

Sounding like a *Sindhèn*. First Results of an Ethno- Phoniatic Investigation on the Javanese Female Voices

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Abstract

Female traditional singing called *sindhèn* is one of the most renowned and widespread vocal genres in Java. Early ethnomusicologists defined the *sindhèn*'s voice as "nasal" or «similar to a *rebab*» (Kunst 1973) while other scholars have mainly concentrated on the semi-improvisational singing technique, without focusing on the mechanisms of voice production. Despite the important role that *sindhèn* play in contemporary Javanese performing arts, the specificity of the vocal technique has not been thoroughly investigated.

Practice-led research has been useful to determine how local singers achieve this voice quality by imitation, what is the most used terminology and how it is related to Javanese aesthetic. However, for a deeper investigation it is necessary to rely on international singing methods (as EVT, Estill Voice Training and CVT, Complete Vocal Technique) and on the inter-disciplinary approach. Methodologies borrowed from phoniatics, phonetics and acoustics can be applied in the analysis of the singing voice under an innovative perspective.

The multi-disciplinary approach is what we have adopted in our team research project (sponsored by La Sapienza University) concerning a phoniatic study of *sindhèn* voice quality. The fieldwork was conducted in four different districts of the Special Region of Yogyakarta, with the support of the Indonesian Arts Institute (ISI) in Yogyakarta. We collaborated with 22 female singers (*sindhèn*) of various ages and experience levels who underwent analysis of the vocal tract during singing activity via fibro-endoscopy. The

¹ Iliaria Meloni: paragraphs 1, 2, 3, 4, 5, 6, 9, 10. Silvia Spinelli: paragraphs 7, 8.

fibro-endoscopy data analysis was closely correlated with the ethnomusicological practice-based data collection, in what we defined an “ethno-phoniatric” study. This interdisciplinary research project revealed the main physiological traits of the *sindhen* voice with common features and differences, the mechanisms of voice production, and the principal stylistic aspects that sonically identify the factors that contribute to the development of this vocal practice within the Javanese performing arts context.

Suonare come una *sindhen*. Primi risultati di un’analisi etno-foniatrica sulle voci del canto femminile giavanese. *Il canto femminile sindhen è uno dei generi più diffusi e rinomati a Giava. Alcuni etnomusicologi del passato hanno definito la qualità vocale sindhen come “nasale” o «simile al suono di un rebab» (Kunst 1973) mentre altri studiosi si sono soffermati sulle tecniche della semi-improvvisazione del canto, senza approfondire i processi di produzione della voce. Nonostante l’importanza ricoperta dalle sindhen nel panorama delle arti tradizionali giavanesi, la specificità della loro tecnica vocale non è stata ancora accuratamente investigata. La ricerca sul campo tramite osservazione partecipante è stata utile a capire le modalità di apprendimento del canto tramite imitazione, qual è la terminologia più utilizzata dai maestri e come essa è relazionata alla concezione estetica giavanese. Tuttavia, per un’analisi più approfondita si è ritenuto necessario basarsi su metodi di studio di canto internazionali (come l’EVT, Estill Voice Training e il CVT, Complete Vocal Technique) e su un approccio inter-disciplinare. Metodologie prese in prestito da foniatria, fonetica e acustica possono essere applicate all’analisi della voce cantata sotto una prospettiva innovativa. L’approccio multi-disciplinare è stato quello che abbiamo deciso di adottare in questo progetto (sponsorizzato dall’Università La Sapienza di Roma) in lavoro d’equipe, per uno studio foniatrico della qualità vocale sindhen. La ricerca è stata condotta nei quattro diversi distretti della Regione Speciale di Yogyakarta con il supporto dell’Istituto Indonesiano delle Arti (ISI) di Yogyakarta. Abbiamo collaborato con 22 cantanti donne (sindhen) di varie età e gradi d’esperienza che si sono sottoposte ad analisi del tratto vocale durante l’attività canora via fibro-endoscopia. I dati emersi dall’analisi endoscopica sono strettamente correlati con l’attività di ricerca etnomusicologica ed osservazione partecipante, in quello che abbiamo definito come uno studio “etno-foniatrico”. Questo progetto di ricerca interdisciplinare è stato utile a rivelare i principali tratti fisiologici della qualità vocale sindhen con elementi comuni e differenze, i meccanismi della produzione vocale, e gli aspetti stilistici fondamentali che contribuiscono ad un’identificazione sonora dei fattori che hanno contribuito allo sviluppo di questa pratica vocale all’interno del contesto delle arti performative giavanesi.*

1. Introduction

The most difficult challenge that I faced over my seven years fieldwork and singing activity in Java has been the investigation of the voice quality of the female singers named *sindhen*. I have learnt the *sindhen* repertoire in 2013 and I performed in *gamelan* music sessions (*klenengan*) and shadow puppet theatres (*wayang kulit*), practicing with experienced singers and teachers on daily basis. However, despite my yearly practice united to the academic research, many elements of the *sindhen* voice still remained obscure. Several aspects of the female singing – the semi-improvisation of the vocal patterns, the chanting of the Javanese poems, the correct spelling and articulation of Javanese language – are taught by local teachers and, partially, in central Javanese conservatories. However, the voice quality is considered to be acquired simply “by ear” or “by heart”, thence: «Aural

more than oral» (Solís 2014: 61), and it lacks of theoretical support. Therefore, in order to achieve a deeper comprehension of the *sindhen* vocality (and its interesting socio-cultural implications) I decided to rely on disciplines such as phoniatics and sound studies.

The history of transcultural, inter-disciplinary study on vocal techniques includes remarkable contributions, starting from Lomax (1968) and Léotaud (2005) who attempted the first classifications of the vocal techniques over an intercultural spectrum. For what concerns the acoustic and sound studies, significant are those of Castellengo (2015), Sundberg (1987) and Adamo (2011). Within the Asian music context, those of Ki-Hwan Hong (2006, 2011) on the voice in Korean *pansori* are innovative in terms of phoniatic approach. Other interesting works are those by Venkataraja (2016) on the vocal health in Indian singing, those on the timbre in Thai classical singing by Latartara (2012) and the conspicuous studies on overtone and throat singing, starting by those of Trang Quang Hai (1980-2002) which significant is the adoption of software as *Overtone Analyzer*. All these works constitute important examples of sound studies in an intercultural perspective. However, still much work has to be done in order to cover unexplored aspects of the vocal techniques within oral cultures.

For what concerns Indonesian music, very few contributions have been produced on the voice subject. Remarkable are the works of Edward Herbst (1997) and Hirschfeld-Medalia (1984) about the *dalang* (puppeteer) voice and vocal training. Of particular relevance for this paper are the studies by the linguist Podjosoedarmo (1988, 1993) which investigates the *sindhen* voice type from a linguistic perspective and to whom we owe the merit of inspiring us this research project. Considering the scarcity of the sources specifically addressing *sindhen* voice quality, and the difficulty to find satisfactory explanations by local teachers and vocal experts (including the singers themselves), largely inspired by the opportunities offered by the inter-disciplinary inquiry, we decided to conduct a team research in Java, involving phoniatics, ethnomusicology and *karawitan* (Javanese classical music and music science).

It is safe to say that this paper is intended to be a report of a pioneering investigation (the very first one of this kind within the Javanese vocal music framework) and not a definite, systematic study of a complex phenomenon. What we would like to convey through these pages, more than uncovering several aspects of the “Javanese female voice quality”, is the complexity of the investigation methodology and the importance of the inter-disciplinary, cross-cultural and partially practice-led approach in the field of ethnomusicology.

2. About the research project

This project is the result of a collaboration between La Sapienza University of Rome and Institut Seni Indonesia (the Indonesian Institute of the Arts) of Yogyakarta.² It has been

² In 2012, La Sapienza University and the Institut Seni Indonesia of Yogyakarta subscribed the Memorandum of Understanding in order to promote the cultural exchange.

conducted within the framework of Progetto Ateneo 2017 “Suoni, Identità, Spazi Urbani” (Sounds, Identity, Urban Spaces) supervised by professor Giovanni Giuriati. A total of 22 *sindhen* (Javanese female singers) from the DIY (*Daerah Istimewah Yogyakarta*, “Yogyakarta Special Region”, Central Java, Indonesia) has participated in this study. The singers have undergone endoscopic analysis during singing activity, correlated by audio-visual recordings both of the activity of the vocal tract and of the endoscopy process. Previous to the research activity, we conducted a survey to all the hospitals and phoniatic clinics (THT) in Yogyakarta.³ However, we came to the conclusion that we would better conduct the research by directly bringing the equipment (a flexible endoscope) on-the-spot. Therefore, we organized group endoscopic examinations to the singer’s houses, correlated by interviews and vocal training sessions. We performed the endoscopies in the four districts of Yogyakarta Special Region, assisted by a local *karawitan* teacher and vocal expert from ISI, Prof. Petrus Suparto. The data obtained through the acoustic analysis and video-laryngoscopy has been analyzed in order to understand some relevant features of the *sindhen* voice quality and the related implications.

3. *Sindhen*: The fluctuating voices of the *gamelan*

Who are the *sindhen*, what do they sing and how? It took several years fieldwork to answer these questions. Basing on the written sources, it can be stated that *sindhen*, a terminology derived from the Sanskrit root *sind*, transposed in *kawi* language (old Javanese), means: “to sing”. In modern Javanese language, the term refers to female Javanese vocalists, or women singing with *gamelan*. More broadly, *sindhen* are women singing in *gamelan* orchestras and in all the *gamelan* music-related performative contexts,⁴ showing specific vocal skills and expertise in music elaboration (which is embedded in the concept of *nasa*, “feeling” or “intuition”).⁵ Moreover, they sing with a specific voice quality, concentrated in the upper vocal tract, with a prevalently high register, on the Javanese scales *slendro* and *pelog* (Becker 1984).

The tradition of female singing with *gamelan* developed in the Javanese courts of Surakarta and Yogyakarta between the 19th and the 20th centuries. Originally, the *sindhen* repertoire was limited to accompanying *bedhaya* and *srimpi* court dances and it consisted of choral pieces and sung poems (*macapat*). Consequently, the female singing practice developed towards a more “virtuoso” technique, designated *sindhenan*, consisting of a semi-improvisation of melodic patterns (*cengkok*) on an instrumental melody. *Sindhen* chiefly learn these basic patterns via oral transmission and through imitation, with teachers and other singers or from cassette recordings (recently also YouTube) and,

³ THT (Telinga Hidung Tenggorokan, “Ears Nose Throat”) is the Indonesian equivalent of otorhinolaryngology.

⁴ We refer to “contexts” and not “context” since, currently, many are the implications of *gamelan* music within the Javanese performing arts, from the royal palace to the villages, involving manifold forms of ritual and entertainment.

⁵ See Benamou 2011.

SOUNDING LIKE A SINDHEN

Bal.	2	3	5	6̂
Sindh.	2	1̄ 2̄	6̄ 2	.
	Ro kan__ ca- ne			
Bal.	5	3	2	1̂
Sindh.	.	. 2̄	2̄ 2̄ 2̄'	1̄ 1̄'
		2̄ 6̄ 1̄	5 2	3-2̄ ³²¹ 1
	A- ja le- ren yen jang- kan-e du- rung te- ka			

FIGURE 1. *Cengkok* transcription (Uler Kambang by Sukesri Rahayu), in *kepatihan* notation.

to a certain extent, in music academies. Their function is to elaborate ornamentations on these basic patterns, in order to literally “embellish” the *gamelan* music. As emerged from many colloquia, *sindhen* literally “embellish” the *gamelan* orchestras (both visually and musically). According to Kartomi: «The rhythmically free line of the *sinden* floats above the quadruple-metric beat of the *gamelan*» (1973: 76). This “floating” is, in truth, a semi-improvisation of melodic patterns called *cengkok*, in a free rhythm and with embellishments depending on the singer’s own style, which gives the impression of literally “fluctuating” on the quadratic rhythm of the *gamelan* stratified heterophony. The full transcription in *kepatihan* notation (Audio example 1, Musical example 1) shows how the full semi-improvisation is articulated, alternating patterns in a free-rhythm to a more syllabic and metrically regular execution of the melody. Below, I show an exert of the *sindhen* semi-improvisation on a fix melody both in *kepatihan* (cyphered local notation) and custom staff-notation (Audio example 1, Figs. 1-2).⁶

The more the *sindhen* is expert, the more she can improvise a good melismatic contour on the skeleton melody and produce articulated ornamentations. However, the notation systems (both *kepatihan* and customised staff notation) can only show an approximation

⁶ This extract starts from min. 00:45. I’ve chosen the version of my teacher in Surakarta Sukesri Rahayu, one of the most talented *sindhen* in central Java. She executed a version for voice and *gendèr*. However, I decided to report only *balungan* (skeleton melody, abbrev. “Bal.”) and *sindhen* (abbrev. “Sindh.”), to make clear how the semi-improvisation on the fixed melody works. The first notation system is *kepatihan* is a cyphered notation adopted in national conservatories since the XIX century and it’s reproduced with *KepatihanPro Font*. Each number indicates a pitch (in this case of *slendro* scale, *sanga* mode); numbers with upper dots signal the higher register, number with inferior dots signal the lower register. The dots in the melodic line indicate rests. Upper lines indicate note duration (single line for half of the duration, double line for a ¼ of the duration). Circles and semi-circles on the notes indicate *gong* interpunctuation. I added diacritical signs (ww for vibrato, ‘ for breath, and ˘ for glissando). In the second example I used a custom staff notation created with *Finale* and inspired by *rante* court notation (Hood 2016) and Balinese vocal notation used by Herbst (1997). While the cyphered notation can better show the “colotomic structure” (Kunst 1973), this custom notation is created with the intent to give an impression of the diverse interval width and the overall melodic contour of the vocal melody.

Bal.

Sindh.

Ro kan ca - ne

Bal.

Sindh.

A - ja le - ren yen jang - ka ne du - rung te ka

FIGURE 2. *Cengklok* transcription (*Uler Kambang* by Sukesri Rahayu), in custom staff notation.

of the complex ornamentation of the *sindhèn* vocal patterns and tell nothing about the voice quality.

The “good voice” is one of the three fundamental requisites for a *sindhèn*, in addition to: the embodiment of the Javanese feminine ideal depicted by court aesthetics and the *gamelan* music knowledge. To have the right vocal quality it’s reputed an essential skill in order to become *sindhèn*. However, there are no theoretical prescriptions concerning how to train this specific “sound”, often vaguely identified by ethnomusicologists as “nasal”. The “good voice” is not only necessary in order to be part of the *gamelan* heterophony but it’s part of the *sindhèn* embodiment of the Javanese “hyper-feminine” and a vehicle to exert the erotic power (Cooper 2001) or *shakti* (“feminine energy”, Becker 1993, Sunardi 2015). Everything *sindhèn* express, through their bodies and their voices, resembles that ideal. The posture is another key aspect of the *sindhèn*: they have to remain kneeled throughout the whole duration of the performance (which can last until eight hours overnight). They have to observe a certain public behaviour, handed down via court ethics (*tata krama*). They have to limit, or “constrict” every movement, even facial expressions. For instance, during singing activity, the lips can’t be opened wider than two fingers width. According to all the aesthetical, spatial, linguistic and musical parameters investigated, the keyword for *sindhèn* displayed or performed identity (Clayton, Dueck e Leante 2013, Turino 2008) is: “constriction”. This is a first step to start from in order to analyse all the features of the *sindhèn* performance, including the voice quality itself. But, first of all, we have to set a step backwards, and ask ourselves, as I asked myself when I was first attempting to learn *sindhèn*: How do I achieve this voice quality?



FIGURE 3. *Sindhen* during a *gamelan* session in Wonosari, Gunungkidul district, 28th August 2019 (photo: I. Meloni).

4. Local knowledge and the achievement of the *sindhen* voice

During a class with Sukesri Rahayu, one of the most popular singers in the shadow puppet theatres of central Java, she revealed to me:

The most important factor is the voice. For becoming a good *sindhen*, you must have a good voice. If you have a good voice, then you can study the *cengkok* [vocal patterns] improvisation technique, that is the second step. You can study the improvisation technique, but you cannot study a good sound. You get a good voice from your heritage, it's a family factor, or it's given by God. So, if you are given a good sound, by the genetics, then you can start studying *sindhen* (Sukesri Rahayu, 29th May 2018).

Sukesri's thought on the innate inheritance of the *sindhen*'s voice quality (by family DNA or by God), seems to be shared by the average of the teachers and the musicians that I've been in contact with. Amongst locals, the common terminology associated to a "natural inclination" is *alami* ("natural" or "spontaneous"). *Alami sindhen* are singers who started singing from a young age and never studied how to use the vocal tract nor

specific breathing techniques. They just trained by practice and imitation of other singers, performing and playing music with local groups until reaching shadow puppet theatre stages (considered as an “artistic debut”). In some cases, they hire a vocal teacher or enroll in local music academies. Here they develop some aspects of their vocal style, as the melodic pattern variation, the right spelling of the Javanese language, how to read cyphered notation. But they never afford a proper study on the singing voice and its analysis and techniques. It is understandable why, at present, there are no theoretical manuals about the *sindhen* vocal technique and why teachers can’t offer a systematic knowledge on the proper use of the voice.

Considering that the voice is one of the fundamental requisites to become a *sindhen* and that it has to have a specific “sonority” (distinguished, for instance, from the *penyanyi*, the “pop singer” or singer of non-Javanese music genres) it almost appears paradoxical that there are no guidelines on how to achieve it. The so called *sindhen jaman dulu* (“singers of the past”) are reputed “naturally” able to sing on *gamelan* music. It’s logical if we consider that there were no academies or music notation systems previous to the XX century. Singers, as well as musicians and puppeteers, were expected to possess the *rasa* (Benamou 2011), a “cognitive”, almost “metaphysical” quality inherited by family descendance (another “gift”) or by practice. To be “gifted” doesn’t seem to be uncommon amongst the female performers, if we think that, originally, for becoming a singer-dancer (which is recognized as the ancestor of the court *sindhen*, Sutton 1984) a woman was supposed to be invested by the *indang* (“inner vocation” or “gift”). The *indang* means to show an innate quality in singing and dancing, associated to the personification with Dewi Sri, the rice goddess (Tohari 2012: 8). In ancient times, to be invested by the *indang* often meant to be possessed by a female goddess and to participate in fertility rituals involving terrain forms of eroticism. Ethnomusicologically speaking, the “gift”, in terms of achievement of the “good vocal quality”, might be explained with the process of “learning by imitation”, which is an acknowledged methodology amongst many oral cultures around the world.

In the attempt to understand the anatomical specificity of *sindhen* vocal tract during singing activity, I proceeded via gradual steps. First, I took classes with local singers and teachers, in order to establish the key elements of the local knowledge in matter of voice. Second, I relied on Western singing theories to find some useful methodologies. Third, I’ve landed to the current research project, involving phoniatics. In 2014, I started taking classes with different teachers (in Yogyakarta, Surakarta, Banyumas, and East Java). I’ve learnt precious skills and a good amount of knowledge about Javanese music, female singing, language, repertoires and improvisation techniques, but none of my teachers ever taught me how to achieve the “good voice”. They expected me either to “be gifted” or to “learn by ear”. They only offered me some hints on how to sound closer to the *sindhen* voice, using adjectives as *merdu* (“clear”), *los* (“loose”), or *halus* (“refined”) and *dengan power* (“with power”), the latter often meaning that I should avoid *falsetto* but

I should “resonate” more. Regarding to this parameter, we should observe that, previous to the introduction of the microphones, *sindhén* had to be hearable over *gongs* and metallophones orchestras, thence, their voices should “resonate”, high and sharp, over metallic high frequencies.⁷

Since none of the teachers seemed to have a specific methodology, I decided to rely on my past singing experience. In 2012, I went through the EVT (Estill Voicecraft Training, Estill & Colton 1978) a method based on the anatomical knowledge of the vocal tract, aimed to form singers who are conscious of the mechanisms operating behind their vocal emission. This way, each singer can knowingly choose a specific “recipe” for the voice quality wanted. The voice control is obtained through the combination of thirteen figures linked to specific parts of the vocal tract (true vocal folds, false focal folds, cricoid, thyroid, larynx, epiglottis, and so forth, see McDonald 2005). The combination of these figures, according to the right “recipe”, let the singer obtain one of the six voice qualities identified by Estill as: Speech, Falsetto, Sob or Cry, Twang, Belting, Opera. Each vocal quality can be further personalized by literally playing with the vocal tract figures, arranging them in different positions. Basing on my *sindhén* listening experience to and on the teachers’ guidelines, I assumed that the best quality to use in order to sound the closest to a *sindhén* was Twang, specifically Oral Twang. Twang is a quality having a resonance on medium-high frequencies, with a clear, crystalline sound. With Twang, one can be heard over a long distance, overpowering background sounds, being perceived as literally “twanging” or “ringing”, “brassy”, “metallic” (Sundberg et al. 2020). Another characteristic of Twang is that of being perceived as “nasal”, which recalls the definitions of some ethnomusicologists like Kartomi (1973) and Kunst (1973).⁸ As a matter of fact, singing Twang doesn’t necessarily mean to sing “nasal”. Oral Twang and Nasal Twang differ in the position of the velum (opened in Nasal Twang, closed in Nasal Twang). Oral Twang has more “power”, while Nasal Twang has not. According to Elisa Turlà: «The majority of what people call “nasal” is, in truth, Twang» (communication of February 2012). The main mechanism to obtain Oral Twang quality is a constriction of the pharynx, operated via the closure of the epiglottis, with the larynx in a medium-high position. The epiglottis is a muscle positioned at the edge of the vocal tract, which opening or closure determines the restriction or expansion of the tract itself. This constriction produces, as a consequence, a minor glottal airflow, creating the “twanging”, metallic, resonating sound. Other than the pharynx constriction, the Oral Twang “recipe” includes: larynx

⁷ This was also true in the case of Thai classical singing, as reported by Swangviboonpong: «Some singers say that singing in a high register is a feature of Thai classical singing. The reason given by many singers for this is that in the past there were no microphones or amplifiers available, and therefore the singers had to sing in a loud and high register in order to make their singing heard – particularly when the ensemble joined in» (2003: 21).

⁸ Kunst defined the *sindhén* voice similar to that of the *rebab*, the Javanese two-stringed fiddle (1973: 122). Here is another interesting correlation with Thai voice quality, defined similar to that of *ซอสามสาย* (three-stringed fiddle) (Swangviboonpong 2003: 22). In both the traditions, voices and fiddles are those elaborating the more melismatic contours on fixed melodies.

and tongue in a medium-high position, use of the false vocal folds, closed velum. The Twang “recipe”, according to Estill (see McDonalds 2005) is:

Physiology:

- Narrowing of the epiglottis funnel
- Overall restriction of the vocal tract (pharynx constriction)
- Tongue and larynx in a high position
- Retracted, thin vocal folds
- Opened velum (Nasal Twang) o closed velum (Oral Twang)

Acoustics:

- Resonance on the medium-high frequencies

Perception:

- Voice in the upper vocal tract, behind the nose
- Penetrating, metallic, sharp sound

Sundberg describes this voice quality as: «Typically associated with loud and high-pitched singing and is used to create an impression of energy and expressivity» (2010). He identifies the main parameters as pharyngeal constriction and narrowing of the vocal tract in a “V” or megaphone shape (which also regulates the airflow). Twang has been observed in genres as country, Eastern-European folk-singing and Asian music (Estill & Colton 1978).

In 2016, I analysed some *sindhen* vocal patterns with Sonic Visualizer. I found out that the parameters revealed by the spectrum corresponded to the Twang definition (Meloni 2018). I found another confirmation of my hypothesis in the work of Podjosoedarmo (1988), a linguist who analysed the differences in the phonation of *sindhen* and *seriosa* (Opera singers). Podjosoedarmo compared spectrograms and direct observation (lips position, breathing) to find out that a strong characteristic of the *sindhen* voice type lied in the pharyngeal constriction. The minor air flux showed in the spectrograms indicated the closure of the epiglottis and a possible figure of the larynx on a medium-high position.

Unfortunately, until 2019 there were no many chances to go forth in this investigation. The research was stuck at the assumption that the key in the *sindhen* voice quality was the pharyngeal constriction, therefore they must use a voice quality close to Oral Twang. That was enough to be able to continue the training as foreign *sindhen* and to sing the classical repertoire, but not to give a definite answer to the question: is there a specific *sindhen* voice quality? Moreover, I was aware that relying on a Western methodological approach to understand a specific phenomenon within an oral culture doesn't mean to stick that phenomenon and all its possible variants in a rigid categorization. With this I mean that understanding how *sindhen* use their vocal tract via Estill methodology doesn't mean that is possible categorise *sindhen* voice within the same parameters. It is not possible for two reasons. First, assumption that *sindhen* voice quality might be

achieved via the shortcut of Twang quality “recipe” doesn’t mean that *sindhen* necessarily use Twang. In fact, as already explained, they learn by imitation and not following a “recipe” or a specific vocal training. Therefore, they know what “sound” they should obtain but not “how to”, this meaning that every *sindhen* follows her distinct path, her own personal “recipe”. Furthermore, and most important, behind *sindhen* voice there is more than a technical preparation and the achievement of the perfect technique. What Javanese listeners appreciate in a female voice is mainly the embodied “aesthetic”. The voice quality which resembles that specific aesthetic is considered suitable to become “the voice of the *gamelan*”, thereby to express through music the implicit values of the Javanese traditional culture.

5. Singing terminology and Javanese aesthetics

Comparing what emerged from the first hypothesis on the *sindhen* voice quality (the “pharyngeal constriction” and Twang-like “recipe”) with the local terminology, it’s possible to find some interesting interconnections. If we try to translate the generic guidelines of local teachers into phoniatic or Estill terminology, that is what we obtain (the hypothetical *sindhen* “recipe”):

- *Tinggi*: high = (on medium-high frequencies)
- *Merdu*: clear = sharp (“metallic”)
- *Los*: loose = not forced or constricted (vocal folds in a retracted position)
- *Power*: diverse from *falsetto* = limited quotient of airflow (lifted epiglottis, closed velum)

Estill methodology revealed to be useful to understand what the vague local terminology meant in terms of physiology and acoustic.⁹ But why is this “recipe” the “good” one to obtain the *sindhen* sonority?

To give a satisfying answer, we should look at the Javanese aesthetics and gender in performing arts, and how they are associated with voice types. What emerged from the talk with Pak Sutejo (Yogyakarta, 22nd August 2019), a renowned puppeteer of Yogyakarta Royal Palace, is the existence of two different voice types: a “low, robust” (*antep*) one (often associated with puppeteers) and a “high, sharp” (*nyari*) one (associated with the singers). While males might master both the qualities (though often mastering only one of those), female are almost always identified in the “high, sharp” quality. For this reason, it’s very rare to find female puppeteers able to reproduce the male voice. According to Pak Sutejo, this is one of the major reasons why females are more likely to become *sindhen*, instead of puppeteers. The puppeteer gives voice to all

⁹ The same process has been followed by Latartara (2012) in the acoustical investigation of the timbre in Thai classical singing, starting from subjective terms used to describe the voice quality perception, as “tense”, “strained”, “smooth” and “nasal”, to eventually going through a physical analysis of the sound.

the puppets (males and females) each with a specific characterization (the King, the giant, the soldier, the goddess, the princess and so forth) and a specific range on the Javanese musical scale. Some specific puppets have particular pitches and rhythms associated with (ex. Arjuna or Bima, see Mrázek 2005). He gives voice to all the dialogues, narrations, songs (mantras or tuned poems) and throat effects (e.g., giants laugh, battle cries). Forasmuch as that the majority of the characters are male (and that the female ones are less specifically delineated in terms of voice type, limiting to a “high” register and a “sharp” voice) it’s generally recognised, as Pak Sutejo suggested, that a male puppeteer is more favoured than a female one. In *wayang*, we find what Medalia defines: «a cacophony of highly expressive noises» (1984: 217). In fact, the puppeteer stretches his voice over two octave register (not only for singing mantras but also for dialogues and narration), producing all sorts of voice effects: «a squeezing-out and cracking of the tone at the top of a long, upward glide; moans; rough “vocal fry” effects; hoarse, husky, and breathy tones; high pitched barks; and deliberate exaggeration of register breaks» (1984: 217). Singers, on the other hand (both males and females), are not required to produce anything different from the *nyari* (“clear, high”) sound. This is one of the reflections of the hierarchy in performing arts. The puppeteer sits at the top of this hierarchy, he is the one directing the orchestra and the singers. He is the master; he detains control over the entire performance. This explains why while he can play all the voice types, singers have a limited choice, so they have to identify with only one voice type. Female singers have an even more limited choice. On this wise, it can be said that *sindhen* are played by the puppeteer as human marionettes (which voice resembles the female characters type, “high and sharp”). This is evident in the dynamics of the comic interlude (Meloni, in course of publication).

The gendered meaning of sound in performing arts is a common trait of Asian cultures, as other studies demonstrate (Koskoff 2014). An interesting case is presented by Peng Xu (2014), in the analysis of the relation between voice and gender through adjectives found in late Ming dynasty literature. In this case, the intimate solo female singing, soft and swallow, was distinguished to the full-throated masculine singing, and recurred in literature with onomatopoeic terms as *lik lik* (resembling a quasi-staccato consecution of notes, like what in Western art music is indicated as “trill”) often associating it with the twittering of an oriole. The male quality, instead, was often expressed by the onomatopoeic *wou wou* (indicating a loud, vigorous voice) and associated with: «[...] the legendary cry of a crane atop a freezing peak visited by a Daoist immortal» (2014: 408). If we look at Javanese literature and philosophy, the voice types can be grouped in two macro categories, which defines Javanese aesthetics: *halus* (“refined”) and *kasar* (“rough”). *Halus*, often simplified in translations with “refined”, refer to individuals who have a total control over their instincts and passions. This inner quality is displayed by their external behaviour. An *halus* person would never talk loudly, they will limit movements, act with extreme calm and serenity, exert self-control in the relations with

others and observe an overall “constricted” way of acting, talking and interacting. This behaviour is index of a great inner power, which can be strengthened through practices of asceticism and meditation (the *gamelan* music itself is reputed to have a meditative nature). Conversely, a *kasar* individual is overwhelmed by his/her own passions and emotions. This lack of self-control is manifested through actions, language and relations with other individuals (Brenner, 1995: 29, Anderson, 1972: 38). *Halus* and *kasar* dichotomy does not only defines individuals but also areas (the more distant to the Royal Palace, the core of the “refined” culture, the more *kasar*) and performing arts. While courtly derived arts, like *gamelan* and *wayang* are considered to be at any rate *halus*, other “rural” or “folk” (*rakyat*) arts are often classified as *kasar*. An example of this dualism is evident the [Video example 1](#), recorded during a *bersih desa* (“village cleaning” ceremony) in Wonosari area (28th August 2019).¹⁰ Many groups of artists are present during this occasion, to celebrate with music and dances. Performances of various kind follow one another, from the more “refined” (*halus*) ones, as *gamelan* with *sindhen* voices, to the “rough” (*kasar*) or “folk” (*rakyat*) ones, as horse trance-dances and *reyog* (a trance-dance coming from Ponorogo, central-east Java). As courtly-originated singers, acting in court-derived performing arts, *sindhen* should embody by no other means the *halus* aesthetic.

Another significative adjective, often found in literary sources to describe the female voice, is *arum* (literally: “perfumed”, meaning “sweet” or “smooth”). We can read it, for example, in the verse: *sindhen estri swara rum* (“the singers with the sweet voices”) in the poem *Kinanthi Kang Titis*, often sung in court *gamelan* music. *Sindhen*, the female singers which are the emblem of the court aesthetic, are not only an incarnated identity of the *halus* aesthetics, but the most “refined” personification of Javanese hyperfeminine. They express the “refinement” under many aspects: their appearance (e.g., the posture, the gesture, the language, the costume), their knowledge (e.g., Javanese literature, *gamelan* music) and their voice. *Sindhen* voice should be *halus*, “refined”, which is a combination of multiple elements (*tinggi*, *nyari*, *merdu*, *los*, *power*) phoniatrically corresponding to the “recipe” above mentioned (“acute” “sharp” “twangy”, and with a high resonance in the upper vocal tract).

How to connect this theoretical groundwork with the acoustic investigation? Finally, in 2019, I had the chance to meet Dr. Silvia and, thanks to the collaboration of Giovanni Giuriati and the united intents of La Sapienza University and ISI Yogyakarta, this project came alive. We were going to Java to conduct endoscopies able to reveal *sindhen* vocal tract’s activity. Aware of the multiple-variants existing within diverse local communities and “regional” micro-variants (Sutton 1991) we decided to consider the districts of the DIY as a starting point of our research.

¹⁰ *Bersih desa* is a yearly ritual (each village celebrating according to its own cycle) lasting over a week. During these days, the village community gather to literally “clean the village” from bad spirits and to summon positive energies (both animists and Islamic) to bless the forthcoming harvest.



FIGURE 4. The districts of Yogyakarta Special Region <<https://petatematikindo.wordpress.com/2013/03/24/administrasi-provinsi-di-yogyakarta/>>.

6. Looking for answers: on-the-spot endoscopies

We planned the survey relying on previous on-the spot investigations that Ilaria conducted in 2014 to meet what Prof. Pak Parto (Petrus Suparto), defined *alami sindhen* or “natural sindhen”. Pak Parto demonstrated to be an excellent guide and a determinant source for gathering a greater number of volunteers in the project. But, most of all, he has been an excellent intermediary, capable to put the final stone of a bridge between Silvia (the “foreign doctor”), Ilaria (the “yogyanese adopted *sindhen*” and “foreign researcher”) and the *sindhen*, the Javanese vocalists. This chain was essential in order to conduct the research in a proficient way (according to Western academic standards, a limited time and the boundaries of the research permit) and to engage, at the same time, a broader dialogue with the singers, involving them in the discussion, answering to their questions as they were answering to ours.

Armed with a suitcase full of phoniatic equipment, a bag with the audio-visual apparatus and few notebooks, we have been driven by Pak Parto around the four districts of the DIY, plus the *kota* (meaning the core of the city enclosed within the *beteng*, the



FIGURE 5. Java administrative regions (Banten, Jakarta, West Java, Central Java, East Java and the Special Region of Yogyakarta); <https://d-maps.com/carte.php?num_car=133924&lang=en>.

Royal Palace walls, red in Fig. 4). Beside the “city”, the Special Region of Yogyakarta is divided in four districts: Gunungkidul (South-East, dark green in Fig. 4); Kulonprogo (South-West, light green in Fig. 4); Bantul (South, yellow in Fig. 4); Sleman (North, purple in Fig. 4).

We started from Gunungkidul district, more precisely, Wonosari regency. It is a mountainous area which Pak Parto defined: «The *sindhen* garage» (personal communication, 20th August 2019), meaning that here dwells the main concentration of the yogyanese *sindhen*. According to Pak Parto, the consistent presence of *sindhen* in this area might be linked to geographical factors. He suggested that *sindhen* living in a mountainous environment can naturally train their voice and be subject to minor vocal diseases, compared to those living in the city (personal communication). What is certain is that Wonosari isn't only a *sindhen* well but is the place in which the majority of “artistic families” (*keluarga seni*) live. Wonosari is among the areas registering the highest concentration of daily and weekly performances (mainly *gamelan* sessions and shadow puppet theatre). As Cooper reports: «One retired singer who had been a local star in her day said: «The inhabitants [of Gunungkidul] love Javanese music» (2000: 615). By what emerged from the endoscopies, is it possible to say that, among all, *sindhen* born and raised in Wonosari Gunungkidul showed an overall safer condition of the vocal folds and a wider nasal cavity. Wonosari *sindhen* are also those who better reacted to the medical inspection. For instance, they didn't manifest any discomfort during the insertion of the flexible tube, contrary to *sindhen* gathered from other areas. They also didn't show pathologies affecting nasal turbinates and other minor diseases. Indeed, more investigations should be conducted on this issue, in order to establish a correlation between vocal health and the surrounding environment.

Before starting the endoscopies and the vocal examination, we conducted a survey aimed to meet the singers and verify our working space accessibility (starting from an adequate electric system for our equipment). On 20th August 2019, we met the first five

singers (Kasini, Sumiyati, Pariam, Sarina, Tumiyati) at Pak Martono's house, in Tawarsari village. Pak Martono, a close friend of Pak Parto, is a musician and a reference point for many *sindhen* of the area. We spent many hours talking with the singers and with the two men (Pak Martono and Pak Parto) sitting on bamboo mats while drinking hot tea and delicacies from Wonosari (like the *tiwul*, warmly offered by the host).¹¹ Dr. Silvia (translated by Ilaria and mediated by Pak Parto) explained them what endoscopy consisted of, showing them video examples, and checked the status of their vocal folds. We also obtained short interviews divided in two parts. In the first part, we discussed their artistic background, singing history, education and training and their performing activity. The second part of the interview was focused on their general clinical history, such as hereditary diseases, neurologic diseases, hormonal and immunity disorders, asthma and other respiratory conditions, and voice disorders. All these preliminary activities are showed in [Video example 2](#).

As already detected from the 2014 survey, the majority of the singers living in Wonosari are what Javanese call *alami* ("natural") singers. It means that they use to learn «aurally» (Solis 2012: 61), therefore by imitation or with *rasa*, conversely to those defined as *akademi* ("academic") attending local conservatories. Further, many of them have been mostly exposed to *gamelan* music throughout their entire lives, almost totally ignoring other musical genres (international pop, jazz, rock or Western art music). Besides, as emerged from the interviews, they had never undergone endoscopy before nor they knew the existence of a doctor specialized in singing voice. On average, when experiencing vocal fatigue, they rely on natural remedies (balsamic oils, herbal drugs, infusions, traditional massages) or medicines prescribed by a general practitioner or a local physician, as *Dagirol* (Dequalinum Chloride) or *Methylprednisolone* (Corticosteroid). Despite they use to sing for the duration of eight consecutive hours, often overnight and in open spaces, they never use any kind of voice training or voice healthcare.

On 21st August 2019 we officially started our phoniatic investigation. We were driven once again to Wonosari, at *sindhen* Kasini's place, were all the other selected volunteers gathered. The first five selected *sindhen* underwent a video-laryngoscopy with a flexible endoscope Xion EF-N and a digital camera PROCAM ECLERIS. In order to make the women feel more comfortable, and also to recreate the singing condition, both the *sindhen* and Dr. Silvia sat in front of each other in a semi-kneeled position, using the traditional cloth-chair (*dingklik*), as in performance.

We articulated the endoscopy in three main sections. First, the *sindhen* were required to count from 1 to 10 in Javanese language, to sustain vowel sounds and to articulate a "siren" (Castellengo 1991: 155; McDonald 2005). Second, the *sindhen* were required to recite the lyrics of a musical piece (*wangsalan* riddles) without intonation. Last, we asked the *sindhen* to sing one of the selected pieces. We chose three of the most popular

¹¹ *Tiwul* is a typical dish of Wonosari made of minced cassava with coconut and brown sugar.



FIGURE 6. Dr. Silvia during an endoscopic session with *sindhen* Kasini; Wonosari, 21st August 2019 (photo: I. Meloni).

pieces in *sindhen* repertoire, being: *Jineman Uler Kambang* (a classical piece), *Langgam Caping Gunung* (a neo-traditional piece with a solo vocal opening) and, optional, *Macapat Pangkur Banyumasan* (a sung poem in the style of Banyumas, another “regional style”, characterized by a different vowel articulation).¹² They performed each selected piece without instrumental accompaniment.

All the subjects have been recorded with a Tascam DR 40 throughout the endoscopy. All endoscopic examinations have been stored on digital support for future re-evaluation. Activities of the larynx, the pharyngeal walls, and the soft palate were observed during singing activity. We evaluated vertical laryngeal position (described as higher or lower

¹² In Banyumas language (*ngapak*, a linguistic variant of Javanese), “A” in semi-final and final position of a word are not closed in “O” as in central Javanese variant (es. *rama*, pron. “romo”). This is interpreted as a *kasar* element, because it implies a wider mouth opening. This “opening” is perceived a less “refined” both physically (as already mentioned, according to court aesthetic, *sindhen* mouth opening is limited to two fingers width) and spiritually. To be too “open”, meaning direct or frontal towards another individual, is considered an index of lack of self-control (Herusatoto 2008). To my seven years of experience living in Java, I can confirm that it’s very rare to obtain a spontaneous, sincere display of private emotions from a central Javanese (especially those living in the courtly centres), even from a close friend. Central Javanese public display of calm and imperturbability doesn’t of course mean that they are not warm and welcoming.



FIGURE 7. Pak Parto playing *gendèr* (metallophone) during a *gamelan* session in Wonosari, 28th August 2019 (photo: I. Meloni).

than the respiratory one), the presence of pharyngeal walls constriction, laryngeal hyperfunction and the velum activity during vowel emission. Between one session and another, we set up a group vocal training guided by Dr. Silvia in order to release vocal tension. It was useful to verify the overall “constriction” of the singer’s facial muscles during singing activity. This also confirmed how none of the singers were accustomed to vocal warm up exercises nor to vocal relaxation techniques. Relevant details of the endoscopic sessions conducted in Wonosari are sum up in [Video example 3](#). We had the chance to meet some of the singers in action on 28th August 2019, in a ceremony called *bersih desa* (“village cleaning”), see [Video example 1](#). It was a precious occasion for observing these women in action within their performing environment. Indeed, it was also an important occasion to notice the first problem of this type of investigation: the difference in the vocal execution with and without *gamelan* accompaniment.

On 22nd August 2019, we conducted an endoscopic session with *sindhèn* of the *kota* (the city centre) and those of Sleman (the Northern district). This time, the survey was hosted by *sindhèn* Titik’s family, at Pak Sutejo’s house. A family picture in Javanese dresses with Obama in the middle welcomed us from the living room wall: «When Obama came

to visit Indonesia, he requested a *wayang* performance to be held to his hotel, we performed for him» (Pak Sutejo, personal communication). Pak Sutejo is an old, renowned puppeteer and an *abdi dalam* (“courtesan”) serving at Yogyakarta Royal Palace. His wife, Jumiati, is an experienced *sindhen* and courtesan, active at the Royal Palace and in local *gamelan* groups. Titik, their daughter-in-law, is one of the most promising singers in the DIY. She is also active in several contexts from Royal Palace to shadow puppet theatres. Descending from an “artistic family”, Titik has continued her education in central Javanese academies (SMKI art high school and ISI) uniting her “natural” or inherited family skills to a more “academical” formation. Differently from Wonosari’s situation, the *sindhen* that we met in this session came all from different and mixed backgrounds. Some of them (as Titik, Jumiati, Siswati and Wahyu) were mostly courtly and academic singers, though still with a partial “aural” formation. Instead, some of them, like Triastari, came from the local pop music framework and only recently turned to the classical singing. Even in this occasion, all the *sindhen* revealed to have never checked their vocal folds status and to ignore the existence of phoniatics. Similar to their colleagues in Wonosari, they asserted to assume medicines prescribed by local doctors or local remedies, such as ginger hot drinks and *kerokan* (a traditional coin massage).¹³ Despite vocal fatigue and voice loss often occurred to many of them, due to their intensive singing activity, they never relied on vocal training programs or to any voice specialist. *Sindhen* of the city have been submitted to the same evaluation of those in Wonosari area. We recorded sustained vowels sound, speech samples (including articulation of numbers and song-texts reciting in Javanese language) and “sirens” (Castellengo 1991: 155, McDonald 2005), previous to the endoscopic evaluation. This time, we could count on a more heterogeneous repertoire, thanks to their different backgrounds. Beside classical pieces in Javanese language, we could collect recordings of pieces in Banyumas dialect and Indonesian pop-songs, to better investigate how language affects voice quality. Endoscopic examination revealed a slight anatomical difference between *sindhen* of the city and *sindhen* of the village (or “academic” versus “natural” *sindhen*). In fact, the latter presented a wider and clinically safer condition of the nasal cavity. *Sindhen* coming from the city showed a narrower nasal sept, other than turbinates and minor obstruction of the sinus. Another difference lied in the vocal execution. While *sindhen* in Wonosari sung without any instrumental accompaniment, this time we asked Pak Sutejo and Pak Sri Mulyono (another puppeteer from Royal Palace) to play *gendér* (a metallophone) to help the singer’s intonation. This substantially improved the voice rendition. During the breaks between endoscopic examinations, we could discuss with Pak Sutejo and the other puppeteers about the voice types

¹³ *Kerokan* is a traditional Javanese massage consisting of a back scratching with a coin. If the skin turns red on the scratched areas, it’s interpreted as presence of “air” or “wind” (*angin*) literally “entered” (*masuk*) in the body. From here, the term *masuk angin*, indicating cold, flue or generic body infirmities. The way to let the “wind” exit from the body is to rub the skin with a metal object (often a coin) and to press or massage the reddened areas (often using oils). The “patient” will expel the air by belching or through the “healer” (belching in turn).



FIGURE 8. Preliminary briefing with the *sindhèn* of Kulonprogo district, 29th August 2019 (photo: I. Meloni).

in Javanese performing arts. That same evening, after the endoscopies, me and Dr. Silvia have been invited to watch a *wayang kulit* (shadow puppet theatre) performance in which Titik was going to sing. It was another wonderful occasion to observe *sindhèn* in action and to listen to their voices in their very environment, without the tension caused by the medical examination. All the main aspects of the endoscopic session in the city are showed in [Video example 4](#).

The third endoscopic session has taken place in Kulonprogo district at *sindhèn* Mamik's house on 29th August 2019. *Sindhèn* Mamik is another of Pak Parto's most promising students. Before starting the session, we grouped all the *sindhèn* for a preliminary talk about their vocal background. As it happened in other circumstances, we ended up singing, eating and chatting, getting to know each other and easing down the tension. Pak Parto explained them what they were going to do, and asked them not to be too formal or too rigid. We also asked if some could sing "regional style" pieces from Banyumas, Banyuwangi or East Java, as we already did in the other areas. Like in Wonosari, these *sindhèn* revealed to scarcely know other vocal traditions outside central Java. In this regard, *sindhèn* from the city and from academia showed a wider repertoire and a major opening to non-central Javanese classical pieces. Before starting the examination, we or-



FIGURE 9. Dr. Silvia preparing the equipment for the endoscopic session in *sindhen* Mamik's house, 29th August 2019 (photo: I. Meloni).

ganised group and individual singing sessions of the two mainly evaluated piece: *Caping Gunung* and *Uler Kambang*. Following, we had talks and interviews revealing a more or less similar background (*alami* or with Pak Parto as private teacher), performing activity (excepts for Mamik who was a former local pop singer, all the others were strictly linked to the classical Javanese art context), vocal knowledge and conditions of the vocal folds. Similar to the *sindhen* in Wonosari, singers of Kulonprogo district didn't show any discomfort during the endoscopies and recited, articulated, pronounced and sang what we requested (excepts for the repertoire in other "regional styles"). An interesting aspect that we could notice in all the endoscopies was the absence of a unique, standard version of the pieces. This is because of the improvisatory nature of the female classical singing. Every *sindhen* has her own style, meaning that she elaborates different vocal ornamentation from the others and uses diverse lyrics (which are part of the *wangsalan* ancient riddles corpus): «No two Javanese vocalists sing their songs in the same way» (Kunst 1973: 126). The highlights of this endoscopic survey are showed in [Video example 5](#).

The last endoscopic session, conducted on 31st August 2019 in Bantul district, revealed to be less successful than the others. We have to admit that it was partially our mistake. We hurried up the session because we were having troubles with visas and research permits



FIGURE 10. *Sindhen* Nanik and Dr. Silvia Spinelli during an endoscopic session in Kulonprogo, 29th August 2019 (photo: I. Meloni).

and we needed to go back to Italy soon. Thence, unlike other cases, this last session was conducted without preliminary meetings. This meant that singers were less prepared and more diffident to medical equipment. Some of the selected *sindhen* (still via Pak Parto's intercession) didn't get thoughtful husband permissions to take part in the project. Despite all, we managed to collect other four endoscopies with correlated audio-visual material.

Eventually, we collected audio-visual material of 22 *sindhen*, including endoscopies, interviews and group trainings and discussions, other than unforgettable fieldwork experiences as a heterogeneous team: a phoniatician, a *karawitan* teacher and a foreign *sindhen*-ethnomusicologist. We intertwined our competences, approaches and methods in this embryonal research project. Within all its unforeseen difficulties, lacks and limitations, we shared the aim to open new frontiers of the vocal knowledge in Java.

7. Voices of the DIY: A close-up

We selected the most relevant cases amongst the 22 volunteer subjects for two main reasons. The first concerns the vocal condition of the singers during the period of our investigations. As also emerged from the interviews, the months of August and September

register the highest activity peak due to the *tujubelasan* (celebration of August the 17th or *Hari Kemerdekaan*, Indonesian “Liberation Day”). We reputed this to be a favourable period to gather the higher number of volunteers, but we didn’t consider how this could affect their voices. Ilaria, throughout her experience of foreign *sindhén*, rarely experienced problems such as voice loss or fatigue. It’s also true that she used Oral Twang on purpose (thence following the “recipe” and doing constant training). Also, she didn’t perform to make a living, contrarily to the locals, so she faced periods of inactivity in order to avoid voice abuse. During the preliminary colloquia, many of the singers revealed to often experience vocal fatigue with the difficulty in reaching lower pitches. Despite the discomfort, they demonstrated to be still in the condition to carry out eight hours performance for several times a week. Medalia noted a similar pattern in Balinese puppeteers:

Two of the performers interviewed have subjected their voice to a lifetime of what we would regard as vocal abuse, and yet they are still, in their sixties or seventies, functioning as active and high respected members of their profession with relatively little diminution of their powers. (Medalia 1984: 217)

The preliminary diagnosis showed that nine singers suffered from respiratory allergies while six cases reported symptoms of gastroesophageal reflux. None of them smoked or reported regular drugs consumption. Only three of them, among those living in the city, reported a previous ENT evaluation for voice disorder, but no endoscopic analysis had ever been performed. They often used a cortisone-based medicine (*Methylprednisolone* 8 mg tablets) to fast recover. One of the singers had an acute bronchitis, therefore she didn’t undergo the endoscopy (in fact, initially they were 23 to participate in the study). The second reason of the selection concerns the repertoire. We selected two of the most popular pieces in *sindhén* classic repertoire, plus additional “regional” pieces or pop songs, according to each *sindhén* ability. However, many of the singers sung different version of the same piece (in line with the improvisatory execution technique of the classical singing) or they picked other pieces according with their own style and background.

We compared 11 selected endoscopies on 22 in order to find the recurring elements in the use of the vocal tract during singing activity. Simultaneous activities of the larynx, the pharyngeal walls, and the soft palate were submitted to video-endoscopy with synchronous voice recording and studied with spectrum analysis of discrete segments of the total phonation range. The laryngeal hyperfunction was described as supraglottic constriction, if medial compression occurred, with squeeze of the false vocal folds, or as anterior-posterior constriction, with compression of the epiglottis and arytenoid cartilages towards each other. Anterior-posterior (A-P) hyperfunction was defined as mild if more than 50% of the vocal folds was still visible and moderate if less than 50% of the vocal folds was still visible. True vocal folds contact was assessed as entire vocal fold. We could not evaluate vocal fold contact if the supraglottic hyperfunction was severe enough to preclude visualization of the true vocal folds. Our dual endoscopic study showed that:

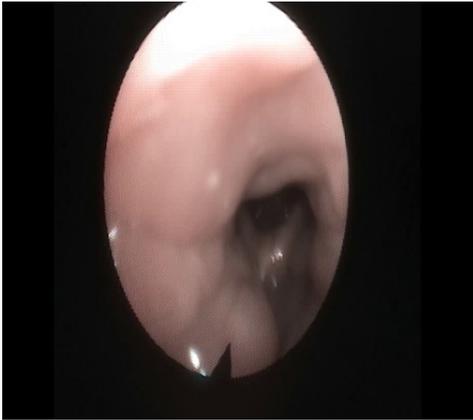


FIGURE 11. Pharyngeal constriction and larynx position of *sindhen* Jumiati (photo: S. Spinelli).



FIGURE 12. Pharyngeal constriction and larynx position of *sindhen* Siswati (photo: S. Spinelli).

- Pharyngeal walls were contracted on various degrees while the larynx rose in all subjects with the production of higher frequencies, while it lowered with the production of low frequency sounds (Figs. 11, 12).
- With the highest fundamental frequency, the lateral pharyngeal walls significantly contracted toward the midline in an upside-down V shape, creating a very narrow pharyngeal tube (Fig. 13).
- The soft palate lifted and the velopharyngeal port narrowed considerably with higher frequencies (Figs. 14, 15).
- The singers showed various degrees of anterior-posterior (A-P) hyperfunction. It was mild when the singers sang the vowel “I”, while it was moderate when they sang “A/O” vowel (Figs. 16, 17).

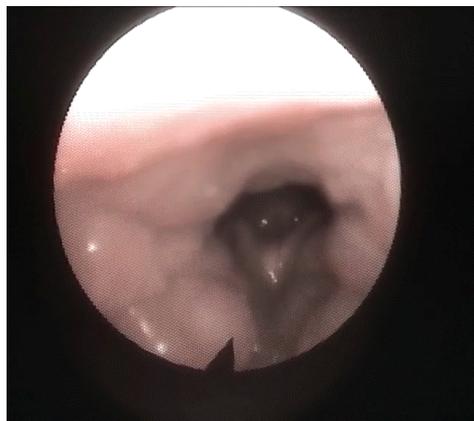


FIGURE 13. “V” shape and contraction of the pharyngeal tube (photo: S. Spinelli).

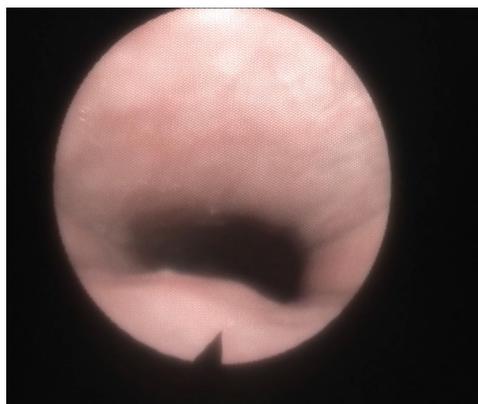


FIGURE 14. Low velum in vowel pronunciation (photo: S. Spinelli).



FIGURE 15. High velum in vowel pronunciation (photo: S. Spinelli).

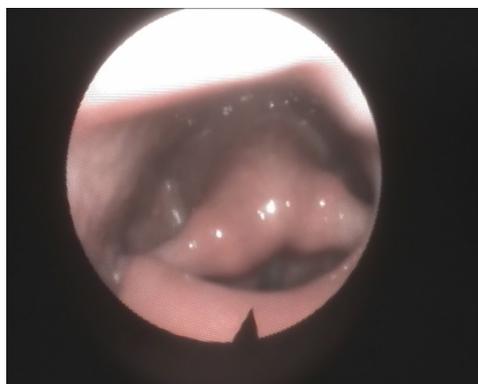


FIGURE 16. Mamik, vowel "O" (photo: S. Spinelli).



FIGURE 17. Mamik, vowel "I" (photo: S. Spinelli).

The opening of the epiglottic funnel is made smaller by bringing the arytenoid cartilages closer to the lower part of epiglottis (the petiole) whereby the sound gets clearer and non-breathy, as the Twang-like sound. The endoscopic analysis on the sustained vowels showed the complete adduction of true folds in all the 11 *sindhen* selected with the presence of anteroposterior hyperfunction.

The singers reported various degrees of Twang, from "necessary" Twang to "distinct" Twang, meaning when the opening of the epiglottis funnel is made even smaller by bringing the epiglottis even closer to the arytenoid cartilages, the sound assumes a sharper and more penetrating, snarling character. Analysis also indicated that the vibrations of the vocal folds are unhindered and unaffected by the Twang. So, the vocal folds are vibrating freely under the Twang. In all the examples where we can see the vocal folds, or look at the laryngograph trace, there seems to be a reasonably regular pattern, and there didn't appear to be any evidence of the effect (or any additional noises) being produced in the vocal fold level. There was evidence on endoscopy or from the Laryngograph of periodic

vocal fold vibration. The basic paradigm that evaluates laryngeal hyperfunction is to look for compression of the supraglottic structures during phonation. This supraglottic constriction may occur as medial compression, with a squeeze of the false vocal folds, or as anterior-posterior constriction, with compression of the epiglottis and arytenoid cartilages toward each other.

8. Beyond the Twang: Common traits and individual specificities

Summing up, we can establish that the selected *sindhen* showed some recurring elements as:

- Closure of the epiglottis thence narrowing of the pharyngeal walls in a V-shape
- Narrowing of the velopharyngeal port (often on higher frequencies)
- Larynx in a medium-high position (often on the higher frequencies)

These parameters match with those identified in the preliminary hypothesis (see paragraphs 4-5), meaning that amongst the classified voice qualities, according to Western methodologies related to voice studies, the closest to *sindhen* is Twang.

However, despite the common traits, which can be said to be the core of the “*sindhen* voice quality”, observing the singular cases, many differences came to our attention. Some (like Jumiat) tended to use a very high degree of oropharyngeal constriction, in others, like Sswati, it was minimum. The narrowing of the epiglottis and cord adduction happened on less variable degrees in six *sindhen* over eleven. Seven *sindhen* showed hyperkinesia of false cords. We conducted further spectrographic evaluations with *Multispeech* program, analysing the onsets of the pieces executed by each singer (*Uler Kambang* and *Caping Gunung*). Here we detected more specificities of the singular singing voices, as the two examples in Figs. 18-19 (*Sindhen* Mamik; [Audio example 2](#)).

From the *Multispeech* exert, we can read the following parameters in *sindhen* Mamik vocal onset. The waveform shows discontinuity and irregularity. The onset is gradual, bottleneck shaped. It lacks of the sustain able to guarantee a constant pressure. The frequency exceeds the 10.000 Hz, typical in higher resonators. High energy concentration is showed in the formant region (5000 Hz) with a sound compression on high frequencies. Sound is not “projected” (in the Western art singing meaning). Mamik acoustical-endoscopic analysis showed arytenoid anteriorization, larynx in a high position, a low degree of lateral walls constriction and no constriction of the hypopharynx (*Sindhen* Siswati; Figs. 20-21; [Audio example 3](#)).¹⁴

¹⁴ Here we selected examples from two different musical executions (*Caping Gunung* in the first case, *Uler Kambang* in the second). However, the scale, mode (*slendro sanga*) and the pitch intervals of the onsets are the same (notes 5-6).

SOUNDING LIKE A SINDHEN

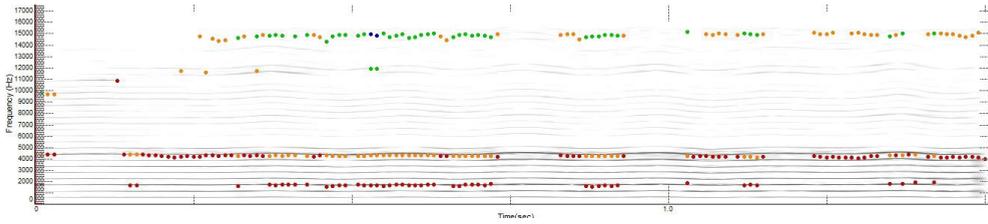


FIGURE 18. *Multispeech*. *Caping Gunung* onset (Mamik).

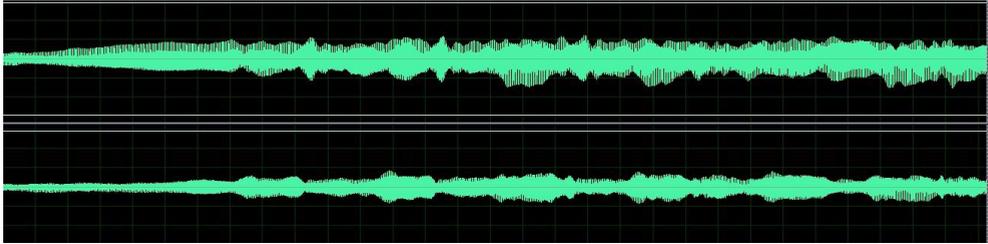


FIGURE 19. Waveform. *Caping Gunung* onset (Mamik).

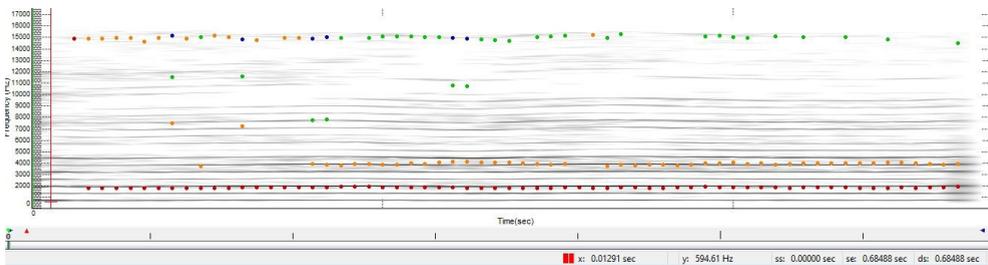


FIGURE 20. *Multispeech*. *Uler Kambang* onset (Siswati).

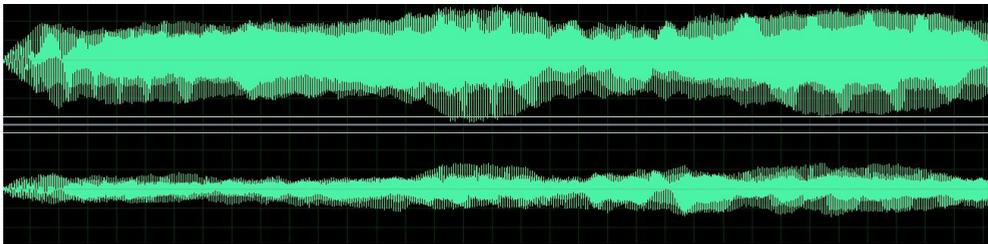


FIGURE 21. Waveform. *Uler Kambang* onset (Siswati).

From the *Multispeech* exert, we can read the following parameters in *sindhen* Siswati vocal onset. The waveform shows more regularity, with a higher sound intensity, compared to Mamik case. The onset is abrupt but without glottal stop, no pre-phonatory apnea and more sustain. The formant is strong under 5000 Hz but absent over 5000 Hz. Here, sound appears more “projected” (in the Western art singing meaning). Siswati acoustical-endoscopic showed arytenoid anteriorization with coverage of the glottis, an elevated

cordal contact with compressed edges, a narrowing of lateral walls at palatin pillars level, high larynx (which we found also in Mamik), and hypopharynx constriction.

An interesting element found in these two examples (and in the overall spectral analysis) is a lack of formants clustering, which is typical in Western art singing (Sundberg 1972). A similar phenomenon occurs in Chinese Opera Singers, according to Sundberg: «The absence of a singer's formant cluster in the Peking opera singers would be related to the enormous timbral differences between the orchestral accompaniments used in the Peking and Western opera traditions» (Sundberg 2010: 141). This consideration might be extended to the Javanese case. These are only two examples amongst many others that can be made. For a more comparative and systematic analysis of the singular cases we refer to future studies. These variants can be, on one hand, what defines each singer's style. On the other, they can be considered an index of the real complexity behind the attempt to identify a standard voice quality.

9. Discussing the outcomes: Towards a definition of the "*sindhén* sound"

The most interesting common trait emerged from the endoscopies and the *Multispeech* analysis is that there aren't real strong common traits to define a standard vocal technique, excepts those recurring on various degrees such as the pharyngeal constriction, the closure of the velum and the larynx in a medium-high position. These might be indicated as the most common physiological features in *sindhén* voice. Acoustically, they are equated by an increment of the medium-high frequencies and the lack of formant cluster. These are also acknowledged to be the main characteristics of Twang quality as described by Estill (1979) and Sundberg (2010). However, it can't be firmly stated that *sindhén* quality is Twang. First, because Twang is a specific technique used by singers with a certain knowledge of what they are doing. Second, because, despite most of the Twang traits emerged from the overall analysis, each singer demonstrated to have her own peculiarities and variants, distancing from the standard Twang figure, giving to the voice a specificity. The existence of these variants, related to a socio-cultural, historical context (which is the Javanese transmission of knowledge and Javanese aesthetics) can't be ignored to isolate the vocal quality into standard parameters. Quoting Adamo:

In sound analysis and psychoacoustical research we tend to use necessarily an analytical approach, that is, we try to isolate single aspects which can be significant for our sound and music perception. But our sound and music perception, at high hierarchical levels, is synthetic. We can try to plan laboratory experiments in order to isolate the effect of variations of a single parameter, but the actual music perception in the real world, within socio-cultural and historical contexts, is much of the time much more complex, in terms of the number of variables and their processing by the ear-brain complex, than our actual knowledge of the involved mechanisms (2011: 147).

Going straight to the point: can we define a *sindhen* voice quality? We can maybe talk about “voice qualities” all based on common, Twang-related features.¹⁵ However, if we take into consideration the discourse on voice and Javanese aesthetics (see par. 4), we can go farther than that. More than *sindhen* voice quality or *sindhen* technique, in fact, we should maybe talk about *sindhen* “sonority” or “sound”, meaning that to sound as a *sindhen* you should obtain a certain degree of pharynx constriction and a resonance on the high frequencies, compressed in the upper vocal tract, which create the effects of “nasalization” and “fluctuation” over *gamelan* music. This sound is connected to the *halus* (“refined”) aesthetic and to the overall “constriction” expressed by the court-derived ideal of Javanese femininity. Otherwise, we can’t assume that there is a prescription, or “recipe” (as Estill would say) for the correct voice quality. There is not a “correct way of breathing”, nor a “correct adduction” nor a standard protocol to follow. As far as you can “sound *sindhen*”, you have achieved the “gift”. Of course, one can rely on theories like Estill (as we did), to use as analytical tools, in order to better understand how to achieve that sound and how it’s produced. It safe to add that considering the nature of Javanese language and the anatomical characteristics of the *sindhen* sinus (especially the *alami* ones presenting a short, wide and clear cavity) it’s not difficult for any local woman to easily achieve that sound in a “spontaneous”, “natural” way or by imitation, without specific theoretical guidelines.¹⁶

At this point, a deontological question might come to the reader’s mind: considering that the majority of the singers still learn *alami* (“natural”) way, is it right to reveal *sindhen* how they sing? As researchers, we wouldn’t mind to reveal singers how they sing, but we would never tell a *sindhen* “how to” sing. As a *sindhen*, I wouldn’t mind to help younger peers to learn the “trick” of pharyngeal constriction in order to achieve “the sound”, leaving all the rest to their own experience and apprentice through imitation, but this is only a personal consideration.

10. Conclusion

From the research reports we can assume that what we call “*sindhen* voice quality” is essentially constituted by some main features which coincides on a certain degree with the main definitions of Twang quality (Estill 1978, Mc Donald 2005, Sundberg 2010). The key element is the “constriction” or “narrowing” of the pharynx (as theorized by Podjosoedarmo) that makes everything concentrated on the upper vocal tract. However, rather than theorizing a unique, defined voice quality, we’d better talk about many

¹⁵ On this point, Sundberg (2010) observed that this feature can be found also in Opera and Belting, which Estill classified as distinct voice qualities from Twang (though they actually contain Twang in their “recipe”).

¹⁶ Trang Quang Hai also asserted that most of Asian people are advantaged in reaching Twang-like sounds because of the “nasal” nature of their languages (communication during the Throat Singing Workshop, ICTM Bangkok 2019).

variants of a voice quality resembling a “*sindhén* sound”. This sound has implications concerning the female power (*shakti*) and the ideal of femininity according to Javanese court aesthetics.¹⁷ Under a pragmatic point of view, this “sound” is what makes singers able to sing within *gamelan* orchestras, resonating on medium-high frequencies and making them seemingly to “float” on the stratified heterophony. Moreover, voice quality is not standardized nor taught on any theoretical basis but only learnt by imitation. The criteria to have a “good voice”, identified in several adjectives as *merdu*, *los*, and so forth, can be said to be identified in being able to “sound like a *sindhén*”, thence reaching the “*sindhén* sound”, which is built up by the characteristics emerged in the endoscopies and in the acoustic analysis.

Indeed, the outcomes provided by this first phoniatic investigation of the *sindhén* voice quality still need to be deepened and perfectionated under many aspects, and more systematic, comparative analysis should be conducted basing on the collected material. To be exhaustive, many other endoscopic sessions need to be carried out on *sindhén* belonging to different contexts and with different repertoires, during singing activity, repeating the sessions until the singers get familiarity with the equipment, also recreating their performing environment as ostensibly possible. An interesting comparison could be operated between *sindhén* performing different “regional styles” (for example *banyumasn* or *banyuwangen*) considered “less refined” than the central Javanese style (Sutton 1991). This way, it will be possible to empirically explain some voice quality features which appear indefinite, ineffable and generic when described by simple adjectives. It is also a way to understand how aesthetic categorizations are translated into vocal practice, and on what extent they remain abstract conceptualizations or expressions of a displayed identity (Hughes-Freeland 2008: 16; Stokes 1997; Clayton, Dueck, and Leante 2013).

Indeed, methodology needs to be improved as well. We would like to enlarge the team research (which Dr. Silvia defined as “ethno-phoniatrics”) involving experts in linguistics, phonostylistics, logopedics and other disciplines offering dynamic methodologies for exploring the singing voice under all its aspects. We wish to go further in this study with a collaborative spirit, uniting the efforts of singers, teachers, researchers and specialists of different fields who wants to disclose some still unquantified music “untalkables” (Hood 1993), counting on new synergies and the aid of modern technology.

¹⁷ Though not totally relatable to this case study, it’s impossible not to think about Lomax correlations between sexual habits of a society and vocal style (in which high degree of narrowing and nasality are indicators of tension) (1968: 195). Other examples of female voice associations with eroticism (metaphysical or terrain) are found by Sorrell (2012: 20) in other musical cultures, including European ones.

Audio examples¹⁸**1. *Jineman Uler Kambang (Floating Caterpillar)*. [1:47]**

Performed by Sukei Rahayu (voice and *gendér*). Recorded by Ilaria Meloni on 29th May 2018. This is a classical vocal piece in Javanese language in *slendro* tuning. The musical execution shows the typical *sindhengan* improvisation technique alternating regular metric patterns and melodic formulas in a free rhythm “floating” on the “skeleton melody” (*balungan*). Lyrics consists in a corpus of ancient and modern riddles which the singer is free to choose (by memory or using booklets) simultaneously with the improvisation of the melodic patterns. Because of the freedom in vocal and textual improvisation, the same piece is executed on a large degree of individual versions, according to each singer’s style. This reflects the importance of variation in *gamelan* heterophonic music.

2. *Caping Gunung (Mountain Shaped Hat) onset*. [0:03]

Performed by Suparmi (Mamik). Recorded by Silvia Spinelli on 29th August 2019. The excerpt analysed with *Multispeech* showed that the onset is gradual and irregular. It lacks of the sustain able to guarantee a constant pressure. The frequency exceeds the 10.000 Hz, typical in higher resonators. High energy concentration is showed in the formant region (5000 Hz) with a sound compression on high frequencies. Sound is not “projected” (in the Western art singing meaning).

3. *Jineman Uler Kambang (Floating Caterpillar) onset*. [0:03]

Performed by Siswati. Recorded by Silvia Spinelli on 22nd August 2019. The excerpt analysed with *Multispeech* showed more regularity, with a higher sound intensity, compared to Mamik case. The onset is abrupt but without glottal stop, no pre-phonatory apnea and more sustain. The formant is strong under 5000 Hz but absent over 5000 Hz. Here, sound appears more “projected” (in the Western art singing meaning).

Video examples

1. *Bersih desa (“Village Cleaning” ceremony)*. [4:51]

Music and performances in a “village cleaning” ceremony in Wonosari (Gunungkidul). Filmed by Ilaria Meloni on 28th August 2019.

The video shows social, ritual and performative activities carried out during a ‘village cleaning’ ceremony in Gunungkidul district, focusing on the dichotomy between the Javanese aesthetics: *halus* (“refined”) and *kasar* (“rough”). While trance dances (like the *rèyog*) are considered an example of *kasar* arts, *gamelan* music and *sindhén* voices are reputed an example of “refinement”. *Sindhén* remain kneeled and steady throughout the whole duration of the *kelenengan* (music gig), according to the court-derived ethics, shifting turns for their solo voice improvisations.

2. Preliminary survey. [8:26]

Reports of a preliminary endoscopic survey in Wonosari (Gunungkidul) area. Filmed by Ilaria Meloni on 20th August 2019.

The excerpt is conceived as a short journey through the first step of our multi-disciplinary

¹⁸ The audio-visual documents were recorded in Java, Indonesia, with a Sony Handycam HDRCX625 and a Tascam DR40.

field-research. With the help of professor Petrus Suparto (from ISI Yogyakarta) we gathered the first five volunteer singers (Kasini, Sumiyati, Pariam, Sarina, Tumiyati). We discussed with them about our project, verified their first reaction to the medical equipment and got to know their artistic and clinical background. We understood the first significant information: the singers had never undergone any endoscopic examination and they were not used to any kind of training, despite the frequent long-hours performance activity. This is in line with their “natural” (*alami*) formation.

3. First endoscopies. [10:43]

Reports of the first endoscopic session in Wonosari (Gunungkidul) area. Filmed by Ilaria Meloni on 21st August 2019.

The five volunteer singers already met in the preliminary survey underwent endoscopic examination during singing activity. The video-laryngoscopy was operated with a flexible endoscope Xion EF-N and a digital camera PROCAM ECLERIS. The *sindhen* were required to: count from 1 to 10 in Javanese language; to sustain vowel sounds and to articulate a “siren” (Castellengo 1991: 155; McDonald 2005); to recite the lyrics of a musical piece (*wangsalan* riddles) without intonation and to sing one of the selected musical pieces (*Jineman Uler Kambang*, *Langgam Caping Gunung* and, optional, *Macapat Pangkur Banyumasan*). Dr. Silvia Spinelli conducted group training which were useful to establish the extent of vocal and facial “constriction” of the singers. First videos of the vocal tract activity revealed the first differences and common traits of *sindhen* voice qualities and the connections with Twang quality (Sundberg 2010; McDonald 2005).

4. Endoscopies in the city. [12:23]

Reports of the endoscopic session conducted in Yogyakarta city. Filmed by Ilaria Meloni on 22nd August 2019.

Six volunteer *sindhen* from the city (Titik, Triastari, Suhemi, Jumiaty, Siswati, Wahyu) underwent endoscopic examination during singing activity. Singers gathered at Pak Sutejo’s house (a puppeteer of the Royal Palace) who accompanied the singing with the *gendér* and was engaged in a discussion on the voice qualities and the aesthetics in Javanese music and performing arts. This investigation was determinant to establish actual dichotomy between the so called *sindhen alami* (“natural *sindhen*”) and *sindhen akademi* (“academic singers”).

5. Endoscopies in the Western district. [8:01]

Reports of the endoscopic session conducted in Kulonprogo district. Filmed by Ilaria Meloni on 29th August 2019.

The endoscopic examination took into consideration a selection of volunteer singers from the Western district of Yogyakarta Special Region. The selected singers (Mamik, Rusiyati, Nanik, Tukinam, Pahinam, Jumi) gathered at Mamik’s house and underwent video-laryngoscopy, following the guidelines adopted in the other areas. As in Wonosari (Gunungkidul), *sindhen* of Kulonprogo showed a musical knowledge limited to traditional and classical pieces, other than a quasi-total *alami* (“natural”) formation. The differences of each *sindhen* voice quality were, also in this case, connected by common traits, like the pharyngeal constriction.

Musical example 1. *Jineman Uler Kembang in slendro sanga* (Sukesri Rahayu).

Bal. $\widehat{6}$

Sindh. 5 6^{ww}, 6¹⁶⁵ 56¹⁶⁴1^{ww}, 5 2 2^{ww}, 2 2²³² 1²³³²5^{ww}, .232 2^{ww} .3~2³³²³²¹ 6

Ja- nur gu- nung__ u- ku- ran bun-der pi_____ na- la_____

Bal. 1 1 6 5

Sindh. . 1 1 . 1 2 1 . 1 2 6²1 3^w 2 5

Sa- e Sa__ e Sa- e Sa-e Da- do- se

Bal. 1 2 1 $\widehat{6}$

Sindh. 5 6 1 2 6⁻1 5 2 . 2 2 2 1 2⁻5 1 2 6

Jo la-li lho mas ko we go- tong ro-yong nyam- but ga- we

Bal. 2 3 5 $\widehat{6}$

Sindh. 2 1 2 6 2 . . .

Ro kan__ ca- ne

Bal. 5 3 2 $\widehat{1}$

Sindh. . . 2 2 2 2' 1 1' 2 6 1 5 2 3~2³²¹ 1

A- ja le- ren yen jang- kan-e du- rung te- ka

Bal. 6 5 6 2

Sindh. . 6 6 . 6 1 5 . 1 6 1 5 . 5 5 ~6' 2

Kin-clong Kin__ clong Sing kin-clong gu- wa- ya- ne

MELONI AND SPINELLI

Bal. 6 5 6 $\widehat{1}$
 Sindh. $\overline{\cdot 2 6^w}$ $\overline{\cdot \underline{6 1}}$ 5 $\overline{\cdot 5 6^w}$ $\overline{\cdot 5 1}$ $\overline{5 2}$ $\overline{6 1}$ 1
 Mu-rub mu- byar men-co- rong ka- ton cah- ya- ne

Bal. 5 2 1 6
 Sindh. $\overline{3 \sim 2}$ $\overline{2^{121}w 6}$ $\overline{\cdot \cdot 1 2}$ $\overline{\cdot \cdot 1 6}$ $\overline{\cdot \cdot 5 3}$ $\overline{2 6}$
 Ra- ma O- ra bu- tuh ka- e ka- e

Bal. 2 1 6 ⑤
 Sindh. $\overline{\cdot 6 6 6}$ $\overline{6' \cdot 5 6}$ $\overline{3 3}$ $\overline{5' \cdot 2 3}$ $\overline{\cdot 2 5}$ $\overline{3 3}$ $\overline{1 6}$ $\overline{5 5}$
 O-ra bu- tuh ka- e ka- e bu-tuh ku ten- trem a- ti ne

Bal. 2 5 2 $\widehat{1}$ swk
 Sindh. $\overline{\cdot 6 6 6}$ $\overline{6' \cdot 6 6}$ $\overline{6^{531} 1'}$ $\overline{\cdot 5 6^w}$ $\overline{5 1}$ $\overline{5' \cdot 2 3}$ $\overline{2^{321}}$ 1
 O-ra bu-tuh ka-e ka- e bu-tuh ku ten-trem a- ti_____ ne

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