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Is it the speaker's formant, actor's formant, shouting formant or calling formant cluster?: A proposal for a more proper name/concept

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Abstract

Appropriateness of concepts is a trouble of social and natural scientists. The main problem was created generally by conceptual stretching or assigning different names to the same thing that created an abundance of concepts that have potential to cause unnecessary complexity and uncertainty in the literature. The present study examined the drawbacks of calling the 3-4 kHz spectral energy peak with different names; speaker's formant, actor's formant, shouting formant and calling formant cluster. It concluded that, to call the given acoustical phenomenon as the 3-4 kHz peak ($P_{3\text{-}4kHz}$) may be as simple as it is correct, too.

Anahtar Kelimeler

$P_{3\text{-}4kHz}$
Konuşmacı Formantı
Aktör Formantı
Haykırma Formantı
Kavramsallaştırma

Is it the speaker's formant, actor's formant, shouting formant or calling formant cluster?: A proposal for a more proper name/concept

Özet

Kavramların yerindeliği hususu bilim insanları açısından önemli bir sorundur. Sorunu üreten temel etmenin, söz konusu bir kavramın zorlama bir şekilde genişletilmesi veya aynı bulguya/şeye, literatürde gereksiz bir kavramsal karmaşa ve belirsizlik yaratma potansiyeli üretecek şekilde, farklı isimler verilmesi olduğu görülür. Bu çalışmada, spektral olarak 3-4 kHz bölgede görülen enerji sıçramasının konuşmacı formantı, aktör formantı, haykırma formantı ve çağırma formant demeti gibi farklı isimlerle anılmasının sakıncaları ele alınmıştır. Söz konusu akustik görüngünün 3-4 kHz peak ($P_{3\text{-}4kHz}$) olarak kavramsallaştırılmasının, basit ve bir o kadar da doğru olacağı sonucuna varılmıştır.

Keywords

$P_{3\text{-}4kHz}$
Speaker's Formant
Actor's Formant
Shouting Formant
Conceptualization

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INTRODUCTION

According to Mitrović, "concepts are the intellectual historian's nightmare. While there is little agreement on what they are, various fields of intellectual history are replete with debates about the appropriateness or anachronism of specific concept attributions to individual historical figures" (Mitrović, 2011). It appears that, such a nightmare about the appropriateness of concepts is not particular to historians, but it is also a trouble of social and natural scientists (cf. Jordan et al., 2004; Singh, 2011). Apparently, the problem arises, before all else, from stretching the extent of a concept (Sartori 1970) or by adapting existing terms to new situations for which they were not designed or suited (Buller and Gamble 2002). Moreover, the solution that this *conceptual stretching* creates is superficial: such solution brings with it a much more significant problem: "indefiniteness, elusiveness" (Sartori 1970), and "lack of clarity and precision" (Buller & Gamble, 2002).

The drawbacks created by naming an acoustical phenomenon as 'singer formant' which was used for a long time, was explained in another study of mine. In that case, the main problem created these drawbacks was *conceptual stretching.* Thus, to offer the concept "Western opera singer's formant cluster" (FC_{wos}) was the most valid solution for me (Saruhan, *forthcoming*). However, in the case examined in the present study, the problem arises from assigning different names to an acoustical phenomenon that is located in the 3-4 kHz spectral region. In this case we encounter another problem that is no less important than the problems created by conceptual stretching: that is, an abundance of concepts that have potential to cause unnecessary complexity and uncertainty in the literature. In the present study, I will examine the drawbacks of calling the 3-4 kHz spectral energy peak with different names, and try to offer a solution.

The historical background

The first written works about singing voice, such as those Gulio Caccini, Pier Francesco Tosi and Giambattista Mancini were technical instructions and, rather than acoustical matters, they laid stress on voice registers. They consisted of reflections of singing teachers and were based on experiences and subjective observations of these teachers constructed on a long period of time. What made Garcia II exceptional was his research on vocal cords via the objective method: he was the first in trying to describe registers on an objective anatomo-physiological basis, through laryngoscopic observations of the larynx (Henrich, 2006; Castellengo, 2005). After the second half of 20th century, with the invention of electroglottography by Fabre in 1956 (Henrich et. al., 2003), objective studies about registers that begun with laryngoscopic observations, were turned to enumeration of signals captured by this method, and this still used widely. On the other hand, although the tale of interest in the science of sound, or *acoustics*, begins by the twenty-seventh century BCE, the foundations of spectral analysis begun to be laid only with the 1877 study by Hermann F. L. von Helmholtz titled *Lehre von den Tonempfindungen* (Raichel, 2006). However, because it interested me only to a limited extent, when and by whom spectrum analyzer was used initially on human voice is not clear for me. Besides, in spite of all my effort to learn when the spectrum analyzer was used first on singing voice, I did not meet any study in this regard that was conducted before the 1934 study by Bartholomew. According to Sundberg, referring to the peak in the spectrum between 2 and 3 kHz as the 'singing formant' began after Bartholomew's study, and continued in the studies of Stanley & Sette (1935), Rzhevkin (1956), McGinnis, Zlnick & Kraichman (1951), Fry & Mankn (1957) and Vennard (1964)

(Sundberg, 1968). As I cannot reach other studies, the information I have is restricted to the study of Bartholomew and the 1967 study of Vennard. Although in his study Bartholomew mentioned "*a high formant* for male voices usually lying between approximately 2400 and 3200 cycles" and related it to "the better voice" (Bartholomew, 1934), he did not use the concept of singer's formant. Likewise, although Vennard mentioned the results of Bartholomew and named it as "2800" in his study, and related this acoustical phenomenon to "a good singer who can keep (it) in his voice while singing softly" (Vennard, 1967), he too did not use the concept of singer's formant. Thus, the first place I encountered the concept of "SF", is the 1968 study by Sundberg. Beginning from this date, this acoustical phenomenon has been referred to as "SF". However, as I detailed it in another study, to name this phenomenon as the SF obscures it's specificity to Western opera singers (Saruhan, *forthcoming*). For this reason, I concluded that, the name SF, (that is not only derived from a culturally specific way of thinking about singing and is ill-defined and confusing, but also plays an important role in studies on the acoustics of singing voice), must be replaced by a new name that implies the *thing* itself; that is "Western opera singer's formant cluster" (Saruhan, *forthcoming*). Thus, I will refer to it in the present study as FC_{wos}.

In literature, the function of FC_{wos} is described on the possibility provided by it; in relation to making singers heard by the audience (Sundberg, 2006; Wells, 2006; Bele, 2006; Mendes et al., 2003; Borch & Sundberg 2002; Sundberg, 2001; Sundberg, 1979; Sundberg, 1974; Sundberg, 1972). It was asserted that this possibility are provided by its location "in a frequency region where the competition from the accompaniment is moderate" (Borch& Sundberg, 2002:33) and the supposed physico-acoustical link between laryngeal cavity (LC) and the ear canal that cause it to resonate at the most sensitive region in the auditory spectrum (Titze, 2001; Hunter and Titze, 2005). Although these explanations do not include the entire answer to the question of why it began to be used by opera singers (see. Saruhan, 2016), it is clear for me too, that this phenomenon is related to the technique first used by opera singer in the first half of the nineteenth century in order to resolve the problem of being heard in opera houses which in those decades were able to contain many more spectators and where the orchestra sounded much louder (cf. Vest, 2009; Lamesch et al., 2007).

The connection between formation of vocal techniques and functionality that emerged regarding opera singing, which increasingly became the focus of acoustics-based studies by the mid-20th century, led to the rise of a curiosity in this manner towards other forms of vocal performance, particularly in recent years (Saruhan, 2014). In the study conducted in 1993, Leino found that "the prominence of the 3.5 kHz peak in the LTAS distinguished the actors' good voices from the fairly good and rather poor voices" (Leino, 2009) and" named this peak as the actor's formant" (Nawka et al., 1997). This acoustical phenomenon was subsequently named both as the "actor's formant" (Leino, 2009; Master et al., 2008; Master et al., 2012) and the "speaker's formant" (Bele, 2006; Nawka et al., 1997), and sometimes as the "actor's/speaker's formant"(Leino et al., 2011).

The problem of naming

To my knowledge, the first objection to the name of this phenomenon came from Cleveland et al. According to the authors, although this peak seemed "to be a typical ingredient of the spectral characteristics of good speaking voices in general, because the peak has similar prominence in country singers' singing voices, it may deserve a name different

from speaker's formant" (Cleveland et al., 2001). Later, in their study where they examined the differences between the *klapa* and *dozivački* styles of singing, two different folk singing styles in Croatia, noticing that "the strong spectral peak in the speaker's formant region found for *dozivački* singing may also be seen as a result of louder singing and nearly shouting-like vocal production typically employed in this mode of singing", Kovačić et al. claimed that "the appropriate label for the discussed formant could be the *shouter's ring* or *shouter's formant*" (Kovačić et al., 2003). In their 2006 study Boersma and Kovačić also stated that "the naming of this peak as a speaker's formant may be problematic, since it is found in singing rather than in speaking" and they asserted that "the term *shouter's ring* or *shouter's formant* might be appropriate" (Boersma & Kovačić, 2006). It appears that the source of these objections is the uncongeniality between the *implied* component of the given names and the quality of the practices. It seen that neither of the "actor's formant" and the "speaker's formant" is appropriate for correctly describing the performances of country singers (Cleveland et al., 2001) and folk music singers (Kovačić et al., 2003; Boersma & Kovačić, 2006). On the other hand, it is also seen that; the names proposed by Kovačić et al. and Boersma and Kovačić do not solve the problem. In a study that investigated the register phenomenon and spectral characteristics in a vocal style used by vocal performers (imam-hatips, muezzins, hafizs and mevlithans) of a Muslim community, with my colleagues, we observed that although these performers generally had a strong peak in the 3-4 kHz region centered in vicinity of 3.5 kHz in their performance voices, what they did was neither shouting nor only speaking (Saruhan et al., *In Press*). Also, they were not singers or actors:

> Muezzins are persons who read Adhan (or "ezan" in Turkish), which is the Islamic call to worship, recited from the mosque five times a day, traditionally from a minaret, summoning Muslims for the mandatory worship, which is called "salat" (or "namaz" in Turkish). *Imam-hatips* are the leaders of salat who also give sermon to congregations and pray. *Hafizes* are persons who memorize the whole Qur'an, and the institution of hafızlık (hafizness) is historically considered as the healthiest way of transferring Qur'an to next generations and protecting the holy or sacred message (Kurt, 2012). Thus, what the participant group of our study does can be described as calling the Muslims to worship (like in Adhan, performed by muezzins), preaching and leading prayers, and telling the life of the Prophet Muhammad to congregations (as in Mevlit by Mevlithans). Maybe the most suitable term for all of these acts where in general a loud voice is used could be "calling." (Saruhan et al., *In Press*)

Thus, in our study, also considering that it is not a formant but a cluster of formants, we named this phenomenon the *calling formant cluster* (FCc) (Saruhan et al., *In Press*). However, as a result of the study I conducted on the suitability of the concept of SF (Saruhan, *forthcoming*), I understood the need for re-evaluating the name FCc, as well. As stated by Gerring, "what we wish to know about a social science concept is not merely what it is, but also *where* it is-which is to say, where it *isn't*, [and] in order to perform this task effectively a concept must be sufficiently bounded" (Gerring, 1999). Additionally, the name of a thing must be "based on its scientifically determined distinctive characteristics" (Singh, 2012; Singh, 2011). Thus, in a sense, to name the given acoustical phenomenon in relation to the quality of practice can be considered as useful as well, scientific. In my above-mentioned study that draws attention to the drawbacks of the concept of SF, taking into account its specificity to opera singers, I was offered the concept of the FC_{wos} as a solution (Saruhan, *forthcoming*).

However, as indicated above in the case of the peak located at the 3-4 kHz spectral region, it appears that, to name the given phenomenon in a way that focuses on the quality of practice, produces another problem: the solution to the problem of uncongeniality, this time creates the problem of conceptual confusion caused by usage of different concepts for the same phenomenon. Although *the denoted* is the same acoustical phenomenon, based on the type of vocal production, to calling it with different names; not only makes invisible the thing itself, but also creates an abundance of concepts that have potential to cause unnecessary complexity and uncertainty exemplified in the literature about names of vocal registers. Because, "neither voice teachers nor voice scientists can agree either on how many registers there are or what they should be called" (Austin, 2005), the terminology with regard to voice registers, has suffered from the existence of an abundance of terms and ambiguity of this terms' use, to the extent that only for one register twenty-eight different names have been used in the literature (Mörner et al., 1963). Furthermore, despite significant effort to solve the problem at hand (cf. Roubeau et al., 2009; Miller & Kiesgen, 2006; Reid, 1997), it appears that the literature is presently far away from a consensus.

On the other hand, to call the peak located at the 3-4 kHz spectral region with a new name that will deprive it of direct connection to a specific vocal practice, will cause that specific vocal practice to be listed only in the index of this new name. Thus, seemingly, we have to decide on which of the problems is the lesser 'bad'. In this study after proposing a "sufficiently bounded" name based on its "distinctive characteristics", I will discuss the drawbacks of each alternative.

A new name proposal

The most prominent characteristic of this phenomenon may be listed as:

1. Its frequency was explained to be about 3.5 kHz (Leino et al., 2011; Bele 2006; Cleveland et al., 2001), in the vicinity of 3400 Hz (Pinczower & Oates, 2005), near 3 kHz (Dong et al., 2014), at 3300 Hz (Sundberg et al., 2012), at 3.4 kHz (Nawka et al., 1997), and between 3.0 and 3.8 kHz (Kovačić et al., 2003).
2. It was found in singers and vocal performers such as actors (Leino et al., 2011; Master et al., 2008; Bele, 2006; Nawka et al., 1997), commercial radio broadcast announcers (Warhurst et al., 2013), Croatian folk singing (Boersma & Kovačić, 2006; Kovačić et al., 2003), classical Peking opera (Sundberg et al., 2012), country singers (Cleveland et al., 2001) and musical theatre singers (Sundberg & Romedahl, 2009).
3. It was not found in Western operatic singing style.
4. It is related not only to loud or shouting-like vocal productions (Boersma & Kovačić 2006; Kovačić et al., 2003), but also to "the natural loudness, that is, neither too soft nor with extra effort" (Leino, 2009; see also Leino et al., 2011).
5. It can be produced by "a cluster of F3–F5" (Leino et al., 2011), "a clustering of F4 and F5" (Sundberg et al., 2012), "a clustering of F3 and F4"(Boersma & Kovačić, 2006) or only by "increased F4 energy" (Boersma & Kovačić, 2006; Cleveland et al., 2001). Also, results of another study indicated that, it can be produced by the clustering of F3–F5, only by clustering of F4 and F5 or of F3 and F4, and sometimes with increased F4 energy (Saruhan et al., *In Press*).
6. As studies on this acoustical phenomenon have all been conducted with male subjects outside some exceptions (cf. Stoffels, 2011, Master et al., 2012), it is not possible for

now to make a precise comment on whether this phenomenon is seen in female voices or not (Saruhan, 2014).

As seen, all practices that this acoustical phenomenon was found in are non-Western operatic styles of vocal production. Thus, calling it with a name that emphasizes its categorical difference to $FC_{wos,}$ at a first glance, seems to be reasonable. However, because it was found not only in singers; but also in actors and announcers, such a naming, obscuring its category, has the potential to create a categorical confusion. On the other hand, because it was found in different levels of loudness, calling it with a name based on the level of loudness will be not only undiscriminating, but also incorrect. More importantly than this, calling it as shouting formant; creates questions such as "what is singing, or shouting?", "from the point of musicology, how can we defend calling a practice of a culture considered as singing by that culture as shouting?" etc. It is clear that; naming it with prefix of shouting, whether intentionally or not, results in excluding it from the category of singing. I do not believe that any student of musicology will approve such a practice that comes to denial of musicology itself.

Besides, concepts not only have "important consequences on the selection of the cases that may be part of a sample" (Quaranta, 2013), but also "depending on how they are named, provide in and by themselves guidelines of interpretation and observation" (Sartori, 1970). Thus, because whether it exists in female voices or not is disputatious presently, to relate it with male voice will not only incorrect for now; but implying adequacy of selection of research sample from male, also will cause wrong conclusions about it. Moreover, because it can be produced not only by clustering of several formants, but also with increased energy of one formant, that is F4, a proper name cannot contain the word cluster, as well. Therefore a name that will intensify the spectral location of this phenomenon will be much more functional, especially in regard to Sartori's arguments about the 'categorical concepts' of the either-or type and the 'gradation concepts' of the more-than-less-than type. In his study, Sartori distinguished the 'categorical concepts' of the either-or type from the 'gradation concepts' of the more-than-less-than type and said:

> 'categoric concepts' of the either-or type cannot give way to “gradation concepts” of the more-than-less-than type. What is usually lost sight of is that the either-or type of logic is the very logic of classification building. Classes are required to be mutually exclusive, i.e., class concepts represent characteristics which the object under consideration must either have or lack. Two items being compared must belong first to the same class, and either have or not have an attribute; and only if they have it, the two items can be matched in terms of which has it *more* or *less*... the logic of either-or cannot be replaced by the logic of more-and-less. Actually the two logics are complementary, and each has a legitimate field of application. (Sartori, 1970)

In this regard, to call the peak located 3-4 kHz spectral region as 3-4 kHz peak ($P_{3\text{-}4kHz}$) creates neither lack of clarity and precision by conceptual stretching nor complexity and uncertainty by conceptual abundance.

CONCLUSION

A concept can be considered what is stated by Mitrović "as identifying descriptions, that is mental representations comparable to the lists of the sufficient and necessary criteria

that something has to satisfy in order to be subsumed under a specific concept" (Mitrović, 2011). As indicated above, the subject of our study, the peak known with various names in the literature is not only seen in different types of vocal performance and loudness levels, but it is also controversial in terms of its presence in female voices, and explanations as to which average frequency values it takes place in also vary. These issues leave us with only one alternative that will correspond to the emphasis by Mitrović on 'the necessary criteria', meaning the phenomenon in question is a peak that is seen in the 3-4 kHz spectral region. Additionally, the problem of using the prefix 'shouting' to describe the acoustical phenomenon in question is more serious than the conceptual confusion created by using different names for the same phenomenon. As stated by Harling and Sundberg, "a name has the same meaning as a particular definite description" (Harling & Sundberg, 1998), and naming a thing "endows it with particular, culturally meaningful attributes and repeating a name, standardizing it,...normalizes it" (Peteet, 2005). Therefore, to call the given phenomenon as 'shouting formant', intentionally or not, depriving it from the category of singing will be a normalizing practice of exclusion. On the other hand, even if it does not have such a pejorative hinting, to call it as "calling formant cluster" too, does not resolve the problem of conceptual confusion created by abundance of names. Sometimes, the most correct is the simplest, and apparently, to call the given acoustical phenomenon as the 3-4 kHz peak ($P_{3\text{-}4kHz}$) may be as simple as it is correct, too.

REFERENCES

Austin S. F. (2005). Treasure "Chest": A Physiological and Pedagogical Review of the Lower Mechanism. *Journal of Singing,* 61(3), 241-251.

Bele I. V. (2006). The Speaker's Formant. *J Voice*, 20(4): 555-578.

Boersma P. & Kovačić G. (2006). Spectral characteristics of three styles of Croatian folk singing. *The Journal of the Acoustical Society of America,* 119(3), 1805-1816.

Borch D.Z. & Sundberg J. (2002). Spectral distribution of solo voice and accompaniment in pop music. *TMH-QPSR*, 43(1), 31-35.

Buller J. & Gamble A. (2002). Conceptualizing Europeanization. *Public Policy and Administration*, 17(2), 4-24.

Castellengo M. (2005). Manuel Garcia Jr: A clear-sighted observer of human voice production. *Logopedics Phoniatrics Vocology*, 30(3), 163-170.

Cleveland T. F. Sundberg J. & Stone R. E. (2001). Long term-average spectrum characteristics of country singers during speaking and singing. *J Voice*, 15(1), 54-60.

Dong L. Kong J. & Sundberg J. (2014). Long-Term-Average Spectrum Characteristics of Kunqu Opera Singers' Speaking, Singing and Stage Speech. *Logopedics Phoniatrics Vocology*, 39(2), 72-80.

Gerring J. (1999). What Makes a Concept Good? A Criterial Framework for Understanding Concept Formation in the Social Sciences. *Polity*, 31(3), 357-393.

Harling M. & Sundberg P. (1998). Taxonomy and Philosophy of Names. *Biology and Philosophy,* 13, 233-244.

Henrich N. (2006). Mirroring the voice from Garcia to the present day: Some insights into singing voice registers. *Logopedics Phoniatrics Vocology.*, 31(1), 3-14.

Henrich N. Roubeau B. & Castellengo M. (2003). On the use of electroglottography for characterization of the laryngeal mechanisms. In: *Proceedings of Stockholm Music Acoustics Conference (SMAC 03)*, Stockholm, Sweden.

Hunter E. J. & Titze I. R. (2005). Overlap of hearing and voicing ranges in singing. *Journal of Singing*, 61(4), 387-392.

Jordan G. Halpin D. & Maloney W. (2004). Defining Interests: Disambiguation and the Need for New Distinctions? *BJPIR*, 6, 195-212.

Kovačić G. Boersma P. & Domitrevic H. (2003). Long-Term Average Spectra in Professional Folk Singing Voices: A Comparison of the Klapa and Dozivački Styles. Institute of Phonetic Sciences, University of Amsterdam, *Proceedings*, 25, 53–64.

Kurt Y. (2012). Kur'ân'ın Korunmasında Hâfızlık Müessesesi. Hitit Univ. İlahiyat Fakül. Derg., 11,229–251.

Lamesch S. Expert R, Castellengo M. Henrich N & Chuberre B. (2007). Investigating voix mixte: A scientific challenge towards a renewed vocal pedagogy. *CIM07 proceedings.*

Leino T. (2009). Long-term average spectrum in screening of voice quality in speech: untrained male university students. *J Voice*, 23(6), 671-676.

Leino T. Laukkanen A-M. & Radolf V. (2011). Formation of the Actor's/Speaker's Formant: A Study Applying Spectrum Analysis and Computer Modeling. *J Voice*, 25(2), 150-158.

Master S. De Biase N. Chiari B. M. & Laukkanen A-M. (2008). Acoustic and perceptual analyses of Brazilian male actors' and nonactors' voices: long-term average spectrum and the 'actor's formant'. *J Voice*, 22, 146-154.

Master S. De Biase N. & Madudeira S. (2012). What About the "Actor's Formant" in Actresses' Voices? *J Voice*, 26(3), e117-e122.

Mendes A. P. Rothman H. B. Sapienza C. & Brown W. S. (2003). Effects of vocal training on the acoustic parameters of the singing voice. *J Voice*, 17(4), 529-543.

Miller R. & Kiesgen P. (2006). Voice Pedagogy: Registration. *Journal of Singing*, 62(5), 537-539.

Mitrović B. (2011). Attribution of concepts and problems with anachronism. *History and Theory*, 50(3), 303-327.

Mörner M. Fransson F. & Fant G. (1963). Voice register terminology and standard pitch. *STL-QPSR*, 4(4), 17-23.

Nawka T. Anders L. C. Cebulla M. & Zurakowski D. (1997). The speaker's formant in male voices. *J Voice*, 11(4), 422-428.

Peteet J. (2005). Words as interventions: naming in the Palestine – Israel conflict. *Third World Quarterly*, 26(1), 153-172.

Pinczower R. & Oates J. (2005).Vocal Projection in Actors: The Long-Term Average Spectral Features That Distinguish Comfortable Acting Voice From Voicing With Maximal Projection in Male Actors. *J Voice,*19(3), 440-453.

Quaranta M. (2013). Fuzzy set theory and concepts: A proposal for concept formation and operationalization. *Comparative Sociology*, *12*(6), 785-820.

Raichel D. R. (2006). *The Science and Applications of Acoustics*. 2th ed., Springer.

Reid C. (1997). Vocal Mechanics. *Journal of Singing*, 54(1), 11-18.

Roubeau B. Henrich N. & Castellengo M. (2009). Laryngeal Vibratory Mechanisms: The Notion of Vocal Register Revisited. *J Voice*, 23(4), 425-438

Sartori G. (1970). Concept Misformation in Comparative Politics. *American Political Science Review*, 64(4), 1033-1053.

Saruhan S. (2014). Opera-dışı vokal icra türlerinde bir akustik görüngü: konuşmacı/aktör formantı. The Journal of Academic Social Science Studies, 29 (Autumn III), 293-312. Doi: http://dx.doi.org/10.9761/JASSS2548.

Saruhan S. (2016). Şarkıcı formantı: bir zorunluluk mu yoksa tercih mi? The Journal of Academic Social Science Studies, 50 (Autumn II), 273-296. Doi: http://dx.doi.org/10. 9761/JASSS3631.

Saruhan S., Guclu E. & Ertugrul A. (*In Press*). Spectrographic and Electroglottographic Findings of Religious Vocal Performers in Düzce Province of Turkey.

Singh A. R. (2011). Science, Names Giving and Names Calling: Change NDM-1 to PCM. In: (Singh A.R. and Singh S.A. eds.) Brain, Mind and Consciousness: An International, Interdisciplinary Perspective, *MSM*, 9(1), 294-319.

Singh A. R. (2012). Proposal about Scientific Names Giving. *Mens Sana Monogr*., 10, 181-183.

Stoffels H. E. (2011). *Acoustic Analysis of Actresses' Voices*. Master's Thesis, University of Utrecht.

Sundberg J. (1968). Formant frequencies of bass singers.*STL-QPSR,*17(1), 1-6.

Sundberg J. (1972). A perceptual function of the "singing formant". *STL-QPSR*, 2-3(13), 61-63.

Sundberg J. (1974). Articulatory interpretation of the 'singing formant'. *J Acoust Soc Am.* 55, 838-844.

Sundberg J. (1979). Perception of singing. *STL-QPSR,* 20(1), 1-48.

Sundberg J. (2001). Level and Center Frequency of the Singer's Formant. *J Voice,* 15(2), 176-186.

Sundberg J. (2006). The KTH Synthesis of Singing. *Advances in Cognitive Psychology*, 2(2-3), 131-143.

Sundberg J. & Romedahl C. (2009). Text Intelligibility and the Singer's Formant-A Relationship? *J Voice*, 23(5), 539-545.

Sundberg J. Gu L. Huang Q. & Huang P. (2012). Acoustical study of classical Peking opera singing. *J Voice*, 26(2), 137-143.

Titze I. R. (2001). The Larynx and the Ear - How Well Do They Match? *Journal of Singing*, 57(5), 41-43.

Vennard W. L. (1967). Singing: the mechanism and the technic. New York: Carl Fischer.

Vest J. C. (2009).*Adolphe Nourrit, Gilbert-Louis Duprez, and Transformations of Tenor Technique in the Early Nineteenth Century: Historical and Physiological Considerations*. Doctoral Dissertation, University of Kentucky.

Warhurst S. McCabe P. Yiu E. Heard R. & Madill C. (2013). Acoustic Characteristics of Male Commercial and Public Radio Broadcast Voices. *J Voice,* 27(5), 655, e1-e7.

Wells B. (2006). On the voice-Belt Technique: Research, Acoustics, and Possible World Music Applications. *Choral Journal,* 46(9), 65-77.