Tuning in *Gender Wayang*: voices, concepts, and analysis

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS

in

THE FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES
(Ethnomusicology)

THE UNIVERSITY OF BRITISH COLUMBIA
(Vancouver)

January 2014

Abstract

This thesis brings light to *gender wayang*'s (metallophone ensemble) unique and complex tuning system, which has yet to be explored thoroughly in academic circles. In the thesis I examine the tuning of *gender wayang* instruments through cultural and scientific analysis of the four Balinese tuning concepts *ulu suara* (pitch), *sruti* (interval), *angkep-angkepan* (octave), and *ombak* (waves). The cultural analysis focuses on the ways that *pande gong* (metalsmiths), *tukang laras* (*gamelan tuners*), *juru gender* (*gender wayang* musicians), and *dalang* (puppeteers) conceptualize the tuning of *gender wayang* instruments. I juxtapose their perspectives against measurements of nine sets of *gender wayang* instruments that are spread throughout four of Bali's nine regencies—Gianyar (Central Bali), Tabanan (West Bali), Badung (South Bali), and Buleleng (North Bali)—and then analyze the measurements with particular attention focused on the four concepts. Following the discussion of these concepts, and informed by them, I investigate tuning levels and their connection to *dalang*. The thesis also describes *gender wayang* instrument construction in detail. This provides the reader with suitable background information about the relationship between *tukang laras* and *pande gong*.

Preface

This thesis is original, unpublished, independent work by the author, I Made Kartawan.

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List of Symbols and Abbreviations

The symbols of musical Balinese pitches:

O /o	=	*dong*
E / e	=	*deng*
U /u	=	*dung*
A /a	=	*dang*
I /i	=	*ding*

Glossary

Adeg-adeg: two wooden supports that stand upright on either side of the instrument case (*pelawah*)

Akaka: one note above or below a note in a given mode, also called a neighbor note

Angkep-angkepan: octaves

Angieng: the slowest type of *ombak*—the difference between *pengumbang* and *pengisep* is very small, usually only 1-2 Hz

Barangan: metallophone*gender wayang* instrument using medium and high octaves

Begbeg: narrow interval between E – U and A – I

Bilah: keys

Bumbung: tube resonators made from bamboo or PCV pipe

Cagak: small supportsfor the keys

Cengkalak: foot of the*gender wayang* instrument

Dalang: puppeteer

Dupak: wooden base with a trapezoidal shaped

Gamelan: sets of instruments orchestra include gender wayang as well

Gegorok: holes in the keys

Juru gender: musicians that are experts in playing *gender*

Kuping gender: ears of the *gender wayang* instrument that are located on both sides of the *adeg-adeg*

Laras: a synonym for *saih*

Nada dasar: basic tone

Ngelanting: the opposite of *nyerod*. In this case, slightly higher than double the frequency

Ngumbang-isep: beating waves resulting from slight variations in the tuning of paired instruments

Nyerod: one octave higher than a tone, but slightly lower in pitch than double the frequency. For instance, one octave higher than a note tuned to 220 Hz would be 440 Hz. However, in the case of *nyerod* an octave higher would be slightly lower than 440 Hz

Ombak: the beats created by striking paired *pengumbang* and *pengisep* instruments simultaneously

Pande gong: metalsmith

Pelawah: instrument case

Pemade: *gender wayang* instrument with the lowest and medium octaves

Pencon: small gong

Pengayun: a type of *ombak* that is slow; the difference in frequency is usually 3-4 Hz

Pengisep: the higher in pitch of instruments tuned in pairs

Pengumbang: the lower in pitch of instruments tuned in pairs

Pengumbang lambat: a type of *ombak* that is faster than *pengayun* with an average difference in frequency of 5-7 Hz

Pengumbang bulus: the fastest *ombak*: 9-10 Hz that is used in the instruments

Pengumbang sedeng: a type of *ombak* that is not too fast and not too slow, about7-8 Hz

Pengejer: the type of *ombak* faster than *pengumbang bulus* that the difference is 11- 15 Hz

Pengetor: the fastest *ombak*: 16 -20 Hz

Petuding: the master scale

Saih; a "scale" or "mode" in Balinese music. *Saih* refers to the structure of notes in a particular order. Sometimes *saih* is called *laras*.

Saih gedenan: describes the lowest *saih* within the variations of tuning in one kind of ensemble

Saih cenikan: the opposite of *saih gedenan*

Slepek: wood inserted between every tube resonator

Sruti: intervals

Sunduk: crown of the *gender wayang* instrument that is positioned horizontally between the *adeg-adeg*

Wayang kulit: shadow puppet theatre

Tirus: the interval between E – U and A – I is stretch

Tukang laras: gamelan tuners

Tukang pelawah: carpenter

Tukang ukir: craftsmen

Ulu suara: departure pitch

Acknowledgements

I am very grateful to the Directorate General of Higher Education of the Republic of Indonesia, because without their financial support it would not have been possible to for me to study abroad. I also extend my deepest gratitude to my parents, I Wayan Sundri and Ni Made Cacep, who supported me with their thoughts and prayers while I was away. I am deeply saddened by the passing of my father, I Wayan Sundri, who passed away during the writing of this thesis. I still believe he has witnessed the entire process. A special *suksmaning manah* goes to my wonderful advisor, Prof. Michael Tenzer, who patiently advised me throughout the writing process. Special gratitude also goes to my teachers at UBC, Prof. Nathan Hesselink and Prof. Kofi Gbolonyo. Numerous individuals have assisted me in this study, among them are I Wayan Rai and I Wayan Sudirana, who supported and helped me throughout the study, my buddy Jonathan Adams, who pushed me to finish the thesis on time and patiently assisted me with revisions to the first draft, especially regarding English grammar. A special *suksma* goes to my teachers I Wayan Beratha, and my friends and colleagues I Ketut Gde Asnawa, I Ketut Gde Sugita, and I Nyoman Sudiana. I owe a tremendous debt to my informants I Wayan Suweca, I Made Terip, I Wayan Pager, I Made Sutama, I Made Subandi, I Ketut Sukayana, I Wayan Nartha, I Ketut Nuada, and Dewa Wicaksana. Finally, I express my sincere gratitude to my supportive wife Ni Made Supeni, my daughter Ni Putu Suci Pramesti, and my son I Kadek Hari Candana.

This thesis is dedicated to my late father, I Wayang Sundri, who passed away while I was preparing this manuscript.

Chapter 1: Introduction

1.1 Introduction

The following thesis is an analytical study of tuning practices used in the construction of Balinese metallophones known as *gender wayang*. The thesis explores the instruments through analysis of Balinese conceptions of tuning as well as through analysis of tuning measurements taken from nine sets of *gender wayang* instruments. Several Balinese tuning concepts inform this study. They include *ulu suara* (pitch), *sruti* (interval), *angkep-angkepan* (octaves), and *ombak* ("beating" waves resulting from small differences in the tuning of paired instruments). These terms connote the basic concepts applied by gamelan makers or tuners in Bali.

In Bali expert musicians and gamelan makers are generally aware of three tuning levels used in the construction of *gender wayang* instruments. Using the Balinese tuning concepts just mentioned I examine *gender wayang* instruments and the three tuning levels in several different but related ways. First, I describe how the instruments are constructed and tuned. This provides the reader with background knowledge that will make topics discussed in later chapters easier to follow. I then explore how experts in *gender wayang* performance (*juru gender*), *gender wayang* instrument construction (*pande gong*), gamelan tuning (*tukanglaras*), and shadow puppeteering (*dalang*) each conceptualize the above-mentioned tuning levels.

Next, utilizing computer software, I measure the pitch of several sets of *gender wayang* instruments and juxtapose these measurements against the conceptions of tuning drawn from the experts in interviews. In total I measure nine sets of gamelan *gender wayang* spread throughout four of Bali's nine regencies—Gianyar (Central Bali), Tabanan (West Bali), Badung (South Bali), and Buleleng (North Bali)—and then analyze the measurements with particular attention

focused on the above mentioned tuning concepts of *ulu suara* (pitch), *sruti* (interval), *angkep-angkepan* (octaves), and *ngumbang-isep* (waves).

Finally, I explore the relationship the voice of *dalang* (shadow puppet master) and the tuning of the instruments. Although *gender wayang* is often performed as an instrumental ensemble, its repertoire and performance setting is most often associated with Balinese *wayang kulit* (shadow puppet theater), in which the ensemble provides musical accompaniment. In this setting the *dalang*'s voice is central and the tuning of *gender wayang* should be carefully matched to the vocal range of the *dalang*. This thesis is based on research conducted in Bali during the months of May-November of the year 2013.

1.2 The Term Gender Wayang

The term *gender wayang* refers to a certain class of Balinese metallophones, collections of such instruments in the form of ensembles, and the repertoire that is performed on them. Balinese musical ensembles are customarily separated into three categories: *gamelan tua* (old), *gamelan madya* (middle), and *gamelan baru* (new). Ensembles of the *gamelan tua* category are mostly sacred, smaller, and without *kendang* (drums). They are also believed to be the earliest musical ensembles in Bali and it is within this category that *gender wayang* belongs. The *gender wayang* is one of the smallest ensembles in Bali and most often consists of four instruments split into two pairs: a pair of *pemade* (larger and lower pitch) and a pair of *barangan* (smaller and higher in pitch). However, in North Bali it is common to find ensembles consisting of just a single pair of *pemade*.

1.3 Performance Settings

Today, in Bali *gender wayang* ensembles are played in various performance contexts, including secular and religious ones. In religious settings *gender wayang* is performed in association with *wayang wong* (masked theater), *wayang kulit* (shadow puppet theater), or as instrumental music during rituals such as *metatah* (tooth-filing) and *ngaben* (cremation). In secular settings *gender wayang* is performed in association with *wayang kulit* or as instrumental "background" music for the enjoyment of tourists.

Since the 1950s secular performance settings have become more and more commonplace. This is because since then tourism has come to dominate many aspects of Balinese life and many aspects of Balinese culture have become commodities for tourism (see Michel Pichard 1996, Leo Howe 2005, Adrian Vickers, 1996, Djoko Moeljo 1993). By the 1950s *gender wayang* were being performed as part of a series of tourist programs in hotels, restaurants, and other tourist destinations. This includes performances of *gender wayang* in association with *wayang kulit* as well as instrumental *gender wayang*. More recently, recordings of such music have begun to be played for tourists. For example, at the Ngurah Rai international airport in Denpasar these recordings greet newly arriving tourists, and in spas and massage centers all over Bali they are used to promote relaxation.

When associated with *wayang wong* and *wayang kulit*, *gender wayang* provides thematic music that accompanies story telling. In both cases *gender wayang* can accompany singing or provide thematic background music. In *wayang wong* singing is performed by live actors, while in *wayang kulit* all dialogue and singing is performed by the *dalang*. *Wong* literally means human and the dialogue, songs, and movements of all characters in *wayang wong* are performed by dancers that don masks and costumes representing figures in the story. The *wayang wong*

draws its stories from the Hindu Ramayana or Mahabharata, stories which came to Southeast Asia from the Indian sub-continent before being translated into local languages. In *wayang kulit* the *dalang* brings to life stories through puppets with both ancient Hindu as well as Javano-Balinese origins. These include the Ramayana, Mahabharata, *Tantri*, and *Babad*. Unlike the Ramayana and Mahabharata, *Tantri* and *Babad* have autochthonous Javano-Balinese origins. *Tantri* are animal stories and *Babad* are historical tales often about early kingdoms and ancestors.

Wayang kulit plays a central role in ceremonial and secular Balinese life and can be witnessed at night or during the day. Daytime performances are called w*ayang lemah* and night time performances are called *wayang peteng*. *Wayang lemah* is more deeply embedded in ceremonial processes and it usually plays an important part in the ceremony itself. It is also sacred. *Wayang peteng* take place in the vicinity of a temple, market place, or a public community center. This kind of performance is usually in honor of a private celebration that is connected with a ceremony or entertainment.

In Balinese religious life g*ender wayang* is also essential to certain rites of passage during which instrumental music is performed. These include *metatah* (tooth-filing) and *ngaben* (cremation) ceremonies—purification and sanctification rituals of the human spirit. In these contexts, *gender wayang* provides background music that is played during ritual proceedings. In this case there is no repertoire specific to the occasion, but players usually select slower and softer instrumental repertoire, including compositions such as *Sekar Sungsang*, *Rebong*, or *Alas Arum*, as well as pieces from the various *wayang kulit* repertoires.

1.4 Gender Wayang Tuning Overview

In Balinese music, scale is known as *saih* or *laras*; *saih* not only refers to scale but also to the number of tones in a scale. For example, *semar pagulingan saih pitu* has seven tones, and *semar pagulingan saih lima* has five tones—*lima* and *pitu* referring to five and seven. *Angklung saih lima* has five tones, while *Ankglung saih pat* has four—*pat* referring to four. The scale that *gender wayang* use is called "*saih gender wayang*" and refers to a five-tone *selendro* scale. *Selendro* is often described as an equidistant pentatonic scale. That is, a single octave contains five intervals, all of which are roughly the same size. A scale that uses intervals of unequal size is usually referred to as *pelog* and it consists of scales using five and seven tones, but it is not relevant to *gender wayang*.

In all Balinese gamelan the tuning varies from ensemble to ensemble and affects the music produced. *Tukang laras*, *pande gong,* and most Balinese musicians recognize that tuning has an important role in the quality and character of sound produced by an ensemble. For example, in *gong kebyar*, to the well-trained and well-informed ear lower tuning often produces the impression of "*begah*" and "*wibawa*" (heavy and prestigious), whereas higher tuning often has the impression of "*manis*" and "*halus*" (sweet, soft, and refined). The impression created by a particular tuning is determined by a combination of the *ulu suara*, *sruti*, *angkep-angkepan*, and *ngumbang-isep*, which all influence the quality of the sound that the ensemble produces. Variation within these aspects of the tuning process contributes to an abundance of differing musical timbres and characters of sound in different ensembles.

In *wayang kulit* performances the tuning of the instruments is an important consideration because of the presence of a *dalang* whose vocal range must be aligned with that of the instruments. The selection of the appropriate tuning model helps the *dalang* cover the widest

range of vocal techniques possible, i.e., traditional chants, melodic metered poetry, vocal timbres, and traditional songs. In other performance contexts the relative tuning level of the instruments is not as important of a consideration. In *wayang wong* theater there are several dancers and each dancer has unique vocal qualities. This makes it difficult to determine a particular pitch-level for the *gender wayang* instruments to be tuned. It is rare for a *wayang wong* dancer's voice to be a determinant of a gender wayang ensemble's tuning.

In *gender wayang* instruments there are three tuning levels that facilitate this process of selection. These models can be distinguished from one another primarily by their relative pitch level: lower, medium, and higher. The three tuning levels are referred to by the names *Pudak Setegal*, *Sekar Kemoning*, and *Asep Menyan / Sekar Sandat*. However, different *gender wayang* tuning centers vary in the way they apply the terms to the three relative pitch levels. For example, in Kayumas *Pudak Setegal* refers to the lowest of the three relative tuning levels; *Sekar Kemoning*, the middle; and *AsepMenyan/SekarSandat*, the highest; while in Sukawati, the lowest relative tuning level is *Sekar Kemoning*; the middle, *Pudak Setegal*; and the highest, *Asep Menyan/Sekar Sandat*.

Furthermore, musicians in North Bali refer to the tuning levels with different terms: *Segara Wera* refers to the lowest, *Nyinom* refers to the middle, and *Mangkur* refers to highest. Some *pande gong*, *tukang laras*, musicians, and *dalang* also use terms for the three tuning levels that are associated with regional styles. They are *saih* Buleleng, which refers to the lowest; *saih* Kayumas, which refers to the middle; and *saih* Sukawati, which refers to the highest.

The four most famous villages where the tradition of *wayang kulit* is cultivated—Kayumas (South Bali), Sukawati (Central Bali), Tunjuk (North West Bali) and Munduk (North Bali)—will be the focus of this study. These villages are centers of *gender wayang* activity and

have developed unique styles of *gender wayang* performance that have spread beyond their village boundaries, and to such a degree that *gender wayang* performed anywhere on the island is usually equated with one of these four styles regardless of where it is performed. Although these are centers of *gender wayang* activity, the instruments are not necessarily produced in the villages themselves. *Gender wayang* instruments are usually made in Blahbatuh (Central Bali), Tihingan (East Bali), or Sawan (North Bali). Generally, *gender wayang* musicians acquire *gender wayang* instruments from the nearest center of production and have a say in the tuning of the instruments that they order. This means that each center of activity maintains patterns in tuning that do not necessarily correlate with where the instruments were procured.

1.5 Motivation

My motivation to explore this topic stems from my own experience and training as a musician and a *tukang laras* (gamelan tuner). I started to play gamelan *gender wayang* when I was fifteen years old and I began to apprentice as a gamelan tuner with I Wayan Beratha (a Balinese gamelan maestro) at twenty five.[1] I Wayan Beratha believes that the problems in tuning have never been exhaustively researched and explored. He also once advised me with the following statement, "*de med- med melajahin ene sawireh sing je bakal telah baan ngenehang*," which means "don't grow tired of learning about tuning because there are many problems in Balinese tuning practices which need to be solved." This statement encouraged me to continue learning about Balinese tuning systems and music.

[1]I Wayan Beratha was born in 1926, at Sadmerta-Denpasar. He was recently awarded the inaugural title of Empu Seni Karawitan (master of the art of traditional music) by the Indonesian Arts Institute (ISI) in Denpasar for his lifetime achievements and dedication to preserving Balinese traditional music that has also included the creation of around 20 musical compositions, various dances, *gending* (traditional songs) and dance-drama performances.In 1987, Beratha created the gamelan Semara dhana—a new form of gamelan that is a combination of two orchestras' tuning; gamelan gong kebyar and gamelan semar pagulingan.

I began to notice differences in the tuning of *gender wayang* when I was studying with I Wayan Beratha and as a result I began to question gamelan teachers and gamelan makers (*pande gong*) regarding these differences. Most of them answered, "that it depends on the taste of the *tukang laras* (gamelan tuner) or *pande gong* (gamelan maker)." However, their answers did not satisfy my curiosity. Thus, in this research project I seek comprehensive answers not only from *pande gong* and *tukang laras,* but also from musicians, *dalang*, and the analysis of tuning measurements themselves.

There are several purposes for studying this subject. The first is to ascertain the sources of the three models of tuning in *gender wayang*. These models have been passed down from generation to generation through oral traditions of learning. Here there are two main questions: 1) Why were these models created?; and 2) How were these models developed through the interactions of *dalang*, *tukang laras,* and *pande gong*? The third purpose is to examine the relationship between these models and the *dalang*'s voice. Finally, the fourth is to preserve the various tuning models that have appeared in *gender wayang*–more recently musicians and *dalang* have had a preference for just one model, the *saih* Kayumas.

Many scholars have discussed at length variation in tuning practices in Balinese gamelan music, but we remain with an incomplete understanding of this variation or its sources. For example, Andrew Toth states that "most of the Balinese ensembles have variation in tuning. Therefore, no two gamelans are tuned exactly alike" (Toth 1993: 93). Collin McPhee describes things similarly in Music In Bali, "no two gamelans are tuned exactly alike, and deviation in what is considered to be essentially the same scale can be great, so that one might with reason state that there are as many scales as there are gamelans" (McPhee 1966: 36). Furthermore, Michael Tenzer states that "there is no agreed upon norm that would make all gamelans on the

island compatible with each other.[2] This ensures that each set of instruments has its own characteristic sound and tonal personality" (Tenzer 1998: 31). Indeed, Balinese gamelans demonstrate great variation in tuning. However, this research will make more sense of this variation with respect to the *gender wayang* ensemble. This will be done through an investigation of cultural practices, analysis of tuning measurement, and will include explorations of the conceptions of *angkepan* (octave) and *ngumbang-isep* (wave).

Several recent publications add to this more detailed picture. I Wayan Rai S in his "*Keragaman laras Gong Kebyar di Bali*" (The Various Scales of Gong Kebyar in Bali) reveals that there is variation in tuning in *gong kebyar*: *tirus, memecut, sedeng*, and *begbeg*. He measured several *gong kebyar* ensembles spread throughout Bali. He also used two different approaches to examine the characteristics of each model, specified by pitch and interval range within an octave. Rai helps foster a more complete understanding of variation in *gong kebyar* and his research has inspired me to approach this topic similarly. I will, however, extend the analysis beyond instruments and tuning and include their relationship with the human voice.

My earlier research "*Peranan Ngumbang-isep Dalam Gamelan Bali*" (The Role of *Ngumbang-isep* in the Balinese Gamelan) investigates the tuning concept *ngumbang-isep* in Balinese gamelan. *Ngumbang-isep* has two different meanings. Regarding the first, the research examines the practice of tuning gamelan instruments in pairs, a characteristic unique to Balinese music. In this case, paired instruments are tuned slightly apart from one another producing beating waves called *ombak*. The terms *ombak* and *ngumbang-isep* can be used interchangeably. *Ngumbang* refers to the lower note of the pair and *isep* the higher. These are more formally known as *pengumbang* and *pengisep*. In the paper I measured several gamelans with different

[2]See Andrew Toth (1993) pg. 93, McPhee (1966) p.36, Tenzer (1998)p.31

scales, both *pelog* and *selendro,* and compare the *ombak* of both of them. The result is that the *pelog* scale has faster waves than *selendro*.

Regarding the second definition, *ngumbang-isep* refers to techniques of striking the instruments in order to produce higher or lower volume. *Ngumbang* leads to higher volume and *isep* leads to lower volume. Generally, the term is invoked when referring to the unity of an ensemble's production of these volumes. In Balinese music, *ngumbang-isep* plays an important role in creating the appropriate aesthetic and is thus an integral part of any performance. In the present study I focus on the first meaning of the term. However, I will expand my presentation of the *ngumbang-isep* phenomenon using two different approaches to the practice of tuning *gender wayang* instruments: qualitative and quantitative.

1.6 Chapter Summaries

In chapter 2, I explore the instruments and examine their construction. I divide the exploration of the instruments into several parts: *bilah* (keys), *bumbung* (resonators), and *pelawah* (case). The first two are explored in more detail because they are important in the determination of instrument tuning.

In chapter 3, I analyze the tuning of *gender wayang* from the perspectives of *pande gong* and *tukang laras* with a focus on *ulu suara*, *sruti*, *angkep-angkepan*, and *ombak*. I also use the measurements from chapter 3 in order to investigate differences between theories and actual tuning practices.

In chapter 4, I explore various specialists' perspective regarding the three tuning levels in *gender wayang* instruments. I then juxtapose their perspectives against measurements of the

nines sets of *gender wayang* instruments that I analyzed in chapter 3. I also investigate the relationship between the *dalang*'s voice and the tuning of the instruments.

1.7 Research Method

In Bali, the tuning of gamelan instruments is not based on standard or absolute pitches. Therefore, variation in *laras* (tuning) appears in all types of ensembles, including *gender wayang*. In order to discuss general tuning differences between one ensemble and another, *tukang laras*, *pande gong*, *dalang*, and musicians describe these differences usingspecial terminology. For example, the term *saih gedenan* refers to an ensemble with a lower scale, and *saih cenikan* refers to an ensemble with a higher scale. However, just how high or low the ensemble's relative tuning is cannot be expressed with much precision. This leads *tukang laras*, *pande gong*, *dalang*, and musicians to assess tunings differently. Because this terminology cannot describe the tuning precisely I believe measuring the tuning of instruments is necessary. I have therefore decided to use a combination of methods, both qualitative and quantitative.

The qualitative method addresses aspects of culture that are related to tuning and will focus on tuning practices used by *tukang laras* and *pande gong*. The traditional Balinese tuning method is called *meguru kuping* and it also refers to a conventional tuning pedagogy meaning "learning by hearing." *Meguru* literally means learning and *kuping* means ear. Learning to be a gamelan tuner in Bali is achieved through a process of enculturation in an oral tradition. Each *tukang laras* and *pande gong* undergoes a unique process of learning their craft and this affects their aural sensitivities uniquely. This means that the parameters or "tools" that they use to qualify an ensemble's tuning are also unique. Through interviews with several *tukang laras* and *pande gong* I attempt to hone in on these perceptions. This helps us better understand the process

by which *tukang laras* and *pande gong* achieve a desired tuning, as well as the parameters that govern the way they qualify an ensemble's tuning. Despite their unique aural sensitivities, *pande gong* and *tukang laras* share some terminology.

The quantitative method of this study stresses the scientific method, especially when related to the measurement of tones in an ensemble. To do this I use a microphone and PC computer running two software programs: PC Tuner Program Version 1.3 and Waveform Analysis Version 5.3. These tools are used to obtain precise measurements of frequency in Hertz as well as the note that is closest in the standardized Western scale with A equal to 440 Hz. I make use of western notes occasionally in order to assist readers familiar with Western tuning. Using these measurements I then calculate the intervals between pitches in an ensemble and compare different ensembles.

There are several reasons why I have chosen these two methods. In my opinion, using a combination of methods will produce a more complete representation of *gender wayang* tuning systems. Furthermore, Mantle Hood states that an accurate descriptive method is essential to other scientific methods. He bases this on the assumption that if we are to be accurate in our descriptions we have to also use reasonable and accurate tools. Only then can we have a clear understanding of precisely what we are describing (Hood 1971: 115). His statement has inspired me to do the same in the present study.

Chapter 2: The Gender Wayang Instrument, Construction, and Ensemble

2.1 Introduction

This chapter focuses on the *gender wayang* instrument. This includes the instrument parts, their construction and design, the tuning of the keys and resonators, and sets of these instruments in the form of ensembles. Each of these aspects of *gender wayang* demonstrates that the topic is more complex than has previously been presented. There are many people involved in *gender wayang* construction, tuning, and performance, and different perspectives are common. Furthermore, the *gender wayang* ensemble is an interesting issue because it is tied to the identities of people and regions where *gender wayang* is cultivated and has yet to be given serious attention.

Gender wayang is a unique musical instrument that comes in a variety of shapes and styles, from the very simple to the extraordinarily elaborate. All *gender wayang* cases share certain features like feet (*cengkalak*), supports for the keys (*cagak*), and *kuping gender* (the ears of the *gender*), but some instruments have additional features that are not included in other specimens. This includes carved motifs on the instrument case itself (*pelawah*) or additional supporting frames. The process for constructing these instruments involves many specialists—*pande gong* (metalsmiths), *tukang laras* (gamelan tuners), *tukang pelawah* (carpenters), and *tukang ukir* (craftsmen)—and each completes one of several necessary tasks. This includes forging and tuning the *bilah* (keys), making and tuning the *bumbung* (resonators), or making and carving the *pelawah* (instrument cases). Because several specialists are needed to complete the construction of a *gender wayang* instrument, a complex workflow is generated between them. This is particularly true regarding the involvement of *pande gong* and *tukang laras*. An

understanding of this workflow is necessary in order to explore tuning systems thoroughly, which will be undertaken in chapter three.

Forging and tuning the keys are particularly important aspects of instrument construction in this chapter because they play a role in the generation of *saih* (scale). Both *pande gong* and *tukang laras* have significant roles in the production of *saih* because they tune the instruments. Furthermore, the traditional tuning concepts of *ulu suara* (pitch), *sruti* (interval), *angkep-angkepan* (octave), and *ngumbang-isep* (wave), which will be explored in detail in chapter three, are also dependent on the tuning activities of *pande gong* and *tukang laras*. For this reason, the process of making and tuning the keys and resonators will be explained thoroughly, and the roles of *pande gong* and *tukang laras* in that process clarified.

2.2 Instruments

The *gender* family of instruments consists of metallophones with thin bronze keys suspended over tubular resonators. The keys are freely-suspended by means of cords (*jangat*) that rest on supporting hooks (*cagak*) which protrude from the top of the instrument case (*pelawah*). This keeps the keys elevated above the tubular resonating chambers, which amplify the sound of the instrument. These resonating tubes (*bumbung*) are generally made of bamboo and stand vertically. When the key is struck the air-column in the resonator vibrates and reinforces the sounding key. The keys are struck with mallets that are slender and symmetrical with wooden disc heads and conical horn rattles. Their shape allows players to fit the mallets between the second and third fingers so that keys can be struck and dampened simultaneously with the wrist and fingers using minute rotating motions of the fore arms.

The *gender wayang* instrument consists of three parts: the *pelawah* (case), *bilah* (keys), and *bumbung* (resonators). The *bilah* are made from bronze, the *pelawah* is made from wood, and the *bumbung* are made from bamboo or PVC piping. The keys are suspended from a cord that is anchored on the two posts that make up the ends of the instrument. Traditionally this cording is made from leather, but today it is common to use plastic.

Figure: 2.1 The *Gender Wayang* Instrument

2.2.1 The Pelawah

In Bali, instrument cases are called *pelawah*. Generally, the *pelawah* of *gender wayang* is made from the wood of a Tamarind (*tamarin dusindica*) or Jackfruit (*artocarpus*) tree. These are tropical hardwoods and typically older trees are used. *Gender wayang pelawah* come in three basic styles and the differences lies in which of the following components are included: supports (*adeg-adeg*), base (*dupak*), and crown (*sunduk*). The simplest *gender wayang pelawah* includes only the supports (*adeg-adeg*). The second and most common style today adds a base (*dupak*). The third style adds a crown (*sunduk*).

Figure: 2.2 Three Different Style of *Pelawah*

Adeg-adeg are two wooden supports that stand upright on either side of the *pelawah*. Generally, they have a long rectangular shape and are a bit wider at the top where two short sticks called *kuping gender* (the ears of *gender*) are attached. The *kuping gender* are where the cording that suspends the keys is tied. *Adeg-adeg* often include carvings such as *karang daun* (leaves), *karang sari* (sari), *karang goak* (thunderbirds), *patra china* (Chinese motifs) and *patra mesir* (Egyptian motifs).

Figure 2.3 The types of carving

a. Karang Daun

b. Patra cina

c.Karang Goak

d. Patra mesir

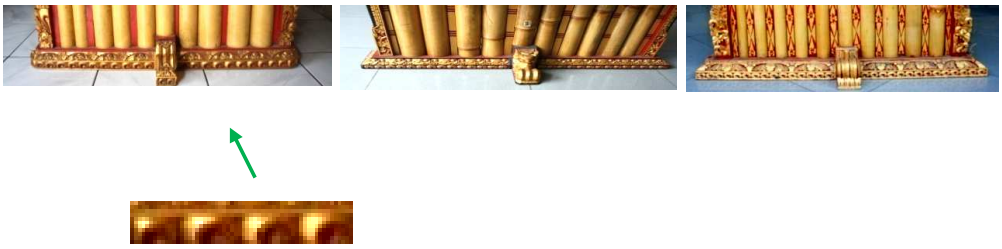
e. Karang sari

There are no requirements for including certain carvings or specific motifs, but there are many that are used more frequently than others. The final outcome or the carvings depends on the imagination of the craftsman himself.

Figure: 2.4 *Adeg-adeg*

Dupak is a wooden base with a trapezoidal shaped. It is positioned at the bottom of the instrument in a horizontal position and functions as a support for the *adeg-adeg* and resonators. There is one hole for each resonator in the *dupak*. In addition to this there are two holes located at both ends where the *adeg-adeg* are inserted. The *dupak* usually includes carvings, especially *patra kakul* (snails) that often line the bottom.

Figure: 2.5 Various *Dupak*



Patra Kakul

Sunduk is positioned horizontally between the *adeg-adeg* at the top of the resonators and just below the keys. Similar to the *dupak*, a number of holes are also made in the *sunduk*. However, unlike the *dupak*, the holes pass all the way through the *sunduk* so that the resonator tubes are not covered. The ends of the *sunduk* are also inserted into the *adeg-adeg*. Unlike the *adeg-adeg* and *dupak*, the *sunduk* is rarely carved. Perhaps, this is because the carvings are often covered by the *cagak*.

Figure: 2.6 *Sunduk*

The *pelawah* is completed with small supporting rods that suspend the keys above the resonators called *cagak* and two feet that prevent the instrument from tipping called *cengkalak*. An instrument usually has eight *cagak* and a pair intersperse every two keys. *Cagak* often have thunderbird carvings, called *karang goak*, and an ornament made from leather that is shaped like a leaf (*karang daun*), called *badong*.

Figure: 2.7 *Cagak* and *Cengkalak*

Finally, the *pelawah* are usually painted. The most common colors are red, black, and gold. When the instruments are not painted they are left the natural color of the wood or stained. This occurs most frequently in *pelawah* that do not have elaborate carvings.

2.2.2 The Keys

In Bali, bronze musical instruments are divided into four categories. The first consists of metallophones with keys (*bilah*); the second includes vertically and horizontally suspended gongs (*pencon)*; the third, bells (*gentorag*); and the fourth, large and small cymbals (*cengceng*). Gender wayang instruments fall into the *bilah* category.

Instruments in the *bilah* category have keys with one of two different shapes, trapezoidal or arched and semicircular. Trapezoidal keys have a shape that is divided into three elongated lines stretching across the length of the key. These keys are referred to as *limas,* meaning trapezoidal. Arched and semicircular keys have a semicircular surface that is arched across its length. The keys are referred to as *belahan penyalin,* meaning semicircular. *Bilah* with a *belahan penyalin* shape are usually thicker and cannot be used on instruments in the lowest registers of Balinese gamelan. *Limas* keys, however, can be used on instruments in all registers. *Gender wayang* use keys of the *limas* type.

Figure: 2.8 The Shape of the keys

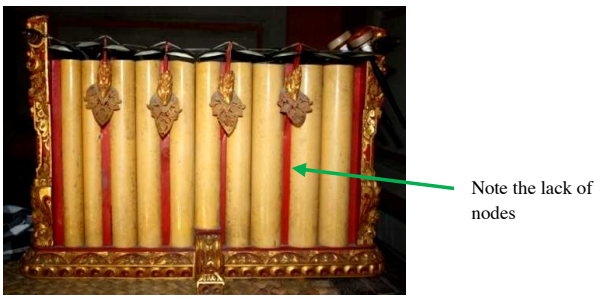
a. Limas *b. Belahan penyalin*

2.2.3 The Resonators

Resonators play an important role in maximizing the volume of the instruments and achieving high sound quality. Resonators function to support the sound produced by the keys by making them louder and clearer. There are two factors that determine the quality of the resonators: the material and the accuracy of their tuning. By way of resonance, when the key is struck the air column in the resonator will also vibrate and this vibration achieves maximum resonance if the tube is tuned accurately to the pitch of the key. The quality of resonance also depends on the walls inside the tube. For example, the outer surface of bamboo is hard while the inner surface is soft. The soft inner wall sustains the note longer than is the case when PVC tubing is used, which has walls that are firm inside and out.

In *gender wayang*, resonators also function as part of the supporting case. One bamboo tube or section of PVC piping is suspended below each key and has a diameter that closely matches the width of the key above. Keys with lower pitch are wider and this means that resonators with lower pitch have larger diameters.

Figure: 2.9 PVC piping



In Bali several different species of bamboo are available. However, there are three kinds that are commonly used for resonators in *gender wayang*. These are *santong*, *tamblang*, and *tutul*. Although these species have different colors and skin texture, they all have the same desired qualities that are often absent in other species. These are congested pores, thin walls, and strong skin. They also grow straight.

Figure: 2.10 Types of Bamboo

a. *Tamblang* b. *Tutul* c. *Santong*

According to I Wayan Pager and I Made Sutama, a *pande gong* in Tihingan village of Klungkung, the three species of bamboo grow in both highland and lowland areas. However, they agreed that bamboo that grows in highlands is better. This is because highland areas have

drier soil where bamboo grows strong and is not easily eaten by termites. The age of the bamboo is also an important consideration, such that older is better. The age can be identified by the inter-nodal segment, which gets longer as the bamboo ages, and by skin color, which is dark green when the bamboo is of the appropriate age. After the desired bamboo is identified it is cut and then dried for three months before being used for resonators.

2.3 *Gender Wayang* Construction

Gender wayang and gamelan construction has often been expressed as a simple problem by scholars of Balinese music, Balinese and non-Balinese alike. The construction process, however, often involves a complex workflow that includes several specialists. However, the workflow is not only complex because of the involvement of many specialists, but also because it is often affected by the interactions between the customer (*pemesan*) and producer (*perajin* gamelan). In fact, the main factors that determine workflow are the customer's level of input in the process, such as requests for special carvings, tuning, and a certain level of quality in the work and materials; and the request's interactions with the producer's own pre-established work process. If a customer requests a certain style of *pelawah* (instrument case), particular *saih* (tuning), or special carvings, and the producer does not have the appropriate specialist on-site, the producer must seek off-site specialists to complete the work. This means that the precise nature of the workflow can take many shapes and be unique to each set of newly constructed instruments.

The construction of *gender wayang* is divided into separate activities. This includes the making of the case (*pelawah*), the forging and tuning of the keys (*penempaan* and *pelarasan bilah*), the tuning of the resonators (*pelarasan bumbung*), the carving of the *pelawah*, and

painting (*prada*). There are at least three different specialists involved in the construction of every instrument, but the process may involve four. These are: *pande gong*, *tukang pelawah*, *tukang ukir*, and occasionally *tukang laras*. When all of the necessary specialists are present at a workshop the whole process can be completed in one location, as long as the customer has not made any requests that require off-site specialists to become involved. For example, I Wayan Pager manages the activities of *pande gong*, *tukang laras*, *tukang pelawah*, and *tukang ukir* in a single workspace and can complete the entire process there. However, as stated before it is often the case that the process is split up between several workshops that specialize in specific tasks. For example, I Wayan Suweca orders the keys from a *pande gong* in Blahbatuh, the *pelawah* and carvings in another location, and then assembles the instruments at this home before performing the activities of a *tukang laras*—his specialty in the *gender wayang* production process.

Regarding tuning specifically, the workflow is more complex when a *tukang laras* is involved. Whether or not a *tukang laras* is involved, the instruments will first be tuned by a *pande gong*. When a *tukang laras* is involved they will check the tuning made by the *pande gong*, change the tuning to one that suits the *tukang laras*'s ear if it is necessary, or create a tuning that suits the request made by the customer.

Tukang laras and *pande gong* are especially relevant to the next chapter, which focuses on tuning systems, and the terms deserve some clarification here. *Tukang* addresses certain professions, as does a related word *juru*, and either of these term scan be used refer to a wide-range of professionals working in different fields. For example, a professional *gender wayang* player may be referred to as *tukang gender* or *juru gender*, and a cleaner, a *tukang sapuh* or *juru sapuh*. The term *pande,* however, is an honorific title reserved for professionals working in metal. *Pande* also refers to an exclusive lineage to which the bearer of the title belongs (see

Tenzer 1998). There are several types of *pande* and they are distinguished from one another by the type of metal they work with. Examples include *pande besi* (expert in working with iron), *pande mas* (expert in making jewelries from gold), and *pande gong* (expert in making bronze musical instruments). The term *pande gong,* more specifically, refers to people that make gamelans made from bronze, although today a more conventional term has emerged for the profession of gamelan maker: *perajin* gamelan. Sometimes *perajin* gamelan are *pande gong*, but often they are not. When this is the case they function like producers of gamelan and go to *pande gong* when they need bronze materials such as *bilah, pencon*, or *ceng-ceng*.

In "Balinese Music" Michael Tenzer writes "the honorific *pande* precedes Gableran's name because as a metalsmith he belongs to the special Pande clan, an exclusive lineage that has been entrusted with the sacred responsibility of casting musical instruments and other important metal object (such as *krisses*) for centuries" (1998: 29). Indeed most of the iron metalsmiths (*pande besi*) come from the *pande* clan. However, not all metalsmiths working in musical instruments, called *pande gong*, come from the *pande* clan. Even *pande* Gableran, a *pande gong*, does not come from the *pande* clan. He comes from the *Arya* clan. Today, *pande gong* may come from any clan, such as I Wayan Widia from Penarungan village, and Dewa Putu Parsana from Binong village in the Mengwi district of Badung.

Both *tukang laras* and *pande gong* have significant roles in the tuning of gamelan. This is because during the process of constructing *gender wayang* the tuning will be finalized by either a *tukang laras* or a *pande gong*. There are, however, several things that differentiate them. *Pande gong* are capable of completing the entire process of making the keys, including *peleburan* (smelting), *penempaan/pembentukan* (forging/shaping), and *pelarasan* (tuning), but *tukang laras* only tune keys. Each *pande gong* also has a *perapen* (furnace) where they heat the bronze and

this means that the location of work must also meet several requirements. *Tukang laras,* however, are not bound by these restrictions. Generally, because of the *perapen, pande gong* work in isolated places with plenty of open space. This is in order to avoid disrupting the surrounding environment and ensures that there is enough air circulation. The smelting activity involves melting material and pouring it into molds. During the melting process the temperature must be very high and it requires sufficient air circulation to prevent the environment from becoming too hot.

2.3.1 Making and Tuning the Keys

Gender wayang keys are made from bronze. In Balinese the term for bronze is *kerawang*. When it is used for musical instruments it consists of approximately three parts copper (Cu) to ten parts tin (Sn). Bronze is commonly used for musical instruments because it has good mechanical properties, is stable at room temperature, has good acoustic properties, and a long sustain (Lisovskii 2007, Hosford 2005, Sugita 2011).

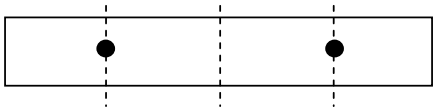
The construction of the keys involves several steps: smelting, forging/shaping, and tuning. The bronze is smelted in order to make the material a liquid. Generally, the ideal temperature that is achieved during this procedure is 1000 ° C. *Pande gong* can recognize this temperature by color of the molten material. When the material is a combination of red and yellow that means the right temperature has been reached. After this the liquid is poured into a mold. Liquid that has congealed is called *laklakan* (prospective keys). According to I Made Sutama, each

prospective key has the same weight (~ 1 kg or 2.2046 lbs.), although the keys of *gender wayang* have different sizes.[3]

During the forging process the material must be preheated. This is in order to avoid cracks in the material. The *laklakan* will be forged and heated several times until it obtains the appropriate shape. At least two to three workers are involved in this process. One of them directs the work while the other two forge the material. Generally, a key can be finished in two to three hours. However, thinner and wider keys need more time than thicker and narrower ones.

After the forging process has been completed, two holes (*gegorok*) are drilled where the cording that suspends the keys will be inserted. The location of the holes is important because the location of the hole affects the key's vibration. There are two different ways to determine the best location. The first one involves measuring the key and dividing it into four equal lengths. Two holes are then drilled one quarter length from both ends of the key. The second is a more advanced technique and requires greater sensitivity and more tuning experience. In this case, without pre-measuring the key the tuner holds it vertically where he predicts the best location of the hole will be. He then strikes the key in order to check if the intended vibration has been achieved. If necessary this process is repeated until the best location has been determined.

Figure: 2.11 The Location of the *Gegorok*



In some cases, the sound of the key will change for a period of time after it is forged. This is because the particles in the bronze continue to shift for some time. The length of time depends

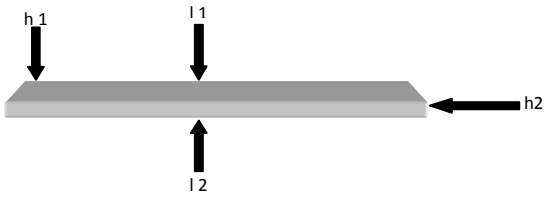
[3]Telephone interview with I Made Sutama, *pande gong* located in Tihingan village, Klungkung, made on June 6, 2013.

on the quality of both the material and forging process. If the material and forging process is good, the length of time is longer. During this period it is common for the keys to get higher in pitch. This phenomenon also occurs after the forging of *pencon* (small gong) instruments. However, the period of time is longer for *pencon* instruments than it is for *bilah* instruments.

Gender wayang ensembles vary in the relative sizes of their keys. This is directly related to the relative pitch-level of the ensemble. Thin and wide keys indicate that an instrument has lower pitch. Keys that are too thin, however, do not result in *munyine seken*—a term used to describe an instrument with a sound quality that is clear and strong. Gamelan makers also avoid making keys that are too thick because the technique that is applied in *gender wayang* playing is compromised when the keys are too thick. This is because it is difficult to generate enough force to excite thicker keys. Thus, the thickness of the key is determined by what produces *munyine seken*.

In Bali, the process of tuning musical instruments is called *melaras*. The term *melaras* is derived from the word "*laras*," which means scale. The prefix "*me*" converts the noun *laras* into a verb. Thus, *melaras* means "to tune the scale." In practice, there are two techniques for making a key higher in pitch, but there is only one to lower the pitch. To make pitches higher the tuner usually grinds away or cuts material from the narrow edges of the key (h 1 and h2 in figure 2.12). To make the pitch lower material is scraped from bottom surface of the middle of the key (l 1 and l 2 in figure 2.11).

Figure: 2.12 Tuning Locations on a Key



2.3.2 Making the Resonators

The manufacturing and tuning of *bumbung* (resonators) is performed by either a *pande gong* or *tukang laras* and many of them have their own ideas about the tuning process and best materials. Traditionally, bamboo has been used for the construction of resonators in most Balinese musical instruments. Gradually, however, PVC piping has been increasingly common and it affects not only the techniques used to tune the resonators but also the instruments overall appearance. Moreover, different opinions exist among *pande gong* and *tukang laras*, especially regarding the quality of resonance that is produced by these materials.

I Wayan Pager, I Made Sutama, I Wayan Suweca, and I MadeTerip all stated that the tuning of resonators is a difficult process. They asserted that a gamelan tuner must have sensitive ears in order to correctly achieve the correct tuning of the keys and resonators. During an interview, I Made Sutama stated "*kadang tiang pepes masih pelih yadiastun tiang sube pang liu bakat entasin. Irage harus dueg metetenger*," which means "I often make mistakes, although I have done it many times before. We should be able to estimate accurately." According to him, if a gamelan maker makes a mistake too often they will lose money because a lot of bamboo is wasted. That is why I Made Sutama usually cuts bamboo for the *pengumbang* instrument first. The *pengumbang* is the lower instrument of the pair and its resonators are longer. A mistake occurs when a resonator is cut too short, which makes the pitch too high. If the resonator is too low it is simply shortened until it is the desired pitch. A resonator, however, cannot be lengthened after it has been cut too short. In this case a new resonator is needed and the process must start again. However, if such a mistake is made on a resonator for the *pengumbang* instrument it can often still be used for the shorter resonators of the *pengisep* instrument.

The following is a detailed description of the process of tuning bamboo resonators compiled from interviews with I Wayan Pager, I Made Sutama, I Wayan Suweca, and I Made Terip. These steps are performed by either a *tukang laras* or *pande gong*. The process for tuning PVC piping is different and will be explained after, as will the merits of using PVC piping. The steps for tuning bamboo are as follows.

1. Drying the bamboo

Bamboo that is fairly old, is the correct diameter, and is also straight, is cut down. Logging is done during an auspicious month on the Balinese calendar system, called *sasih*. The best *sasih* is *sasih kawulu*, which usually occurs in January or February, or *sasih karo,* which usually occurs between August and September. Traditionally, the logger makes an offering before he starts to cut. The offering is made with the intention of asking permission from god to cut down the bamboo. Balinese generally believe that all creatures have souls and this includes bamboo. After the bamboo has been cut it is dried under the sun for three months. Dried bamboo has yellow skin color and the weight is reduced drastically from its weight at the time of cutting.

2. Selecting the diameter the bamboo

The diameter of the bamboo opening should be the same or smaller than the width of the key—but by no more than 5 mm. When bamboo is used it must be turned upside down so that it is at its widest at the top and where it remains open to the vibrations from the key. Bamboo is naturally widest at the base and narrows at it reaches into the sky, and because it is difficult to find bamboo that is wide enough to match the width of the key, the bamboo is always turned upside down.

3. Tuning the bamboo

Traditionally, bamboo is tuned manually using a handsaw. At the beginning the *pande gong* or *tukang laras* pays attention to the nodes of the bamboo. Generally, each piece consists of one node that will become the partition between the resonating end of the tube and the end that will rest on the base. The resonating end of the bamboo is shortened bit by bit and the tone is checked repeatedly. Occasionally, tuners blow or strike the bamboo by stomping it on the ground softly. The process is repeated until the tone of the tube is slightly higher than the key, *pengumbang lambat* (~5-6 Hz). There are two ways to make sure that the tube is in perfect tune and produces maximum resonance. The first involves putting the bamboo in the case and suspending the keys above the tube. The key is then struck softly several times. The best resonance is marked by louder and longer resonance. The second way involves closing and opening the tube while the key is sounding.

The process of tuning PVC piping is a bit simpler than the process of tuning bamboo. This is because PVC piping is available in several sizes, which makes the selection step that is needed for bamboo unnecessary. The steps for tuning PVC piping are as follows. First, piping with diameters that are as near to the width of each of the keys is selected from several available sizes and cut to the height of the instrument. Each tube is then plugged with a wooden disc, generally 2-3 cm thick, which functions like the node of a bamboo resonator. Tuning is accomplished by moving this disc higher or lower in the tube. The disc must fit snugly inside the tube or air will escape and the tube will not resonate properly. The remainder of the process is the same as that for bamboo.

4. *Fitting the resonators*

The final step involves fitting the resonators in the *pelawah* (case). First, a *slepek* is inserted between every two tubes. A *slepek* is a narrow piece of wood that functions to support the *cagak* and make the *pelawah* stronger. Second, holes must then be drilled through all of the resonators and the *slepek* at approximately 5-8 cm from the ends of the top and bottom of the tubes. These holes allow two small wooden rods to be inserted through all of the resonators and *slepek*. These rods are called *sesuluh*. The protruding ends of the *sesuluh* on both sides of the connected resonators and *slepek* and are then inserted into two carved *adeg-adeg* that make up the ends of the instrument case.

PVC vs. Bamboo

Since the 1980s PCV piping has been used for making resonators in almost all Balinese musical instruments including *gender wayang*. *Pande gong* and *tukang laras* have different opinions about the quality of sound created by bamboo and PVC piping. I Made Sutama and I Wayan Suweca do not believe that PCV piping produces the same quality of sound as that is produced by bamboo and revealed several of its weaknesses. First, various diameters are not available to match the width of the keys—an instrument consists of ten keys with different widths and thus ten tubes with different widths are needed. Second, the quality of the walls of the tube means that the sound dissipates faster. This is because PVC piping does not have porous walls, which allow the tube to hold the vibrating air longer. Thus, vibrations that enter the PVC piping will bounce more quickly, which causes the sound to dissipate more quickly, too. I Wayan Beratha, a Balinese music maestro that I apprenticed with, also expressed similar views. When I was studying the process of tuning gamelan with him he often said "*tusing ada luungan teken*

tiing, sawireh ia ngelah sisik anggone nyimpen munyi," which means "there is nothing better than bamboo because it has pores that can hold the sound longer." The third and final criticism that I Wayan Suweca and I Made Sutama made is PVC piping's lack of an interesting appearance. They believe that inconsistencies in the skin complexion of bamboo and resonators with variations in diameter make the instrument more beautiful.

According to I Wayan Pager, a *pande gong* in Blahbatuh, Gianyar, the quality of bamboo is also important.[4] I Wayan Pager, who has a lot of experience as a *pande gong* and gamelan *tuner* and has been making instruments since he was fifteen years old, supports the view that both bamboo and PCV piping can result in the same sound quality. He has used PVC piping in most of the instruments that he has produced in the past two decades and feels that bamboo and PVC piping achieve the same amount of resonance. During an interview he also asserted several advantages of PVC piping. For example, *"pipane lebih praktis bandingang teken tiing, yadiastun ia mael kewala aluh ngalih ne. Lenan teken to, yen nganggo pipa aluhan baan nyetel munyi sawireh iraga cukup ngeserang sumpelne ngalih munyi ane cocok*," which means "piping is more efficient than bamboo, although it is more expensive because it is easier to find," and "PVC piping is easier to tune than bamboo because we can adjust the plug to change the pitch." He also noted that PVC piping is stronger than bamboo and weather resistant.

I would like to share some of my own experiences with resonators of both types. I do not intend to support Pager's statement. I only reveal the fact that I have found some truth in some of his statements. I have had a lot of experience tuning gamelan, not only in Bali, but also in several places in Indonesia and abroad, including the United States (2007), Japan (2006, 2010, 2011), Denmark (2010), and Canada (2013). All of the gamelan that I tuned abroad had problems with

[4]Telephone interview with I Wayan Pager, a gamelan maker from Blahbatuh, Gianyar, on June 7, 2013. His father, Made Gableran was a famous gamelan maker in Bali. I Wayan Pager now owns the company Sidakarya, a major producer of gamelan.

the resonators and almost all of them used bamboo, which had cracked and led to imperfect sound quality. I usually repaired these resonators with tape and glue. Although this not the best solution, it is the best method I have found abroad where bamboo is not available. In 2013 I tuned a gamelan at Montreal University and made the decision to change all of the resonators from bamboo to PVC piping because I did not want the resonators to break again in the future. In Bali the humid climate prevents bamboo from cracking, however, abroad the climate is often drier and causes the bamboo to crack. Although I believe that bamboo is better than PVC piping, it is better to have PVC piping that is intact than cracked bamboo. This means that the climate where the gamelan will reside may also play a part in deciding which material to use for the resonators.

2.4 The *Gender Wayang* Ensemble

A set of *gender wayang* instruments can consist of two instruments with a total pitch gamut spanning two octaves (*angkepan*) or four instruments with a total pitch gamut stretching across three octaves. In the case that there are four instruments the three octaves are split between two pairs of instruments, which only differ in size and pitch level. The two lowest octaves are covered by a larger pair of instruments called *pemade*, while the other pair of instruments, called *barangan,* is one octave higher and a bit smaller. Within each pair the instruments are also tuned slightly different from one another in order to produce beats (*ngumbang-isep)*. When only two instruments are used the ensemble consists of only the two lower *pemade* instruments. This has been customary in Buleleng, North Bali, but is also witnessed in South Bali occasionally. When this is the case in South Bali it is usually because not

enough musicians are available or the *gender wayang* is performed on cremation towers that are carried through the streets and have limited space.

Some scholars focusing on Balinese music have contributed to a representation of *gender wayang* that does not take into account the practices in North Bali. They only state that *gender wayang* is a quartet ensemble. This includes Colin McPhee (1936), Nicholas Grey (2010), and I Wayan Dibia (1993). Perhaps, they have ignored the performance practices of North Bali because their research was primarily carried out in South Bali.

Lisa Gold paints the most complete picture in her 1998 dissertation on *gender wayang*. She states that "Gender wayang is one the smallest ensembles in Bali. It consists of a pair or quartet of ten-keyed metallophones with bamboo resonators which are played with delicate wooden panggul (mallets) with disc-shaped ends, using a complex two-handed technique (1998: 23)" Mashino Ako also contributes to a fairer representation of the ensemble in his article "Competition as a New Context for the Performance of Balinese Gender Wayang" (2009). In his book *Karawitan Bali* (1983) I Wayan Madra Aryasa (a Balinese music scholar) wrote that *gender wayang* consists of one or two pairs of metallophones and each instrument has ten keys with bamboo resonators. He also divides *gender wayang* ensembles into two forms. The first form uses only a pair or quartet of *gender wayang* instruments, and the second form uses additional instruments such as *gong, kendang* (drums), *kajar, klenang* and *tawa-tawa* (small gong), and *ceng-ceng* (cymbals). In this formation the ensemble is called *batel wayang*.

In the region of Buleleng in North Bali it has been customary to use only a single pair of *pemade*. However, today it is increasingly common to find ensembles adding *barangan* instruments. During an interview I was told by I Made Terip, a well-known musician and *tukang laras* from Munduk, Buleleng, that the first time he used *barangan* in his ensemble was at a

wayang kulit performance in 1963. He believes that this is the first time that they were used in Buleleng. He adopted the practice of using two *barangan* in addition two *pemade* for *wayangkulit* performances from southern Bali. At the time, he had hoped that this would increase the music's appeal. He expressed this to me in his statement "*a pang ramean bedik*," which means "in order to make the crowd bigger." However, today he no longer uses the *barangan* because he wants to preserve what he refers to as the Buleleng performance style. During that same interview he revealed to me that he is "committed to preserving the custom of using just the two larger *pemade* at *wayang kulit* performances." He feels this way because he does not want to lose the practices that were handed down to him from his teachers.

In 2005, at the Wayang Kulit Competition at the Bali Arts Festival in Denpasar, South Bali, an ensemble of four instruments—two *pemade* and two *barangan* that had been tuned by I Wayan Konolan in Kayumas, Badung and brought to Buleleng earlier—were played by a group from Tejakula, Buleleng. I Made Terip was involved in preparing the group for the competition and believes that this event was the catalyst to other groups in Buleleng adopting the practice of performing at *wayang kulit* with two *pemade* and two *barangan*. The Wayang Kulit Competition at the Bali Arts Festival 2005 also misrepresented the *gender wayang* tuning practices of most groups in North Bali because the instruments were tuned to *saih Kayumas* and not *saih Buleleng*. Because the group used a quartet ensemble of instruments the performance was not in alignment with I Made Terip's desire to preserve the use of a single pairs of *pemade* in *wayang kulit* performances. He was forced, however, to comply with the criteria that were laid out by the festival committee. This required groups that entered the competition to use a quartet of instruments.

I Made Terip not only wishes to preserve the use of a single pair of *gender wayang* instruments in Buleleng. He also wishes to preserve the use of the *gender wayang* ensemble at *wayang kulit* performances, which he believes has become threatened by the use of other ensembles in its place. He also criticizes *wayang kulit* performances that use other ensembles, such as *semar pagulingan*, *semaradhana*, *gong kebyar*, and *palegongan*. He asserted that *gender wayang* is the spirit of *wayang kulit* performance.

From my perspective, issues of musical identity appear implicitly in I Made Terip's desire to maintain his regional style. In this case, musical identity is not only based on the number of instruments, which he believes represent his regional style, but also the tuning of the instruments. Musicians from Buleleng, such as I Made Terip, believe that using a pair of *pemade* is indicative of Buleleng performance style, but in my experience, Balinese living outside of Buleleng are unaware of this association. Most *pande gong*, *tukang laras*, musicians, and *dalang* that I interviewed do, however, agree that lower *gender wayang* tuning is indicative of a Buleleng tuning style. In chapter three we will explore similar issues in each of the three tuning models, which have come to be associated with different regions of Bali and are often referred to as such: *saih* Buleleng, *saih* Badung, and *saih* Sukawati.

2.5 Conclusion

This chapter has countered presumptions about the simplicity of the *gender wayang* construction process, the parts of the instrument, the tuning methods, and representations of the ensemble. It has shown that each of these facets of *gender wayang* is quite complex. This theme will be even more pronounced in chapter three, where I analyze *gender wayang* tuning systems and show that they are not only influenced by the involvement of musicians, *tukang laras*, *pande*

gong, and *dalang*, but that these people also have different aesthetic tastes, use different terminology to describe the tuning systems, and have different understandings of the way these tuning systems are applied.

Chapter 3: Four Tuning Concepts in Gender Wayang

3.1 Introduction

In this chapter I analyze the tuning of *gender wayang* from two different perspectives, cultural and mathematical. From the cultural perspective I use a qualitative approach to compare terminology used by specialists to describe *gender wayang* tuning. These specialists work in two areas of expertise related to *gender wayang* performance and instrument construction. They are *tukang laras* (gamelan tuners) and *pande gong* (metalsmiths), and they both play an important role in the determination of tuning. Alongside the analysis of specialist's ideas about tuning, I conduct analysis of nine sets of *gender wayang* that I measured using pitch analysis software in order to juxtapose their "theories" with actual tuning practices. This is not intended to be a comprehensive study, as tuning practices in Bali are incredibly varied and the present sample size is not broad enough to be comprehensive or authoritative. Rather, I intend to show that there are sometimes discrepancies between theory and practice, as well as regional tuning styles that are measurable. Furthermore, I hope that these explorations will raise awareness of *gender wayang*'s many and varied tuning possibilities.

In this chapter there are four respondents that inform the study and they represent four different areas of expertise related to *gender wayang* performance and construction. The first two respondents, I Wayan Pager and I Made Sutama, are *pande gong* that produce *gender wayang* instruments. The other two, I Wayan Suweca and I Made Terip, are professional *gender wayang* musicians and *tukang laras* that tune many Balinese musical instruments, including *gender wayang*.

The analysis of tuning focuses on the four Balinese tuning concepts of *ulu suara* (pitch), *sruti* (interval), *angkep-angkepan* (octave), and *ngumbang-isep* (waves). The nine sets of *gender*

wayang instruments that I measured represent Buleleng, Sukawati, and Kayumas regional tuning styles, and three sets of instruments were sampled from each style. Representing *saih* Kayumas are instruments owned by I Wayan Suweca, I Wayan Rai, and ISI Denpasar; representing *saih* Sukawati are instruments owned by Mangku Yasa, I Wayan Moda, and I Wayan Rasta; and representing *saih* Buleleng are instruments owned by I Wayan Wijaya, I Made Terip, and I Ketut Klentit. Although some of these instruments reside in locations that are different from the regional tuning style that they represent, each set has been confirmed by its owner and/or experts to be tuned in the regional tuning style that it represents in this study. The sets owned by I Wayan Suweca, I Wayan Moda, ISI, and I Wayan Rai are located in Denpasar (Southern Bali); the set owned by I Made Terip and I Ketut Klentit are located in Buleleng (Northern Bali); the instruments owned by Mangku Yasa and I Wayan Rasta are located in Sukawati; and I Wayan Wijaya's instruments are located in Tabanan regency (Northwest Bali).

3.2 Brief Information about *Pande gong* and *Tukang laras*

The four specialists that I interviewed are well known and respected in their professions. They were also all immersed in *gender wayang* from an early age and live and work in three regions of Bali where *gender wayang* production and performance is cultivated. The unique experiences of each of these informants have contributed to their individual perspectives about tuning. I chose them because they have knowledge and experience that is related to my research goals. Furthermore, they were accessible to me because I already had relationships with most of them. The exception is I Made Terip who I contacted because of his reputation. The others were all colleagues when I was an undergraduate at the Institute of the Arts (ISI) in Denpasar.

I Wayan Pager was born in Blahbatuh village Gianyar (Center Bali) in 1961. He is the son of the famous *pande gong* I Made Gableran, also well known as Pande Gableran. Pager has been making gamelan with his father since the 1970s, and he is the owner of Sidakarya Company, the biggest gamelan producer in Bali. In addition, Pager is also a *tukang laras*. He has considerable experience tuning gamelan in Bali and has also tuned gamelan throughout Indonesia and abroad.

I Made Sutama is the grandson of the famous *pande gong* and *tukang laras* Pande Tomblos. He was born in Tihingan village of Klungkung (East Bali) in 1959. Today, he is a well known as *pande gong* and *tukang laras*. In the 1960s, when he was in elementary school, he learned to make and tune gamelan with his grandfather, Pak Tomblos. I Made Sutama has a gamelan workshop in Tihingan village—the center of *pande gong* and *tukang laras* activities in Bali.

I Wayan Suweca is a musician, composer, and *tukang laras*. He was born in 1948 in Kayumas village, Denpasar. In 1956 he began to learn *gender wayang* performance with his father, I Wayan Konolan. The late Konalan was an expert *gender wayang* musician and *tukang laras*. With his father, Suweca not only learned how to play music but also how to tune *gender wayang*. Suweca's family is well-known for its expert *gender wayang* musicians and they have recorded several *gender wayang* albums. Suweca was a professor at the National Arts Academy of Indonesia (STSI) in Denpasar and co-founded two gamelan ensembles abroad: Gamelan Sekar Jaya in Berkeley, California and Giri Kedaton in Montreal, Canada.

I Made Terip was born in Munduk village, Buleleng (North Bali), in 1952. He is a musician, composer, and *tukang laras*. He began to study *gender wayang* performance from his father Putu Togog and the famous *dalang* Wayan Sudama in 1958. He is a multitalented gamelan

musician. He is an expert in *gong kebyar*, *rindik*, and *gambang*. He taught Gamelan Sekar Jaya in Berkley, California in 2004 and 2005. He is also the founder of Sanggar Tripitaka (gamelan club) in Munduk, Buleleng.

3.3 Four Traditional Concepts

As I mentioned in chapter one, *saih gender wayang* refers to a five-tone scale that consists of intervals which are roughly the same size. The characteristics of a particular *saih gender wayang* that distinguish it from other *saihgender wayang* depend on differences in *ulu suara* (pitch), *sruti* (interval), *angkep-angkepan* (octave), and *ngumbang-isep* (wave). These are Balinese concepts that are used by *pande gong* and *tukang laras* to refer to various aspects of tuning and they are essential to an understanding of Balinese tuning systems.

In the book *Music in Bali* (1966) the composer and ethnomusicologist Colin McPhee described the great degree of variation that is found in Balinese gamelan:

> No two gamelans are tuned exactly alike, and deviation in what is considered to be essentially the same scale can be great, so that one might with reason state that there are many scales as there are gamelans…Despite their variability in tuning, all Balinese instrumental scales may be considered as belonging to either one or the other of two different tonal systems which in Java are known as *pelog* and *slendro*. (1966: 36-37)

Indeed, almost all Balinese ensembles have variation in tuning and this can be most easily observed in the aspects of tuning that are referred to by the four Balinese concepts that are the subject of this chapter. How the tuning practices to which these four concepts refer are conceptualized is the central focus of each of the following sections, in which I analyze and compare the measurements of the nine instruments I introduced above with the thoughts and ideas of the specialists that I interviewed.

The frequency (Hz) of every pitch in each ensemble was measured and intervals between them were converted into Cents when necessary. In Bali musical pitches are referred to using a system of solmization much like Western *solfège*. In *gender wayang* these syllables are *O E U A I* and they are used in the following formations *d**o**ng*, *d**e**ng*, *d**u**ng*, *d**a**ng*, and *d**i**ng*. The preceding "*d*" in each pitch is often replaced by "*n*" or "*nd*," transforming these solemnizations into *ndong*, *ndeng*, *ndung*, *ndang* and *nding*. In this thesis, however, I only use the symbols *O, E, U, A, I*.

3.3.1 *Ulu suara* (Departure Pitch)

According to I Made Sutama, who is the main respondent that informs this section, *ulu suara* is a pitch that functions as a departure point for determining the other pitches in a *saih*. In *gender wayang* this is usually the fifth note *I* in the lowest octave. *Ulu suara* is much like another concept that I was introduced to by I Wayan Suweca, called *nada dasar* (basic tone). Suweca explained to me that *nada dasar* is also a departure point for determining *saih,* although it is not the tone *I* that plays this role, as is the case in *ulu suara*. *Nada dasar* gives this function to the lowest tone in the *saih, O*. *Nada dasar* will be discussed briefly in the next chapter, but is important to state its similarity to *ulu suara* here. I was unable to gather enough information about *nada dasar* from other respondents and therefore decided it would be too problematic to include it here. For this reason I only focus the discussion of departure pitch on *ulu suara*.

The *ulu suara* functions in much the same way that a tuning fork does in the process of tuning a piano. When tuning a piano a tuning fork tuned to a specific frequency, usually *A 440 (Hz)*, guides the tuner at the beginning of the process. A piano tuned to *A 440* will be in-tune with other pianos that share this determinate frequency, and throughout the entire pitch gamut. In *gender wayang,* however, this is not the case. Two instruments from different ensembles that

share *ulu suara* of exactly the same frequency will likely deviate from one another throughout the rest of the pitch gamut. In the process of establishing the *ulu suara* in *gender wayang, pande gong* and *tukang laras* use a transfer medium called *petuding*. The *petuding* functions as either a master scale, from which copies and modifications are made, or a "blank canvas," which is used to create an entirely new *saih*. In both cases the *saih* is first established and modified in the *petuding* before it is copied to a new set of keys that will eventually be part of a new instrument. *Petuding* are usually made from bamboo, but occasionally a *pande gong* and*tukang laras* will have one, or several, made from bronze.

To establish the *ulu suara*, *pande gong* and *tukang laras* use either a process of duplication, modification, or creation. Duplication and modification are more common than creation. In the case of duplication, the *ulu suara* is copied from an available *gender wayang* instrument or a pre-existing *petuding*. In the case of modification a tone that was duplicated from a *petuding* or an available instrument is altered. Usually, the alteration is one of several predetermined sizes called *pengayun*, *pengumbang lambat*, *pengumbang sedeng*, or *pengumbang bulus*. *Pengayun* refers to an interval of roughly 3-4 Hz and the altered tone would be this distance away from the tone from which it was copied. This distance can be checked by striking the keys simultaneously and listening for beats created by the "out-of-tuneness" of these tones. In this case, the beats would be heard at a rate of approximately 3-4 per second. This is similar to listening for *ombak*, which will be discussed at length in section 3.3.4. *Ombak*, as defined in chapter one, refers to the beats created by striking the same tone in paired *pengumbang* and *pengisep* instruments simultaneously. *Pengayun* is not employed in the tuning of instrument pairs, and it is only used to refer to the distance between non-paired tones. For example, when checking the relative tuning level of different ensembles, comparing the tuning of specific tones

in different ensembles, or, in this case, when altering tones in the generation of *saih*, the distance can be checked by playing the two tones simultaneously and listening for the rate of beats. This informs the *tukang laras* or *pande gong* of their distance from one another.

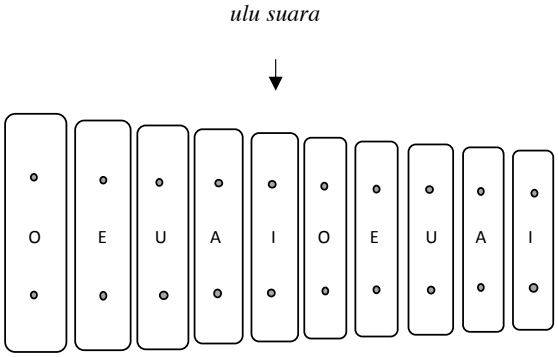
The other three pre-determined sizes do, however, refer to various types of *ombak* and they are used in the tuning of instruments pairs as well as in the process of altering *saih*. *Pengumbang lambat* refers to an *ombak* of roughly 5-6 Hz and the altered tone would be this interval away from the one from which it is copied. In the case of *pengumbang sedeng* the alteration would be roughly 7-8 Hz, and in *pengumbang bulus* roughly 9-10 Hz.

When one of these predetermined sizes is employed, the tone that the *ulu suara* is copied from—whether it be from the *pengumbang* or *pengisep* of an available instrument or from a *petuding*—now serves as a "hypothetical" *pengumbang* or *pengisep* instrument, and the *ulu suara* will be tuned to the opposite of the pair. If the note from which the *ulu suara* is copied is functioning as *pengumbang* then the *ulu suara* will be tuned higher as if it were a *pengisep*. Conversely, if the note from which the *ulu suara* is copied is functioning as *pengisep* the *ulu suara* will be tuned lower as if it were the *pengumbang* of the pair.

When the *ulu suara* is determined through a process of creation the *pande gong* or *tukang laras* create the *ulu suara* independently from other *gender wayang* instruments or *petuding*. This is more challenging than the other processes. In this case, the *pande gong* or *tukang laras* use their own judgment. For example, they might createa new *saih* by singing a melody and experimenting with imagined *saih*. After they have foundone that is desirable the *ulu suara* is then transferred to a bamboo or bronze key. Alternatively, the *pande gong* or *tukang laras* might use a *suling* (bamboo flute) to experiment with new *saih*. In this case, the *pande gong* or *tukang*

laras tune and re-tune a *suling* until a desired *saih* is achieved and then transfer the *ulu suara* to a bamboo or bronze key.

Figure 3.1 *Ulu Suara* in *Gender Wayang*



The following table contains measurements from the nine sets instruments that I introduced earlier. Each set of instrumentsspans a total of three octaves—since the *pemade* and *barangan* overlap by one octave—except for Klentit's, which only consists of a single pair of *pemade*. The measurements are of the *pengumbang* instrument (lower in pitch of the pair). The table is organized with *ulu suara* arranged from lowest to highest and the *ulu suara I* is indicated in yellow. The lowest and highest notes of each instrument are indicated in green in order to display their lack of correlation with the *ulu suara* as the *ulu suara* rise in each successive instrument in the figure.

Table: 3.1 *Ulu Suara* of Nine Ensembles

Tones	Wijaya	Klenzit	Yasa	Terip	Suweca	ISI	Rai	Rasta	Moda
1	1190		1290	1210.5	1290	1292	1285	1297	1311
2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	592	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	289	290	298	303	307	310	311	325.5	326.5
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	161	167.5	169	168.5	171	173	171	183	182

The *ulu suara* in the nine sets of *gender wayang* instruments range from 289 – 326.5 Hz, a variation of 37.5 Hz or 211 Cents. According to these measurements, the frequencies of the lowest notes in the ensembles do not rise in the same sequence as the *ulu suara*. For example, Yasa's *ulu suara* is lower than Terip's, but Yasa's lowest note is higher. The same also occurs in ISI's and Rai's instruments. Furthermore, Suweca's lowest note is the same frequency as Rai's but Rai's *ulu suara* is higher. This implies that the level of *ulu suara* is not independently responsible for the relative tuning level of the instrument, though it does influence it. The relative tuning level is also largely dependent on the structure of the other tones.

3.3.2 *Sruti* (Interval)

"*Sruti yang baik akan menghasilkan saih yang baik pula*."

"Good intervals will result in a good *saih*."

- Common phrase stated by *tukang laras* and *pande gong*

The term *sruti* is derived from Sanskrit and comes from Indian Vedic texts. In Bali it refers to the interval between two notes. The above statement implies that *sruti* has an important role in tuning and I believe that *sruti* is an integral part of a *saih*'s aesthetic appeal. In this section I would like explore how *sruti* function in the tuning of *gender wayang* instruments. I do this by first discussing the terms *begbeg* and *tirus* which inform the processes of generating *sruti* and are used by *pande gong* and *tukanglaras* to describe the qualities of certain *saih*. I then conduct analyses of the nine sets of *gender wayang* instruments by comparing their interval patterns in order to look at the way *begbeg* and *tirus* are implemented in these instruments.

Like *ulu suara*, *sruti* are determined by way of three processes: duplication, modification, and creation. When the *sruti* are duplicated or modified from a *petuding* or available instrument the process is nearly the same as it was for *ulusuara*. However, the *pandegong* or *tukanglaras* can either duplicate or modify the entire pitch gamut of a two or three octave *petuding* or available instrument, or, duplicate or modify only the lowest octave and create the *sruti* in the other octaves. Because octaves are intentionally never exactly double the frequency, this leaves room for creativity and variation in the upper octaves, even if the lower octave was duplicated from a *petuding* or another instrument. Duplication tends to be utilized when instruments are produced in large numbers because it is faster and easier.

When *pande gong* or *tukang laras* create *sruti* they start from the *ulu suara*, or *nada dasar*, and tune the other notes while paying special attention to the intervals. In this case, *pande gong* or *tukang laras* are guided by two fundamental concepts: *begbeg* and *tirus*. In each case, stress is given to the interval size between *E* (*deng*) – *U* (*dung*) and *A* (*dang*) – *I* (*ding*), and as a result they are crucial for determining the interval pattern in a *saih*. *Begbeg* means straight or parallel and leads to an interval pattern of roughly equal sizes between all tones. In this case, the interval between *E* – *U* and *A* – I is not significantly wider or narrower than the other intervals in the *saih*. *Tirus* means stretch and is associated with stretching the interval size between *E* – *U* and *A* – *I* until they are noticeably wider than the intervals between the other tones.

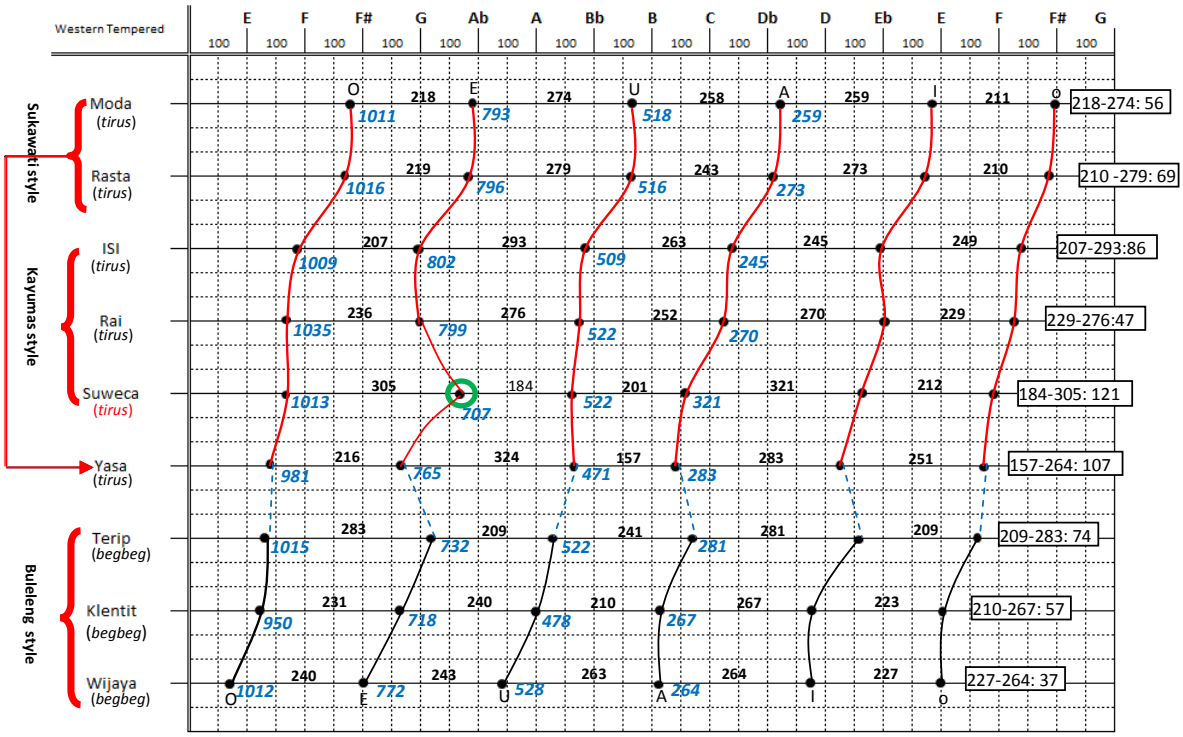
Although all *pande gong* and *tukang laras* are familiar with the concepts *begbeg* and *tirus*, and make reference to them when describing tuning practices, *pande gong* and *tukang laras* often have different understandings of the precise nature of these concepts. For example, there is no standardized interval size between *E* – *U* and *A* – *I* in *begbeg* or *tirus*; rather, the precise size of the interval is chosen by the *pande gong* or *tukang laras*.

In my interviews with *pande gong* and *tukang laras* several comments were made regarding the nature of these terms. I Made Sutama and I Wayan Pager emphasized the *kesan* (impression) that is created by the two different interval patterns. According to them, lower relative tuning levels often use *begbeg* and higher, *tirus*. *Begbeg* often produces the impression of "*begah*" and "*wibawa*" (heavy and prestigious), whereas *tirus* is often associated with "*manis*" and "*halus*" (sweet, soft, and refined). Pager asserted that the impression results from the interval pattern itself. In addition, he stated that two instruments will result in different *kesan* if they are tuned with different interval patterns even if they have *ulu suara* of the same frequency. I Wayan Suweca and I Made Terip suggested that *begbeg* is commonly used in *saih gedenan* (the lower

saih) typical of most *gender wayang* ensembles in Buleleng, North Bali, and *tirus* is commonly used in *saih cenikan* (the higher *saih*), typical of South Bali in places such as Sukawati and Kayumas. Terip asserted that *"sejauh yang saya tahu begbeg lebih banyak digunakan pada gender wayang Buleleng*," which means "As far as I know, *begbeg* is most often used in *gender wayang* in Buleleng." Terip also stated that *gender wayang* with *tirus* interval patterns have been appearing more frequently in Buleleng recently.

In the nine instruments that I analyzed the lowest three are said to be *begbeg* and the highest six are said to be *tirus*. In order to facilitate comparison of interval patterns, the *sruti* in all nine sets of instruments are presented together in the following table, which is organized sequentially based on the lowest pitch of each instrument. The lowest octave is chosen deliberately because the *sruti* are established in the lowest octave before they are generated in the higher octaves. In addition, it is more consistent with the earlier section on *ulu suara* (pitch) where the analysis was based on the lowest octave. The measurements include all notes in the lowest octave and the first note in the medium octave of the *pemade* instrument tuned to the lower of the pair, *pengumbang*. The black dots represent the note positions which are placed sequentially from the left to the right: *O*, *E*, *U*, *A*, *I*, and *o* (medium *dong*) in the next highest octave. The interval value between a note and its neighbor is positioned on the top of the line, while the distance from *ulu suara* (*I*) to the other notes is situated under the line and beside the note name. Western tempered tuning is displayed at the top for reference and is merely there to help readers unfamiliar with Balinese tuning to imagine the tones.

Figure: 3.2 *Sruti*



It is clear from the measurements presented in the figure that some of the instruments have similar interval patterns. Of the six *tirus* style instruments, five of them have similar interval patterns. These are: Moda's, Rasta's, ISI's, Rai's, and Yasa's instruments, which have almost the same interval pattern, marked by the red line in figure 3.2. Suweca's are an anomaly among them and I exclude it in this part of the analysis. The similarities between the other instruments can be identified by the distances between the tones. In these instruments the interval *O – E* ranges from 207-236 Cents, *E – U*: 274-324 Cents, *U – A*: 201-263 Cents, *A – I*: 245-321 Cents, and *I – o*: 210 – 249 Cents. In sequential order, and based on the average of these values from smallest to largest, the intervals are *U – A, O – E, I—o, A – I, E– U*. Across the six

instruments the interval *O – E* has an average size of 233.5 Cents, *E – U*: 271.6 Cents, *U – A*: 223 Cents, *A – I*: 275 Cents, and *I – o*: 227 Cents. This is a total variation of 223 – 275 Cents with a difference of 42 Cents.

The intervals *E – U* and *A – I* are both significantly larger than the other intervals across all five of these instruments. The interval *E – U* is 38.1 Cents larger than the next biggest interval, which is *O – E*. The interval *A – I* is 41.5 Cents larger than this interval. The other three intervals, *O – E, U – A,* and *I – o*, are all within 10.5 Cents of one another. Based on the concept of *tirus,* as it was presented to me by the respondents, these measurements confirm the characterization of *tirus* because *E – U* and *A – I* are indeed significantly larger than the other intervals.

The case with *begbeg* is, however, more interesting. Terip's, Klentit's, and Wijaya's *begbeg* instruments also have similar interval patterns, marked by the black line in figure 3.2. However, they are not what I expected to find. In these instruments *O – E* ranges from 231-283 Cents, *E – U*: 209-243 Cents, *U – A*: 210-263 Cents, *A – I*: 264-281 Cents, and *I – o*: 209-227 Cents. In sequential order, and based on the average value from smallest to largest, these intervals are *E – U* or *I – o*, *U – A*, *O – E*, and *A – I*. In these instruments the interval *O – E* has an average size of 251.3 Cents, *E – U*: 230.6 Cents, *U – A*: 238 Cents, *A – I*: 270 Cents, *I – o*: 219.6 Cents. This is a total variation between 219.6 – 270 Cents and with a difference of 50.4 Cents.

Across all three instruments the interval *A – I* is significantly larger than the other intervals. However, according to my respondents, *begbeg* style interval patterns are said to be characterized by nearly equally sized intervals across all intervals. According to the measurements in figure 3.2, the interval *A – I,* as was the case in the *tirus* instruments, remains

significantly larger than all of the other intervals. It has an average size of 270 Cents. This makes it 18.7 Cents larger than the next largest interval, *A – I*, which itself remains slightly larger than the other intervals though not as pronounced as it was in the *tirus* instruments. While the measurements seem to conflict with the characterizations of the *saih* by my respondents, these instruments should still be categorized as *begbeg*. Although the interval *A – I* is noticeable larger, the other intervals have similar sizes *O – E*, *E – U*, *U – A* and *I – o*. There is a pattern in these tuning practices, and it is measurable, but the pattern I discovered in the measurements does not match the theory that led me to explore it.

The following table displays the average size of the intervals in the nine sets instruments side-by-side. The table is divided into two lines: *tirus* and *begbeg*. The calculation of averages in the top line is made from the interval sizes of the five *tirus* instruments and in the second line the three *begbeg* instruments. In the third line of the table the difference between them is listed.

Table: 3.2 Average Interval Sizes in *Begbeg* and *Tirus*

	O –E	***E – U***	***U – A***	***A – I***	***I – o***
Tirus:	233.5	271.6	223	275	227
Begbeg:	251.3	230.6	238	270	223
Difference:	**17.8**	**41**	**15**	**5**	**4**

The table above displays that there are differences between *begbeg* and *tirus* interval patterns. The table shows the difference between *E – U* is large, while between *A – I* and *I – o* it is negligible. The interval size between *O – E* and *U – A* are moderate. Indeed, the average interval sizes between all of the intervals is consistent with the way *pande gong* and *tukang laras*

conceptualize *begbeg* and *tirus*, apart from *A – I*. According to the responses I gathered, the difference width of interval *A – I* should be large in *tirus* and smaller in *begbeg*. However, there is no significant difference. This reinforces the notion that there is gap between the way tuning systems are conceptualized and actual tuning practices.

The *pande gong* and *tukang laras* that I interviewed stated that *sruti* with *tirus* characteristics have larger intervals between *E – U* and *A – I*. The measurements are consistent with this. However, in the case of *begbeg,* which were characterized as having intervals of roughly the same size, it is not entirely consistent. The interval between *O – E*, *E –U*, and *U – A* are of similar sizes, but the intervals between *A – I* are as large as those in the *tirus* category, which means that are significantly larger that the other intervals in the *begbeg* style. If this is true, then we might expect there to be less variation in interval sizes in *begbeg* instruments than *tirus* instruments. However, when we compare the variation in interval sizes, which is displayed in nine boxes on the right side of figure 3.2, we find that the variation in intervals sizes in *begbeg* instruments is not smaller than it is in *tirus* instruments.

According to this data, we also find an interesting situation among the Kayumas instruments. Because Rai's and Suweca's instruments were both produced by *tukang laras* in Kayumas at Suweca's workshop we might expect them to have similar variation in interval sizes. However, the variation in Suweca's instrument is 121 Cents, while in Rai's it is 47 Cents. This suggests that within Kayumas style tuned instruments, there are different degrees of variation in interval size. Perhaps this results from the fact that Suweca's instruments have a very unique interval pattern that does not conform to the patterns of any of the other instruments that I measured. Suweca said that most of the instruments with Kayumas tuning style have *tirus* interval patterns. Indeed, in two of the instruments that I measured with Kayumas tuning, the

tirus interval pattern is clearly present. However, in Suweca's instruments the situation is more complex. The intervals *O – E* and *A – I* are significantly larger than the other intervals and this does not match with the way *tirus* was characterized by the respondents, including Suweca. This results from an anomaly in the placement of *E*, which is indicated by a green circle in figure 3.2. This is quite unusual and indicates that what Suweca said about the interval pattern of this instrument, that it is *tirus*, is imprecise.

Figure 3.2 also clearly shows a correlation between interval patterns and regional tuning style. This confirms comments that were made by I Wayan Suweca and I Made Terip. During interviews Terip and Suweca both spoke about an association between *tirus* and Kayumas tuning style. Terip, however, went on to say that in addition to Kayumas, the *tirus* interval pattern is also present in Sukawati, and most *gender wayang* instruments tuned in Buleleng style have *begbeg* interval patterns. Terip believes this phenomenon may be related to the voice of *dalang* in Buleleng, which will be explored in chapter four.

The interval pattern present in Terip, Klentit, and Wijaya, which are all tuned to Buleleng style, is unique to the three. Although the *begbeg* interval pattern that I deduced from measurements was inconsistent with what all the respondents said, a clear relationship between the pattern, as it is characterized by the measurements, still exists. The case with Kayumas is a bit more complex. Rai's and ISI's instruments have *tirus* interval patterns, which is indicated by the larger *E – U* and *A – I* intervals, but is difficult to say that Suweca's instruments are *tirus* because the pattern is inconsistent with the other two. This suggests that a correlation may be present here, but the anomaly in Suweca's instrument points to a need for more Kayumas samples to say with any certainty. And finally, in Sukawati the situation seems to be quite clear.

Yasa's, Rasta's, and Moda's instruments all have *tirus* interval patterns, which confirms the comments made by Terip.

In addition to a correlation between the interval patterns and regional style, there is a noticeable correlation between relative tuning level and regional style in figure 3.2. The instruments can be grouped according to tuning level, with the exception of Yasa's, whose instrument is much lower than the other Sukawati instruments. Based on the lowest tones, the lowest three instruments are Buleleng style, the two highest are Sukawati style, and the three below that are Kayumas style. This suggests that a correlation does indeed exist, but it is too complex of an issue to explore here. I merely wish to point it out now, but withhold a detailed discussion of this aspect *gender wayang* tuning until the next chapter, in section 4.3.1.

3.3.3 *Angkep-angkepan* (Octave)

The term *angkep-angkepan* is derived from the term *angkep*, which literally means "double or multiply." In daily life the term refers to the activity of folding something, but in the context of tuning, *angkep* is associated with the repetition of octaves. In this case the tuning of octaves by *pande gong* and *tukang laras* might be understood abstractly as "multiplying" tones. This "multiplication," however, is not a simple doubling as is often the case in other musical systems. In Balinese tuning systems octaves are not achieved by merely doubling or halving a frequency. They are conceptualized in two ways that indicate that octaves are slightly more or less than double the frequency. *Pande gong* and *tukang laras* refer to them with the following terms: *nyerod* (slide down) and *ngelanting* (hang up). The term *ngepas* (perfect) refers to octaves that are exactly double the frequency, but in practice this is practically a theoretical possibility or nearly impossible "ideal."

As I asserted in the definition of terms in chapter one, *nyerod* is one octave higher than a tone, but slightly lower in pitch than double the frequency. For example, one octave higher than a note tuned to 220 Hz would be 440 Hz, but in the case of *nyerod* an octave higher would be slightly lower than 440 Hz. *Ngelanting* is the opposite of *nyerod*, meaning it is slightly higher than double the frequency. *Ngepas* is exactly double the frequency, but as I stated before, it is merely a theoretical term and is rarely, if ever, utilized in practice.

In this section I explore how octaves are created in *gender wayang* instruments. First, I explore the three terms introduced above, which helps to demonstrate how *pande gong* and *tukang laras* conceptualize octaves in *gender wayang*. Second, using the measurements I made of nine sets of instruments, I analyze and compare the *angkep-angkepan* in order to illustrate the amount of variation that exists in the tuning of octaves and its nature.

The process of tuning octaves depends on the preliminary process of establishing the *sruti*. If the *sruti* were duplicated or modified using all of the tones in a *petuding* or available instrument, the *pande gong* or *tukang laras* only need to check the octaves to ensure that they are indeed satisfying. In this case they will adjust them only if it is necessary. However, if only the lowest octave was duplicated or modified, or if the *sruti* in the lowest octave were created from scratch, the *pande gong* or *tukanglaras* must then set to work creating the tones in the higher octaves. It is necessary to stress that the notes in the lower octave are never simply duplicated in the octaves above by way of doubling the frequencies.

Pande gong or *tukang laras* have their own methods for tuning octaves. In my interviews with *pande gong* and *tukang laras* they did not reveal clearly why octaves are not exactly double the frequency, though the term *ngepas* suggests that they understood that doubling the frequency is some kind of "ideal." Their inability to clearly articulate the reason for this phenomenon

further sparked my curiosity about tuning issues in *gender wayang*. Regarding octaves, they mostly spoke of the challenging process involved in creating them. *Pande gong* or *tukang laras* only rely on the sensitivity of their ears and describe the process of tuning in this way using the concept of *metetenger*, a term meaning to estimate accurately.

Angkep-angkepan are strongly related to *sruti*. In an interview with I Made Sutama, he said that *sruti* influence the tuning of *angkep-angkepan*. According to him, instruments with a *begbeg* interval pattern tend to produce octaves of the *nyerod* type. When the instruments have a *tirus* interval pattern then they tend to result in octaves of the *ngelanting* type. Sutama did not refer to the octave of *ngepas*, perhaps because they are never used. He also stated that *pande gong* and *tukang laras* deliberately make octaves a bit higher or lower in order to create a certain impression. Here he referred to the concept of *ngungkulin*, which means domination. *Ngungkulin* is also often associated with instruments that produce a unique impression. In this context the impression created is one where the instrument dominates other instruments. However, the impression of domination that I Made Sutama referred to in octaves is difficult to identify.

Regarding *nyerod* and *ngelanting*'s association with *sruti,* I Wayan Pager has the same opinions as I Made Sutama. In an interview with him he stated that instruments with octaves of the *nyerod* type often have *begbeg* interval patterns, and instruments with octaves of the *ngelanting* type often have *tirus* interval patterns. Although the tones are higher or lower than double the frequency, the distance from this "ideal" is restricted. If the frequency is too far from this ideal, it is called "*sing ngangkep*," which means "not an octave."

In *Gamelan Gong Kebyar: The Art of Twentieth-Century Balinese Music*, Michael Tenzer writes that

> The intervals between adjacent tones are slightly different in each register because the multiplicative increase in frequency from octave to octave must be reconciled with the

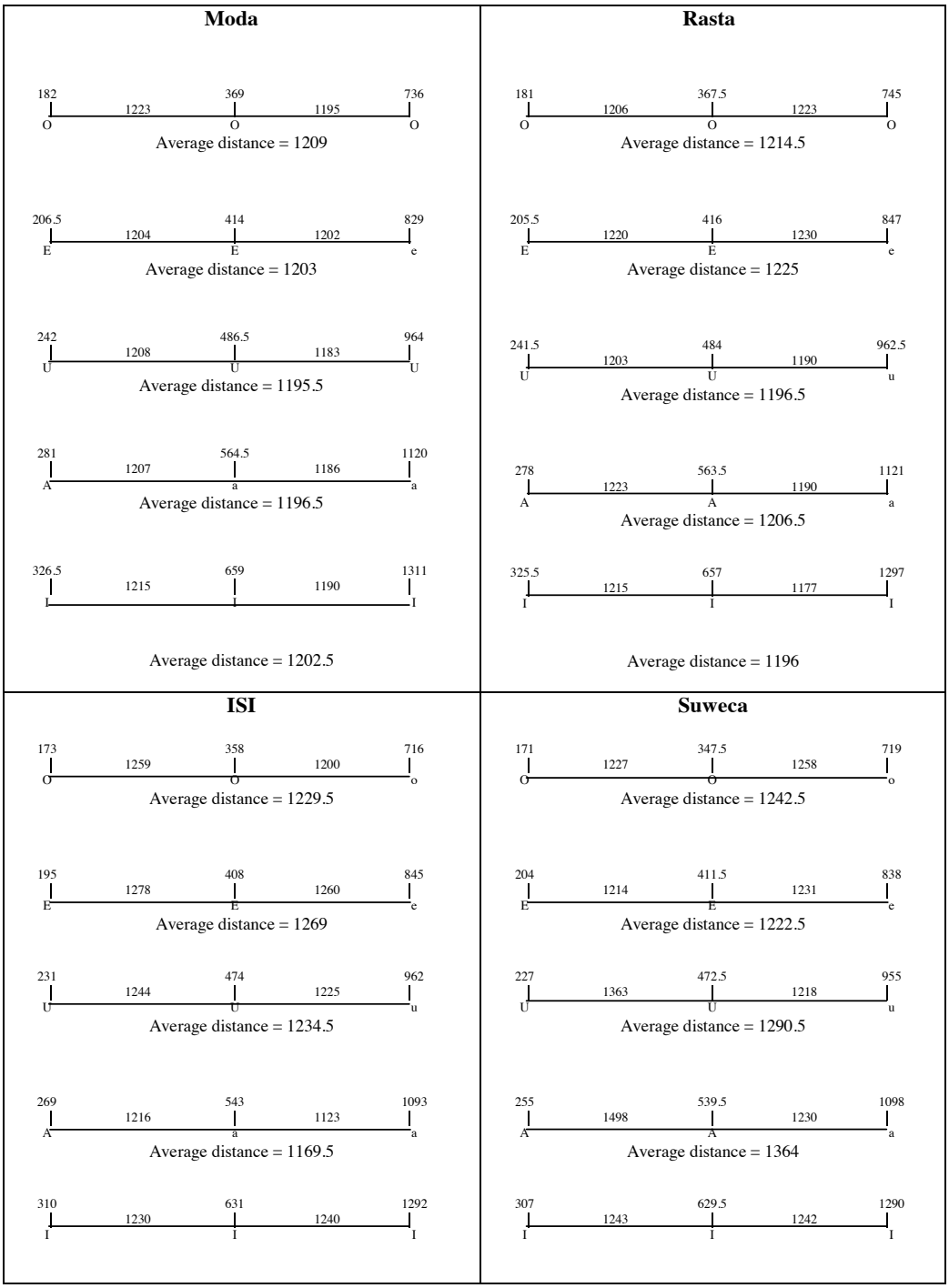
> uniform difference in Hz between *pengumbang /pengisep* pairs on which the *penyorog* depends. To achieve this, gamelan tuners work outward from the central octave (*petuding*), slightly altering the size of the octave relationship between register…. Broadly speaking, if *pengumbang* octaves are tuned exactly 2:1 throughout the entire gamut, the *pengisep* octave must shrink progressively as they rise. Or if the *pengisep* octaves are tuned exactly, *pengumbang* octaves stretch as they rise. But these arrangements are hypothetical. (2000: 32)

Michael Tenzer paints a clear and logical picture of the issues present in the tuning of octaves. Further, it may even explain why octaves are never tuned to exactly double or half of a frequency. *Pande gong* and *tukang laras*, however, have their own understandings of this issue and do not refer to the logic of scientific explanations. Rather, *nyerod*, *ngepas* and *ngelanting* guide them duringthe tuning of octaves.

To understand how these concepts are used in practice, I have analyzed the octaves in the nine sets of*gender wayang* instruments. In the following figure I present only the measurements of the *pengumbang* instruments in the ensemble because *pande gong* and *tukang laras* usually use only a *pengumbang* or a *pengisep* in the process of creating them and not both. I have also chosen the *pengumbang* instrument because it is consistent with the measurements presented in the sections above.

Figure 3.3 displays the distance between the octaves of each tone as well as the average distance between them. This is done in all three octaves of the nine sets instruments, except for Klentit's (3.3), because his ensemble only consists of two.

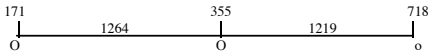
Figure 3.3 *Angkep-angkepan* in Nine Instruments



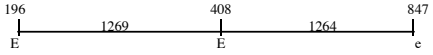
Average distance = 1235

Average distance = 1242.5

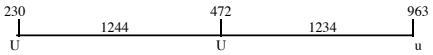
Rai



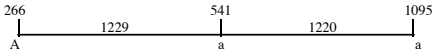
Average distance = 1241.5



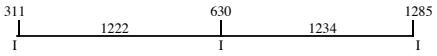
Average distance = 1266.5



Average distance = 1239.5

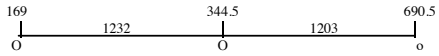


Average distance = 1196

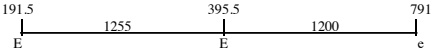


Average distance = 1228

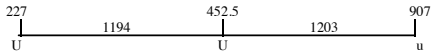
Yasa



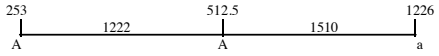
Average distance = 1217.5



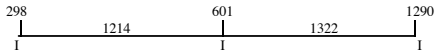
Average distance = 1227.5



Average distance = 1198.5

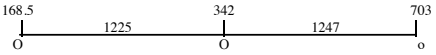


Average distance = 1366

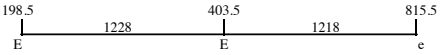


Average distance = 1268

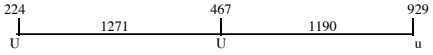
Terip



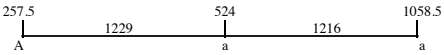
Average distance = 1236



Average distance = 1223



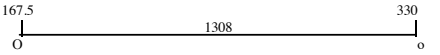
Average distance = 1230.5



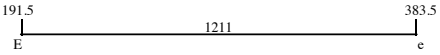
Average distance = 1222.5

Average distance = 1198

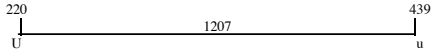
Klentit



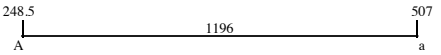
Average distance = 1308



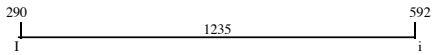
Average distance = 1211



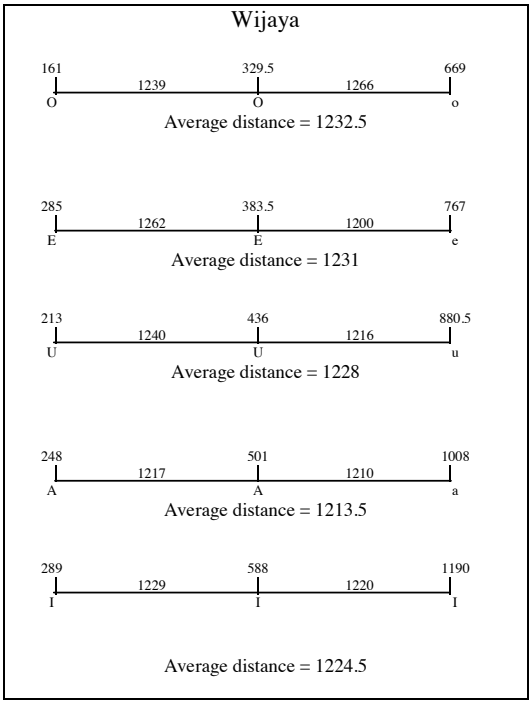
Average distance = 1207



Average distance = 1196



Average distance = 1235



Using the above figure we can investigate the octaves with the terms *nyerod*, *ngepas*, and *ngelanting*. Sometimes, an instrument may exhibit qualities of two or even all three concepts. Rai's and Suweca's instruments only exhibit qualities of one.

Using the data in the figure we can deduce that Moda's octaves range from 1183-1223 Cents with a difference in range of 40 Cents; Rasta: 1177-1230 Cents with a difference in range of 53 Cents; ISI: 1123-1278 Cents with a difference in range of 155 Cents; Suweca: 1214-1498 Cents with a difference in range of 284 Cents; Rai: 1219-1269 with a difference in range of 50 Cents; Yasa:1194-1510 Cents with a difference in range of 316 Cents; Terip: 1177-1271 Cents with a difference in range of 94 Cents; Klentit: 1196-1308 Cents with a difference in range of 112 Cents; and Wijaya: 1200-1266 Cents with a difference in range of 66 Cents.

All of the instruments have variation in octaves. Moda's has higher and lower different values. For example, the *O* (*dong*) of the lowest octave is 1223 Cents from the *O* below and the

O in the highest octave is 1195 Cents higher from this one. This means that the *O* in Moda's instrument makes use of two concepts: the lowest *O* is *ngelanting* and the highest one is *nyerod*. The same cases also arise in the other tones—*U*, *A*, and *I*—while in both the lowest and highest octaves *E* is *ngelanting* and nearly *ngepas*. Therefore, all of the lowest octaves of Moda's instrument have *ngelanting* octaves and four of five in the highest octave have *nyerod*.

Ngepas and *ngelanting* are used in two instruments. In the ISI instruments all of the tones in the lowest octave and four of the five tones in the highest octave have *ngelanting*, and the *O* in the highest octave has *ngepas*. The same case occurs in Yasa's instrument, but the *ngepas* lies in *E* of the highest octave. Suweca's, Rai's, and Wijaya's instruments have *ngelanting* in all tones. In addition, all tones in the highest octave of Terip's instruments have *ngelanting*, however, two tones in the highest octave (*U* and *I*) have *nyerod*, while *O*, *E*, and *A* have *ngelanting*. Klentit's instrument only consists of the lowest two octaves and four of the five notes (*O*, *E*, *U*, and *I*) have *ngelanting* while *A* has *nyerod*.

Considering all of the octaves in all of the nine sets of *gender wayang* instruments, it is clear that *nyerod* and *ngelanting* are the most prevalent. *Ngepas* is only present in a few. *Pande gong* and *tukang laras* sometimes apply these concepts intentionally in the process of tuning. And, as was stated before, this is sometimes done with the intention of creating certain impressions, which likely explains some of the variation. No correlation between octaves and the regional tuning styles *saih* Buleleng, *saih* Kayumas, and *saih* Sukawati is present in the measurements, nor did the respondents suggest that there would be.

3.3.4 *Ombak* (Wave)

Most Balinese musical instruments are tuned in pairs. This is done in order to produce beats caused by slight variations in tuning between instrument pairs, which is a phenomenon called *ombak*. The lower of the pair, called *pengumbang*, is slightly lower in pitch than the upper one, which is called *pengisep*. The speed of the resulting beats depends on the difference in pitch between the *pengumbang* and *pengisep* instruments. A larger interval between the pairs results in faster beats. For example, a difference of 6 Hz will produce six beats per second, and 10 Hz will produce 10 beats per second.

Across all Balinese gamelan the *ombak* ranges from approximately 5 to10 Hz and is divided into these three types. In my earlier research, "Peranan Ngumbang-isep Dalam Gamelan Bali" (The Role of Ngumbang-isep in Balinese Gamelan), I discuss and measure *ombak* in several Gong Kebyar, Semar Pagulingan, Gender Wayang, and Angklung Klentangan ensembles. In the course of conducting that research I found that in the tuning of *pengumbang* and *pengisep* pairs there are three terms that are used to refer to the speed of *ombak* and, indirectly, the distance between the instrument pairs that is required to achieve these speeds. These three terms were already mentioned in the discussion of *ulu suara* above. They are *pengumbang lambat*, *pengumbang sedeng*, and *pengumbang bulus*. *Pengumbang lambat* is roughly 5-6 Hz, *pengumbang sedeng* is roughly 7-8 Hz, and *pengumbang bulus* is roughly 9-10Hz. *Pengumbang lambat* is used in Angklung Klentangan and Gender Wayang; *pengumbang sedeng* is used in Semar Pagulingan and Gong Kebyar; and *pengumbang bulus* is used in only Gong Kebyar. This research, however, had limited scope and only focused on instruments in South Bali: Gianyar, Denpasar, and Badung regencies. Therefore, it resulted in a limited picture of *ombak* in *gender wayang* instruments, which also exist outside of South Bali.

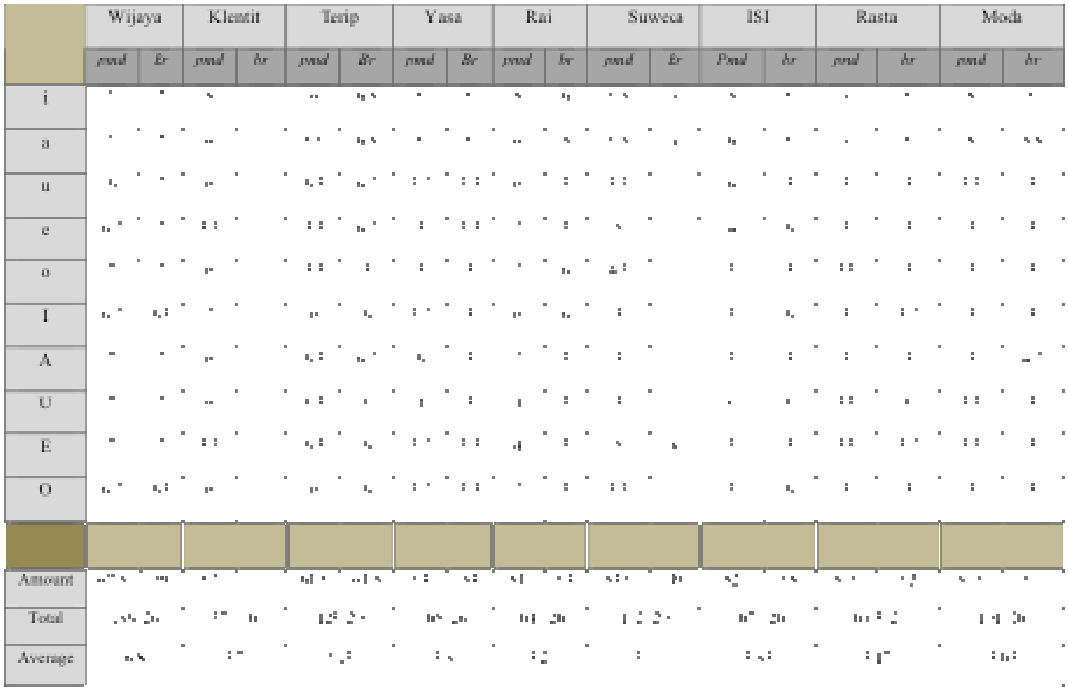
During the present study, I found a *gender wayang* instrument owned by I Wayan Wijaya that has an *ombak* of 7 Hz. If I compare this value with the categories as I described them in my previous research, this instrument would be categorized as *pengumbang sedeng*. However, in the present study I cannot force the application of these earlier categories. In the present study two of three *gender wayang* instruments that are from Buleleng are faster than *pengumbang lambat* (table 3.3)—Wijaya's and Terip's. I confronted I Wayan Suweca and I Made Sutama about this phenomenon and they suggested that *gender wayang* instruments that have *ombak* speeds faster than *pengumbang lambat* are tuned in this way deliberately because the instruments are only used for instrumental music. This would support the characteristics of instrumental music, which is more dynamic, especially because these pieces tend to have faster tempi. Although these views are unconventional, perhaps they can help us make sense of Wijaya's faster *ombak*. Taking these recent discoveries into consideration, I must revise my earlier proposition and now update it. Because *gender wayang* instrument pairs are tuned roughly 5 to 7 Hz apart from one another in my current sample pool, I believe the *pengumbang lambat* category should be stretched to incorporate them.

While faster *ombak* may be related to instrumental repertoire, as Suweca and Sutama suggested, slower *ombak* tunings in *gender wayang* may be connected to the *dalang*'s voice. This is because the *dalang* uses a vocal technique that also produces waves, called *gregel*. *Gregel* is a timbre that is produced through movements in the throat. The speed of *gregel* is usually slow and leads to a fusion in timbres between the *gender wayang* ensemble's slower *ombak* and the *dalang*'s voice. I Wayan Pager asserted that "*munyin dalang kal megulung-gulung ajak munyin gamelane*," which means "The *dalang*'s voice rolls with the sound of the

[*gender wayang*] gamelan." The relationship between the *dalang*'s voice and the tuning of *gender wayang* will be explored in more detail in the next chapter.

The following table displays measurements of the difference in tuning between *pengumbang* and *pengisep* instrument pairs in the nine sets *gender wayang* instruments that I measured. Below each instrument the average *ombak* is listed. Measurements of the *pemade* (*Pmd*) and *barangan* (*Br*) are listed, except in the case of Klentit's because his ensemble does not have a higher pair of *barangan*.

Table: 3.3*Ombak* in Nine Instruments



	Wijaya		Klentit		Terip		Yasa		Rai		Suweca		ISI		Rasta		Moda	
	pmd	*Br*	*pmd*	*br*	*pmd*	*Br*	*pmd*	*Br*	*pmd*	*br*	*pmd*	*Br*	*Pmd*	*br*	*pmd*	*br*	*pmd*	*br*
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Amount																		
Total																		
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The table shows that there is variation in *ombak* in the nine sets of instruments. It also shows that the difference in *ombak* ranges from 4-7 Hz, with the average difference ranging between 5.1—6.8 Hz. I Wayan Suweca's instrument has the slowest *ombak* and I Wayan Wijaya has the fastest. Wijaya's instrument is also the most consistent across all tones ranging between

just 6.5 Hz and 7 Hz. This suggests that Wijaya instruments are tuned precisely and the unusually fast speed of the *ombak* is not the result of the instrument pairs having gone out of tune. Yasa's instrument has considerable variation in *ombak,* ranging from 4, 5, 5.5 and 6 Hz, suggesting that the instruments may be in need of re-tuning.

Six of the nine sets of *gender wayang* instruments fit into my earlier *pengumbang lambat* category and all of them come from Kayumas and Sukawati (South Bali). One of the three sets of instruments from Buleleng (North Bali), Wijaya's, would have been put into the *pengumbang sedeng* category. Terip's instruments are also a bit fast for my earlier characterization of *pengumbang lambat*. I propose that *gender wayang* instruments with lower relative tuning levels tend to use faster *ombak* than those with higher relative tuning levels.

The measurements in the figure make it clear that *gender wayang* do not have perfect *ombak* in all note pairs. Perfect *ombak* is an ideal that is difficult or impossible to achieve. This means that some amount of variation is acceptable. However, if the instruments have considerable differences in *ombak* across the entire pitch gamut it will affect the quality of the overall sound. I Wayan Beratha said, "*care nganggon gamelan duang barung*," which means "It is like using two ensembles." His statement implies that unity in *ombak* can make an ensemble sound like two ensembles. Unity in *ombak* is one of the aesthetic requirements of Balinese music and musicians often express this with the words "*munyin gamelane ngatih*," which means "the sound of the gamelan is integration." If the *ombak* is too varied it will lead to a lack of unity. The sound of instruments will be "*bero*" (false) and this will jeopardize the instruments ability to support a successful performance.

3.4 Conclusion

The four traditional concepts of tuning are integral to understanding tuning practices in Balinese tuning systems. Each of these concepts is implemented by way of several other additional concepts. For example, there are three possible concepts within the process of forming *ulu suara*: duplication, modification, and creation; in *sruti*, two: *begbeg* and *tirus*; in *angkep-angkepan*, three: *nyerod*, *ngepas*, and *ngelanting*; and in *ombak*, two: *pengumbang lambat* and *pengumbang sedeng*.

Chapter 4: Tuning Perspectives and the *Dalang*'s Voice

4.1 Introduction

This chapter has two foci. First, I present the perspectives of *pande gong*, *tukang laras*, *juru gender*, and *dalang* regarding *gender wayang* tuning levels and in several cases juxtapose these against measurements of the nine instruments that I analyzed in the previous chapter. Second, I explore the connection between *dalang* voices and *gender wayang* instrument tuning. Before embarking on these studies I would first like to share some of the challenges that I met as I dug deeper into these topics.

Making sense of the divergent perspectives I encountered during research was a difficult task. Perspectives often conflicted with one another and/or the measurements I had made, and this meant that synthesizing a coherent discussion would be incredibly challenging. The more I investigated issues in *gender wayang* tuning and the more I tried to make sense of these perspectives, the more challenging the topic became. I soon felt like I was lost in a dense jungle. Making my way through the data that I had collected during fieldwork was like wandering through dense vegetation. I did not know how to make sense of it at first, but this was necessary in order to build a path out of the brush. Although this analogy might sound excessive, it is true. I found tuning issues in *gender wayang* increasingly complicated, and much more so than I had expected them to be when I decided to conduct research on this topic.

At first I thought that the tuning problem would only be solved by comparing the different perspectives and collecting as much information related to tuning in *gender wayang* as possible. However, the challenge was not so easily overcome. Eventually I submitted to the complexity and I decided to expose it through qualitative and quantitative methods. They support one another and illuminate the diversity of tuning practices in *gender wayang* as well as the

diversity in perspectives that underlay them. This has allowed me to accept the complexity instead making an attempt to synthesize a single coherent tuning system. If my earlier analogy about being lost in the jungle still holds true, then this is tantamount to remaining in the jungle instead of trying to escape from it.

The combination of both qualitative and quantitative approaches allows me to understand and represent the many ideas that I confronted while exploring tuning in *gender wayang*. Each respondent has their own ideas about tuning levels in *gender wayang*, but they all organize the tuning of *gender wayang* into three levels. The different ideas center around the use of different terminology that they use to refer to the levels. Sometimes the names of the three levels come from abstract concepts, rather than from identifiable characteristics of certain *saih* like *begbeg*, *tirus*, *nyerod*, *ngepas*, and *ngelanting*. And at other times, the terms connect the *saih* with regional styles, as is the case in the terms *saih* Buleleng, *saih* Kayumas, and *saih* Sukawati, which were mentioned in the previous chapter. In this case the terms result from common usage of certain *saih* in certain regions. The abundance of terminology and its sometimes contradictory usage has led me to juxtapose these perspectives against measurements of the nine sets of the *gender wayang* instruments that I analyzed in the previous chapter. The hope is that this will help make sense of the variation in tuning levels in a quantifiable and concrete way.

4.2 Brief Information about Musicians and *Dalang*

Before presenting the perspectives on tuning levels, it is necessary to introduce the people behind them. These are additions to the specialists that I introduced in the previous chapter, who will also make appearances in this chapter. The additions are two *juru gender* and three *dalang*.

I Ketut Sukayana is a professional *gender wayang* musician. He was born in Sukawati village in 1973. When he was seven years old he started to play *gender wayang* with his father, the late I Ketut Loceng, a well-known *gender wayang* musician. In 1997 Sukayana graduated from STSI (The School of the Arts) Denpasar, today called ISI (The Institute of Arts Indonesia). Sukayana has accompanied several famous *dalang* at *wayang kulit* performances, including *dalang*s I Made Ganjreng and Ketut Juanda. He has performed not only in Bali and throughout Indonesia, but also in the Czech Republic, Japan, Singapore, and the United States.

I Made Subandi is a Balinese composer and musician. He was born in 1966 and began to study *gender wayang* with his father when he was ten years old. He has a lot of experience teaching in Bali and abroad. He currently teaches at SMKI 3 Sukawati (Vocational High School), formally known as KOKAR (Conservatory of Music). As a composer he has created many instrumental works, including pieces for *wayang kulit*, as well as works that accompany dance.

I Wayan Narta is a professional *dalang* from Sukawati. He was born in Sukawati, Gianyar in 1942. He began to study *dalang*, *gender wayang*, and puppet carving in 1950. Narta is not only well known around Sukawati but also in neighboring villages throughout Gianyar regency. He is currently a teacher in the Department of Shadow Puppetry at ISI Denpasar. His students come from Sukawati, neighboring villages, as well as abroad.

Dewa Ketut Wicaksana was born in Batununggul village on the island of Nusa Penida, which is part of Klungkung regency, in 1963. He is currently a faculty member in Performing Arts at ISI Denpasar. He began to study as a *dalang* in 1986 through formal education at ASTI (today called ISI) as well as with I Nyoman Purwa, a *dalang* from Lembongan village on Nusa Penida. He graduated from ISI Denpasar in 1989 and in 1997 began postgraduate studies at Gajah Mada University.

I Ketut Nuada was born in Tumbak Bayuh village in Badung regency (Southwest Bali) in 1971. He began studying as an Arja dancer in 1990 and as a *dalang* in 1992. In 2008 began to study as a *dalang* in the Department of Shadow Puppetry at ISI Denpasar where he completed his bachelor's degree in 2013. Nuada is also well known in Bali as the *dalang* Joblar.

4.3 Instrument Tuning Perspectives

The tuning levels are expressed by *pande gong*, *tukang laras*, musicians, and *dalang* in contrasting ways. This is not only discernible in the terms themselves, but also in the descriptions of these terms. In this section I explore the different perspective about the tuning levels in *gender wayang* instruments by comparing the views of *pande gong* (metalsmith), *tukang laras* (gamelan tuner), *juru gender* (gender wayang musicians), and *dalang* (puppeteer). I also support the comparisons with measurements of the nine sets of *gender wayang* instruments, which offer an alternative understanding of these issues.

As I have already mentioned, there are different perspectives on the tuning levels in *gender wayang* instruments. However, I would like to begin by sharing my own experience of these as a student, in order to show how these terms and understanding spread. When I was studying as an undergraduate at STSI (The School of Arts) in Denpasar in 1992-1997 I took a course on "*spesialisasi karawitan gender wayang*" (specialization of music in *gender wayang*). In the course I learned *gender wayang* performance with I Wayan Suweca. We were not only taught how to play the instrument, but also about the *gender wayang* instrument itself. Suweca also explained that there were three tuning levels in *gender wayang*. According to him, the information came from his father, the great *gender wayang* master performer and *tukang laras* I Wayan Konolan. Suweca told us that the tuning levels were called *Pudak Setegal,* which refers

to the tree *Pandanus Park*, *Sekar Kemoning* (the flower *Murraya Paniculata)*, and *Asep Menyan* (the pleasant smelling burnt tree sap *Benzoin*).

After that I thought that the tuning levels in *gender wayang* were simple like the way Suweca explained them. I had no reason to think otherwise. I felt this way because Suweca did not explain that there are differences in the three levels. He only referred to several regions that were connected with each level tuning. For example, we were told that *Asep Menyan* is mostly used in Sukawati, *Sekar Kemoning* in Kayumas, and *Pudak Setegal* in Buleleng. He also said that *Pudak Setegal* refers to the lowest of the three tuning levels, *Sekar Kemoning* is the medium, and the highest is Asep Menyan. This is story is not intended to suggest that Suweca made a mistake, but rather that the diffusion of theories about Balinese music in the institution are problematic.

When I decided to investigate issues in *gender wayang* tuning I contacted Suweca and asked him for more information on the tuning levels. During the interview he said that *Pudak Setegal* is also commonly referred to as *saih gedenan*. *Gedenan* means bigger, and refers to the lower tuning level. Suweca also said that it is commonly used in Buleleng, in villages such as Munduk, Sukasada, Tejakula, and Ngelekungkang. Regarding the second tuning level, *Sekar Kemoning*, he described this model with term "*sedeng*," meaning medium. He said this is a moderate tuning that is appropriate for *dalang* with medium vocal ranges and also appropriate for instrumental music performances. He stated that most of Balinese musicians and *dalang* in Kayumas (South Bali) and around Denpasar prefer this model. He also said that some musicians and *dalang* in Sukawati (Southeast Bali) prefer it, too. Regarding *Asep Menyan,* the highest tuning, he said that it is used by musicians in the villages of Sukawati and Tunjuk. He also asserted that his gamelan, which I measured and presented in the previous chapter, is tuned to the *Sekar Kemonig* model.

According to Suweca, the difference between the three tuning levels is determined by the distance between one tone and another, which he calls *akaka*—a note above or below another note in a *saih*. He also stressed that the lowest note in a *saih* functions as a point of departure for the other notes in the *saih*, as was discussed briefly in the previous chapter. He calls this note *nada dasar* (the basic note) because according to him all of the intervals in a *saih* are established with primary consideration of their relationship with the lowest note. In addition, Suweca stated that the lowest tuning, *Pudak Setegal*, is the departure point for the medium and high tuning levels. Thus, the level of tuning from the lowest level to the medium is one tone, and to the highest it is one more. The following figure illustrates Suweca's view.[5]

Figure: 4.1 Suweca's *Akaka* Perspective

Asep Menyan	:	O E U A I o e u a i
Sekar Kemoning	:	O E U A I o e u a i
Pudak Setegal	:	O E U A I O e u a i

According to Suweca, the second note of *Pudak Setegal* becomes the first note of *Sekar Kemoning* and the third note of *Pudak Setegal* becomes the first note of *Asep Menyan*. This means that *Sekar Kemoning* has higher "*akaka*" than *Pudak Setegal* and *Asep Menyun* has higher "*akaka*" than *Sekar Kemoning*. It is important to stress that although *Sekar Kemoning* is one level higher than *Pudak Setegal* and its lowest note is the same as the second note in *Pudak Setegal*, the other notes are not the same as those in *Pudak Setegal*. The same is also true in *Asep Menyan*.

Musicians in the village of Sukawati also refer to three tuning levels in *gender wayang*, but the terms that are used to refer to them are a bit different from Suweca's. Of the three presented by Suweca, they only use the terms *Pudak Setegal* and *Sekar Kemoning*. The tuning

[5] Telephone interview with I Wayan Suweca June 18, 2013.

levels that they refer to, however, are swapped. I Ketut Sukayana stated that musicians in Sukawati refer to the lowest level as *Sekar Kemoning* and the medium as *Pudak Setegal*. He said that the highest is referred to as *Sekar Sandat*, which was not mentioned by Suweca at all. This indicates that musicians in Kayumas and Sukawati use different terminology to refer to the tuning levels.

In addition to variations in terminology between different villages, there are different understandings of the tuning levels within villages. In Sukawati, I would like to compare Sukayana's statements about the tuning levels with those of his father, the late I Wayan Loceng, which are presented in Lisa Gold's chapter in *Balinese Music in Context* called "Musical Expressions in the Wayang Repertoire: A Bridge between Narrative and Ritual":

> Loceng speaks of three types of *gender* tunings, classified according to timbre and pitch: "*Sekar Kemoning*", the lowest tuning, is not appropriate for night performances according to Loceng; "*Pudak Setegal*", a medium tuning is described by Loceng as "*terlalu manis*" (too sweet), while "*Sekar Sandat*", the highest in range, "has more of a pure sound during the night" ("*lebih mulus suaranya kalau malam*"). Loceng explains that the last name refers to the night blooming *sandat* flowers which is more fragrant at night. (1992: 247)

Loceng's statement is similar with Sukayana's regarding the terms of the three tuning levels, but he also links tuning to performance with the statements about *Pudak Setegal* being "terlalu manis" (too sweet) and *Sekar Sandat* having "*lebih mulus suaranya kalau malam*" (a more pure sound during the night). Sukayana does not agree with his father's view as it is presented by Lisa Gold. In my interview with Sukayana, he stated that he does not agree with this characterization and that he does not connect the characteristics of tuning with aspects of performance. In fact, he said "*menurut saya deskripsi itu terlalu abstrak*," which means "In my opinion, this description is too abstract." He suspects the terms are only related to the vocal range of *dalang* and believes that the *dalang* chooses the tuning that is appropriate with his/her voice.

This idea refers to the commonly held belief that the tuning of *gender wayang* instruments is related to the vocal range of *dalang*, which will be discussed later in this chapter.

Furthermore, Sukayana also said that the difference between the three tuning levels lies in their first notes. Like Suweca, Sukayana stresses that the tuning of *gender wayang* is based on the lowest tone, Suweca's *nada dasar* (see chapter 3). However, he calls it *nada pokok*, meaning basic tone. Sukayana also agrees with Suweca's idea that the relative level of the *saih* can be recognized by the lowest note on the instruments. He asserted that the lowest note is like a point of departure to the next note of the scale.

In an interview with I Made Terip he also mentioned that there were three relative tuning levels, but he used entirely different terms from Suweca and Sukayana. They are *Segara Wera, Nyinom*, and *Pangkur*. *Segara Wera* refers to the lowest tuning, *Nyinom*, the medium, and *Pangkur*, the highest. He said that these terms are used by some musicians in Buleleng, but unfortunately he did not say which musicians these are. In addition to these terms Terip also mentioned other terms that associate the tuning levels with regional tuning styles. These are *saih* Buleleng, the lowest, *saih* Badung, medium, and *saih* Sukawati, the highest. According to him, each of these *saih* have their own style that can be recognized by both tuning level and interval structure (*sruti*).

I Wayan Pager also connected the tuning levels and intervals with regional tuning styles, but went even further to suggest that other aspects of the tuning are also specific to certain regions. In an interview he asserted that the three tuning levels, as they are referred to by *pande gong,* are the same as those stated by Terip: *saih* Buleleng, *saih* Badung, and *saih* Sukawati. Furthermore, in addition to tuning level and interval these regional tuning styles also rely on octaves and the presence of each tuning level in a specific area. He said that a *saih* that is

customarily used in a certain region adopts certain traits of that region and this becomes "*seperti identitas*," meaning it is like an identity. According to him, the strength of the identity depends on the quantity of similarly tuned instruments in a specific region.

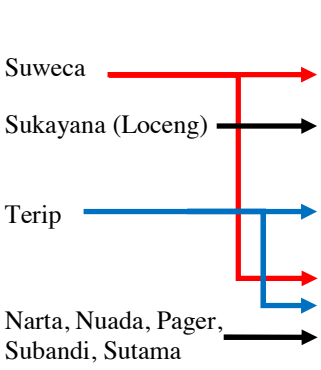
In contrast with Suweca's statements, Pager also reveals that the three tuning levels are not only related to the level of the lowest tone but also the *sruti* in the *saih*. A scale that has narrow intervals will create the impression of lower tuning without actually being tuned lower. He also said that the differences between the lowest, medium, and highest tuning levels cannot be based on the concept of "*akaka*" because, in practice, the difference between the tuning of the lowest tones in each tuning level is smaller than the distance between the tones of a *saih*. Pager offers a contrasting perspective. He estimates that the difference is usually between *pengayun* and *pengumbang bulus*, which means a difference of only 3-10 Hz. Furthermore, he said that the difference between *saih* Badung and *saih* Sukawati is negligible because they have almost the same frequency in the lowest note. In next section I investigate both Suweca's and Pager's claims with measurements of instruments.

I Made Sutama, I Wayan Narta, I Made Subandi, and I Ketut Nuada use regional terms that are consistent with Pager's to refer to the three tuning levels. Although they use the regional terms to refer to the tuning levels, they also acknowledge the existence of some of the other terms, such as *Pudak Setegal*, *Sekar Kemoning*, and *Asep Menyan/ Sekar Sandat*. Subandi said "*saya pernah mendengar istilah itu tetapi saya tidak mendalaminya*" (Indonesian), which means "I have heard those terms before but I have not explored them deeply." Indeed, Subandi reveals that those terms are unclear to him. He suspects that the terms may have been created by scholars who desire to describe tuning issues more easily, especially for academic purposes.

Sutama, although consistent with Pager on the above points, emphasizes that the three tuning levels are dependent on *sruti* and not the lowest tone. For example, he said that "*dong ane di gede mesliaban, kewala srutine ane melenan*," which means "the first note '*dong*' of the three models have almost the same frequency, but the others notes have variation in frequency." Sutama did not state clearly what the nature of this variation is, but this suggests that the tuning levels result from impression created by the *sruti* rather than actual changes in the relative tuning level.

If we consider all of the views of the respondents there are four versions of terminology used to refer to tuning levels in *gender wayang*. Although the terms are not consistent, they all refer to one of three tuning levels that are agreed upon: low, medium, and high. The following figure displays them in one place in order to facilitate comparison.

Figure: 4.2 Different Terms of Tuning



Low	Medium	High
Pudak Setegal	Sekar Kemoning	Asep Menyan
Sekar Kemoning	Pudak Setegal	Sekar Sandat
Segara Wera	Nyinom	Pangkur
Saih Buleleng	Saih Kayumas Badung	Saih Sukawati

The figure above clearly displays the different perspectives in terms that refer to tuning levels in *gender wayang* instruments. Suweca, Sukayana, and Terip have their own ideas, however, all of them (except Sukayana) also refer to the different tuning levels associated using the regional terms *saih* Buleleng, *saih* Kayumas (*saih* Badung), and *saih* Sukawati. This includes

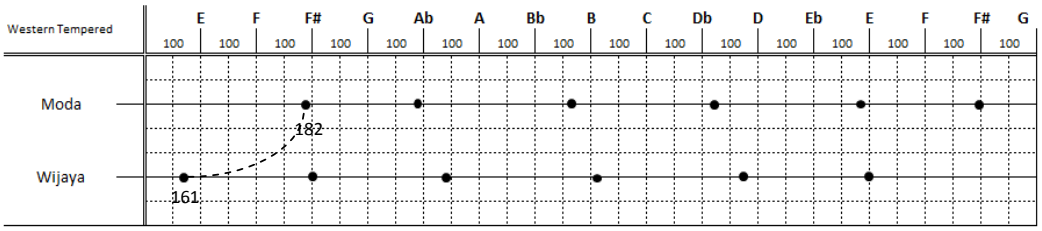
Narta, Nuada, Pager, Subandi, and Sutama. This suggests that the terms related to regional tuning styles in *gender wayang* are more widely used than the others.

4.3.1 Instrument Tuning Perspectives and Measurements

In this section, I investigate the perspectives of I Wayan Suweca and I Wayan Pager regarding the three tuning levels of *gender wayang* instruments. I juxtapose their perspectives against the measurements of the nine sets of instruments that I analyzed in chapter 3. The examination is not intended to discern whose view is correct, but rather to investigate differences in theory and practice.

In chapter three I mentioned that Suweca described the difference between the three tuning levels using the concept of *akaka*. *Akaka* refers to an interval that is one note above or below a given note in a *saih*. However, the measurements of the nine sets of *gender wayang* instruments suggest that this is not possible. Figure 4.3 displays the highest and lowest instruments that I measured and by comparing these tuning levels we can conclude that none of sets of instruments are far enough apart to be accurately made sense of using the concept of *akaka*.

Figure : 4.3 Tuning Level Comparison of Wijaya's and Moda's Instruments



In the figure above, the distance between the lowest tone of Wijaya's instruments (the lowest instruments that I measured that use *saih* Buleleng) and the lowest note of Moda's

instruments (the highest instrument that I measured using *saih* Sukawati) is 212 Cents. The position of the second tone of Wijaya's instrument is close to the first tone of the Moda's instrument, which would make describing their difference with *akaka* accurate. However, even here, between the lowest and highest sets of instruments the interval is not wide enough. Furthermore, Wijaya's instruments are *saih* Buleleng and *Moda's* instruments are *saih* Sukawati. Suweca, however, said that the difference between *saih* Buleleng and *saih* Sukawati would be two notes. If this were the case in these instruments, Wijaya's *U* would need to be roughly the same as Moda's *O*. However, in this case Moda's *O* is close to Wijaya's *E*. Obviously the difference between the other sets of instruments are even harder to make sense of using the concept of *akaka*.

Perhaps if we were to measure more instruments we would find two sets with relative tuning levels that are wide enough to fit Suweca's understanding of the three tuning levels. However, among the nine instruments that I measured, which I believe are sufficiently representative of variation in *gender wayang* tuning, we have yet to find such a case.

Furthermore, Pager asserted that judging the difference between tuning levels using the concept of *akaka* is not possible. During an interview he stated that "*Tiang tusing taen ningehang gender wayang ane selisih ne kanti Akaka*," which means "I have never heard that the difference between tuning levels in *gender wayang* is '*akaka*'." Pager believes that we can know that this is impossible just from considering the *dalang*'s voice. According to him, *dalang* do not have wide enough vocal ranges to be able to match the tuning of the instruments if the levels were dependent on *akaka*. They would simply be too high or low in the highest and lowest tuning levels.

Pager explained that he believes the difference between the three tuning levels most likely ranges from *pengayun* to *pengumbang bulus*. As stated in chapter 3, and according to my earlier research, *pengayun* refers to a difference of 3-4 Hz and *pengumbang bulus* refers to a difference of 9-10 Hz. However, not all of the distances between the three tuning levels match Pager's estimations. The difference is a bit wider than he suggests and fits between the range spanned by the theoretical intervals of *pengayun* and *pengumbang bulus*.

The following figure compares the relative tuning levels of all nine sets of *gender wayang* instruments that I measured. The comparison is based on the lowest tones, which are used to measure the distances between each *saih*. The distances between them are displayed in Hertz on lines extending from the lowest note of each instrument to the lowest note of other instruments. The blue line refers to those that fit Pager's estimates and the red lines refer to those that do not fit.

Figure: 4.4 Tuning Level Comparison: Wijaya's and *saih* Kayumas Instruments

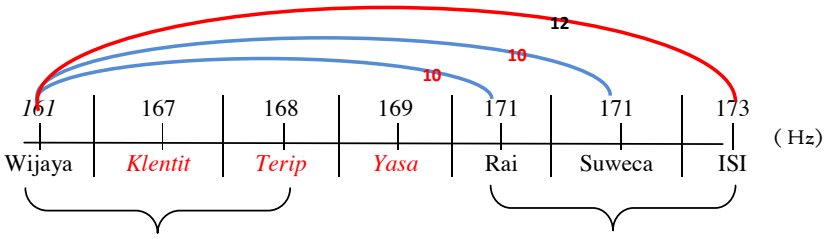


Figure 4.4 displays the differences between Wijaya's instruments (*saih* Buleleng) and the instruments tuned to *saih* Kayumas. The distance from Wijaya to Rai and Suweca, whose lowest notes share the same frequency, is 10 Hz or *pengumbang bulus*. The distance from Wijaya to ISI

is 12 Hz, or *pengejer*. This means two of the three distances fit with Pager's estimate. The distance between Wijaya and ISI is wider than *pengubang bulus*. This means it does not fit Pager's estimate.

Figure: 4.5 Tuning Level Comparison: Klentit's and *saih* Kayumas Instruments

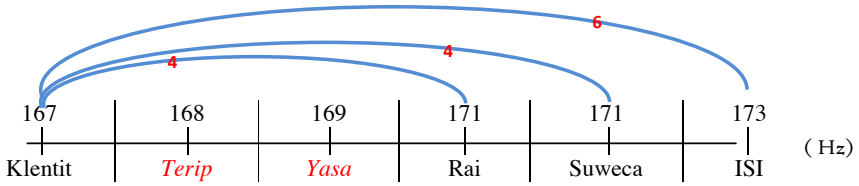


Figure 4.5 displays the differences between Klentit's instruments (*saih* Buleleng) and the instruments tuned to *saih* Kayumas. The distance from Klentit to Rai and Suweca is 4 Hz or *pengayun*. The distance from Klentit to ISI is 6 Hz, or *pengumbang lambat*. This means that all three fit Pager's estimate.

Figure 4.6 Tuning Level Comparison: Terip's and *saih* Kayumas Instruments

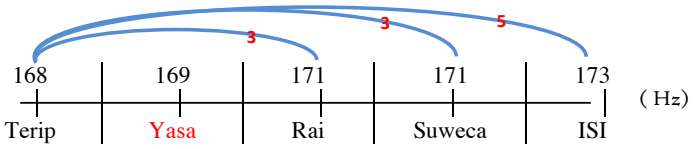


Figure 4.6 displays the differences between Terip's instruments (*saih* Buleleng) and the instruments tuned to *saih* Kayumas. The distance from Terip to Rai and Suweca, whose lowest notes share the same frequency, is 3 Hz or *pengayun*. The distance from Terip to ISI is 5 Hz, or *pengumbang sedeng*. This means that all three distances fit Pager's estimate.

Figure 4.7 The Different Intervals between Instruments within *saih* Buleleng

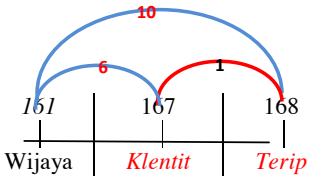
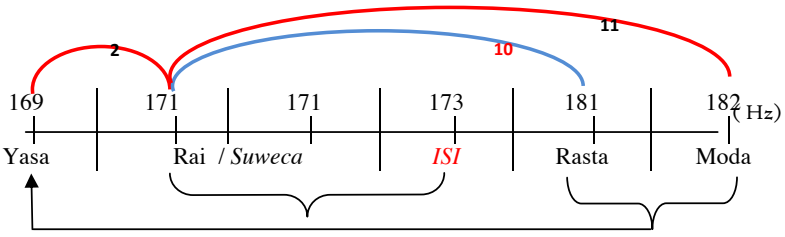


Figure 4.7 displays the differences between instruments within *saih* Buleleng. We find that even within the instruments tuned to *saih* Buleleng two of the distances are wide enough to fit Pager's estimate. From Wijaya to Terip the distance is 10 Hz, or *pengumbang bulus*, and from Wijaya to Klentit the distance is 6 Hz, or *pengumbang lambat*. The difference between Klentit and Terip is 1 Hz, or *angieng* (the slowest type of *ombak*), which means it does not fit Pager's estimate.

Pager's estimate that the differences between *saih* Buleleng and *saih* Kayumas is *pengayun* to *pengumbang bulus* accurately describes most of the differences between tuning levels in the instruments that I measured. This means that the difference between *saih* Buleleng and *saih* Kayumas is primarily between 3 Hz–10 Hz, or *pengayun* to *pengumbang bulus*. If we were to stretch this range from 3 Hz–12 Hz all would fit.

Figure 4.8 Tuning Level Comparison: Rai's and Suweca' and *saih* Sukawati Instruments



Saih Kayumas *Saih* Sukawati

Figure 4.8 displays the differences between Rai's and Suweca's instruments (*saih* Kayumas) and the instruments tuned to *saih* Sukawati. The distance from Rai and Suweca, whose lowest notes share the same frequency, and Rasta is 10 Hz, or *pengumbang bulus*. The distance from Rai's or Suweca's to Moda's is 11 Hz, or *pengejer*. This means that two of the three distances fit Pager's estimate. The distance from Rai and Suweca to ISI is wider than *pengubang bulus*.

Figure 4.9 Tuning Level Comparison: ISI's and *saih* Sukawati Instruments

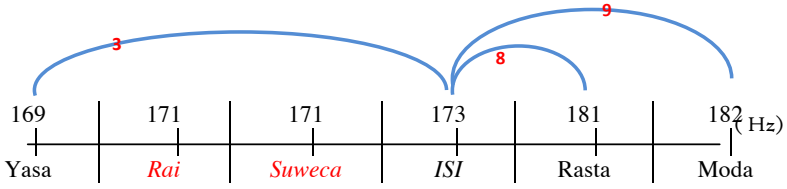


Figure 4.9 displays the differences between ISI's instruments (*saih* Kayumas) and the instruments tuned to *saih* Sukawati. The distance from ISI's and Rasta is 8 Hz or *pengumbang bulus*. The distance from ISI's to Moda's is 9 Hz, or *pengejer*. The distance from ISI's to Yasa's is 3 Hz, or *pengayun*. This means all of the three distances fit Pager's estimate.

Figure 4.10 The Different Intervals between Instruments within *sai*h Kayumas

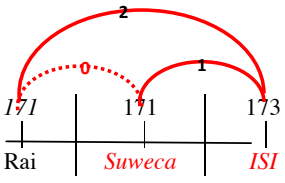


Figure 4.10 displays the differences between instruments within *saih* Kayumas. We find that within *saih* Kayumas there are no the distances that are wide enough to fit Pager's estimate. From Rai to ISI the distance is 2 Hz, or *angieng*, and from Suweca to ISI the distance is 1 Hz, or *angieng* (the slowest type of *ombak*). This means that the Kayumas style instruments are tuned relatively close together.

Pager's estimate that the differences between *saih* Kayumas and *saih* Sukawati is *pengayun* to *pengumbang bulus* accurately describes most of the differences between tuning levels in the instruments that I measured. However, it must be widened slightly to encompass all of the tuning levels, apart for Yasa's, which is an anomaly in the data. This means that the difference between *saih* Kayumas and *saih* Sukawati is primarily between 2 Hz–10 Hz, or *pengayun* to *pengumbang bulus*.

Figure 4.11 The Different Intervals between Instruments within *sai*h Sukawati

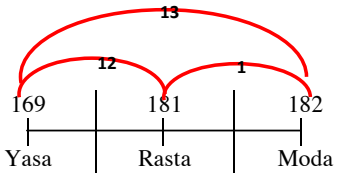


Figure 4.11displays the differences between instruments within *saih* Sukawati. We find that within *saih* Sukawati two of the three distances are too wide to fit Pager's estimate. From Yasa to Moda the distance is 13 Hz, or *pengejer*, and from Yasa to Rasta the distance is 12 Hz, or *pengejer*. The difference between Rasta and Moda is 1 Hz, or *angieng* (the slowest type of *ombak*), which is too narrow to fit Pager's estimate. This means that there a lot of variation in tuning levels between instruments tuned to *saih* Sukawati.

The figures above displayed the differences between *saih* Buleleng and *saih* Kayumas is a bit wider that Pager's estimate. This means that the difference between *saih* Kayumas and *saih* Sukawati is between the range of 2 Hz–12 Hz, or *agieng* to *pengajer*.

As we can see from the analysis above, I Wayan Pager's estimate is roughly correct. Based on the measurements that I analyzed in figure 4.3, the difference between *saih* Buleleng and *saih* Kayumas ranges between 3-12 Hz and the difference between *saih* Kayumas ranges between 2 Hz and 12 Hz. This means that the difference between tuning levels is roughly between *ageing* and *pengejer*. However, *pengumbang bulus* is most dominant.

I conclude that Balinese tuning terminology dominates the way of *pande gong* and *tukang laras* than theorize tuning levels. However, there are several contradictions between individual perspectives. This suggests that the conceptualization of tuning levels can be unique to individuals and independent from actual tuning practices.

4.4 Perspectives on the Relationship between *Dalang* and *Gender Wayang* Tuning

In Balinese *wayang kulit* performance the tuning system of *gender wayang* and the vocal range of *dalang* have a close relationship. This is because the *dalang*'s voice and the instruments should complement each other in both pitch and timbre. To achieve this, the *dalang* must either adapt their voice to the tuning of the ensemble that is present at the site of the performance, or bring an ensemble that they have used before. In the latter case, the selection of an appropriate tuning helps the *dalang* cover the widest range of vocal techniques possible, including traditional chants, melodic metered poetry, vocal timbres, and traditional songs. In performance contexts without vocals the relative tuning level of the instruments is a less important consideration.

In the following three sections I discuss the relationship between *dalang* and the tuning of *gender wayang* instruments. The discussion has three foci: first, the relationship between the *dalang*'s voice and the tuning of the instruments; second, how a *dalang* adapts to the tuning of the instruments; and third, how *dalang* participate in the determination of *gender wayang* tuning. Regarding the first, I compare the perspectives of four *dalang* concerning the relationship between voice and instrument. I also incorporate the perspectives of several scholars that have written on the subject. Regarding the second, I explore different approaches that *dalang* use in order to successfully adapt to the tuning of instruments during a performance. And finally, in the third, I explore the role that *dalang* have in the determination of tuning through stories that were told to me by I Wayan Suweca and I Made Subandi. These stories convey that *dalang* do indeed play a part in the determination of tuning instruments, and in the case of I Wayan Suweca's story, suggest a connection between a *dalang* and the birth of a regional tuning style.

4.4.1 Unity of Voice and Instrument

The unity between a *dalang*'s voice and the tuning of the instruments is important for a successful *wayang kulit* performance. This was stressed by three *dalang* that I interviewed, I Wayan Narta, I Ketut Nuada, and Dewa Ketut Wicaksana, as well as by I Ketut Mandra, who is cited in a text by I Made Bandem. All four *dalang* also stress the need for *dalang* to be able to adapt to the tuning of the instruments, but they invoke different concepts to describe how this should be done.

I Ketut Madra's views about the relationship between *dalang* and *gender wayang* instruments serve as a good introduction. They are presented in Bandem's book titled *Wimba Wayang Kulit Ramayana (Ketut Madra)* where Bandem quotes I Ketut Madra stating:

> *titiang nguningayang bah-bangun minakadi pengepahan babat wayang sane biasa mange ring Sukawati, Gianyar. Wantah kategul antuk rincian gender. Sayuwakti pinaka uger-uger antuk para dalang, rikala ngolahang minakadi ngepah bagian pewayangan punika*. (Bandem 1982/1983: 6)

Translated into English this means "I would like to inform you about the wayang performance structure that is commonly used in Sukawati, Gianyar. It is bound by the *gender* [*wayang* instrument]. It becomes the rule for dalang when he/she is performing." Although Madra's statement does not assert the relationship with the tuning in *gender wayang* explicitly, the statement firmly signifies the need for the *dalang* to follow the *gender wayang*.

Another perspective about this relationship was expressed by I Wayan Narta. During an interview I conducted with him he also brought up the relationship between the *dalang*'s voice and the tuning of the *gender wayang* instruments in *wayang kulit*. He stated that:

> *Suara dalang dan suara gamelan sangat berkaitan. Karena seorang dalang harus memiliki vokal yang sama dengan suara gamelan. Dalang akan merasa nyaman karena kualitas suara sudah melampaui batas suara gamelan, atau ngungkulin. Kalau suara gamelan dan suara gamelan sudah menyatu, ini merupakan kepuasan tersendiri dari si dalang*. (personal interview September 6, 2013)

Translated into English this means "The voice of dalang and the tuning of instruments are related. The dalang's voice must match the tuning of the instrument. The dalang will have confidence if their voice blends with the tuning of the instrument, which is called ngungkulin. If unity of sound is achieved, the dalang will be satisfied." His statement not only implies that the relationship is important, but also connects its success to the capacity for *ngungkulin*, which means roughly 'to take control of the situation during a performance." According to Narta, *ngungkulin* has two meanings. First, it is related to the *dalang*'s ability to fuse the quality of their voice with that of the tuning of the instruments spontaneously and with *gender wayang* instruments they have never used. Second, *ngungkulin* refers to the *dalang*'s power to make the

performance successful. This shows that according to Narta, the unity is only possible because of the *dalang*'s ability.

The same opinion about the relationship between *dalang* voices and the tuning of instruments is revealed by I Ketut Nuada. However, he stresses this in specific terms, asserting that "*suara dalang dan suara gamelan tentu harus selaras. Ini juga menjadi salah satu totalitas pertunjukan wayang. Ketika suara dalang dan suara gamelan menyatu, itulah yang dinamakan konsep taksu*," which means "The *dalang*'s voice and the instruments should be in tune. This is a requirement for a complete *wayang kulit* performance. When the *dalang*'s voice and the *gender wayang* instruments are united, the performance will have *taksu* (spiritual energy)."[6]

Nuada's statement emphasizes the importance of the relationship between *dalang*'s voice and instruments more deeply. He suggests that a lack of unity between the voice of the *dalang* and the tuning of the instruments will lead to an unsuccessful performance and that the production of *taksu* is dependent on the unity of a *dalang*'s voice and the tuning of *gender wayang* instruments. Scholars suggest that *taksu* is a kind of power or inspiration that comes from the gods and imbues certain objects with prestige or charisma (see I Wayan Dibia 2012, Edward Herbst 1997). According to Nuada, *taksu* is not only obtained through external power, but *dalang* can also create *taksu* through successful union with the tuning of the instruments. This means that *taksu* can only be produced if the *dalang* has the ability to harmonize their voice with the tuning of the instruments.

Dewa Wicaksana, an expert *dalang* from Nusa Penida, also highlights the importance of the *dalang's* ability, but in different terms. During an interview he stated:

> *kemahiran seorang dalang salah satunya bisa di ukur melalui kemampuannya dalam meyelaraskan olah vocal dengan instrument. Ini berarti bahwa dalang yang baik adalah dalang yang memiliki penguasaan yang baik terhadap tuning gamelan. Jika dalang telah*

[6] Interview with I Ketut Nuada September 19, 2013

> *melakukan ini maka disinilah letak kemahiran seorang dalang*. (personal interview November 10, 2013)

Translated into English this means "The *dalang*'s *kemahiran* can be understood through their ability to match their voice with the instruments. It means that an expert *dalang* is a *dalang* that has good mastery of instrument tuning. If the *dalang* is able to do it, it is a sign of expertise." Dewa Wicaksana's statement implies that the relationship between a *dalang*'s voice and the tuning of *gender wayang* instruments is significant in *wayang kulit*. *Kemahiran* means skill and in this case refers to the skill of a *dalang* in a performance. For Wicaksana the *dalang*'s *kemahiran* is measured by their ability to match the tuning of the instruments, and if the tuning is matched it an indicator of expertise.

As asserted by Mandra, Narta, Nuada, and Wicaksana, *dalang* are important figures in *wayang kulit* performances and the relationship between their voice and the tuning of the ensemble is crucial for a successful performance. The four *dalang* also stress the need for *dalang* to be able to adapt to the tuning of the instruments, but they invoke different concepts to describe how this occurs. These concepts are *ngungkulin*, *taksu*, and *kemahiran*. *Ngungkulin* refers to a *dalang* that has the ability to control the situation. *Taksu,* in connection with *dalang* and tuning, refers to the spiritual energy generated by the *dalang'*s ability to control their voice and match the tuning of the instruments. And *kemahiran* refers to a *dalang*'s ability to match the tuning of the instruments. Each of these concepts relates to the need for *dalang* to match the tuning of the instruments in order to achieve a successful performance. The methods that *dalang* use to adapt to the tuning of the instruments are discussed in the next section.

4.4.2 Adapting to the Tuning of Instruments

In this section, I discuss the different methods that *dalang* use to adapt to the tuning of *gender wayang* instruments by comparing the perspectives of I Made Subandi and Dewa Wicaksana. I also elaborate on the discussion with my own thoughts and the experiences of *dalang*. However, before we investigate how the *dalang* adapt to the tuning of the instruments, it is necessary to understand the nature of the songs that are sung by the *dalang* during a performance.

There are two types of songs that are sung by the *dalang* during a performance. These are *bebaturan* and *tetandakan*. According to Dewa Wicaksana, *bebaturan* is a poetic song that is bound by the music of the *gender wayang*, and *tetandakan* is a free song that it not bound by the music played by the *gender wayang*. This is articulated by Lisa Gold as well in "Musical Expression in the Wayang Repertoire: A Bridge between Narrative and Ritual." In the article Gold states that the main distinction between *bebaturan* and *tentandakan* lies in the relationship between the *gender* and vocal lines (1992: 253). Interestingly, she also asserts that *tetandakan* are also referred to as *sesendon*.

Herbst (1997) defines *sesendon* and *tetandakan* differently than Wicaksana and Gold. Herbst defines *sendon* as "poetic lines or verses sung by *dalang* or *penasar topeng* [that come] from behind the curtain and often [contain] a series of brief fragments of *Kawi* poetry strung…[They are]free of gamelan's melodic contours, usually used during *batel* or *bapang* ostinato sections, and still [keep] or [play] off of *gambelan* pitches" (Herbst 1997:182). He defines *tandak* as "sung poetry that follows, and plays off of, the instrumental melody in *topeng*, *legong*, *wayang* , and so on" (Herbst 1997:182).

Gold and Herbst have different perspective about *tetandakan* and *sesendon*. Gold says that *tetandakan* and *sesendon* are used to refer to the same style of song. On the other hand, Herbst defined the two terms *tetandakan* and *sesendon* differently. Regarding the discrepancy in terminology I do not wish to comment. However, I would like to stress that both types of songs require the *dalang* to adapt to the tuning of the instruments.

Based on my experience as a *juru gender* (*gender wayang* musician), during the performance I establish contact with the *dalang* when we are playing the *bebaturan*, also called *penyacah parwa*. During the *bebaturan*, which has a free rhythm melodic line, the *juru gender* accompany the *dalang*. Therefore, it forces the *juru gender* to concentrate on the melody while the *dalang* is singing. This requires the *dalang* and *juru gender* to remain interconnected, which is called "*saling intip*" (in contact). This term implies that *dalang* and *juru gender* should pay attention to one another during the performance and stresses that the *dalang*'s vocalizations are not independent from the *gender wayang*. The same is also true in *tetandakan*. Although the *dalang* may sing a free and improvised line, this line is always accompanied by *gender wayang*. The *dalang* do not ignore the tuning nor the melodic lines played on the *gender wayang*. The *dalang* aim to remain united with the instruments rhythmically as well as melodically.

There are two main techniques for singing Balinese songs properly and accurately: *pace periring* and *ngewilet*. In *pace periring* the singers sing the songs with a basic melody. In this case, the songs "taste flat." This method is usually used by beginners and is rarely used by *dalang*. In *ngewilet*, the singers produce variations on the melody using *gregel* and long vocalizations (Aryasa 1983). *Sesendon* and *tetandakan* usually make use of the *ngewilet* technique, but do not disregard the tuning of the instruments. This means unity between the voice and tuning of the instruments is the responsibility of the *dalang*. Even if a *dalang* has great

skill in producing these songs and making use of the technique *ngewilet*, if they ignore the tuning of the instruments then the quality of the song will be jeopardized. In this case the *dalang* must adapt to the instruments.

The need to adapt to the tuning of the instruments does not only receive attention from *dalang*, but also musicians. I Made Subandi, an expert *juru gender* (*gender wayang* musician), suggests that the best way that a *dalang* can adapt to the tuning of the gamelan is by owning the instruments that they perform with. He stated that "*dalang harus punya gamelan sendiri agar bias sering beradaptasi dengan gamelan*," which means "The *dalang* must have their own [*gender wayang*] gamelan, in order to be able to adapt to [it]." Subandi emphasizes that the *dalang* must have a lot of experience singing with the instruments in order to adequately adapt to them. By owning their own instruments they can immerse themselves in the tuning. This means that the situation is dependent on the *dalang*'s financial capacity to buy instruments. Generally, *dalang* that do not own instruments have a relationship with a *sekaa gender wayang* (a *gender wayang* club). In this case the *sekaa gender wayang* and *dalang* prepare for the performances irregularly. Thus, the *dalang* has limited time to adapt to the instruments because it is only possible during rehearsals.

Dewa Wicaksana, however, contradicts Subandi's statement. During an interview he stated that "*dalang tidak perlu memiliki instrument sendiri*," which means "The *dalang* does not need to own their instruments." According to him *dalang* should be capable of adapting to any instrument that is present—not only *gender wayang* instruments but also others ensembles, such as *semar pagulingan*, *angklung*, and *palegongan*. Therefore, the *dalang* will have experience with many tunings and increased capacity to adapt. His statement is supported by his experience as a *dalang*. He said that sometimes the person that has commissioned a performance by him

provides the instruments for the performance. These instruments have their own unique tuning and this means he must adjust to the tuning of instruments with which he is unfamiliar. In situations like these, if the *dalang* has not nurtured the ability to adapt, the performance will be unsuccessful.

In order to adapt to the tuning of the instruments spontaneously the *dalang* make use of a number of methods. Dewa Wicaksana says that he always pays attention to the *tabuh petegak* (the opening instrumental music). A part of the performance structure of the *wayang kulit* performance, as well as other Balinese arts theatres such as *calonarang*, *arja*, and *gambuh*, the *tabuh petegak* always comes before the actual performance begins. The *tabuh petegak* functions to invite the spectators to come to performance space. In *wayang kulit* performances the *tabuh petegak* is also the time when the *dalang* prepares for the performance. Dewa Wicaksana says that at this time he focuses on the *juru gender*. Sometimes he sings quietly to himself and follows the melodic contours of the *tabuh petegak* in order to catch the tuning of the instruments. He attempts to immerse himself and adapt as quickly as possible so that he will be ready when he begins to sing.

Regarding Dewa Wicaksana's opinion, using many and varied instruments will influence the *dalang*'s ability to adapt to instrument tunings. It can foster increased self-confidence and creativity. This is logical if we observe the fact the most famous *dalang* in Bali—such as Ida Bagus Ngurah from Buduk village in Badung regency, Dewa Rai Mesi from Bangli regency, I Wayan Wija from Sukawati, I Wayan Nardayana from Blayu village in Tabanan regency, and I Ketut Nuada from Tumbak Bayuh village in Badung regency—have experience using different instrument tunings, and not only the *gender wayang* ensemble. Ida Bagus Ngurah has used the *gambuh* ensemble, comprised of long *suling*, drums, and gongs. Dewa Rai Mesi has utilized

semar pagulingan, a seven-tone ensemble. I Wayan Wija has used *gamelan palegongan*, a five-tone ensemble. I Wayan Nardayana has used *gamelan Semaradhana*, a new seven-tone ensemble. And I Ketut Nuada has used *gamelan Angklung*, a four-tone ensemble. These *dalang* are not only proficient in using *gender wayang* instruments but also have the ability to explore their voice when accompanied by entirely different ensembles.

I Wayan Narta made an interesting point when expressing his experience adapting to the tuning of instruments. Although I Wayan Narta does not reveal his own perspective regarding his methods of adaptation, his experience portrays another aspect of it. Narta said that when he started study as a *dalang* in the 1960's, he and other *dalang* in his village used the same ensemble to practice. They used Mangku Yasa's *gender wayang* instruments because they were the only instruments in Sukawati. They created a schedule and alternated their use of the instruments, and sometimes they practiced together. This situation forced all of them to adapt to one tuning level though they had different vocal ranges. They had to adapt their voice to these instruments because there was no alternative. Thus, their vocal talents formed uniformly, and perhaps led to a certain standard among them. This case reinforces Dewa Wicaksana's proposition that adaptation is a skill that *dalang* must develop in order to achieve successful performances.

I Wayan Narta also commented on economic factors. He said that *dalang* with adequate financial resources are able to choose a *gender wayang* instrument tuning that is appropriate with their voice. Thus, the *dalang* is more capable of exploring their natural vocal range. *Dalang* without these resources, however, will be forced to accept the instruments that are available to them. While it could be said that this will hamper their ability, I Wayan Narta affirmed that it would improve their creativity. Dewa Wicaksana also made comments that are consistent with

this. He stressed that economic factors influence the creativity of *dalang*. However, he went a step further and suggested that these factors also allow *dalang* to participate in the determination of *gender wayang* instrument tuning, which will be explored in the next section.

4.4.3 The Role of *Dalang* in Determining Instrument Tuning

I conclude this chapter by recounting two stories that were told to me by I Wayan Suweca and I Made Subandi. Both stories reveal the role that *dalang* can play in determining the tuning of *gender wayang* instruments.

On June 7, 2013, I Wayan Suweca eagerly recounted a story about his father, the late I Wayan Konolan. I Wayan Konolan was an expert *gender wayang* musician and *tukang laras*. During the 1960s-'80s I Wayan Konolan often accompanied the famous *dalang* Ida Bagus Ngurah from Buduk village in Badung regency. Ida Bagus Ngurah, also well-known as Dalang Buduk, asked Konolan to make a set of *gender wayang* instruments for him and Konolan fulfilled this request by making a set of *gender wayang* instruments with Sukawati tuning style. When the instruments were completed he gave them to Dalang Buduk. Dalang Buduk began using the instruments and adapting his voice to their tuning. However, after a few months, Dalang Buduk complained because the tuning was not appropriate for his voice. He said that "*gamelane bes kenyat*," which means "the gamelan is too tight." His statement implied that the tuning of the instrument was too high and he could not comfortably reach its entire range with his voice.

Konolan decided to change the tuning for him. He modified the original tuning to make it a bit lower. In this case, the *pengumbang* instrument became the *pengisep* and Konolan tuned the other instrument lower, creating a new lower *pengumbang*. Konolan left the *sruti* the same, but tuned the new *pengumbang* using *pengumbang lambat*. Dalang Buduk approved the new *saih*.

He felt more confident using it and said “ne mare nyidaang jani nandakin,” which means “its tuning makes me confident when I sing *tetandakan*.” From then on this *saih* was used by Dalang Buduk. Most people now recognize this *saih* as Kayumas style. The characteristic of this *saih* is that it is a bit higher than *saih* Buleleng and a bit lower than *saih* Sukawati. Thus, *saih* Kayumas is at a medium level.

There are two main points that can be noted by I Wayan Suweca’s story. First, a new *saih* was created, and second, the *dalang* took part in the determination of this *saih*. Regarding the first point, the creation of a new *saih* led to a modification in tuning of *gender wayang* instruments. During this process as I mentioned in chapter three, *pande gong* and *tukang laras* can change the tuning from the available instrument to be able to make new *saih*. As a *tukang laras* and *gender wayang* musician, I Wayan Konolan realized that the *dalang* needed to be properly supported with the appropriate tuning during the performance. Regarding the second point, a *dalang* took part in determination of tuning *gender wayang* instruments. Although the *dalang* was not directly involved in the process, the *dalang*’s needs directed the *tukang laras*.

The second story was told to me by I Made Subandi, who told me about his experience assisting I Ketut Partha (a *dalang* from Sukawati) when he bought new instruments in the 1990s. Before they went to the *pande gong* to order the instruments, they discussed *gender wayang* instrument tuning because they wanted them to match Partha’s vocal range and they decided to check his voice with an available instrument at the *pande gong*’s workshop. Once at I Wayan Pager’s workshop in Blahbatuh village, Pager offered him a set *gender wayang* instruments. I Ketut Partha liked them because he felt they were somehow suitable with his voice, but he asked Pager to make his instruments a bit lower than these available instruments. I Made Subandi says that this happens rarely.

This story also demonstrates how a *dalang* can influence the tuning of *gender wayang* instruments. However, a *dalang* that is not involved in the determination of the tuning of the instruments does not affect the modification or creation of new *saih*. As I mentioned in chapter three, the three regional tuning styles *saih* Buleleng, *saih* Kayumas, and *saih* Sukawati are options. For example, I Ketut Nuada who has a low vocal range decided to choose the Buleleng tuning style when he bought instruments. He feels more confident when using *saih* Buleleng. Dewa Wicaksana prefers *saih* Kayumas because it is a moderate *saih*. He also stated that most *dalang* prefer this tuning. I Wayan Wija uses *saih* Sukawati. According to I Wayan Narta and Dewa Wicaksana, I Wayan Wija has a high voice and he is the only *dalang* capable of a wide vocal range. Thus, Wija can sing *tetandakan* with any level of tuning.

4.5 Conclusion

This chapter explored perspectives of tuning levels in *gender wayang* instruments, juxtaposed these against measurements of instruments, and sought connections between *dalang* and instrument tuning. I first presented terminology that is used by specialists to refer to each of three tuning levels and noted the more commonly used terms that make reference to them through association regional tuning styles. The results of this were then displayed in figure 4.2. Following this I investigated the difference between the three tuning levels by comparing the contrasting perspectives of I Wayan Suweca and I Made Pager with measurements of instruments. Here I found a discrepancy between Suweca's description of the difference between tuning levels and the way the instruments that I measured were tuned, whereas with Pager I found a strong correlation between his description and the measurements.

Regarding the relationship between *dalang* and instrument tuning, I focused on the need for *dalang* to be able to adapt to the tuning of the instruments and demonstrated that many *dalang* believe that unity between voice and instrument is necessary for a successful performance. Furthermore, I shared two stories that suggest that *dalang* are not only required to adapt to instrument tuning, but also influence the tuning of instruments. The first story, shared with me by I Wayan Suweca, showed that in at least one case a regional tuning style was influenced by the participation of a *dalang* in the activities of a *tukang laras*. The second story, shared with me by I Made Subandi, showed that in the process of purchasing instruments *dalang* occasionally make special requests for instrument tunings that are suitable for their vocal range.

Chapter 5: Conclusion

The *gender wayang* ensemble plays an integral role in many aspects of Balinese life. This includes religion, society, arts, education, politics, and economics. Most scholars of Balinese music, however, have characterized *gender wayang* as one of the most complex genres of Balinese music because of the syncopated nature of its compositions, the employment of a variety of interlocking techniques called *kotekan*, fast tempi, and the contrapuntal relationship between the left and right hands. In this thesis I have helped to shed light on aspects of the ensemble that are yet to be fully explored. I focused the investigation on the instruments' construction, tuning system, and the relationship between the tuning of the instruments and the *dalang*'s voice. Even as a Balinese and a *gender wayang* performer, I found the tuning system more complex than I had anticipated it would be before I embarked on this research.

In this thesis I began my exploration with the instrument's construction and design, the process of tuning keys and resonators, and collections of these instruments in the form of an ensemble (chapter 2). I showed that there are a variety of shapes and styles of the instrument, ranging from the very simple to the very intricate. I also explained the process of making the instruments and the many specialists involved, which led me to portray the process as a complex workflow. The complex workflow focused on the making of keys and resonators because they are particularly relevant to instrument tuning and involved the specialized work of *pande gong* and *tukang laras*. I also mentioned that in some cases the customers were involved in the process and influenced the workflow. This discussion demonstrates that the making of instruments is complicated. I also countered presumptions about the simplicity of the *gender wayang* construction process, the parts of the instruments, the tuning methods, and representations of the ensemble that fail to account for the practices in North Bali.

In the next chapter I showed how *pande gong* and *tukang laras* pay attention to the four traditional concepts of tuning *ulu suara*, *sruti*, *angkep-angkepan*, and *ombak* (chapter 3). By way of two kinds of analysis, cultural and scientific, I examined the tuning of nine sets *gender wayang* instruments and juxtaposed the measurements with the four concepts. The concepts help us understand how *pande gong* and *tukang laras* create, duplicate, and modify the tuning of *gender wayang* instruments. They are intertwined with the generation of new *saih* and variation of *saih* in *gender wayang* ensembles. I also expanded my earlier research on *ombak* in *gender wayang* ensembles. In my earlier research I found that *gender wayang* ensembles use *pengumbang lambat*-style *ombak* ranging between 5-6 Hz. However, in the course of this research I found that two sets of *gender wayang* had *ombak* that are beyond this range, at or near 7 Hz.

In chapter four I investigated several perspectives surrounding *gender wayang* tuning and compared them to measurements and analysis of the nine sets of instruments presented in chapter three. This focused on terms and concepts related to tuning levels in *gender wayang* that were increasingly complex as I incorporated more views. This is because *pande gong*, *tukang laras*, musicians, and *dalang* have different perspectives, which are sometimes ambiguous or conflicting. It is clear that these specialists also have different aesthetic tastes, use different terminology to describe the tuning systems, and have different understandings of the way these tuning systems are applied. However, certain terminology was shared by many. In particular, these were the terms that associate tuning level with the regional style. I also explored the relationship between the *dalang*'s voice and the tuning of the instruments. I interviewed three expert *dalang* and musicians and compared their perspective about the adaptation of *dalang* to

the tuning of the instruments, and through two stories I explored the role *dalang* can have in determining the tuning of *gender wayang* instruments.

Through this thesis I have been able to contribute a detailed analysis of tuning based on theory and practice to a body of literature that has documented other aspects of the *gender wayang* ensemble. The research has also sparked new curiosities and questions for further research. I was surprised when Dewa Wicaksana stated that a trend is growing in *dalang* of South Bali. He said that they now tend to choose Kayumas tuning style because it feels more suitable to their vocal range. If Dewa's observation is true, then this suggests that Kayumas tuning style is becoming more prevalent and other tunings are in decline. This is further confirmed by the comments made by I Made Terip (chapter 2) about the influence of the *wayang kulit* competition ensembles in Buleleng. I Made Terip worries about the effects of the competitions on his regional style and suspects that the competitions are a threat. This is because the criteria for the ensembles entering the competition are founded on a certain style. This is problematic because, as I have demonstrated, tuning styles have regional characteristics that are varied on many levels.

In my opinion, as an insider, I would like to echo I Made Terip's concerns. The Balinese government instituted a goal to preserve *gender wayang* and *wayang kulit* ten years ago. Recently they have even increased their efforts. However, because the government lacks an understanding of the precise nature of that which they hope to preserve, I believe this has been counterproductive to their preservation goals in many ways. The government often organizes competitions and most of the committee members running the competitions come from the government as well. I believe the competition committee was mistaken when they created the criteria for the competitions based on specific styles. Competitors want to win and because of

these criteria they may need to modify their style in order to match the expectations that are spelled out in the criteria. This is true of instrument tuning as well. I believe the committee needs to be reminded of their preservation goals and be properly informed so that they can establish a more suitable program that will maintain the vibrant and varied *gender wayang* practices that they originally sought to preserve. I hope this research and the views expressed in this thesis make a contribution in this regard and deepen our understanding of the rich and varied *gender wayang* ensemble.

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Appendices

Appendix A: The pitch of Moda's instrument, Sidakarya-Denpasar

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	E +38	3	182		187.5		5
				218.6439		208.5204	
E	G +21	3	206.5		211.5		5.5
				274.8383		272.1250	
U	A +31	3	242		247.5		5.5
				258.6756		250.3039	
A	C -27	4	281		286		5
				259.8154		255.5924	
I	Eb -45	4	326.5		331.5		5
				211.8453		208.8352	
o	F -36	4	369		374		5
				195.0251		192.5576	
e	Ab -49	4	413		418		5
				271.0576		269.8267	
u	Bb +3	4	483		488.5		5.5
				262.2563		257.2882	
a	C +2	5	562		567		5
				259.8154		257.6866	
i	Eb – 25	5	653		658		5

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F -36	4	369.5		374.5		5
				192.6809		190.2446	
E	G +47	4	413		418		5
				272.1326		269.8267	
U	Bb -26	4	483.5		488.5		5
				262.7209		261.0388	
A	C +7	5	562.5		568		4.5
				258.2758		254.6359	
I	Eb +11	5	653		658		5
				207.1473		205.6631	
o	F +11	5	736		741		5
				200.7708		199.4912	
e	Ab -31	5	826.5		831.5		5
				270.0100		268.5060	
u	Bb -6	6	966		971		5
				263.0262		261.0027	
a	C +19	6	1124.5		1129		5.5
				259.0454		258.7466	
i	Eb -47	6	1306		1311		5

Appendix B: The pitch of I Wayan Rasta's instrument, Sukawati-Gianyar

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F# -37	3	181		186		5
				219.7784		218.3284	
E	G# -18	3	205.5		211		5.5
				279.4617		272.7216	
U	B -38	3	241.5		247		5.5
				243.6740		235.5492	
A	C# +5	3	278		283		5
				273.0871		268.6178	
I	E -21	4	325.5		330.5		5
				210.1040		209.4303	
O	F# -11	4	367.5		373		5.5
				214.6071		209.5735	
E	G# +2	4	416		421		5
				262.1082		262.7538	
U	B -34	4	484		490		5
				263.2902		257.2543	
A	C# +28	5	563.5		568.5		5
				265.7733		263.6050	
I	E -5	5	657		662		5

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F# -14	4	367		372		5
				212.9775		212.1638	
E	G# -1	4	415		420.5		5.5
				269.8480		268.3406	
U	B -31	4	485		491		6
				258.1802		252.2014	
A	C# +26	5	563		568		5
				267.3101		266.4354	
I	E -5	5	657		662.5		5.5
				217.6164		214.7641	
O	F# +11	5	745		750		5
				222.1458		220.7554	
E	G# +33	5	847		852		5
				221.3094		220.0898	
U	B -44	5	962.5		967.5		5
				263.9133		262.6479	
A	C# + 19	6	1121		1126		5
				252.4706		251.4271	
I	E -28	6	1297		1302		5

Appendix C: The pitch of ISI's instrument, Denpasar

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F -16	3	173		178		5
				207.2425		218.9736	
E	G -8	3	195		201		6
				293.3024		276.6381	
U	A# -15	3	231		237		6
				362.6559		244.8166	
A	C +48	4	269		273		4
				245.5944		247.7410	
I	D# -6	4	310		315		5
				249.2296		245.5412	
O	F +42	4	358		363		5
				226.3314		227.5934	
E	G#-30	4	408		413		5
				259.5814		256.0843	
U	A# - 28	4	474		480		6
				235.2781		226.2077	
A	C# -35	5	543		547		5
				260.0253		260.9831	
I	D# +24	5	631		636		5

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F +33	4	356		362		6
				236.0302		228.1852	
E	G -30	4	408		413		5
				255.9252		253.0426	
U	A# +25	4	473		478		5
				229.2430		230.2683	
A	C# -45	5	540		546		6
				272.3581		266.8709	
I	D# +26	5	632		637		5
				216.0420		216.8465	
O	F +42	5	716		722		6
				286.7901		282.5568	
E	G# +29	5	845		850		5
				224.5026		225.0530	
U	B -45	5	962		968		6
				221.0215		218.1589	
A	C# -24	6	1093		1098		5
				289.5752		295.0216	
I	E -35	6	1292		1302		6

Appendix D: The pitch of I Wayan Rai's instrument, Renon-Denpasar

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F -36	3	171		176		5
				236.2287		228.7271	
E	G	3	196		201		5
				276.9362		269.3178	
U	A# -23	3	230		236		6
				251.7508		245.7837	
A	C# +28	4	266		272		5
				270.5860		259.5814	
I	D#	4	311		316		5
				229.0853		230.4891	
O	F +28	4	355		361		6
				240.9001		232.9715	
E	G# -30	4	408		413		5
				252.2612		245.7837	
U	A# +21	4	472		476		4
				236.2100		237.5272	
A	C# -42	5	541		546		4
				263.6678		261.4267	
I	D# +21	5	630		635		5

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F +28	4	355		360		5
				240.9001		237.1583	
E	G# -30	4	408		414		6
				255.9252		248.8558	
U	A#+25	4	473		478		5
				229.3430		230.2683	
A	C#+95	5	540		545		5
				264.1207		261.4267	
I	D# +18	5	629		635		6
				229.1085		227.0797	
O	F +47	5	718		724		6
				286.0537		283.8672	
E	G# +33	5	847		852		5
				222.2085		218.9535	
U	B -43	5	963		968		5
				222.3877		222.8826	
A	C# -21	6	1095		1101		5
				277.0049		274.2679	
I	E -44	6	1285		1290		5

Appendix E: The pitch of I Wayan Suweca's instrument, Kayumas-Denpasar

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Note	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	Fb + 48	2	171		176,5		5,5
				305,4874		300,8654	
E	Ab + 19	2	204		210		6
				284,9478		172,4826	
U	Bb – 8	3	227		232		5
				201,3659		197,2642	
A	C-10	3	255		260		5
				321,2897		315,6413	
I	Eb + 4	3	307		312		5
				214,5292		208,8353	
O	F + 13	3	347,5		352		4,5
				292,6553		295,4409	
E	Ab + 9	3	411,5		417,5		6
				239,3062		234,2813	
U	Bb + 43	5	472,5		478		5,5
				229,5703		227,0942	
A	Db – 29	5	539,5		545		5,5
				267,1001		264,6004	
I	Eb + 35	5	629,5		635		5,5

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Note	Bali	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F# - 42	4	365		361		5
				252,9205		253,8049	
E	Ab + 11	4	412		418		6
				271,6666		232,2092	
U	Bb + 43	5	478		482		4
				228,4782		230,2648	
A	Db -26	5	545		550		5
				232,5341		258,6983	
I	Eb + 32	5	629		634		5
				241,1228		217,8107	
O	F# - 49	5	719		724		5
				255,5455		275,4491	
E	Ab + 25	5	838		843		5
				226,2606		225,0021	
U	B – 49	6	955		960		5
				247,8619		232,5261	
A	Db -16	6	1098		1102		4
				279,3934		278,9916	
I	E -37	6	1290		1295		5

Appendix F: The pitch of Mangku Ketut Yasa's instrument, Br. Babakan Sukawati-Gianyar

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Note	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F -1	3	169		174,5		5,5
				216,3854		300,8654	
E	G +8	3	191,5		197		5,5
				324, 6582		272,4826	
U	Bb -45	4	227		231		4
				157, 4934		228,3118	
A	C -17	4	253		259		6
				283,4099		274,4933	
I	Eb -42	4	298		303,5		5,5
				251,03		244,3151	
O	F +1	4	344,5		349,5		5
				239,0085		235,8117	
E	G +37	4	395,5		400,5		5
				233,0881		232,2544	
U	Bb +28	5	452,5		458,5		5,5
				215,5611		211,4535	
A	C -19	5	512,5		517,5		5
				275,7756		276,1652	
I	Eb -42	5	601		607		6

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Note	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F +3	4	344,5		350		5,5
				230,2316		226,8406	
E	G +30	4	393,5		399		5,5
				239,951		234,9665	
U	Bb -34	5	452		457		5
				217,4751		215,2376	
A	C -19	5	512,5		517,5		5
				277,2153		274,7385	
I	Eb -44	5	601,5		606,5		5
				238,892		237,0514	
O	F -7	5	690,5		695,5		5
				235,2435		234,7486	
E	G +27	5	791		679,5		5,5
				236,9098		235,3802	
U	Bb -37	6	907		912,5		5,5
				213,4275		213,0558	
A	C - 24	6	1026		1032		6
				278,4029		275,4769	
I	Eb -48	6	1205		1295		5

Appendix G: The pitch of I Made Terip's instruments, Munduk-Buleleng

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	E +38	3	168,5		174,5		6
				283,6685		278,8762	
E	G +21	3	198,5		205		6,5
				209,2317		202,9714	
U	A +31	3	224		230,5		6,5
				241,2884		234,9254	
A	C -27	4	257,5		264		6,5
				281,6944		272,4827	
I	Eb -45	4	303		309		6
				209,6142		203,2874	
o	F -36	4	342		347,5		5,5
				286,2868		282,1054	
e	Ab -49	4	403,5		409		5,5
				253,0247		253,5163	
u	Bb +3	4	467		473,5		6,5
				199,3731		196,786	
a	C +2	5	524		530,5		6,5
				271,5843		287,164	
i	Eb – 25	5	613		619		6

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	F -36	4	342		348		6
				284,1402		279,6162	
E	G +47	4	403		409		6
				225,2572		222,1558	
U	Bb -26	4	459		465		6
				234,2359		233,0346	
A	C +7	5	525,5		532		6,5
				280,6993		276,1437	
I	Eb +11	5	618		624		6
				223,1014		218,644	
o	F +11	5	703		708		5
				256,9922		258,4668	
e	Ab -31	5	815,5		822		6,5
				225,5925		223,9191	
u	Bb -6	6	929		935,5		6,5
				225,9249		224,4526	
a	C +19	6	1058,5		1065		6,5
				232,2982		230,9709	
i	Eb -47	6	1210,5		1217		6,5

Appendix H: The pitch of I Ketut Klentit's instruments, Buleleng

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	E +27	3	167.5		173.5		6
				231.8199		215.5123	
E	G -40	3	191		196.5		5.5
				240.1909		242.15.21	
U	A	3	220		226		6
				210.8907		205.6114	
A	B +10	3	248.5		254.5		6
				267.3684		255.6591	
I	D -21	4	290		295		5
				223.6957		225.2955	
O	E +1	4	330		336		6
				269.1180		262.4488	
E	G -28	4	385.5		391		5.5
				224.9880		223.9640	
U	A -3	4	439		445		6
				249.3177		246.1841	
A	B +45	4	507		513		6
				268.3337		265.4239	
I	D +13	5	592		598		5

Appendix I: The Pitch of I Wayan Wijaya Instrument, Tunjuk-Tabanan

Pemade

Tone			***Pengumbang***		***Pengisep***		**Average**
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	E +22	3	161		167		6,5
				240,5575		236,3343	
E	G -35	3	185		192		7
				243,9938		235,6767	
U	A	3	213		220		7
				263,384		255,5925	
A	C -44	4	248		255		7
				264,8752		255,1931	
I	D +10	4	289		295,5		6,5
				227,0508		224,938	
O	E +35	4	329,5		336,5		7
				262,7377		255,4411	
E	G -8	4	383,5		390		6,5
				222,1219		216,6867	
U	A + 7	4	436		442		6
				240,579		240,9386	
A	B +48	5	501		508		7
				277,2067		273,6734	
I	D +22	5	588		595		7

Barangan

Tone			***Pengumbang***		***Pengisep***		**Average** (Hz)
Bali	Western	Octave	Pitch (Hz)	Interval (Cents)	Pitch (Hz)	Interval (Cents)	
O	E + 33	4	392,5		336		6,5
				260,4791		258,0155	
E	G - 8	4	383		390		7
				224,3805		220,5991	
U	A + 11	4	436		443		7
				240,579		237,0262	
A	B + 48	5	501		508		7
				227,2067		272,218	
I	D + 21	5	588		594,5		6,5
				223,4281		222,4157	
O	E + 43	5	669		676		7
				236,6644		234,3724	
E	G -22	5	767		774		7
				238,9157		236,8963	
U	A + 14	6	880,5		887,5		7
				234,1209		232,3928	
A	B +47	6	1008		1015		7
				287,3591		285,5321	
I	D + 32	6	1190		1197		7