

Voice Classification by Phonetography

Voice Classification by Phonetography:

*A Manual for Voice Testing,
Education, Therapy and
Research*

By

Hugo Lycke

**Cambridge
Scholars
Publishing**



Voice Classification by Phonetography:
A Manual for Voice Testing, Education, Therapy and Research

By Hugo Lycke

This book first published 2022

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Copyright © 2022 by Hugo Lycke

All rights for this book reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

ISBN (10): 1-5275-8634-0

ISBN (13): 978-1-5275-8634-5

TABLE OF CONTENTS

Foreword	ix
Hugo Lycke	
Introduction	1
Chapter 1	3
Subject classification in voice research	
Chapter 2	11
The influence of singing education on voice characteristics	
Chapter 3	14
Contemporary singing education and voice classification	
Chapter 4	16
Voice classification in practice: criteria in contemporary singing education	
Chapter 5	32
Voice classification in voice research	
Chapter 6	49
Parameters of voice revealed by F ⁰ -SPL-Profiles	
6.1. Vocal range (= pitch range)	49
6.1.1. Overlapping of voice categories	53
6.1.2. Classification problems around specific frequencies	56
6.2. Voice intensity	60
6.3. Voice quality	71
6.4. Vocal registers	81
6.5. Habitual pitch and optimal (= optimum) pitch.....	95
Chapter 7	106
The importance of voice classification and its impact on voice diagnosis and therapy	

Chapter 8	114
Own procedure of F ⁰ -SPL measurement	
8.1. Introduction.....	114
8.2. Aim of the study	116
8.3. Own methodology.....	116
8.3.1. General aspects.....	116
8.3.2. Methodological aspects	117
8.4. Voice range: results and discussion	124
8.4.1. Male Voices.....	124
8.4.1.1. Lowest tones	124
8.4.1.2. Highest tones	126
8.4.1.3. Combination of lowest and highest tones	128
8.4.2. Female voices.....	129
8.4.2.1. Lowest tones	129
8.4.2.2. Highest tones	131
8.4.2.3. Combination of lowest and highest tones	133
8.5. Voice intensity: results and discussion	135
8.5.1. Male voices	136
8.5.1.1. Results of maximum intensity measurements of each tone of the vocal range	136
8.5.1.2. Results of minimum intensity measurements of each tone of the vocal range	156
8.5.1.3. Results of the differences between the maximum and minimum intensity measurements of each tone of the vocal range (dynamic range)	181
8.5.1.4. Results of the differences between the minimum values of the maximum and the maximum values of the minimum intensity measurements of each tone of the vocal range ...	196
8.5.2. Female voices.....	198
8.5.2.1. Results of maximum intensity measurements of each tone of the vocal range.....	198
8.5.2.2. Results of minimum intensity measurements of each tone of the vocal range	212
8.5.2.3. Results of the differences between the maximum and minimum intensity measurements of each tone of the vocal range (dynamic range)	232
8.5.2.4 Results of the differences between the minimum values of the maximum and the maximum values of the minimum intensity measurements of each tone of the vocal range ...	246
8.5.3. Comparison between male and female voices.....	248
8.5.3.1. Comparison of maximum intensity measurements of	

each tone of the vocal range.....	249
8.5.3.2. Comparison of minimum intensity measurements of each tone of the vocal range.....	257
8.5.3.3. Comparison of dynamic range measurements of each tone of the vocal range	264
8.6. Voice quality: results and discussion	271
8.6.1. Male voices	271
8.6.1.1. Results of maximum intensity measurements of the singing formant of each tone and of the vocal range...	271
8.6.1.2. Results of the differences between the maximum intensity measurements and the maximum intensity measurements of the singing formant of each tone of the vocal range in males.....	282
8.6.2. Female voices.....	292
8.6.2.1. Results of maximum intensity measurements of the singing formant of each tone of the vocal range	292
8.6.2.2. Results of the differences between the maximum intensity measurements and the maximum intensity measurements of the singing formant of each tone of the vocal range in females.....	302
8.6.3. Comparison between male and female voices.....	316
8.6.3.1. Results of maximum intensity measurements of the singing formant of each tone of the vocal range	316
8.6.3.2. Results of the differences between the maximum intensity measurements and the maximum intensity measurements of the singing formant of each tone of the vocal range	325
8.7. Register location	332
8.8. Voice classification by phonetography: a step- by- step procedure.....	333
8.8.1. Male voices: results and discussion.....	333
8.8.2. Female voices: results and discussion	336
8.8.3. Case studies	337
Chapter 9	364
Case studies revealing longitudinal aspects of phonetography	
9.1. Introduction.....	364
9.2. Results and discussion.	371
9.3. Case studies.....	375
9.3.1. Case studies over a long period of time.....	375
9.3.2. Case studies over a short period of time.	398
9.3.3. Longitudinal phonetograms of aging voices.....	409

Chapter 10	411
Identification of three natural voice groups by phonetography: a data driven approach	
10.1. Introduction.....	411
10.2. An unusual experiment	413
10.3. Own methodology.....	414
10.3.1. Statistical analysis and methods	416
10.3.2. Results	417
10.3.3. Feature construction	417
10.3.4. Voice research and the register enigma	420
10.3.5. Clinical implications.....	421
10.3.6. Conclusions	422
 Chapter 11	 423
General conclusions	
 References	 428
 Addendum: Description of Subjects	 527

FOREWORD

As a young medical student, I was a member of many singing choirs, giving some solo performances (as a tenor). Taking singing lessons at the local music academy with some minor voice problems as an unexpected result, provided my first insight about the possible importance of an exact voice classification.

As a fervent opera, operetta and musical lover, I attended many theatrical performances in different European countries. For many years I was an active member of 'Youth Opera', E.C.O.V. (European Centre for Opera and Vocal Arts), and the study-group "Musical Theatre", both situated in my native city Ghent (Belgium). These experiences allowed me to get in contact with the world of theatre and also had an impact on the choice of my future studies. So, in 1963 I graduated as a Speech-Voice-Language Therapist, at the H.R.P.B., A.Z. University Ghent, on a rather atypical thesis: "The Dysodia - functional disorders of the singing voice".

As a secretary of the Belgian Professional Association for Speech Therapists for many years, with a special mandate for the organization of national and international conferences, I noticed, to my great consternation, that less than 5% of all speech therapists and E.N.T. specialists were really interested in the singing voice. That's why, being invited to give an academic speech at the Royal Conservatory of Ghent (1975), in the presence of the Belgian Minister of Education, I launched the term "*the missing link*" to situate the important role of a specialized speech and voice therapist between the singing teacher and the E.N.T. specialist.

A few years later I did a lot of vocal tests with opera singers during the "Wagner-Festspiele", Internationales Jugendfestspieltreffen, Bayreuth, (Germany). Meanwhile, I participated as a choral member in the production: "Acis und Galathea" (G.F. Haendel) and I attended many conferences and masterclasses.

While at that time voice testing manuals only mentioned if the voice was normal, soft, or loud, my first experience as a student with the use of an old complex decibel meter convinced me about the importance of measuring vocal intensity in an objective way. So, after having carried out my first phonetograms in 1963, I strongly advised in my thesis that this

method should be refined in future voice investigations, “by measuring the voice intensity of each tone and each half tone of the whole voice range and of all vowels, in order to obtain *a typical curve for each voice type*, thus largely facilitating the troublesome “voice classification.” This was quite a statement from a young student at that time!

It wasn't until 1968 that Waar and Damsté drew the attention of people working in the field of voice on the possibility of combining the measurement of pitch (frequency) and loudness (vocal intensity). They called the graphic result of this measurement a “phonetogram”. Other names for this procedure are: Voice Area (Measurement), Voice Profile Measurement, F°-SPL Measurement, F°-SPL Profile, Voice (Range) Profile, Phonetography, Phonogram, Voice Field, Fundamental Frequency-Intensity Profile, Voice Curve, courbes vocales, Stimmfeld...

From 1978 on, the U.E.P (Union of European Phoniaticians) advised “Schallpegelmessung” as “one of the, in all cases, essential methods for the diagnosis of voice disorders, although the technical or methodological development of phonetography is not yet completed”.

I witnessed the upcoming interest of the scientific world in the seventies and eighties for the many aspects of the singing voice. I became a founding member of the “International Association for Experimental Research in Singing” at the 90th convention of the ‘Acoustical Society of America’, San Francisco, 1975.

Between 1977 and 1981, I organized, for the first time in Belgium, a series of 4 international conferences on the singing voice, with introduction and discussion of the film: “Regulatory Mechanism of Voice in Singing”, produced by Prof. dr. Minoru Hirano, Kurume-University, Japan), the most famous voice specialist at that time. In 1979, Prof. dr. Minoru Hirano came to Europe for the first time, accepting my invitation to give a lecture on his fundamental research on voice before an enthusiastic audience of European phoniaticians, O.R.L. specialists and voice therapists.

As one of the few European voice therapists, I was present during four consecutive years (1977-1980) at the famous Juilliard Symposia “Care of the Professional Voice” in New York. These yearly symposia provided me with the unique possibility of an intense exchange of ideas between medical specialists, voice pathologists, singing teachers etc., with ensuing invaluable professional contacts for many years. At the same time, quite

new devices for objective voice testing appeared on the market, which I tested in my own private practice.

Being asked as a member of the jury involved with the production of an international opera-project by the Royal Opera La Monnaie, Brussels and the Holland Festival, Amsterdam, I learned much about the changed opera scenery. During the auditions in Amsterdam (Stoopera), Brussels (Opéra Royal de La Monnaie), Helsinki, London, Milano, and Paris, I did screenings and voice tests with voice classification by phonetography on actors, singers, and dancers, followed by vocal coaching at rehearsals.

Working for many years as a vocal coach/voice therapist, I assisted, as a special member of the jury, at all kinds of auditions at international opera companies. This privileged position provided me with the unique opportunity to critically observe not only *what happened behind the stage*, but also to try out my own methodology of voice classification by means of phonetography on the many candidates for a major role in a new opera production. In the beginning I was only occasionally admitted as a silent observer, sitting next to important people like the manager of the opera-company, the producer, the director, the conductor, the choirmaster, the choreographer, and the répétiteurs. Their very particular attention was directed to choosing the right person for a specific role out of hundreds of candidates. However, I observed that the members of the jury frequently disagreed. They all seemed to hear something which I couldn't hear myself. For a young speech and voice therapist, this was quite frustrating. So, I continued listening to what they had to discuss *after the auditions* were finished. Then I became aware that, in many cases, those professionals didn't agree at all about *voice classification*, which was, of course, very important to assess if the candidates could apparently sing the specific scores of the written music and if they could continue these strenuous efforts, for a whole series of performances, if possible, without voice problems. Common discussions were, e.g., "was this female singer, producing some warm, dark sounds, a real mezzo or was she rather a contralto, or perhaps a soprano, because she could occasionally produce some very high pitches?" Some judges even insisted on the presence of an X-factor which some singers seemed to possess. Obviously, I was not able to measure this mysterious X-factor with my decibel meter! However, after some time, I dared to demonstrate my secret weapon: a brand-new type of decibel meter which was supposed to discriminate between apparently equal voices, in a more objective way.

A breakthrough happened when the Royal Ballet of Flanders at Antwerp started with a Musical Theatre Company, which successfully toured in Belgium and abroad for many years. For 12 years I assisted as a vocal coach on all auditions, judging several thousands of candidates from European countries, all trying to get an important role in a new musical production. I also assisted at the rehearsals and tried to help the singers, actors, and dancers with their many occurring voice problems.

One must recall that in the eighties and the nineties Musical Theatre became extremely popular in European countries. Young people were attracted to this new medium, but, unfortunately, this growing popularity came along with newly arising problems during the auditions. I was confronted then, not only by technical problems of classically trained singers, trying to master new singing techniques, specific for the new Musical Theatre, but also with all kinds of vocal performers, with or without vocal training. Especially the great variety of vocal techniques – good ones and bad ones – (think about the growing success of *belting* at that time), used by singers, actors, and dancers of the Musical Theatre, provided an excellent opportunity to experience the large diagnostic possibilities of phonetographic analysis. The revolution of this new singing theatre, depending on a new kind of performers who could sing, act, and dance altogether, also opened challenging possibilities for education and research, but also put at risk non-educated voices of young people, hoping to get famous and rich in the shortest possible time by merely imitating other non-educated voices which were, for one reason or another, successful at that time. In my opinion, the need for an objective voice classification was obvious.

I observed that almost every voice problem, which occurred during the short but very intensive rehearsals, and during the performances afterwards, primarily had to do with *voice classification*. Again, in my experience as a voice therapist, phonetographic analysis proved to be very helpful to actors, singers, singing students, singing teachers, conductors, and directors of contemporary Musical Theatre.

This original viewpoint has been stated for many years by the author, at numerous international scientific conferences, and finally resulting, many years later, in a PhD thesis on ‘Voice Classification by Phonetography’, based on a data base of more than 1000 phonetograms, proving for the first time, the real existence of three specific natural voice groups for each gender (2013). Before the official defense of my doctoral thesis at the Catholic University of Louvain (Belgium), many presentations (papers and

workshops) on the same subject were given at different international conferences between 2007 and 2012: Frankfurt-am-Main (Germany), Groningen (The Netherlands), Helsinki (Finland), London (U.K.), Louvain (Belgium), Marseille (France), Paris (France), Poznan (Poland), and Stuttgart (Germany). The real apotheosis happened at the ‘Cost Action 2103 International Workshop 2011 and CoMet Annual Meeting 2011’ at Frankfurt-am-Main (Germany), when, for the first time, the distinct picture of three separate basic voice types appeared on the big screen, receiving a standing ovation by the Chairman, Prof.Dr.Izdebski and the whole audience.

Remarkably, exactly 50 years passed since I wrote my speech therapist’s “atypical” thesis on the singing voice (1963), and the publication of my PhD thesis (2013) on the same subject! Moreover, 30 years passed since the early collecting of data for the elaboration of *an extensive pattern card of the parameters of the human voice*, now for the first time published in this manual.

The results of this complex scientific study demonstrated for the first time that parameter combinations of the voice range profile can yield a clear cluster separation to discriminate between three basic voice categories of each gender, which may serve as the *basis to resolve the riddle of voice classification*.

Hopefully, the many practical research data in this manual, collected during a lifetime, and dedicated to the amazing voice phenomenon, may inspire many readers for their own practice.

Dr. Hugo LYCKE, PhD, MSc, MA.
Doctor in Biomedical Sciences
Vocal Coach, Speech and Voice Therapist

INTRODUCTION

The human voice is an amazing phenomenon, comprising many psychological, sociological, artistic and biological aspects. Vocal possibilities and limits are based on individual biological properties. Individual vocal qualities can give rise to optimal and even high-class artistic vocal performances, while vocal restraints can cause functional and organic voice disorders.

Professional voice users, using their voice as a primary tool, are especially prone to voice problems. Vocal nodules, for instance, most often based on overload of the voice, e.g., due to an incorrect voice classification, are well-known in clinical practice. Therefore, it is important in voice and in singing education to know the physiological limits of the voice and to carefully watch them.

Chapter 1 of this manual gives an insight into the many difficulties encountered in trying to classify a voice. Chapter 2 confronts us with the considerable influence of singing education on voice characteristics. Chapter 3 indicates how, at present, music education and performance can be divided into two broad categories: Classical Music and Commercial Music, and how contemporary singing education deals with voice classification. Chapter 4 analyses the results of our study, based on three questionnaires, clearly showing the need for an objective voice classification. The many contradictory scientific publications on voice classification are analysed in Chapter 5, while Chapter 6 is dedicated to the different parameters of voice, revealed by F° -SPL Profiles. Chapter 7 stresses the importance of voice classification and its impact on voice diagnosis and therapy. In Chapter 8 an extensive analysis is given of our own procedure of F° -SPL measurement, elaborated during many years of voice testing, and based on 5 parameters, according to the method of Seidner et al.: maximum intensity measurement, minimum intensity measurement, difference between maximum and minimum intensity measurement, intensity of the singing formant, and difference between the maximum intensity and intensity of the singing formant. All data were listed in a statistically balanced step-by-step procedure of voice classification, resulting in the elaboration of an extensive pattern card of

the parameters of the human voice. Our results for male and female voices, including some specific case studies, were compared to the results found in the literature and discussed in an effort to provide useful clinical conclusions. Chapter 9 provides some interesting case studies, revealing the importance of the longitudinal aspects of phonetography. Chapter 10 is dedicated to our PhD- study “Identification of Three Natural Voice Groups by Phonetography. A Data Driven Approach” (2013), proving for the first time in scientific research, the real existence of three specific natural voice groups for each gender. Recent studies, based on this relevant finding, are added. General conclusions are expressed in Chapter 11.

CHAPTER 1

SUBJECT CLASSIFICATION IN VOICE RESEARCH

Our whole thinking and reasoning - as far as it concerns general names and conceptions – consists in classifying. Even logic could be defined as the theory of classification. A fixed methodical rule for classification doesn't seem to exist. First requisite for a good system of classification is *functionality*. A second requisite for a valid system of classification - very important from a scientific viewpoint – is one requires that such a system should make possible the greatest number of *general statements*.¹ However, “great intra- and inter-individual as well as intra- and inter-investigator variations are typical in all measurements of psychophysiological phenomena in humans”.²⁻⁴

Psychologists employ two basic kinds of classification: *qualitative* and *quantitative*. In fact, the line between the two is not entirely distinct. In addition to its value as an instrument for scientific enquiry, qualitative classification in psychology frequently produces results of considerable practical value. In a quantitative classification, categories are determined, based on different degrees of some measurable characteristics.

Classification is one of the major objectives of scientific endeavour. According to Brewer⁵, in the panel discussing “The Integration of Voice Science, Voice Pathology, Medicine, Public Speaking, Acting, and Singing”, “research teams should look at acoustic phenomena and their possible detectable correlates. *Further studies on e.g., voice categories (accurate descriptions) are necessary*”.

In voice research, emphasis is put on the accurate describing of the specific qualities of the subjects used in the proposed study. The more accurate this description of the subjects, the more other researchers can understand the results of the study and compare them with other attempts of the same kind. However, in voice research, the classification of the subjects remains a weak point. If we look at the actual bulk of literature on voice, we can distinguish some major policies. Every study provides reliable information on the exact *number of the subjects*, their *gender*, and

their *age*. Some studies make a distinction between the so-called “*normal people*” and “*voice patients*”. Few studies make a distinction between again, the so-called “*normal people*” and “*singers*”. At this level the confusion becomes exorbitant. This confusion can readily be understood if we consider the following assessments:

1. The scientific validity of much of the research that is being carried out on singers has been questioned.

Hollien and Keister⁶, for instance, state that: “First, to be able to generalize obtained data to singers and singing, it is necessary to study them in groups rather than just as single singers. Second, what is meant by the term “singer” must be defined and these operational definitions must be included in the published reports of the experiments so that others can understand the specific referents utilized by the scientist in his research. Third, any experiments on the behaviour of singers must include non-singers as controls. In other words, it is necessary to establish control groups and define them if the behaviour and capabilities of the singers are to be understood. Fourth, there are many specific terms that must be defined when research on singers is carried out and published.”

Coleman⁷, however, evokes a possible difference in research philosophies - i.e., concerning the use of large groups vs small groups. To him, utilization of small groups, particularly when the subject is used as his own control, is a valid research technique too. Other authors agree with this viewpoint, stressing the value of comparing the obtained results with those of “standard” subjects or with former results of the same subject.⁸

2. There still exists no exact definition of the singing process.

As there are many ways to produce the same tone, there is no reason to assume that there exists only one correct singing technique. Besides, the many personal and emotional aspects of singing cannot be reduced to objective numbers.⁸ Some authors consider that the acoustic principles of speaking, and singing are basically the same⁸⁻¹⁷ and do admit that the speaking and singing voice are strongly interdependent.¹⁸⁻²⁰ There are only gradual differences between speaking and singing. In speech the meaning is the main point, in singing the voice timbre is a main point.²¹ A lot of verbal productions are intermediary between singing and speaking (cfr. Sprechgesang, “Parlando” singing, recitatives).²²⁻²⁷

Moreover, as Sundberg et al.²⁸ stated: “Most voice research in the past has focused on operatic singing, while the equally phonatory interesting type

of singing cultivated in the performance of popular songs and musicals has been largely neglected by voice scientists. Therefore, the vocal techniques used in nonoperatic singing are poorly understood". Other authors²⁹⁻³⁴ too, claim the necessity to broadening the horizon of research in singing by including various singing styles.

Hoit et al.³⁵ found no clear differences in variability of the respiratory function between the speaking and singing activities of professional country singers.

Belting, a method of voice production in which the vocalist "extends" the frequency range of the chest register upward, can be seen as an exaggerated use of the speaking voice or the modal register.³⁶⁻³⁹ Different singing styles are most likely based on considerable variation of various muscles.⁴⁰

The mechanisms involved in transformation of the speaking voice to the singing voice engage the interest of vocal coaches and voice scientists. On the other hand, training to influence aspects of the singing voice may also affect aspects of the speaking voice.⁴¹

According to Sundberg et al.,⁴² a major difference between speech and singing is that a precise and independent control of loudness and pitch is needed in singing but not in speech. In acting and emotive speech, however, parallels between respiratory behaviour in speech and singing are obvious.⁴³⁻⁴⁴ Principally loudness demands in acting seem quite like those necessary in classical singing.⁴⁷⁻⁴⁸

Speaking is characterized by small but steady gliding pitches around the fundamental, whereas the melody and the time are indicated in singing. In analysing single sounds of the same pitch, it is difficult to say whether these sounds are spoken or sung. One needs more sounds to do this adequately.⁴⁹ In singing, the words are presented artificially, because the composer dictates the pitch and the duration of the notes.⁵⁰⁻⁵³ Vowels are dominant in singing.⁵⁴ In normal speech, lung volumes just above FRC (Functional Residual Capacity, i.e., the volume of air present in the lungs at the end of passive expiration) are normally used. In singing, a greater portion of the vital capacity is used for phonation⁵⁵ and the velopharyngeal port is closed significantly longer, especially in high pitches.⁵⁶

Singing is supposed to involve different, and probably more careful patterns of control over both the source and the filter⁵⁷⁻⁶¹ as subglottal pressure not only increases loudness but also fundamental frequency.⁶²⁻⁶⁴

Although the lung pressure attained in singing may be more than four times that used in speech, air flow must be kept at a level similar to that in speech.⁶⁵ Singers are more prone to “flow phonation”, thereby reducing excessive subglottic pressure.⁶⁶ Insufficient accuracy in subglottal pressure regulation will lead to singing out of tune.⁶⁷⁻⁶⁹ Therefore, a perfect coordination between the laryngeal muscles and the respiratory muscles is essential.⁷⁰⁻⁷¹ This leads to the conviction that professional singers are a “physiologically and neurologically unique group of individuals”.⁷² However, the term “breath support” commonly used by singers is also used by actors.⁷³⁻⁷⁴ In their acoustic study with three tenors, Hirano et al⁷⁵ found additional harmonics in the high frequency range besides the singing formant.

3. Phonetographic studies have demonstrated the interrelationship between different human vocalizations.

In phonetography the explicit relationship between frequency and intensity is studied. In normal speech, an increase in voice loudness also entails an increase in fundamental frequency⁷⁶⁻⁷⁷ and vice versa, in singing. This is not surprising to Gramming⁷⁸ as a raised subglottal pressure also yields a rise in fundamental frequency. Gramming et al.⁷⁹ studied the existence of habitual pathways in the phonetogram. They also acknowledged the common observation that speakers tend to increase their loudness of speech with the ambient noise (the well-known *Lombard effect*).

Many authors⁸⁰⁻⁸⁹ were interested in situating the position of the speaking voice in the total voice range and in trying to locate a zone of comfortable speaking in the speaking voice. To Pabon⁹⁰, the speaking voice area is the most informative area of the voice, where the most quality change variations take place.

The area of the speaking voice is generally located in the lower third of the phonetogram⁹¹⁻⁹². Schmidt et al.⁹³ confirm that only a small part of the maximum intensity range is used in connected speech, but they admit that little is known regarding the exact location of the speech intensity range within the larger range. They found a rather restricted mean intensity range of about 6 dB in a short sentence, while “highly effective” speakers have been found to have intensity ranges of 16-17 dB and trained speakers even have been found to have a mean intensity range of 20 dB in connected speech.

This brings us to the difficult subject of “*training*”. In discerning an area of the shouting voice next to the transition of chest and head registers,

Hacki⁹⁴ observed that the dynamics of this shouting voice area sometimes exceed the area of the singing voice. Denk and Frank⁹⁵ concluded that the limits of the dynamics of the speaking- and singing voice area approach. The larger voice and intensity range in singing depends on the singing style. But even in an animated, expressive conversation, considerable extremes of frequency and intensity can be found.⁹⁵

In pathology, dissociation of one's speaking and singing voice is a frequently occurring cause of voice problems in singers.⁹⁶⁻¹⁰⁰

4. *It is difficult to control for the amount and type of vocal training.*

It is well known that most of human behaviour depends on strategies which are acquired by learning and training. In voice training and therapy much attention is spent on teaching breathing techniques (cfr. "breath support"). Sundberg et al.¹⁰¹⁻¹⁰², however, express their scepticism regarding the benefit of this strategy from a physiological point of view. In fact, Griffin et al.¹⁰³ even stated that "because breathing patterns among the subjects were so variable, analysis of averaged data is not meaningful".

In an article on 25 years of progress in research of the singing voice production, Cleveland¹⁰⁴ points to the discovery that the modes of vocal fold vibration represent extremes of a continuum from pressed over flow to breathy. In classical singing the subglottal pressure and the adductor forces are moderate, but in a more "Broadway type" voice production, the subglottal pressure and the adductor forces are often greater.¹⁰⁴

Regarding pitch, intensity and quality shifts differing strategies are legion. It is also generally accepted that trained singers acquire specific phonatory behaviours. Supraglottic constriction, however, is often apparent at the pitch extremes in trained singers, a condition which has been described in vocal pathology as well.¹⁰⁵⁻¹⁰⁷

According to Miller¹⁰⁸, "new to the recent history of solo singing is a category of performer known as "the *untrained professional*". In most voice studies, however, trained persons (only) had singing training. Other types of voice training seem to be largely neglected. For instance, there is a lack of information on the many different voice training techniques used in the education of actors and on the training of the speaking voice of students in speech and voice pathology, aiming at a clear voice with carrying-power, using an eutonic posture and diaphragmatic breathing.¹⁰⁹⁻¹¹³ Vocal coaches, however, stress the effectiveness of breathing exercises that use both singing and speaking, moving from one to the other.¹¹⁴⁻¹¹⁷

The fact that performers often must speak or sing and move or even dance at the same time is largely neglected in voice studies. This is exactly the type of vocal performers the author of this manual has been confronted with for many years. Moreover, the fact that everybody speaks more often than he sings is often forgotten as well as the interaction of the speaking voice on the singing voice. According to Sataloff¹¹⁸, dissociation of one's speaking and singing voice is probably the most common cause of voice problems in singers. Misuse of the speaking voice is recognized as resulting in damage that affects singing.¹¹⁸⁻¹²¹

5. *By assigning beforehand different people to different categories there is always a possibility that the same person may belong to more than one category.*

In the Appendix, a compilation is given of 364 descriptions of subjects, as found in the literature by the author!

According to Harvey¹²², the “professional voice user” is, regardless of age, a designation describing countless variations of phonatory abilities and demands (e.g., teachers, attorneys, secretaries, singers, actors). In some studies, however, some groups of singers were excluded. Hollien et al.¹²³, for instance, made a study on the intelligibility of vowels sung at extremely high fundamental frequencies in “singers”, but “no pop or rock singers” were accepted.

Singers who had many years of singing lessons and enjoying a brilliant professional career, can, at a particular moment, be regarded as voice patients who are developing or already have developed a (functional) voice disorder. Teachey et al.¹²⁴, for instance, conducted a study on singers with less than 2 years formal vocal training, which the authors called “untrained singers”, and found that nearly 70% of their subjects characterized their voices as being “hoarse, rough, or raspy”. Twenty percent also described some associated breathiness. Sixty percent of these “untrained singers” presented with vocal fold lesions, almost all of which were vocal nodules. Sapir¹²⁵ too, found nearly one-half of the voice students having sought medical help for voice problems.

Wuyts et al.¹²⁶ draw our attention to the problem of interpreting conflicting effects in voice diagnosis and therapy. They acknowledge that in some cases, the pathology was still present after therapy, even though the voice function was better according to E.N.T. specialist and patient. In other cases, therapy ameliorated just one variable of the voice while the other

variables got worse.¹²⁶

In vocal pathology, mild adduction disorders are neither organic nor functional disorders; rather there is a *continuum* of organic alterations with different laryngeal vocal disturbances¹²⁷⁻¹²⁹, or, as expressed during the ‘Jahrestagung der Deutschen Gesellschaft für Sprach- und Stimmheilkunde,’ Bad Segeberg 1978:” All functional voice disorders are situated between both poles of hyper- and hypofunction”.¹³⁰

Airainer and Klingholz¹³¹ examined patients to whom the diagnosis “hypo- or hyperfunctional dysphonia” or “hyperfunctional dysphonia with a secondary organic lesion” applied. However, they felt that their subjects had to be *a priori* divided into four groups: male non-singers, male singers, female non-singers, and female singers. To be classified as singers, their subjects had to be singing in choirs for several years.

Overlapping of categories also happens when one tries to divide people into non-singers, amateur singers, singing students and professional singers. Schutte and Miller¹³² too, admit that the line between professional and dilettante is indistinct.

But what to do with the bulk of the subjects in our own study? Some of them are “classical” singers, who changed their techniques hoping to get a role in a musical. Others had years of dancing training but just took a few singing lessons before auditioning for a musical production; the same with many actors. Meanwhile, some of them had developed a functional voice disorder. They had no idea about their voice classification or even had forced their voice to simulate a voice type which was not their true natural vocal type.

During many auditions we also encountered “pop” and “rock” singers, without any form of vocal training, but who also wanted to become a “musical star”. During the rehearsals it became clear that their “years of professional experience” as “singers” were not at all useful to meet the high demands of acting, singing, and dancing in a modern musical performance. A lot of them could easily be classified as “voice patients”.

The self-reported voice problems in a questionnaire administered by the author to professional singers of opera, musical theatre, and contemporary music, aged 18 to 69 years (Chapter 8), revealed high rates of vocal disability (69%) and diagnosed bad vocal conditions (44%). Besides, singers can present with hoarseness in their speaking voice or with problems specifically related to their singing voice.¹³³⁻¹³⁵

Singers also differ greatly not only in the technical aspects of their singing technique, but also in their repertoire. Nobody will deny the differences between, for instance, a highly trained Wagnerian opera singer, a Peking opera singer, a Spanish falsetto singer, an American crooner, a well-loaded Irish folksinger, a hoarse jazz singer, a yodelling singer from Tyrol, a heavy metal or rock singer, a double-voice Touvinian singer,¹³⁶⁻¹³⁸ and an operetta-soubrette, and so on. Miller¹³⁹ even points to the recent category of performer known as “the *untrained professional*”. Moreover, as Titze et al.¹⁴⁰ reported, only 15% of the estimated professional singers in the United States are classical singers; the other singers fit into multiple categories. However, all those “singers” have in common that they use their singing voice in one way or another.

Nonetheless, the *loudness* factor seems to be all important to performers engaged in vocally demanding professions and hobbies. As mentioned before, physiological inefficient SPL control strategies are since long acknowledged as potentially injurious to vocal fold tissues¹⁴¹, but the fact that “a comparable acoustic product can be generated using different physiological strategies”¹⁴² is widely ignored in the voice research paradigms.¹⁴³ Phyland et al.¹⁴⁴ too, point to the “wide variability among singers as one of the major confounders in the estimation of the incidence or prevalence of voice disorders among singers”. Variables such as the amount and nature of singing training and experience, the amount and nature of singing demands and the performance environments and the singing style, are of influence on the occurrence of voice problems.

Finally, Peppard et al.¹⁴⁵ advise that, in studies of voice disorders, “voice production in the populations examined should be viewed on a *continuum* with normal singers at one end and non-singers with nodules at the other”. This also means that “further research should look at *larger samples* of normal populations of singers and non-singers and should consider *other sources of variation* to delineate more clearly normal production and deviations occurring with voice disorders”.¹⁴⁵

We are convinced that a basic elementary source of variation is *voice category*. That’s why the author of this book spent a lifetime of testing all kinds of voices, trying to classify them in an objective, scientifically based way.

CHAPTER 2

THE INFLUENCE OF SINGING EDUCATION ON VOICE CHARACTERISTICS

Today's life is immersed in music: willing or not, in almost every situation, day or night, music is in the air. Especially young people have a leaning to listen to contemporary music, songs based on all kinds of regularly changing hit lists, and promoted by the market and mass media. Successful voices of the moment - good or bad ones - are imitated by young people, often without concern of the quality of the sound produced by their idols or by themselves.

The influence of voice training on vocal capabilities is well known from clinical experience and the relationship between the singing teacher and the singing student is particularly interesting in this regard. The singing student often chooses a singing teacher with a particular voice type, which he or she likes and wants to imitate, while the singing teacher in his turn may be inclined to reinforce that attitude. On the other hand, frequently changing from one singing teacher to another during one's singing education and one's professional singing career is common practice. This means that the singer is flooded with different advice over the years, including many comments on his "real" voice type. At the same time, during the singing education the singer becomes aware of the changing features of his or her voice, for the better or worse.

Tarneaud¹⁴⁶ already explained, many years ago, that pitch and timbre not only depend on constitutional and physiological factors but also on educational mimesis, acquired in various surroundings, family, school, and profession. Each singer has not only one characteristic timbre, but a set of timbres, or a timbre transformation. Voice quality depends highly on vocal techniques, thus on voice education. Many singers have developed a functional adaptation of their vocal organs, which is not always in correspondence with their anatomical and physiological abilities.

Nowadays a lot of singing students are often in turmoil: by choosing a kind of education programme - be it classic or commercial - they enter a

protected environment in which they are directed for many years in a particular direction: choosing a repertoire, taking singing lessons which direct them to make restraint choices in connection with their assumed voice type. As the singing teacher is not sure about the exact voice classification at the beginning of the study, very often a cautious repertoire is chosen. Singing teachers then claim the voice of the young singer is supposed to ripen, to mature and so on. However, singing exercises try to expand the singing range in one or another direction and this also influences the singing teacher and the singing students in their perception of their vocal evolution. If the singing teacher is not sure about the right voice type of his/her pupil, there is a great chance that the voice of the young singer is forced in a direction which can damage his future career.

Lycke and Siupsinskiene¹⁴⁷ recently made a study on the *effects of training duration and institution on basic Voice Range Profile parameters*. VRP recordings were made of 162 females, taking individual singing lessons during 5 consecutive years (1st - 5th level) in Dutch, Belgian, English, and French public or private training facilities. Sixty-seven non-singing female students served as controls.

RESULTS

- Vocal capabilities of singing students measured by Voice Range Profile are significantly extended in both frequency and intensity parameters in comparison to non-singing students.
- Training years have a significant effect; conservatory singing students in more advanced singing classes demonstrated a significantly greater frequency range, particularly at high frequencies, than did first-year students.
- Musical theatre training has more positive effects on both frequency and intensity related parameters than does classical training.
- Private and musical theatre training have more positive effects on voice characteristics than do public or classical training.
- Private training has more positive effects on voice dynamics than does public training.
- When compared to non-singers, all singing student subgroups showed significant increases in all basic VRP parameters. However, *the register transition parameter was not influenced by training duration*. This important observation is analysed in a further study.

- We concluded that VRP recording provides both qualitative and quantitative information about vocal capabilities and could serve as a useful tool for voice teachers, offering a way to assess vocal training and training progress.

CHAPTER 3

CONTEMPORARY SINGING EDUCATION AND VOICE CLASSIFICATION

At present, music education and performance can be divided into two broad categories: Classical Music and Commercial Music.

Classical Music represents various genres such as Opera, Lied, and Oratorio.

Traditionally, in Classical Music voices are classified into three principal categories: for the female voice: alto, mezzo, and soprano, and for the male voice: bass, baritone, and tenor. There are, however, many subtypes, according to different roles and based on the characteristics of the voice, such as loudness, timbre, mobility, vibrato, temperament, expression, and personality. In classical singing education great emphasis is put upon voice classification, but little is known how the relatively new music institutions and individual singing teachers deal with voice classification.

Commercial Music represents genres including Pop, Rock, Jazz, Country, Rhythm, and Blues, Hip-Hop, Rap, Gospel, and Musical Theatre.

According to Gilman et al.¹⁴⁸, contemporary Commercial Music is the largest, and possibly the most popular genre of music in the United States. It may be assumed that the same trend occurs in European and other countries, probably due to the emergence of the commercial industry reality TV shows such as ‘The Voice’, ‘Star Academy’, ‘X-Factor’ and so on.

In his master’s thesis in Leisure Studies, “An agogic approach and a government-directed approach of the phenomenon Musical Theatre in Flanders”, Lycke¹⁴⁹ analyzed the decision of the Flemish government to create a specific Musical Theatre Company within the structure of the Royal Ballet of Flanders. The growing popularity of the Musical, compared to the Opera performances, played a major role in this political decision. The results of the questionnaires by the author, analyzed in

Chapter 4, also show the great difference between the preference of contemporary singing teachers for Musical Theatre (66,7%) in comparison to Opera (13%) and all other musical styles.

As mentioned in Chapter 2, the conclusions expressed in the study of Lycke and Siupsinskiene¹⁴⁷ clearly demonstrate the many effects of individual singing lessons on the voice of singing students, *depending on the type of singing education and institute.*

In their study on Commercial Music, Radionoff et al.¹⁵⁰ concluded that “along with nomenclature disparity, a tremendous lack of consistency exists among curriculums of commercial music degrees.” Many singing students are taking private singing lessons which are not curriculum-bound. Contemporary commercial music singers often complain that their singing teachers do not understand the vocal styles and demands of a Contemporary Commercial Music singer.

Classifying a voice means, in the first place, to determine the frequency and intensity voice range in which a subject can work without harming or fatiguing his voice and to which repertoire he should be assigned.¹⁵¹⁻¹⁵⁴ Correct classification of the singer's voice is indispensable to achieve optimum performance. Coleman¹⁵⁵ already stated the consensus that singing and speaking outside a given physiological pitch or intensity range is a potential hazard. The biographies of famous and less famous singers frequently mention examples of the pernicious outcomes for their voice and for their career caused by incorrect voice classification.

CHAPTER 4

VOICE CLASSIFICATION IN PRACTICE: CRITERIA IN CONTEMPORARY SINGING EDUCATION

With the intention to explore how contemporary singing teachers deal with voice classification and which criteria they use, a **first questionnaire** was sent to 200 private singing teachers, who were registered on the commercial Dutch Internet site www.vocalisten.nl and who mentioned their e-mail address. The singing teachers who cooperated in this explorative study returned their answers via e-mail. These private singing teachers recommended themselves for *a total of 134 specialties and styles of singing!* Many of them had a classical singing education, but each of them proclaimed to master a great variety of singing styles like Belting, Blues, Classic, Close Harmony, Country, Disco, Easy Listening, Evergreens, Funk, Fusion, Gypsy, Hard Rock, Jazz, Latin, Opera, Pop, Rhythm and Blues, Salsa, Soft Rock, and World Music. *The private singing teachers were asked if voice classification was important to them and why. They were also asked which criteria for voice classification they applied.*

Aiming to compare the results of the **first questionnaire**, sent to private singing teachers, we also wanted to know the attitude towards voice classification by singing teachers in officially subsidized national music conservatories, submitted to the inspection by the Government. At three conservatories: one Belgian classical conservatory specialized in Opera, Lied, and Oratorio, and one Dutch and one British conservatory specialized in Musical Theatre, a **second questionnaire** was distributed among singing teachers via the Head of the Department. The answers to the questionnaires were collected by one of the singing teachers. The 22 singing teachers from the three conservatories who cooperated in this study classified a total of 165 singing students: 81 singing students (58 females and 23 males) at the Belgian classical conservatory, 63 singing students (55 females and 8 males) at the Dutch conservatory (Musical Theatre), and 21 singing students (9 females and 12 males) at the British