunciation refers to the native language and the mother tongue in the Malaysian context. This paper accumulates a set of mouth-charts that were obtained through visual analysis by experts and translated through animated characters. Arising out of this the mouth-charts suggest the first research phase before being used as a design and reference for the animated character's mouth.

Key words: *Animation mouth-chart, phonology, viseme, lyp-sync.*

Introduction

Movement of the mouth when speaking gives a visual direction to what is being said. This visual movement also informs the personality of the current speaking character. Each nation has different language sounds depending on the context, place, and culture of the nation. The difference in language tail can be considered as a phoneme. In animation design, lip-sync or character speaking is one of the most important elements of a character's life and it can have a real impact on each character designs (Yuyu et al., 2013). Lip-sync is usually animated by the character artist based on the character itself and the origin on which the animated play is

presented. However, realising that each nation's language sounds are different should its characters and mouth-charts be different from those of other nations. This is where the role of the local mouth-chart is created to serve as a guideline for animators to produce animated characters based on more precise and realistic language sounds.

Research Problem

Animation Survival Kits and the Illusion of Life have certainly been used as a reference book by practitioners in the animation industry. It is customisable with the created character. Animators will usually refer to the mouth-chart in the reference book and re-design the mouth-chart to match the created character. There are more than eight kinds of mouths for a character guideline in making addition or reduction and it specifically depends on the character and privileged features created. The development of the mouth-chart for the Malaysian Animation Industry is important as a special reference to the Malaysian Animation. Its meaning is characterised locally in terms of character, language, and social life. The main problem might be due to some words from Malay language are not synchronised to the mouth opening and pronunciation of the words. It is difficult to empathise specifically to its storyline, character, principle and special effects needed. Synchronisation is important to make animation more lively. The development of the mouth-chart for Malaysian Animation Industry is one of the efforts for our animation industry and for educational purposes itself.

Objective

- To investigate the mouth-chart design based on the localisation context for the Malaysian animation industry.
- To develop a set mouth-chart as a guideline and reference for the Malaysian animation industry.

Aim

- Provides guidelines of mouth-chart for the Malaysian animation industry based on local contents that suit the letters and sounds.
- To produce the visualisation of a 2D animated face which can be applied to the mouth shapes of the Malaysia letters and sound model. The construction of Malaysia viseme model is the first to provide the element of localisation to design the mouth-chart.

Literature Review

Introduction

Digital technology development has made huge advancements in the technologies area for expressing characters in domestic animation. It is important to produce 3-dimensional modelling data and automatically realising the animation movement (Felicia et al, 2017). Efforts in resolving the awkwardness of foreign film dubbing and its technology to match lip-sync of Korean speaking character perfectly with lip-sync technology is still at a despicable level (Cho.J., 2013). Meanwhile, in Hollywood Animation, they have developed new software that is needed in productions. It has been used as an independent plugin whenever they are releasing new animations. This has certainly shown their amazing technology. Poor production environment of domestic animations are due to difficulty in social reality and financial limitation. R&D for the development of high-rank technology is inevitable for very minimal effort. Our domestic animation is still considered as a small scale industry compared to other countries. Investment support system and research support for vitalisation of production are at insufficient effort too.

Bozkurt et al. (2007) mentioned in their research that there are many technologies allowing artists to create high-quality character animation, but facial and speech animation is still difficult to sculpt because the correlation and interaction of the muscles on the face are very complicated. Some physically-based simulation methods are provided to approximate the muscles on the face, but the computational cost is very high. It is important to have a natural-looking lip animation. Synchronisation is a very challenging part of animation while making a realistic character. By using speech articulated by a real person, lip synchronisation can be generated. Animation will be visually more natural. A phonetic sequence can be estimated directly from the input speech signal using speech recognition techniques throughout such systems.

Animation

The main task for animating computer-generated characters are the synchronisation of lip movements and speech signals. Synchronisation needs high technical effort, which involves a face tracking system or data gloves. Synchronisation is needed to drive expressions of the character. Animation usually helps in establishing a plan for the pre-production work stage and also towards all prior planning. Voice actors are recorded according to the animation script. Main production which produces whole character animation through production of the first animation lip-sync is made. Lip-sync for the preparatory stage in the animation production pipeline is too rapid. It is diminutive for lip synchronisation. Technical terms that match the voice on the movement of the lip of actor or singer on TV or movie lip-sync are

used as an essential part to express character in animation (character sketch). This technique can be the base to be detailed in the visualisation of character in animation. It could perfectly re-create dynamic performance and expression in the facial part.

The lip-sync technique of animation is generally the work that perfectly matches the character`s lip movement with the actor`s voice in 2D or 3D animation produced with computer graphics. Lip movements must be perfectly synchronised with the audio. Lip movement is determined by the motion of the mouth and tongue during speech. It is a particular technology that visualises lip`s shape and change according to the vocalisation of language to produce the scene that character is speaking. 3D animation is used as a realistic animation production technique through the use of emotional performance by managing the facial coordinates of the character with model data production and transformation. Realistic animation is a crucial part. Humans will typically focus on faces and are incredibly good at noticing the smallest fault in the animation. Human face is probably more important for animation than the other part. Realistic animation includes facial expressions and emotions. Previous research has also shown that an arts-based approach to facial animation research can be adopted to generate detailed predictions regarding the clarity and authenticity of dynamic expressions (Sloan et al., 2009).

Lip synchronisation in speech animation for a character model is more challenging in creating facial animation. It requires much more labour and accuracy in timing for millisecond-precise key-framing (D.F. McAllister et al., 1997). The realistic modelling of speech movements are through automatic facial animation and maintaining audio-visual coherence is still a challenge in both the computer graphics and film industries (Turkmani, 2007). The artist has to first match the position of the lips at their supposed spoken script. The transitions from word to word or phoneme to phoneme are even more important and need to be adjusted carefully. Simple articulated animation which can be key-framed with linear techniques, the transitions between lip shapes are non-linear and it is difficult to model. Meanwhile, the animation pipeline is important to get the overall details before creating the animation. The main steps of the animation pipeline are the steps like concept, design, storyboard, layouts, music, poses and outline (AFTC, 2019).

Principles of Lip-Sync Animation

Lango (2011) executed in his research the four Principles of lip-sync animation. Principle 1 says that letters aren't sounds. Sounds aren't letters. There are not any letters in lip-sync animation. They serve similar roles but in wildly divergent forms. Letters area unit representative symbols on a page (with a corresponding, every which way assigned sound). Once set up along to create words and communicate an idea. However, letters are not created for speech. They are for writing. We are not stimulating writing, but speech. Sounds area unit

utterances (with a corresponding every which way assigned letter price wont to transcribe the sound). Once taken as understood, words can then communicate an idea. Sounds area unit for speech. However, it serves nothing in writing. There are not any letters in speech, solely sounds, and also the form our faces over everything we want to create on those sounds. The excellence is incredibly real. Once you learn to approach lip-sync animation from the angle of vitalising sound shapes instead of letters it will make your world away brighter place.

Principle 2 is about mouth shapes for sounds. It must be animated in context. The prior sound shape affects the upcoming sound shape. Meanwhile, the following sound shape is expected in the current sound shape. The shapes shown must be all in context with the shape or the sound. If anyone get stuck on the idea of making all the "t" sounds in a soundtrack over the same shape, regardless of the prior or following sound or shape context in the dialogue. They will need to do the setting by themselves for a very poppy mouth as it starts animate. Speech is not animating letters. It's animating the flow of shapes which are needed to make the present sounds by means with everything that is being communicated with.

In Principle 3, it is concerning an interpretation of the lip-sync animation. In our animation, we can get the major impressions across the little stuff that we wish for. Just like the impressionist would hint at a cluster of leaves with a single daub of its brush, we should let words and sound shapes slur into the next word or sound shape. In showing the flow, we need to mix the targeted facial weights. Thereafter, we need to get away from showing leaves and then start showing contrast and form. The talking process is more of a flowing thought than an alliterative function of letters. Meanwhile, in Principle 4 is describing how to get the opens and closes done right and build on those. Even if all you have to do is properly hit the opens and closes and wide shapes of the mouth at the right time, you are already more than 75% of the way to great lip-sync. You can get the most out of very little lip-sync animation. If you doubt it, animated properties with projected texture map mouths like "Veggietales" has proven that this is indeed true.

Viseme

In communication using text input, a phoneme must be mapped to a viseme (visual phoneme). Phoneme is the smallest element of a language that can differentiate meaning. Viseme is derived from a group of phonemes having similar visual appearances, the equivalent unit in the visual domain that models a speech recognition system audio-visually. Viseme is a visual phoneme. The importance of a viseme is a process of visualising the phoneme for animation. Phoneme-to-viseme mapping is essential to the visual recognition of speech and the synthesis of talking heads. In this paper, we propose a phoneme-to-viseme mapping for the Malaysia language using a linguistic approach. Many authors have

demonstrated that the incorporation of visual information into speech recognition systems can improve robustness (Potamianos et al., 2003).

Phonemes and visemes have high correlation, and visemes can be derived using the mapping of phonemes to viseme. The mapping has to be a many-to-one map because many phonemes can not be distinguished using only visual cues. Visemes are represented by mouth shapes. Viseme is equal to unit in a visual domain which models a speech recognition system audio-visually.

Viseme is derived from a group of phonemes having similar visual appearances. Using the letter, visemes and phonemes are correlated through phoneme-to-viseme mapping. It has to be a many-to-one mapping because many phonemes can not be distinguished using visual signals. A.T. Erdem (2005) says that after the generation of the 3D head model, a graphic artist defines the mouth shapes for the 16 visemes using a graphical user interface. Sample visemes corresponding to various phoneme classes are shown in Figure 1. Speech has both an auditory and a visual component and the definitions of visemes must be done accurately. These mouth shapes (visemes) are properly interpolated (smoothed) during the actual animation.

Figure 1. Example visemes for phoneme classes

Phonetic

History of Malay Language

According to Norzalina et al (2019), the origin of the Malay language remains vague until now. No concrete evidence was found to prove the existence of the Malay language. However, if viewed from the point of time, the Malay language spoken by people in five countries in Southeast Asia, namely Malaysia, Indonesia, Brunei, Singapore and Southern Thailand. It is considered a national language not only in Malaysia, but also in Brunei,

Singapore and Indonesia. In Indonesia, the Malay language was named after his own country, which is Indonesian. According to Nik Safiah Karim (2010), The term 'Malay' is used in the broad sense and narrow. In the broadest sense, the term 'Malay' refers to the Austronesian peoples who are on the Malay Peninsula and the Malay archipelago. In a broader sense, the term 'Malay' used by UNESCO to refer to ethnic groups in Gaza, including Malay speakers in Thailand, Indonesia, the Philippines and Madagascar. In a narrow sense, the term 'Malay' refers Malay-speaking tribes living in the Malay Peninsula, Sumatra, East coast, Brunei and some places nearby. Constitution narrows the term 'Malay', which refers to people who speak a language other than English, the religion of Islam and the Malay way of life.

Historical development of the Malay language should be viewed from the etymology of the word "Melayu". The origin of this word is still unverified by historians. The best things can be done is to examine some of the evidence that may be associated with the Malay, the Chinese records state that a government Mo-lo-yeu presents the results of the earth to the Emperor of China circa 644-645 century. There is also a view that the government of Mo-lo-yeu centered in Jambi, Sumatra given its name by a river called Sungai Melayu. A Chinese Buddhist monk named I-Tsing using those words when told about the two kingdoms that he visited around the year 675 century. In the ancient Javanese language, the words "Melayu" mean running or wandering. This can be linked to the arrival of Indo-Malay (Austronesian) which being said to be moving from Greece to Malaya. The development of the Malay language is divided into four stages such as the following diagram:

Figure 2. The level of development of Malay Language
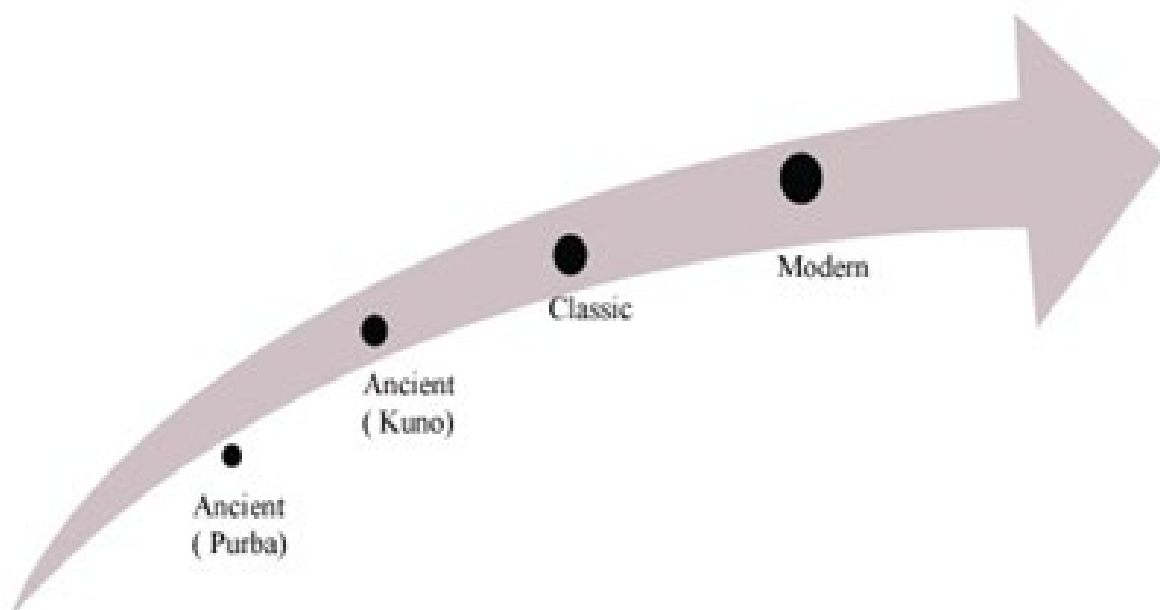
Ancient Malay language was spoken by the *Malay-Duetro*. This level is not the primary stage of development of the Malay language as there is no historical evidence related to this language as the people are not using the writing system. The written evidence that exists is just a form of drawing that is inconsistent. When writing systems exist, the age was changed to the ancient Malay language, then back to the classical Malay, then modern Malay language. Among the ancient Malay language to the level of classical Malay, significant transition period known as the Pre-classical period. Prehistoric times are transitional times that show a mix of Hindu and Arabic influences. There is evidence that this age is bilingual and bilingual in Ancient Malay Language.

Table of Malay Alphabet

The Malay alphabet comprises of 26 letters from the Latin alphabet. Malay alphabet is like the English alphabet. It is based on the Latin script. Malay is a *Malayic* language spoken in Malaysia, Indonesia, Singapore, Brunei, and Thailand. The total number of speakers of Standard Malay is about 18 million. There are also about 170 million people who speak Indonesian, which is a form of Malay (Simon, 2019). The earliest known inscriptions in Malay were found in southern Sumatra and on the island of Bangka and date from 683-6 AD. They had written in an Indian script during the time of the kingdom of Srivijaya. Once Islam arrived in Southeast Asia during the 14th century, the Arabic script was adapted to write in the Malay language. In the 17th century, under influence from the Dutch and British, the Arabic script was reinstated by the Latin alphabet.

Figure 3. Latin Alphabet for Malay (Tulisan Rumi)

Aa	Bb	Cc	Dd	Ee	Ff	Gg	Hh	Ii
e	bi	si	di	i	ef	ji	hec	ai
Jj	Kk	Ll	Mm	Nn	Oo	Pp	Qq	Rr
je	ke	el	em	en	ou	pi	kiu	ar
Ss	Tt	Uu	Vv	Ww	Xx	Yy	Zz	
es	ti	yu	vi	dabel yu	eks	wai	zed	

Phonemes

A phoneme is the smallest unit of sound which becomes a basis for building human speech. Phoneme-to-viseme mapping is essential to the visual recognition of speech and the synthesis of talking heads. In this paper, researchers have proposed a phoneme-viseme mapping for the Malay language using the linguistic approach. There are 36 phonemes in Malay Language. Six of them are vowels, three are diphthongs and 27 are consonants. A grapheme is "a minimal unit of a writing system" or "a unit of a writing system consisting of all the written symbols or sequences of written symbols that are used to represent a single phoneme"(T.P Tan et al., 2010). The table below show the tables for Malay vowels and consonants respectively.

Table 1: Classes of Graphemes

Class	Graphemes
Vowel	'a', 'e', 'i', 'o', 'u'
Diphthong	'ai', 'au', 'oi'
Plosive	'p', 'b', 't', 'd', 'k', 'q', 'g'
Fricative	'f', 'v', 's', 'z', 'sy', 'sh', 'kh', 'gh', 'h'
Affricate	'c', 'j'
Vibrante	'r'
Lateral	'l'
Lateral	'l'
Nasale	'm', 'n', 'ny', 'ng'
Glide	'w', 'y'

Humans produce language and non-language sounds during communication. Non-language is also one of the signals used to communicate which is represented by certain symbols consisting of vowels and consonants. A combination of vowels and consonants will produce the meaning on its own therefore allowing humans to communicate with each other (Syatirah et al, 2016).

Vowel

Vowels are voiced sounds produced by passing air through the mouth without any major obstruction in the vocal tract. Each vowel and consonant has its characteristics. Vowels are classified by how high or low the tongue. The tongue is in the front or back of the mouth. In terms of the vowel phoneme, Bahasa Malaysia or Malay Language only has six vowel phonemes (/a/, /e/, /i/, /o/, /u/, /e'/) (Maris, 1979). Malay vowel sounds are also simple in the way that every vowel sound is different and none are similar to one another in terms of lax or

tense vowel sounds. While vowel sounds (monophthongs) in Malay mostly stayed the same even after the language being transferred, Malay adopted some diphthongs due to transfer. There is no diphthong adopted from Sanskrit because our diphthongs are the same (Mafuzah, 2019).

Consonant

Malay consonant is a speech sound that is articulated by using total as well as partial closure of the vocal region. The term consonant can be employed to refer to a letter of the Malay alphabet that represents a consonant sound. Consonantal sounds can be further divided into labials and coronals. Labials are articulates with the lips. Meanwhile, coronal are articulates by raising the tongue blade. Vowel /a/ widely opens at the front and concurrently the tip of tongue contacted the lowest part at the front of the mouth. Lastly, vowel /u/ is the narrowest at the back and is produced by raising the back of the tongue as high as possible and closer to the teeth.

Table 2: Malay Consonants

Mode of articulation	Place of articulation							
	Bi-lab.	Lab.-dent.	Dent.	Alveo.	Alveopalat.	Palat.	Vel.	Glot.
Plosive	p b			t d			k g	ʔ
Fricative		f v	θ ð	s z	ʃ		x ɣ	h
Affricate				tʃ	dʒ			
Vibrante				r				
Lateral				l				
Nasale	m			n	ɲ	ŋ		
Glide	w				j			

Clasification of Phonolog

According to the Dictionary of the Fourth Edition of the House (2015: 414), phonetics is a linguistic science related to the pronunciation of words and symbols that express their pronunciation while phonology (2015: 414) is a study of the pronunciation of a language. According to Abdullah Hassan (2007), the field of sound study can be divided into two phases: phonetic and phonological. Phonetics is more about studying the sound of human sounds, generally the sounds used in speech or everyday communication while phonetics is more about studying sound systems in languages. Phonetics and phonology are the studies of the sounds of language in order to describe the sounds and to transcribe them (Kanapathy, 2015). These sounds need to be heard first before they are written into sound symbols. In

conclusion, the field of phonetics and phonology of the Malay language can be divided into two important parts of phonetics and phonology (Faridah et al, 2015).

The concept of phonetics and phonology are to make the Malay language as a language which is very easy to learn through a branch of linguistics, named as phonology and phonetics. Almost every letter of Rumi represents a phoneme. Siti Hajar Abdul Aziz (2011) argues that the origin of the phonetic word actually comes from the Greek language called the phone (sound). It is clear that phonetics is a study of the fonts or sounds of the language and how they are produced, heard and even performed. For the study of phonetic fields, language sounds are emphasised such as the way the sounds are heard and the way in which the human organs involved are working to produce the sounds of the language. Another important area also in the Malay language is the field of phonology. Phonology is a field related to the organs of human speech and the way humans use those organs for everyday communication.

According to Siti Hajar Abdul Aziz (2011), phonology is a study of the language system related to the list of sounds and features of the sound as well as specific rules that explain how certain sounds relate to each other. and fields of study of language sounds at a higher level than the phonetic, which is the structure of spoken language. However, phonetic studies are often preceded by phonetics because the phonetic field provides the information it needs to analyse, namely the vowels. Vowels are representations to describe certain sounds. However, according to Abdullah Hassan (2007), the sounds of a language to make a description of the sounds of a language, the mixing of the sounds and the transcriptions. Usually, these sounds will be heard first before they are described. Therefore, the sounds to be studied need to be recorded first and the study will depend entirely on the recording quality of the machine and emphasise that the field of sound phonetic description plays the role of sound as the units that can be studied (Abdullah Hassan, 2007).

Research Methodology

Research Design

The method of research design used in this study was The Design Thinking Process. The Design Thinking Process (DT) is a methodology that provides a solution-based approach to solving problems (Joe, 2019). It's very useful in handling a complex problem that is ill-defined or unknown by understanding the human needs involved, by re-framing the problem in human-centric way. The research will be creating many ideas in adapting the ideas of brainstorming sessions, involving a hands-on approach of prototyping and testing the early stage results (Rikki, 2019). DT research design methodology is inter-related to qualitative research. It's helpful to focus on the five-stage Design Thinking model proposed by the

Hasso-Plattner Institute of Design at Stanford University. This study had followed five classic design thinking process:

- Empathise (search for rich stories and find some love)
- Define (user need and insights – their POV)
- Ideate (ideas, ideas, ideas)
- Prototype (build to learn)
- Test (show, don't tell)

Figure 4. The Design Thinking Process framework (Stanford's d.school, 2015)
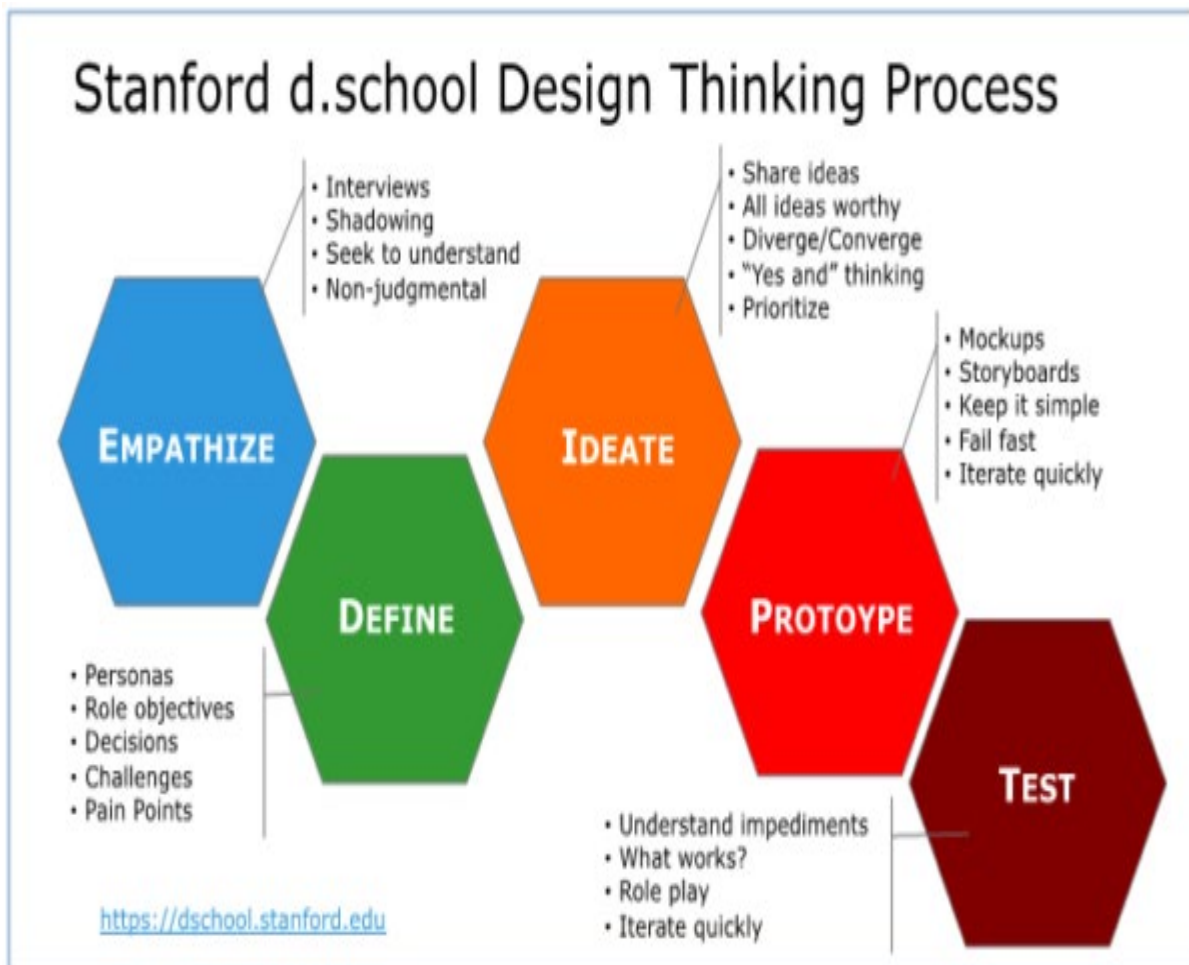
Figure 5. Adaptation framework from Endang Setyati, S. S. (2015). Malaysia mouth-chart Viseme Construction Chart Viseme Construction
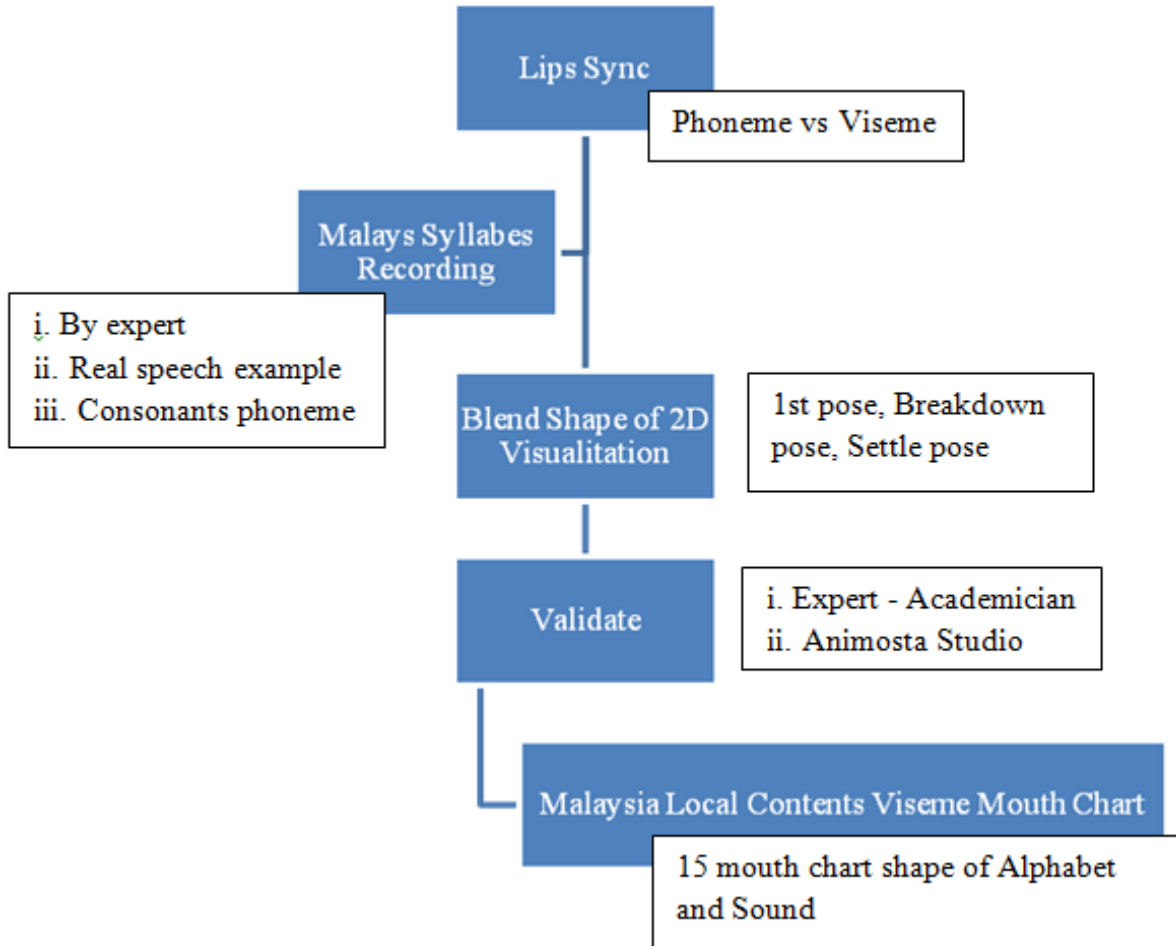
Empathise

This involves the process of understanding the human needs and its core problems through observation of lip-syncs and mouth-charts from many different countries through understanding the journal and case studies from the previous studies. Empathy is vital to a human-centred design process, and empathy allows the researcher to set aside their assumptions about the world to gain insight into consumer-users and their needs. It involved the process of data archival, visual research, observations, and survey. This study also involved using vigorous data and studies from China, Korea, Indonesia and United States. The study of Toon Boom lip syncanation animation being a part of this study. The empathise stage has helped the researchers define the problem through observation in order to create the mouth-chart in Malaysia.

Define

Define is the stage where re-evaluation of the problem has been identified. Researchers will put together the information that they have created and gathered during the empathise stage. Researchers will then analyse their observations and synthesise them to define the core problems or issues that they have identified to this point and stated it is a problem statement. In this process, the pilot study was done by interviewing the three experts in animation industries as a process of data archival and early stage of information. This pilot study to identify the problem of mouth-chart in Malaysia will be linked to the Malaysia language and contexts. An interview with expertise can be a productive way to connect with real people and gain their insights. The ideas of a pilot study can link well the objectives of this study. Questionnaires are open-ended with a question and answer (Q&A) session and is semi-structured. Discussion directly with the people in the field is one of the best ways to understand the research needs and its challenges. Define is a great way in justifying the problem in a human-centric way.

Ideate

Ideate is important in generating ideas. Creative brainstorming is the process of pushing usual boundaries and coming up with new possible solutions. The need of ideate process is to understand the users and their needs. The researchers will be a solid gathered data of the study of lip-sync can help the researcher to analyse and synthesise all the information to end up with problems that are being faced by Malaysia animation industries toward mouth-chart according to Malaysia contents and contexts. A literature reviews from a traditional *Animator Survival Kits (2012), Indonesia Lip-Syncamation, Pheneme- Viseme mapping for Indonesia language based on blend shape animation (2015), Research on Comparison of Phoneme and Viseme Based Acoustic Units for Speech Driven Realistic Lip Animation (2007)* as a base study to understand the problems and issues. The researchers will hold ideation sessions as a way to come up with as many new angles and ideas as possible. There are many different types of ideation techniques that the researcher may use, from brainstorming and mind mapping. It is an extreme lateral-thinking technique that gets the researcher to challenge reputable beliefs and explore new available options. Towards the end of the ideation phase, the researchers will narrow them down to a few ideas and then to move forward.

The dialogue should be recorded before starting any animation. In this task, the words should be broken down into categories and after that those words were turned into mouth shape to be drawn on each frame. The visual break down will be analysed into letters and sounds. The type of phoneme in this study were consonants only. Audio-video materials had been recorded with the expert, Dr. Norzalina Bt Noor from Pusat Bahasa dan Pengajian Umum, Universiti Pendidikan Sultan Idris (UPSI). The recording took place in a creative laboratory

by using a digital camera with high resolution, in a controlled environment. The expert were seated facing the video camera mounted on a tripod one meter in front. The vertical position of the camera was adjusted to the level of the speaker's face. At this stage, the process of exploring, experimenting and implementing the relationship between speech and facial expressions which correspond to articulation. It's very important to show that the perception of speech depends not only on acoustic cues, but also on visual cues such as the lips movements and shapes of the mouth. The recording of audio – video of lip movements can give proper a visual direction about the things spoken. It shows that the use of a video, which contains lip movements, as well as the sound, can increase phonemes recognition more significantly than the use of only the sound. The expert had proposed a phoneme to viseme mapping for Malaysian language by using linguistic approach.

Figure 6. The Malaysian pronunciation syllables recording to speaker

Prototype

Prototype is one of the crucial parts in this research whereby the researchers will try to adopt a hands-on approach of prototyping. This fourth step in the Design Thinking process is all about experimentation and turning ideas into tangible products. It is the process of using a form that allows the researcher to present the idea to others. In the initial stage, the researchers had illustrated the lip-sync into Photoshop in creating the appropriate lip movements of a spoken speech. Then mouth shapes was drawn according to the phonetic syllable. For example, a closed mouth to the wide-open mouth. The visual was analysed to show that the process was important to get the best lip-sync that would suit with the Malaysia contents. Lip-sync key pose has been categorised into three stages of illustration. It was based on the phonemes in the sound track and the mouth shapes for the character to be drawn. Drawing mouth shapes was categorized into key frame of animation stages which was the first pose, last pose and the brake down pose. The result of the mouth-chart could help in preserving the original blend shape and textures better and could help the animator to
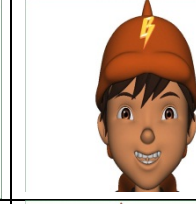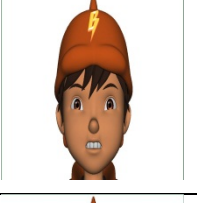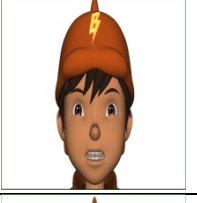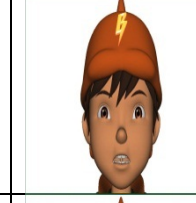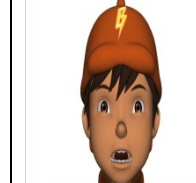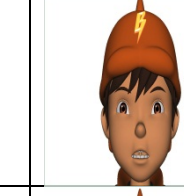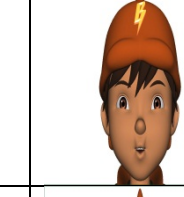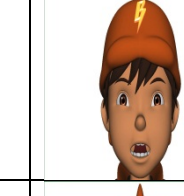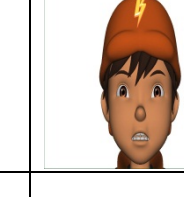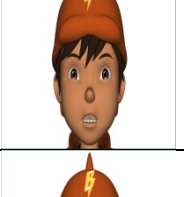
maintain high frequency content and constant throughout the animation. Throughout the prototype stage, the proposed suggestions could either be accepted, improved, redesigned or rejected (Emily, 2019).

Test

The final stage is the test stage. This is the stage where the researcher will show their ideas to others and get all the feedback to further improvise the mouth-chart. The mouth-chart will then be validated by Animosta Studios based on the Boboiboy character designed series that are being used to features film and TV series. There will be 15 mouth shape 2D visualisation based on consonants phoneme. Animosta Studios animators are a well experienced to animate their characters design to suit to the given mouth-chart.. This is called the process of seeking and getting feedback. The results of the testing phase will usually lead the researcher back to the previous step, providing the insights they need to redefine the original problem statement or to come up with new ideas they had thought of earlier.

Table 3: Visual Analysis for Mouth-chart of Alphabet and Sound © 2019 Animonsta Studios Sdn. Bhd. All rights reserved.

No.	Phoneme (Consonants)	1st Post	Breakdown Post	Settle Post
1	B, P			
2	C, J			
3	H			
4	L			

5	M			
6	N			
7	W			
8	Y			
9	K, G			
10	Keh			
11	Ng			
12	Ny			

13	R			
14	S			
15	T, D			

Conclusion

In conclusion, this paper is the first phase on the study of mouth-charts to contribute as a specific reference to the Malaysian animation industry and Malaysian animation education. In this regard, this paper has been a boost to other studies to create the design of mouth-charts that can be applied to animated characters. For this paper, we suggest only the basic phonology and how to pronounce the local language based on the native language of Malaysia. In the future, this set of mouth-chart innovations can be used to create custom lip-sync with the context of local animated characters.

Acknowledgment

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