

# SINGING

the Mechanism and the Technic

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by William Vennard

## I. ACOUSTICS

### A. The Nature of Sound

1. molecules, elasticity
2. compression wave
3. "Sound travels at 1100 feet per second and its intensity is in inverse proportion to the square of the distance.
4. rarefaction wave

### B. Musical Tone

1. Noise - irregular series of sound
  - a. consonants
2. Tone - pendular, regular series
  - a. pendulum experiment - the frequency remains the same regardless of the width of the arc through which the pendulum swings. (Shorten the string to change the frequency.)
3. Tuning fork - simplest musical instrument
4. musical tone has five essential measurable properties

a. Pitch - *Tonhöhe*

- (1) frequency of impulses from source
  - (a) International Concert Pitch - 440v.p.s.
- (2) Pythagoras - double the frequency of a tone creates the octave
- (3) Lowest audible pitch, fifteen cycles per sec.
- (4) Highest audible pitch, ca.20,000
- (5) Ultrasonics

b. Duration - *Dauer*

- (1) length of a tone, musicianship and rhythm
- (2) in some instruments, duration is proportional to intensity

c. Intensity - *Intensität*

- (1) extent to which equilibrium was disturbed
  - (a) effect on the ear interpreted as loudness

*Semantik!*

- (2) amplitude
  - (a) the ear adjusts itself so that doubling amplitude will not double "loudness"
- (3) the ear is more sensitive to high pitches, they have more "loudness" even with equal intensity.
- (4) Energy or power used to create tone dictates its intensity or loudness
- (5) dynamics are effects since the ear adjusts and the mind interprets, the effect is sometimes more psychological

d. Timbre

- (1) quality, tone-color, klang-farbe
- (2) Helmholtz - physicist pioneer in study of acoustics
  - (a) sounded several tuning forks to create various timbres
- (3) Fourier - physicist 1822
  - (a) Theorem "Any curve that repeats itself without doubling back or making loops can be demonstrated to be the sum of a number of simple pendular undulations."
  - (b) Heat, light, sound all obey the same laws.
- (4) Fundamental, first partial
- (5) Overtones, upper partials, or harmonics
  - (a) human voice made up of many partials
  - (b) layered partials - in phase (or not)
    - i) vibrations in phase augment each other
    - ii) vibrations out of phase nullify each other
      - a) wolf tones
  - (c) Harmonic analyser
    - i) spectrum
- (6) Chord of Nature
  - (a) intervals
  - (b) "history of harmony is implied in a single tone with its overtones."
  - (c) Tempered scale

e. Sonance - *Karakteristik*

- (1) Fluctuations of intensity, timbre, pitch forming a pattern
  - (a) "If a tone has duration, it will have sonance."
  - (b) Vibrato
- (2) Noises (consonants) can be included in sonance


C. Resonance

- I. "a relationship that exists between two vibrating bodies of the same pitch."
  - a. Sympathetic or Free resonance
    - (1) when the vibration (motion) of one object sets another object sympathetically in motion without physical contact other than via the atmosphere, sound waves.
  - b. Forced resonance
    - (1) when the vibration (motion) of one object forces another to vibrate by direct physical contact, though the two objects are not in sympathy.

D. The Elements of a Musical Instrument

1. Machine designed to produce musical tone
  - a. ACTUATOR - the source of power, energy (lungs of the singer)
  - b. VIBRATOR - converts the energy of the actuator into a series of compression and rarefaction waves. (Strings or reeds or vocal cords)
    - (1) embouchure (lips)
    - (2) Bernoulli Effect
  - c. RESONATOR - takes the product of the vibrator and increases its intensity and/or improves its timbre.
    - (1) air chambers or columns (flute)
    - (2) bridge and sounding board
    - (3) nodes and overblowing, partials

E. The Voice as an Instrument

1. Voice is a <sup>Bloss</sup>wind instrument 
  - a. Actuator is breathing
    - (1) Golden Age of Song, bel canto taught breathing directly.
    - (2) Caccini, Mancini, Tosi maxims "on the breath"
    - (3) Legato
  - b. Vibrator is Larynx
    - (1) Function lies below conscious level
    - (2) Controlled indirectly
  - c. Resonator is an air chamber which acts as a secondary vibrator.
    - (1) nose, mouth, pharynx, trachia, larynx
    - (2) Shaping of the resonators, "open throat", "singing forward"
    - (3) Registers - voce piena, voce finta
      - (a) Mistaken theory that resonance chambers determine the basic quality of the voice.

- (4) Russell explored the matter and found that the function of the laryngeal muscles is really the primary determiner of the sound.

## II. BREATHING

### A. Correct Posture

*Körperhaltung*

1. Head erect, chest high, pelvis tipped in
  - a. Posture muscles work by themselves when we know what they should be doing.
  - b. Gluteal muscles
  - c. "All muscles are controlled indirectly, in terms of their effects beyond themselves."

### B. The Framework of the Respiratory System

*Atmung*

1. Bone structure system of levers actuated by pulleys (muscles).

### C. The Muscles of the Ribs

### D. The Muscles of the Belly

### E. The Muscles of the Shoulders

### F. Clavicular, Chest, or Shoulder Breathing

1. "The breath of exhaustion"
  - a. Movement of upper thorax should be avoided since it is inefficient for exhalation
  - b. It looks bad
  - c. Leads to tension in the throat
  - d. Abdominal breathing can't take place when ribs are heaving.

### G. Costal, or Rib Breathing

1. Sideward expansion of ribs
2. Breath control - resist tendency to collapse ribs as long as possible

### H. Diaphragmic-abdominal or Belly Breathing

*Zwerchfell*

1. Diaphragm - powerful muscle, partition between ribcage and abdomen

2. Epigastrium

I. Belly Breathing Exercises

J. Muscular Antagonism

1. No muscle works alone.
2. Inhalation - Diaphragm contracts and lowers increasing space in Thorax
3. Exhalation - Diaphragm relaxes and rises, Abdominal muscles contract reducing space in the Thorax
4. The ribs expand with inhalation, but tend to collapse with exhalation (see II. G. 2.)

III. ATTACK

A. The Lungs and Larynx

B. Phonation

C. The Attack

D. The Bernoulli Effect

E. The Bernoulli Effect in Laughing

F. Two Concepts of Vibration

G. The Glottal Plosive

H. The Imaginary Plosive

I. The Stroke of the Glottis

J. Mental Preparation for the Attack

IV. REGISTRATION

A. The Framework of the Larynx

B. The Cricothyroid Articulation

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- C. The Conus Elasticus
  - D. The Musculature of the Larynx
  - E. Research in Laryngeal Function
  - F. The Power Factor - Breath Flow - Respiratory Muscles
  - G. The Pitch Factor - Longitudinal Tension - Cricothyroid Muscles
  - H. An Efficiency Factor - Adduction - Interarytenoid Muscles
  - I. A Second Efficiency Factor - Medial Compression - Lateral Cricoarytenoid Muscles
    - 1. Breathiness in young singers
    - 2. Training the interarytenoids plus maturity
  - J. The Registration Factor - Activity-Passivity - Vocalis Muscles
    - 1. Light vs. Heavy - Head vs. Chest
    - 2. Voix Mixe - Overlapping the "Registers"
    - 3. Full Voice - Blending heavy and light
  - K. Dynamic Vs. Static Adjustment
  - L. The Lift of the Breath *getting over the "break"*
  - M. The Classification of Voices

V. RESONANCE

A. Two Theories of Vocal Resonance

★ 1. Helmholtz - The vocal lips produce a tone with a definite desired pitch, considerable volume, and of complex timbre, having the possibilities of beauty. As this tone passes through the throat and mouth, these cavities encourage those partials which make for power and beauty, and muffle the undesirable ones; or in the case of unskilled singers, the opposite occurs.

2. Scripture - the larynx produces no overtones, but only series of puffs of air. These determine the pitch. Excited air in the resonators set them in motion and they produce their own frequencies. Larynx comparatively unimportant. Lilli Lehmann spoke of "Wirbeln."

3. The resonators function selectively according to the frequencies of the vibrator (larynx). The good singer tunes his throat in harmony to his vocal cords.

B. The Size and Shape of the Resonators

C. The Combining of Resonators

D. The Composition of Resonator Walls

E. The Surface of the Resonators

F. The Chest as a Resonator

1. Chest is not a resonator.

G. The Trachea and Bronchi as Resonators

1. The subglottal system

H. The Larynx as a Resonator

1. The "ring" in the voice - "2800"

I. The Ventricles as Resonators

*eTC Nose, Pharynx, mouth, Sinus,*

J. The Correlation between Resonance and Registration

1. Male - learn to lighten the registration while opening the resonators.
2. Female - learn to give more power to her head voice, open the middle.
3. Advanced Singer - Coordination
  - a. "Sing it the way you speak it."
  - b. "Don't sing it so beautifully, shout it."
  - c. "Yawn-sigh"
  - d. *Carefully add "energy" to tone.*

VI. VOWELS

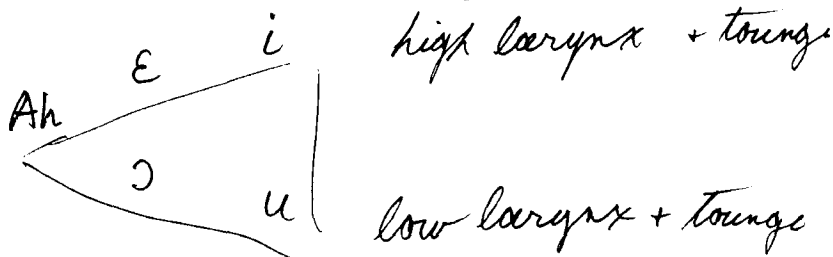
A. Two Theories of Harmonic Structure

1. Relative Pitch Theory - *partials all rel to fundamental*
2. Formant or Fixed Pitch Theory - *fixed fundamental, enforced partials*

B. The Vowel Triangle

## Vowel Triangle

1. Single formants - O and U have one strong overtone each
2. Double formants - E and I have two strong overtones each



### C. The Mechanism of the Formants

1. Change the shape of resonator to form the vowel
2. Control of the **TOUNGE** is the most important factor in good vowel formation.

### D. The Mechanism of the Separated Formants

1. The vowel "Ah" nearest to glottal tone.
2. Ay and EE formed with the tongue.
3. Oh and U with the lips as well.

### E. Vowels other than the Five

1. Umlauts
2. Schwah (dull vowels)

### F. Spreading

### G. Nasty ae

### H. The Nasal Vowels

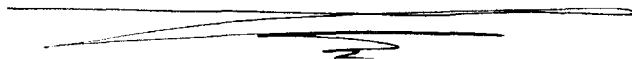
1. French

### I. Consistency of Vowel Color

### J. Emotional Connotations of the Vowels (interpretation) *Vowel colors mood in words*

### K. Resonance Imagery

1. Scientific language is inadequate to teach an art.





## VII. COORDINATION

A. Interrelation of separate functions in Singing

B. Neurology

1. The Brain
2. The Nervous System
  - a. Impulses vs. current

C. Normal Vibrato - *result of Timbres in voice, Schwingung, Larynx gibt nach, Schwingt mit.*

D. Undesirable Vibrato or Tremolo

E. Technical Control of the Vibrato

1. Overloading!

F. Emotional Control of the Vibrato

1. Technic improves. emotional controls developed
2. Vibrato as expressive or style element

G. Musical Control of the Vibrato

1. "come out even" - Tempo of piece
2. Indirect control of the vibrato

H. The Trill

1. Vocal agility

I. Tones without Vibrato

1. Learnable but deplorable in a solo voice
2. *Early Music debate*

J. Vibrato in Ensembles

1. Stabilized Vibrato
2. No Vibrato at all?

K. The Hemispheres of Coordination - *Antipodes, Widersprüche*

1. Student must deal with differences of opinion. *and*

- a. He follows one teacher blindly
- b. He works with many teachers, but believes none, becomes cynical.
- c. He recognized that the truth is greater than any of us.

- L. The Extremes of Pedagogy - Mechanism and Holism  
*x Complex of simple skills*      *o Behaviorism, total response*
- M. The Extremes of Phonation - Breathiness and Tightness  
*Respiration + Phonation = attack yawn-shout!*
- N. The Extremes of Registration - Light and Heavy

1. No argument, use both!

- O. The Extremes of Resonance - Focusing and Covering

1. Both have merit, but not in extreme.

- P. The Extremes of Articulation - Words and Music

- Q. The Extremes of Singing Technic - Freedom and Intensity

1. Yawn-sigh
2. Ping or Focus

- R. Concluding Remark

A Knowledge of Mechanism is the foundation of an objective pedagogy, and a Mastery of the Technic is the prerequisite for artistic expression.