Module 1

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2245010

From a Songwriter's Perspective How Can the Use of Vowels Impact a Listener's Emotions?

Word Count: 4551

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From a songwriter's perspective how can the use of vowels impact a listener's emotions?

Introduction

In this assignment I am going to explore how we can use vowels in songwriting to influence a listener's emotions. I have concentrated on vowels as that is where it is believed that the emotion in the voice is carried (Rummer & Schweppe, 2019) and vowels are often elongated which is often used in songwriting (Pathak & Calvert, 2019). Important topics to consider when looking at this question are the vocal tract, how the voice is created, valence and acoustics, what vowels are and how they differ from consonants.

In order to answer this, I have looked at several topics and have honed my research to answer the following questions and then devised a strategy using this information.

1. How does the vocal tract produce vowels?
2. How do formants influence vowels?
3. How do vowels influence emotion?
4. How can we use this information in songwriting as a strategy?

In order to answer these questions, I feel it is important to define the following terms:

1. Valence
2. Arousal
3. International Phonetic Alphabet (IPA)
4. Vowels

Valence is used as a term within much of the research to gauge whether a stimulus has a negative or positive feeling whether that be a word, face or object (Rummer & Schweppe, 2019).

Arousal is used within the research to gauge whether an emotion is considered high arousal such as joy and anger or low arousal like sadness (Scherer, Sundberg, Tamarit et al, 2013).

The International Phonetic Alphabet (IPA) (see appendix B) is an alphabet with all the known sounds from the world's languages represented. Two tables included within the IPA are separate tables for consonants and vowels. The consonant table describes these sounds in three ways. Firstly, whether they are voiced or unvoiced i.e., vocal folds vibrate or they do not. The second category is where the consonant is placed in the vocal tract and the third is

the manner in which they are spoken, for example a plosive or bilabial sound (Katz, 2013). The vowels are shown in what is known as a vowel quadrilateral. This quadrilateral represents the shape of the oral cavity and shows where all the vowel sounds within all languages are placed within the mouth. The four corners represent the outer extremes of the oral cavity. The symbols that represent the purest sounds of these vowels are known as the Cardinal Vowels created by Daniel Jones, a phonetician (Nicholson, 2017).

Vowels are unobstructed sounds whereas with consonants the airflow is obstructed in some manner by one or more articulator (Nicholson, 2017).

How Does the Vocal Tract Produce Vowels?

The vocal tract (see appendix C) is a malleable tube within the body that starts at the vocal folds within the larynx and ends at the lips or nasal cavity. Air moves up through the lungs creating subglottal pressure which then forces the vocal folds to open and close. The air moves through the opening between the vocal folds known as the glottis, thousands of times per second in order to produce sounds and speech. This movement of the vocal folds vibrating is the source of the voice. The pitch of our speech is dependent on the frequency at which our vocal folds oscillate (Chan, 2019). The higher the frequency, the higher the pitch that is perceived (Chan, 2019). The sound wave moves through the vocal tract and is shaped by the jaw, tongue or lips which do not obstruct the air when vowels are formed (Oganian et al, 2023).

In order to produce speech, there are many variables within the vocal tract that can affect its timbre as the articulators interact with one another. The vocal tract has fixed and moveable articulators that all help to shape the sounds that we produce. The moveable articulators are the tongue, lips, jaw and soft palate. The fixed articulators are the hard palate and alveolar ridge. It is the movement of the articulators within the vocal tract that form our unique timbre and colouring (Nicholson, 2017).

Vowels are created when the oral cavity is unobstructed which allows the air to pass through whilst being shaped by the articulators especially the tongue and the lips. One of the main articulators for vowel formation is the tongue (Delmoral, Ventura & Tavares, 2018). Vowels can be shaped using the tongue with regards to its height and whether it is forward or back. (Oganian et al, 2023). All vowels are voiced and created in the same manner. When the lips are spread this shortens the vocal tract length and when they are protruded this lengthens the vocal tract (Sundberg, 1977).

Individual body size and shape can impact sound (Fuchs, 2019). The vocal tract with different properties can impact sound. Our vocal tract when we are born is like a blank canvas. An example of how our vocal tract can adapt and shape our speech is that a developing child can acquire the exact sounds needed for any language around the world. (Fuchs, 2019). As every human being is unique so is the voice that we have. Different body shapes and sizes affect the colouring and timbre of our voice such as lower frequencies in longer vocal tracts which taller people tend to have. Smaller people with shorter vocal tracts are more likely to have higher frequencies (Fuchs, 2019; Sturdy, Smith & George, 2021). Happiness was found to have a shorter vocal tract length through the lips being spread (Kim, Toutios, Lee et al, 2020).

How do Formants Influence Vowels?

The voice source is found at the vocal folds which oscillate when air is pushed up through the glottis from the lungs. The vocal folds chop the air as it passes through which produces the frequency vibrations which is translated as the pitch we perceive. The higher the frequency, the higher the pitch. The speech we produce is made up of the fundamental frequency F0 which is the pitch that we hear as listeners (Waaramaa, Laukkanen, Alku et al, 2008). On top of the F0 there are also many harmonics or overtones which give the voice its distinctive colouring and timbre. Without the harmonics our voice would sound like a sine wave.

The sound waves we create for speech are filtered through the vocal tract and shaped according to the resonant chambers of the vocal tract. Some harmonics are boosted which are formants and some are quietened. The closer a harmonic is to a formant frequency the more it is boosted (Sundberg 1977).

The vocal tract has four or five important formant frequencies and these all have a particular sound. In order to identify a vowel acoustically, formants are the main way we can do this (Oganian, Bhaya-Grossman, Johnson et al, 2023; Sharifpoor, Dehghan, Matloubi et al 2020). The different formant frequencies are determined by the length and shape of the vocal tract which can be altered using the jaw, tongue and lips.

F1 is the lowest formant and the formants on top of this increase in a logarithmic scale (Bozeman, 2023).

Speech happens when the vocal folds vibrate and vowels are shaped by the movement of the lips and the tongue (Sharifpoor, Dehghan, Matloubi, et al 2020). All vowels are unobstructed (Nicholson, 2017) within the oral cavity. Formant 2 is influenced by how far to the front or back the tongue is placed in the mouth and formant 1 is influenced by how high or low it is (Oganian et al, 2023) within the mouth.

The F0 which is the main contributor for pitch and sound pressure level (SPL) are both increased in emotions with higher arousal such as happiness and anger and decreased in emotions with lower arousal such as sadness (Fuchs, 2019).

The F0, voice quality and intensity are important variables in our speaking voice when communicating emotions. When we sing the pitch is already decided along with the length of the note and the loudness. Singers need to convey emotions such as joy, anger, fear and sadness with these features already predetermined (Waaramaa, 2008) which is different to when we speak. Therefore, singers need to use other strategies to convey the intended emotions.

A way to picture the vowels visually is to think of the vowel quadrilateral as an auditory representation of the sounds we make with the top left of the quadrilateral having the brightest sounds we can make and the bottom right having the darkest sounds that we are capable of making (Nicholson, 2017). This corresponds with the tongue being higher and more forward in the oral cavity for the brighter sounds and lower and further back for the darker sounds. This can be a useful tool as there are no exact positions within mouth where we make the vowel sounds (Nicholson, 2017).

How do Vowels Influence Emotion?

Another important area to consider when looking at how the vocal tract produces vowels is to consider the emotional state of the speaker (Kim et al, 2015 cited in Kim, 2020). (Lee, 2006 cited in Kim, 2020) found that the emotion of a speaker could directly influence the shaping of the vocal tract. As speakers we have low and high arousal emotions, i.e., sadness and happiness respectively. (Ren, 2018 cited in Kim, 2020) found that when someone was in an emotional state of happiness or sadness their vocal tract opening at the mouth was greater than for a neutral state. Lee et al (2006) found there was a wider oral cavity and pharyngeal area when a speaker was angry rather than in a neutral emotional state.

Kim (2020) found that with the high arousal emotions of happiness and anger the vocal tract had greater movement and that the vocal tract length for happiness was shorter than for angry, neutral or sad.

The way we shape vowels and consonants within the vocal tract is different. It is much harder to describe and feel where vowels are, as opposed to consonants because they are unobstructed and do not have an exact location within the mouth (Nicholson, 2017).

Through my research I believe that vowels can influence emotion. Studies I have looked at researched how fictional names are chosen for faces and or objects with a positive versus negative valence. It was found that a positive smiling face were given names which included more /i/s and negative facial expressions were given names with more /o/s (Rummer & Schweppe, 2019) by the participants of the study. In order to create the /i/ sound, the lips have to be spread which uses the zygomaticus major muscle (ZMM) which naturally leads to a smiling position which can impact and induce an automatic response of happiness and positivity which in turn is likely to brighten the sound that we make (Rummer, 2014). Another study by Benczes (2022) found that positive words had more front vowels than negative words which had more rounded vowels.

Aryani (2018) looked at affective meaning vs affective sound for different words and measured them against arousal and valence and found that the sound of a word was linked to arousal more strongly than for valence. In this study it was found that short vowels and voiceless consonants can make words sound more negative and arousing.

It might be argued therefore that longer vowels could be perceived as more positive. Pathak (2019) looked at brand names and whether the length of the name made a brand sound more luxurious as perceived by the listener which it did.

An /i/ can make a word sound brighter partly because it is made with the tongue towards the front of the oral cavity and the lips naturally spread into a smile shape which makes the vocal tract shorter. A shorter vocal tract can make words sound more positive (Sundberg 1977).

How Can We Use This Information in Songwriting?

In order to devise a strategy, I have looked at the vocal tract and how that influences the shapes of the sounds we make, the influence of formants on vowels and how vowels can affect emotions. I have suggested five strategy points that a songwriter could implement to enhance the required emotion of their song.

A strategy that a songwriter could implement to impact a listener's emotions is to instruct the singer through the use of certain vowels at certain points within the lyrics to create their desired effect. The strategy needs to be implicit within the song without actually spelling it out to the singer.

Strategy Point 1:
The vowel quadrilateral could be used to locate the vowels in the oral cavity and then from this, words could be chosen containing those vowels to induce a specific emotion. We know from this quadrilateral that the brightest vowels would be in the top left and the darkest vowels are in the bottom right (Nicholson, 2017).

Strategy Point 2:
Using words with the /u/ vowel which is on the top right corner of the vowel quadrilateral is created through rounding the lips which extends the vocal tract, moves the tongue back in the oral cavity and lowers the larynx which could darken the timbre making a song feel sadder or downbeat (Sundberg, 1977).

Strategy Point 3:
If the songwriter is writing a song with a happy feel, they may want to concentrate on using vowels with the brighter sound towards the top left of the quadrilateral and landing these on the high notes of the melody and if they wanted a more subdued or sad feel to the song, they could concentrate on words with vowels that are concentrated to the bottom right which land on lower notes within the melody (Fenc-Oczlon, 2017). For example, words with /i:/ may have a happier feel because in order to make this sound the mouth naturally moves into a smile shape which makes the vocal tract shorter which in turn lends itself to a brighter, happier sound (Rummer & Schweppe, 2019).

Strategy Point 4:
A songwriter could lengthen or shorten a vowel to strengthen an intended emotion e.g. shorter vowels could be used within a word if they want the song to have a sadder or negative feel (Aryani, 2018).

Strategy Point 5:
Many songs contain elements that are not words, but oohs and aahs which are unobstructed vowel sounds and these can help to reach the high points within a song. For example, open vowels such as oohs and aahs can be used to magnify an emotion (Korner & Rummer, 2023). These can be sprinkled throughout the lyrics of a song to reinforce the required emotion (Chauncey, 1998).

Part 2 – Critical Reflection

When I first started to approach my assignment, I initially thought of researching a topic that was directly related to my voiceover practice. My initial thoughts were that I could research how to warm up the body and voice before I go into the studio and then devise a strategy that myself and other voiceovers could use. Although this would be directly beneficial, I already have many strategies and practices I have learned and use from my research and practice over the years. Therefore, I wanted to research something that would move my practice forward and enable me to develop and further my skills as a practitioner.

As well as being a voiceover artist I also sing and play various instruments, although not professionally. However, this is an area that I have been interested in, and have always loved. It is my desire to incorporate singing and musical skills into my voiceover business in some form or other. Through my creative musical skills, I have also been a keen songwriter and therefore thought that I would like to pursue my research on songwriting. This topic was something I was excited about and was looking forward to research.

Through my research I wanted to learn how one could use songwriting as a tool through the use of vowels to impact a listener's emotions. My rationale for looking at this topic was that I could eventually use songwriting in my voiceover business by creating little musical animations with characters, story and song. This would then incorporate voice acting, singing and creative writing to create the whole story which is something I'm keen to develop to move my skills and practice forward. When creating a character in the booth it is important to communicate the character quickly just through sound without any other body language such as facial expressions involved. Therefore, I thought it would be a useful tool in my kit to learn more about how I can create a character, their voice and emotion through the use of vowels and how the vocal tract can shape the vowels to create a specific, desired effect.

I was instantly drawn to Kolb's model of Experiential Learning Theory (1984) because of its simplicity and the inclusion of experience as I like to learn through doing. I therefore wanted to apply this to my learning. This is a cyclical theory and is based on the premise that one never stops learning. The cycle has four stages which are experience, reflect, think and act. I felt this model was most appropriate for me and my practice because in order to grow it is important to keep learning through experimentation and practice. This cycle allows time for play and reflection and allows for one to examine what has and hasn't worked.

Using Kolb's Experiential Learning Theory Model (1984) allowed me to 'experience, reflect, think and then act. I was drawn to this model because of its simple framework. I like the idea of using experience to learn from and then being able to grow and develop as a result of the reflective part. I like to learn experientially as well as visually and being able to feel and be aware of what is happening within the vocal tract was a pivotal moment for me.

When I started this research on how songwriters can use vowels to impact listeners' emotions, the experience I had was extreme overwhelm. As I reflected the topic seemed huge, which it is, and I felt all at sea with how to approach it. I then thought about how I could tackle the assignment and with the help of my tutor I broke it down to make it feel more manageable. As a result of this I was then able to approach my assignment one step at a time. The breakdown of my assignment topics then highlighted the gaps in my knowledge, and the areas therefore, that I would need to research and focus my attention on.

For instance, I am now more aware of how my larynx affects my voice (Sundberg, 1977). When I lower my larynx, my voice now appears to be lower and when I raise my larynx and speak with more of a smile or lips spread my voice appears to be higher. My research has enabled me to become more experientially aware of how my vocal tract movements can affect the timbre of my voice. Before I started this research, I hadn't connected the theory to the physical act of speaking.

During tutorials and research, I decided to look at the IPA, anatomy, emotions and acoustics. These four topics felt manageable and very appropriate for my research question. The questions that I broke my assignment down into were:

- How does the vocal tract produce vowels?
- How do formants influence vowels?
- How do vowels influence emotions?
- How can we use this information in songwriting to create a strategy for other songwriters?

When approaching the first question, *how does the vocal tract produce vowels,* the first obstacle that I experienced was the gap in knowledge. As I reflected, I realised I had a basic understanding but felt that my knowledge needed greater clarity and a deeper understanding of the mechanics of the anatomy. I then thought about how I could research the vocal tract and decided that I would start with the anatomy which would then give me a greater

understanding. Having a deeper understanding of the anatomy then allowed me to build upon my knowledge with regards to how the vocal tract shapes vowels.

This is still an area for further development but I feel my general research and reading has given me some lightbulb moments. For instance, I never knew what the glottis was until my reading (Katz, 2013). I always thought it was an actual physical piece of tissue. This has become clearer and I now understand that this is just a space between the vocal folds which has made the mechanics and geography of the entire vocal tract much clearer. Using Kolb's cycle, I can see that this learning has made me reflect on the glottis and to picture it in my mind as an open space which has given me a clearer picture of the vocal tract.

Gaining a deeper understanding of the anatomy of the vocal tract has given me clearer insight into what is going on within the body when we phonate. As a result of my reading and research I now can visualise in my mind some of what is happening. This has made me realise that I am very much a visual learner.

Initially, when I began to look at formants and acoustics, I had a very low self-belief which was, and still is a huge obstacle. The topic of physics in general is not something I would naturally gravitate towards, even though I have had, through my work as a voiceover artist developed an interest in sound and how it is made, perceived and measured. Using the audio editor Twisted Wave in my practice as a voiceover artist I have developed some basic knowledge on sound and audio and what the sound waves mean and look like so I can edit and process accordingly. For example, I know that I need to record to certain levels and avoid clipping the audio so I do not have distorted recordings. However, it was apparent that my knowledge in this area was sparse and many gaps needed to be filled. This was, at the beginning, very overwhelming because of the academic and scientific language used that I am not used to. I had a real tug-of-war with myself between wanting to know more and not believing I had the capacity to understand the concepts. As a result, I was scared of this topic.

After some careful reflection when I was out of panic mode, I decided to approach the topic of acoustics and formants like I approached music theory. This is a topic that I really enjoy but struggled to understand at the beginning. However, after hours of persistence, it all fell into place.

In order to understand formants, I needed to broaden my knowledge on vocal acoustics in general. As my research has gained momentum, I have found that there is always more to

know which I will continue to research and gain a deeper understanding. My initial experience was being very vague about formants and harmonics and what they mean for the voice. I had a basic understanding of harmonics through my musical training but it was evident that I needed to take a deeper dive and explore.

When I started to look at the research papers on vocal acoustics my reservations were confirmed in that the academic language was too advanced for me at that stage. I therefore, started to do some general research on the internet to try and find some reading and sources that explained formants and harmonics in laymen's terms which proved to be very useful (Bast, 2022).

When I then moved onto the papers, I had a greater understanding of the concepts, and the language and terminology was not as frightening as I initially had experienced. I was taking away the fear. This felt very empowering and gave me control over my learning which is how I learn the best. A lot of the obstacles at the beginning of the research process are to do with not knowing what you do not know. Reflecting on this, I can relate back to starting my voiceover business when I did not know or understand everything that was needed to get a business off the ground. This was the same kind of learning.

Through my initial study of vocal acoustics, I am keen to take this further. It is a topic that I find fascinating and would like to develop my knowledge on the visual aspects of the voice in spectrograms. I am interested in recording my voice so I can see the fundamental frequency and harmonics at different pitches. Again, having a visual experience of my voice and what it looks like will only enhance my learning experience.

Through my work as a voiceover artist, I have often come across the term standing waves which was a term that I did not understand. After my research and reflection, I now do have more of an understanding of the term and how that can affect my voice within my studio. I was sometimes given the feedback at the beginning of my career that my voice recording sounded like it was recorded in a box. This now makes sense because sometimes a sound wave can be too big for the space. As a result, I expanded my recording space. This makes sense to me now because of how standing waves work. I did not realise that sound waves can be huge depending on their frequency and pitch. If a sound wave is too big for a space it can move back on itself to create standing waves (Sundberg, 1977; Graf, Schwiebacher, Richter et al, 2020).

Conclusion

It has been interesting to learn more about vowels and how as a songwriter we can influence the emotion that we want the listener to perceive from words alone. The intended emotion would also be enhanced through the melody line. From my research I have found that the vowel quadrilateral is a good starting point to understand where the bright and darker sounds tend to fall within the oral cavity. As vowels are harder to pinpoint exactly where they are formed in the mouth it is useful to think of the quadrilateral as a map. If we want to focus on bright sounds these vowels tend to be in the top left which in the mouth corresponds to the tongue being high and forward. If we want to focus on the darker sounds these tend to be made with a lower, back placed tongue.

Overall, this has been a positive learning experience and has enhanced my study skills. I have realised that it is important for me to experience, reflect and think before I act. Making a plan to tackle the learning that is required has helped me to focus and to dismantle the overwhelm that I was initially feeling.

In my personal development plan (see appendix A) I have included tasks that will continue to deepen my knowledge and understanding of vocal acoustics. These tasks have been broken down into manageable chunks so I am able to give myself space and time to consume and learn new concepts. I have also included creative endeavours to enable me to apply the theory and knowledge I have learned on vocal acoustics to songwriting.

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Appendix A

Personal Development Plan

Develop Understanding on Vocal Acoustics

Activity: Watch videos on VSC video library to gain a deeper understanding of vocal acoustics
Objective: To apply this learning to module 3
Action: Watch 2 videos a week
Timescale: Ongoing

Activity: Read books on Vocal Acoustics
Objective: To apply this learning to module 3
Action: Read books by Ken Bozeman
Timescale: Ongoing

Learn how to use a Spectrogram

Activity: Research different software
Objective: To study my voice and others in depth by understanding the harmonics visually
Action: Download software
Timescale: Christmas 2024

Activity: Record my voice using vowels
Objective: Apply my learning from this assignment in the real world
Action: Create a script/song for me to record so I can analyse the acoustics
Timescale: Ongoing

Write Songs for Animations with Specific Emotions in Mind

Activity: Write a happy, sad, and mad song
Objective: Apply learning from this assignment and use the strategy
Action: Write lyrics, apply a chord progression and then improvise over the top
Timescale: Ongoing

Activity: Develop melody writing skills
Objective: To write melodies for my lyrics and chord progressions
Action: Read books on melody writing and songwriting
Timescale: Ongoing

Develop a Story for an Animation

Activity: Brainstorm story ideas
Objective: To create a musical animation
Action: Write the animation scene by scene
Timescale: Ongoing

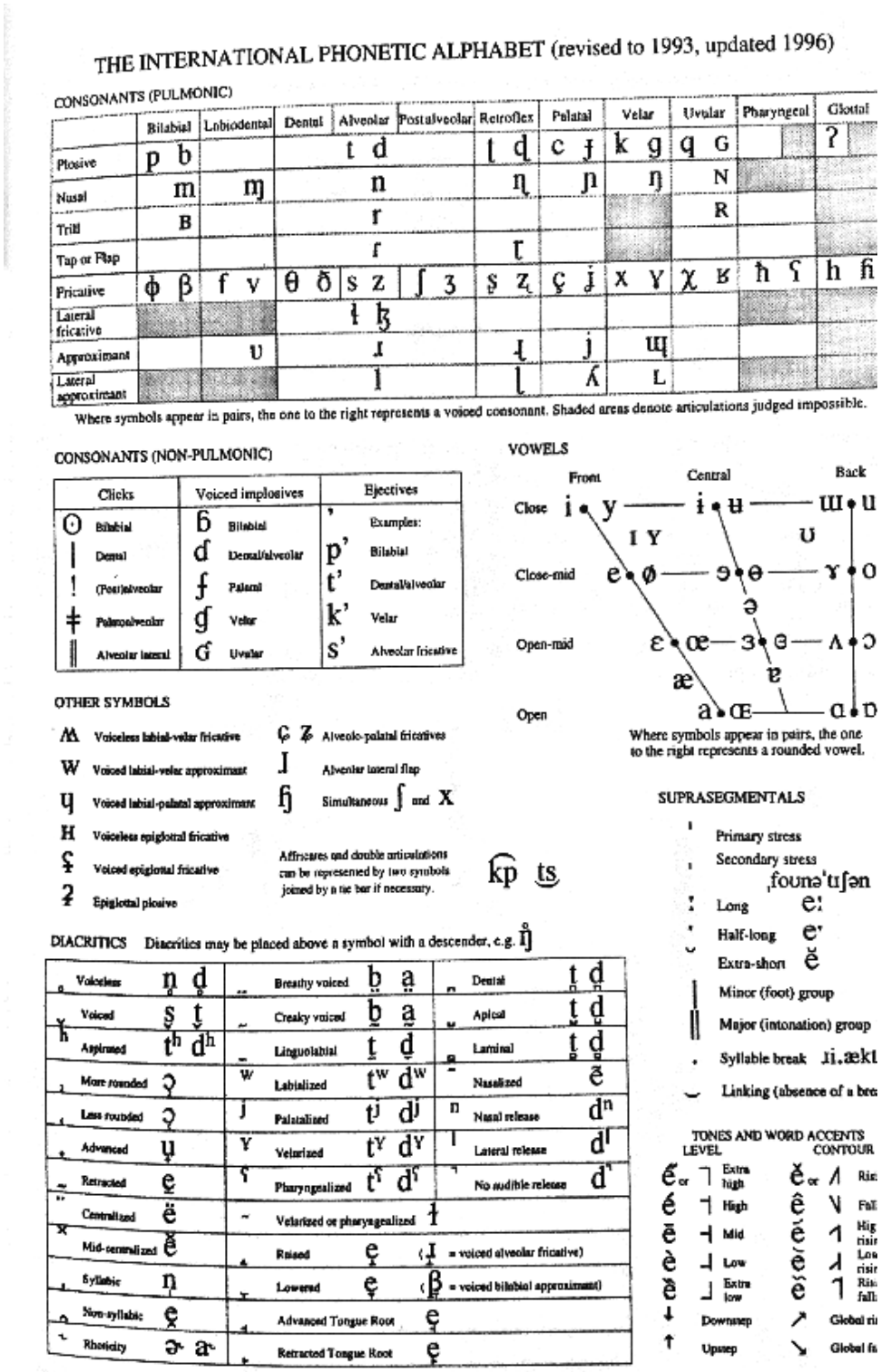
Activity: Create short animations for social media
Objective: To develop animation skills incorporating story development with song and script
Action: Write a 30 second script – approx. 75 words
Timescale: Ongoing

Learn How to Use Garageband

Activity: Write musical ideas using the software
Objective: To develop my skills as a songwriter
Action: Take a course on Garageband
Timescale: Christmas 2024

Appendix B

IPA including the Vowel Quadrilateral



THE INTERNATIONAL PHONETIC ALPHABET (revised to 1993, updated 1996)

CONSONANTS (PULMONIC)

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap				ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks		Voiced implosives		Ejectives	
ʘ	Bilabial	ɓ	Bilabial	ʼ	Examples:
ǀ	Dental	ɗ	Dental/alveolar	pʼ	Bilabial
ǃ	(Post)alveolar	ʄ	Palatal	tʼ	Dental/alveolar
ǂ	Palatoalveolar	ɠ	Velar	kʼ	Velar
ǁ	Alveolar lateral	ʛ	Uvular	sʼ	Alveolar fricative

VOWELS

Where symbols appear in pairs, the one to the right represents a rounded vowel.

OTHER SYMBOLS

- ʍ Voiceless labial-velar fricative
- w Voiced labial-velar approximant
- ɥ Voiced labial-palatal approximant
- ʜ Voiceless epiglottal fricative
- ʢ Voiced epiglottal fricative
- ʡ Epiglottal plosive
- ɕ ʑ Alveolo-palatal fricatives
- ɺ Alveolar lateral flap
- ɧ Simultaneous ʃ and x

Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary. k͡p t͡s

SUPRASEGMENTALS

- ˈ Primary stress
- ˌ Secondary stress ˌfoʊnəˈtɪʃən
- ː Long eː
- ˑ Half-long eˑ
- ̆ Extra-short ĕ
- | Minor (foot) group
- ‖ Major (intonation) group
- . Syllable break ɹi.ækt
- ‿ Linking (absence of a break)

DIACRITICS Diacritics may be placed above a symbol with a descender, e.g. ŋ̊

̥ Voiceless	n̥ d̥	̤ Breathy voiced	b̤ a̤	̪ Dental	t̪ d̪
̬ Voiced	s̬ t̬	̰ Creaky voiced	b̰ a̰	̺ Apical	t̺ d̺
ʰ Aspirated	tʰ dʰ	̼ Linguolabial	t̼ d̼	̻ Laminal	t̻ d̻
̹ More rounded	ɔ̹	ʷ Labialized	tʷ dʷ	̃ Nasalized	ẽ
̜ Less rounded	ɔ̜	ʲ Palatalized	tʲ dʲ	ⁿ Nasal release	dⁿ
̟ Advanced	u̟	ˠ Velarized	tˠ dˠ	ˡ Lateral release	dˡ
̠ Retracted	e̠	ˤ Pharyngealized	tˤ dˤ	̚ No audible release	d̚
̈ Centralized	ë	̴ Velarized or pharyngealized	ɫ		
̽ Mid-centralized	e̽	̝ Raised	e̝	(ɹ̝ = voiced alveolar fricative)	
̩ Syllabic	n̩	̞ Lowered	e̞	(β̞ = voiced bilabial approximant)	
̯ Non-syllabic	e̯	̘ Advanced Tongue Root	e̘		
˞ Rhoticity	ə˞ a˞	̙ Retracted Tongue Root	e̙		

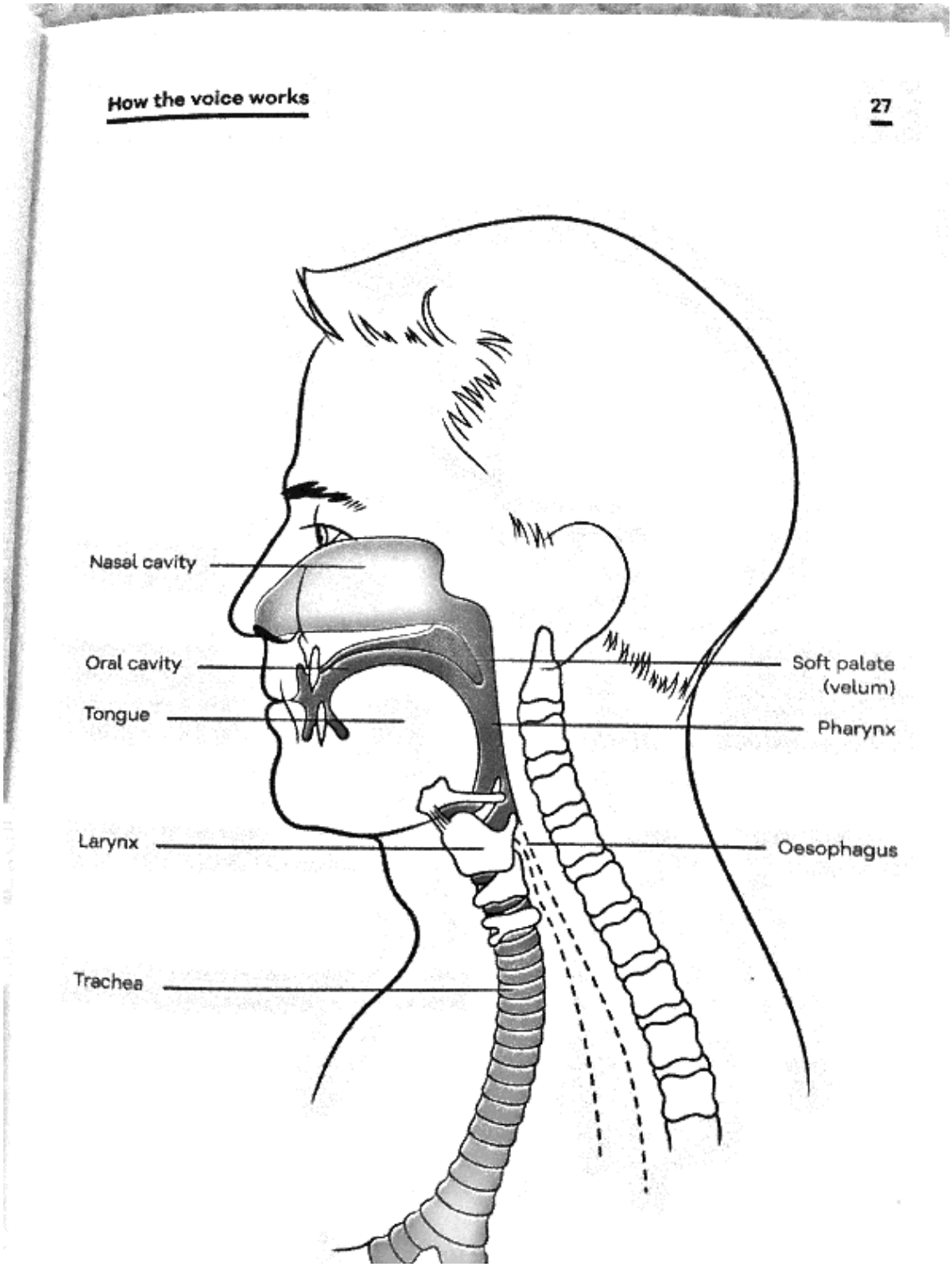
TONES AND WORD ACCENTS

LEVEL			CONTOUR		
ȅ or ˥	Extra high		ě or ˩˥	Rising	
é ˦	High		ê ˥˩	Falling	
ē ˧	Mid		ĕ ˩˧	High rising	
è ˨	Low		ȅ ˧˩	Low rising	
ȅ ˩	Extra low		ȇ ˩˥˩	Rising-falling	
↓	Downstep		↗	Global rise	
↑	Upstep		↘	Global fall	

Handbook of the IPA, 1999, p.ix

Appendix C

The Vocal Tract



Fisher and Kayes, 2018, p27