CHARM Symposium 3, Royal Holloway April 2006

Using Recordings For Documenting Performance

an overview of the field by George Brock-Nannestad

The following is an annotated version of the presentation as it occurred.

NOTES:
Sound examples played during the presentation are not attached - and the references are not even complete in the present version, an omission for which I apologize

Illustrations shown during the presentation are generally not given for the reason that I do not wish to engage in the activity of clearing copyright, an omission for which I do not apologize.

The Recommended Reading list that was handed out during the presentation has been incorporated.

- Introduction: why do we want to study performance?

Sound:
Merikanto: Mustalainen, Salon Orchestra (without Théremin!!)
[a CD transfer, apparently with all noise reducing settings at maximum]

- this is one reason why we need to occupy ourselves with early recordings - we cannot allow future generations to believe that this represents the sound of musicians at their great-grandparents' time.

The study of performance is no more than a formalized manner of handling the experience of a performance, using set standards of measurement or at least of appreciation and a standardized vocabulary. These we know from the musical competitions that are so widespread in some countries. But why do we want to study performance at all? The *first and best* reason is curiosity. How do they do it? Why is this performance better than the other?

- or we may simply wonder at what we hear [unfamiliar rhythmic emphasis]:

Sound:
Schubert Op. 94, No. 3 Conrad Ansorge Parlophone E10986

- or even

Sound:
Mendelssohn, Violin Conc. E minor, Andante Willy Burmester Edison Bell E-N 3098

This is clearly an anachronism - an electrical recording movement from a violin concerto with a piano accompaniment.

The *second* reason is that this information may instruct us how to be better performers ourselves according to some set standards.

A third reason is that we may create synthetic performances that are indistinguishable from a real, human performance. Do we really wish to replace humans by rule-driven computers? It would not be against human nature - most of the scientific development over time has been used by humans to dehumanize human life, including manufacture and artistic expression.

- we may want to study performance in order to integrate it into a new work:

Sound:
Charles Dodge: "Any resemblance is purely coincidental" (w. Kerstin Åberg)
Fylkingen Records FYLP 1025

All of these early sounds were created by people who are now mostly dead and received by people who no more have heard them live.

We need to digress for an important question: **what is *performance*?**

- is it a sound of a musician that was performed personally by him or her?

- is it a sound that merely embodies someone's *idea* of such a sound?

A relevant answer to the first will be based on an attempt to get back to the sound of the musician actually performing.

A relevant answer to the second will accept a sound that is actually the brain-child of the "someone"

In both cases we may decide to concentrate on the sound of *a single tone*, the sound of *a beginning or end of a single tone*, or on the sound of *a cluster of tones*, but when we have a long stretch of sound it must be an *unedited* long stretch of sound, or else our conclusions regarding the musician, rather than regarding the "someone", will not be correct.

Some of the recordings that were available to our great-grandparents are again available to the general public. Some records, like Caruso's or Louis Armstrong's, were never **un**available,

Slide: Caruso VTMC advertisements

but most records had a brief active life, and when the music reproduction systems changed, they became in effect unplayable. The way that the recordings are made available is by transfer to modern media.

This suddenly removes us from the actual source to history, *someone* else has interfered by using a reproducer, and many adjustments and potential manipulations that we know nothing about. The sources are difficult to use, and does that *someone* have sufficient knowledge for OUR purposes? Another question is, if the transfer has been manipulated, can it still be useful?

Let us hear just one example:

Sound:
Robert Parker: CD re-issue "in digital stereo"

- now, this is Adelina Patti with harp accompaniment, except harpists would say that some of the chords are not possible on a harp. I warned Robert Parker about his mistake before he issued this record, but to no avail. We know for a fact that all Patti's recordings were made with a piano.

If we approach the problem in a systematic manner, there are a number of fundamental disciplines that are available to us and which we need to draw on if we shall be able to trust the input to our ears

The systematic consists in looking at subject areas that contribute to our understanding of a recording and its reproduction.

+ how do we get to a reproduced sound recording?
- the sound emitting properties of sound sources
- the musical utilization of these properties
+ the properties of the spaces in which sounds are emitted and listened to
- physiology and psychoacoustics
- objective measurements of musical performance
+ the properties of sound recording equipment
- the properties of sound carriers
- the properties of sound reproducing equipment
+ source-critical approaches to our recordings
+ the restoration and manipulation of sound recordings
- the performance practice movement
- a general knowledge of recorded repertoire
- a general knowledge of ethnomusicology

five of the above (marked +) will be dealt with in greater detail.

- how do we study performance?

Until the rise of objectivism all study relied on human perception and empathy. This is still the predominant approach, even 150 years after the first fixing of a performance as a time function, because it requires no tools, only a good and trained ear, knowledge, and empathy. Anybody may become a master, whithout incurring investment in equipment and the distractions of using such equipment. However, there is no doubt that analysis is put on a much sounder footing when supported by measurement of the sonic event that is the result of performance. This requires us to look analytically at the contributions of the sound generator, the performer, the listening room, the way we perceive sound, the various limitations of recording and reproducing systems, including the human interference called restoration.

The equipment we must use will be dependent on the phenomena we take as representative indicators for performance.

- how do we get to a reproduced sound recording - the basis for it all

It may be regarded as step-by-step process, a path, that starts with an idea in the mind of a composer and ends with a variation in air pressure that is perceived by the ear as sound and interpreted by the listener as music. Inbetween a lot may happen in the functional blocks that are connected in series.

Slide: illustrating

idea
performer
instrument
sound
air
ear

putting some more steps in the path:

idea
performer
instrument
sound
air
diaphragm
transducer
electrical current
transducer
diaphragm
air
ear

and expanding to a considerable time delay:

Slide: "Schallplatte" shows the complete chain via recording and reproduction:

idea
performer
instrument
sound
air
diaphragm
transducer
electrical current
amplifier

transducer
storage medium
transducer
electrical current
amplifier
transducer
diaphragm
air
ear

Slide: input-output chain **with** feedback paths

The interesting thing that happens is that the result and part results are evaluated after the recording - the fixing on the storage medium - has occurred, and that adjustments in the chain of processes are made. This occurs by feedback of various kinds. Feedback is the ideological control of the recording process, and we may distinguish between the many *technological possibilities* given by the functional blocks and the *ideology* that constitutes the feedback.

Slide: Werdegang einer Opernaufführung

This is in contrast to the creation of a live performance, such as an opera. Rehearsals, dress rehearsals, performance. Feedback in a large scale can only occur during planning, the actual performance relies on learnt patterns.

Recommended Reading:
George Brock-Nannestad:
"Respecting the Sound - From Aural Event to Ear Stimulus", AES Convention Paper No. 6146, 116th Convention 2004 May 8-11, Berlin

- the sound emitting properties of sound sources

this is the subject of musical acoustics, which deals very effectively with the composition of signals that emanate in space from a musical instrument

Slide: sonagram, i.e. a 3-dimensional representation time, pitch, intensity

In many cases there is a discernible difference in the quality of a tone played at a low pitch and at a high pitch, apart from the pitch itself. This difference is classified into the "registers" of the instrument, but instrument manufacturers go to great lengths to even out the transition from one to the other. Also, the achievement of this evenness forms part of the advanced training of the performer. This means that a chromatic run will not have a discernible unevenness. The performer in many cases has a choice between neighbouring registers for particular tones and may choose a particular register for expressive effect. Hence, the determination of registers is important to understand a performance.

Some instruments have registers that fall under the above definition, although they are not usually described as such.

In the violin family there are 4:
stopped strings (largest selection of tones),
open strings (4 tones only),
harmonics (many tones available)
pizzicato (a large selection of tones).

The open strings are audibly distinguishable over the stopped strings. Undoubtedly, that is why *scordatura* was resorted to in the introduction to Saint-Saëns' *Danse Macabre*: the hollow and frightening quality is most effective in the discordant double, unstopped bowing in the first violins.

The musical instruments are radiators of sound that have dimensions that for some tones are smaller than the emitted wavelength and for others larger that the emitted wavelength. Furthermore, the same part of the instrument does not radiate the same proportion of the energy at all frequencies. For these reasons there is a very large variation in the spatial radiation pattern of the instrument according to the note played. This means that the quality of the sound of the instrument varies, both with the placement of the ear (or microphone) and with the note played as well as the register utilized.

Slide: Stroh violin from Augustus Stroh's patent

--- pictures of Stroh violin and Stroh cello in use distributed in the audience

The voice is a particular musical instrument, because it is not at all controlled by the hands. In this it resembles the bugle. It is also a confusing instrument to listen to, because in daily life the voice is connected very closely to communication of emotions in the vernacular culture that the listener is used to. Artistic singing may be very different from this, and its reception may need just as much study to understand as the sound of an instrument that is an *extension* of the human. One quality of the trained Western classical singing voice sounds like a particular form of harmonic distortion that is evident in the high frequency range where the ear is most sensitive. It is the so-called *singer's formant* that like all other vowel sounds is obtained by selective filtering of the broad-band vocal cord source signal. The voice also displays registers.

Recommended Reading:

Arthur H. Benade:
"Musical Acoustics"
Dover Publications, New York 1990 (revised reprint of 1976 Oxford University Press edition)

Dayton Clarence Miller:
"The Science of Musical Sounds"
The Macmillan Company, New York 1916, 1922

- the musical utilization of these properties

The music written by the composer is interpreted by the performer and made into sound by the performer, acting on the physical medium the instrument that is only able to produce the intended sound if handled correctly. The performance is the physical act that is observable by ear and eye. In the present study we have left out the visual component, and we must learn all we can from the sound available.

The abilities that are nurtured by the performer (dependent on the instrument) constitute providing the following controlled by the will:

precise instantaneous pitch

precise time envelope

precise timing

precise dynamics

for pianists, organists, chamber groups, and conductors we also have:
precise chord building, rubato

All of these things require fine motor control of several groups of muscles, and we judge the difficulty of execution by the severity of the task. For this reason, it is devastating to the perception of e.g. a piano performance, if we know that the piano in question is a two-manual piano. The Danish pianist Gunnar Johansen undertook to record all solo piano literature, and like Josef Weiss - a Liszt pupil - he used a two-manual piano. The effort is less, and actually too little - it is 'cheating'.

Recommended Reading:

Gardner Read:
"Thesaurus of Orchestral Devices"
Isaac Pitman & Sons, London 1953

Giacomo Lauri-Volpi:
"Voci parallelle"
Garzanti 1960 (revised and expanded on 1955 edition)

Sara K. Schneider:
"Kinesthetic Aspects of Musical Interpretation"
Pendragon Press, Stuyvesant, NY 1994

Joseph Szigeti:
"Szigeti on the Violin"
Frederick A. Praeger, London 1969

Alf Gabrielson (Editor):
"Action and Perception in Rhythm and Music. Papers given at a symposium in the Third International Conference on Event Perception and Action"
Royal Swedish Academy of Music, Stockholm 1987 (Publication No. 55)
(Sound Examples MAK 873 (EP record) pp. 235-237)

Renee Timmers:
"Freedom and constraints in timing and ornamentation: Investigations of music performance"
Shaker Publishing, Maastricht 2002
(Sound Examples on CD: pp. 195-199)

- the properties of the acoustic spaces in which sounds are emitted and listened to

this regards the performers' use of the room as well as that of the listener

Architectural acoustics has determined the requirements of performers in hearing each other and the response of the hall, and also the requirements of listeners to be able to distinguish the various melodic and dynamic lines of the music. The important factor in a listening space is that there is a clear direct transmission of a first sound from an instrument, in order that the reflected sounds arriving later from other directions and possibly with a different spectral content may be properly synchronized in time for the ear to interpret the listening situation correctly.

The actual performance as picked up by ear or microphone is hence very influenced by the acoustic environment, both from the radiation pattern point of view and from the reverberation point of view.

Slide: acoustic recording at Victor 1907 [from internal report by Fred Gaisberg]
Slide: acoustic recording by Sinkler Darby 1907 [from autograph letter]
Slide: acoustic recording ca. 1922 [VTMC balanced diaphragms]
Slide: Columbia soundboxes, but not true [from Wilson & Webb 1929]
Slide: true Columbia soundbox [from Seymour 1918]
Slide: Paderewski recording Morges 1913 [Deutsche Grammophon 1913]
Slide: Marie Novello recording 1925 [Batten 1956]
Slide: radio orchestra Winterthur [Scherchen]
Slide: radio orchestra Winterthur - no gain riding [Scherchen]

Recommended Reading:

Leo L. Beranek:
"Music, Acoustics & Architecture"
John Wiley & Sons, New York 1962

George Brock-Nannestad:
"The Influence of Recording Technology on Performers and Listeners - a Review", AES Convention Paper No. 5533, 112th Convention 2002 May 10-13, München

- physiology and psychoacoustics

the ear has certain properties that may be developed for the appreciation of musical events, but also limitations. These are caused by the mechanism of hearing. There is no doubt that systematic ear training by the systematic presentation of phenomena will permit the perception of phenomena that are hidden to the casual listener. This has much to do with timing and expectation of a particular phenomenon, and the training very much consists in learning to be prepared for such phenomena.

Performance training also means the training of senses and obtaining a bodily experience of the act of performing that is pulled in when hearing a performance. This is absolutely essential for the understanding of performance. It is an advantage to have a bodily experience of violin performance when you study the violin performances of others, and the same applies to each and every instrument.

For instance, in singing, Lilli Lehmann's book "How to Sing" (Meine Gesangskunst) only makes sense if you have studied singing, so that you will obtain what we could call "physiological empathy". If a researcher does not have the bodily experience, the researcher must enter into teamwork with someone who does.

My own shortcut to understanding vocal records was to take for 3½ years vocal training at the University of Copenhagen. Since then I get tenseness in my throat when I hear particular, badly produced sounds.

Also, when listening to records of Luciano Pavarotti, it has become very audible to me that after his encounter and cooperation with Joan Sutherland, he started to support his voice, which he had not done before.

Recommended Reading:

Theo van Leeuwen:
"Speech, Music, Sound"
Macmillan, London 1999

Herrmann L. F. von Helmholtz, translated by Alexander J. Ellis:
"On the Sensations of Tone As a Physiological Basis For the Theory of Music"
Dover Publications, New York 1954 (reprint of 1885 edition)

William A. Sethares:
"Tuning, Timbre, Spectrum, Scale"
Springer, London 1999
(Sound Examples CD: pp. 337-340)

David Butler:
"The Musician's Guide to Perception and Cognition"
Schirmer, New York 1992
(Listening Examples CD: pp. xiii-xv)

James Beament:
"How we hear music: the relationship between music and the hearing mechanism"
Boydell Press, Woodbridge 2001

- objective measurements of musical performance

--- equipment demonstrated

this is all portable manual equipment useful for extraction of a few data points, however when used interactively it may already create very much documented information.

We may use certain tricks, even in the analogue world, to allow analysis. For instance, a vocal line may be analysed very carefully by reducing the speed of a tape to 1/8, and to concentrate on the singer's formant range of 2.5 - 3 kHz, which then becomes very clear and slow enough to observe without any orchestral disturbance at all.

Modern data capture methods enable the following determinations to be done to an overwhelming degree:

- precise instantaneous pitch
this comprises intonation and key as well as pitch vibrato

- precise time envelope
this comprises starting and stopping of notes and intensity vibrato

- precise timing
this comprises tempo in the broadest sense, rhythm and pulse, portamento

- precise dynamics
this comprises the relative strengths of notes, and the deployment of the total range

- for pianists, organists, chamber groups, and conductors we also have:
precise chord building, rubato

A large part of musical acoustics deals with the measureable results of performer-instrument interaction, and many of the phenomena may be isolated and analysed from even a mono recording. For instance, we can determine a bow change very precisely, although perhaps not its instantaneous direction. However, a violinist when interviewed will be able to indicate this.

Recommended Reading:

Daniel Leech-Wilkinson:
"Using recordings to study musical performances", in
"Aural History: Essays on recorded sound"
British Library, London 2001
pp.1-12
(CD tracks 1-4 of Track listing pp. 157-158)

George Brock-Nannestad:
"The Masking of Characteristic Spectra by the Acoustico-Mechanical Recording Process", in
'Proceedings of the Stockholm Music Acoustics Conference SMAC83'
Royal Swedish Academy of Music 1985 (Publication No. 46:1)
pp. 105-111 + Tracks 1 and 2, MAK841A (EP record)

- the properties of sound recording equipment

capturing the sound via microphone or horn

The Victor Talking Machine Company and the Gramophone Company had a row in 1910 over who should record Nellie Melba. The reason was that VTMC had huge problems in utilizing the metals they obtained from England. The groove was not wearing well and the records wore out too quickly. The Gramophone Company wanted to experiment with the parameters and obtained the services of Melba to obtain her range of intensities and the clearness of obtainable sound.

Sound:
Melba Distance Test 1910

Slide: groove photo [from VTMC]

I was called upon to make acoustic disc recordings of an important singer who wanted to compare his own performance with the likes of Caruso, and I had access to original acoustic recording equipment. This permitted me not only to make controlled experiments but also to observe the "horn behaviour" of the *artiste*. So, where he wanted to record to hear if he was better than Caruso, I wanted to observe him trying to emulate Caruso

Sound:
British actor commenting on 'listening while speaking' to the recording horn

I can play you a snippet of the result of the first tests:

Sound:
anonymous tenor: 'Vinceró!'

Converting to mechanical vibration, light variation, or variation in magnetic field: these are the physical phenomena relied on for storing sound. However only mechanical discussed here

Slide: acoustic recording lathe [Courtney-Bryson 1935]

this is a fairly wobbly affair, and result is not surprising:

Sound:
Pugno from CD re-issue - 'Paris piano twang' preserved

Slide: electric (Neumann) recording lathe ca. 1934

Electric amplification meant spatial freedom during the recording

Sound:
Ernst Rolf (rather faint piano, suddenly close-miked voice)

Sound:
castagnettes - radiation pattern

The recording machines had different groove pitches; for HMV and Columbia they were as shown here:

Slide: H.M.V. Gravity, Columbia 'meat slicer' [from EMI]

Capturing keyboard performance by parallel lines on paper: piano rolls. They are the MIDI of yesteryear. Here the pitch and the speed are completely independent.

Recommended Reading:

Joe (Joseph) Batten:
"Joe Batten's Book: The story of Sound Recording"
Rockliff, London 1956

H. E. Roys (Editor):
"Disc Recording and Reproduction"
Dowden, Hutchinson & Ross, Stroudsburg, PA 1978
(Benchmark Papers in Acoustics, Vol. 12)

Marvin Camras (Editor):
"Magnetic Tape Recording"
Hutchinson Ross/Van Nostrand Reinhold, New York 1985
(Benchmark Papers in Acoustics, Vol. 20)

George Brock-Nannestad:
“The Objective Basis for the Production of High Quality Transfers from Pre-1925 Sound Recordings”, AES Preprint No. 4610, 103nd Convention 1997 September 26-29, New York

idem:
“Can You Retrieve the Original Studio Acoustics In Pre-1925 Recordings?”, Proc. XII Colloquium Musical Informatics (Argentini, A. et Mirolo, C., Eds.), Gorizia 1998
pp. 157-8.

- the properties of sound carriers

a linear track, scrolled in a spiral or rolled up in a helix; mechanical, optical, magnetical

physical non-sound information: manufacturing marks, identification
corruption: physical and chemical breakdown of the carrier

Sound: sounds of an empty groove: crackly noise

Slide: Principal steps in manufacture [GBN 1983]
Slide: copper crystal growth with original lacquer [EMI]

--- demonstration of what a 78 rpm record looks like

A lot of the physical markings on shellac records can tell you something of discographical value, and to aid in that I have prepared a text with a vocabulary, and it is available on the internet.

Slide: The physical object: a listing of markings created during manufacture

Recommended Reading:
Kevin Bradley (Editor):
"IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects"
IASA, International Association of Sound and Audiovisual Archives 2004

George Brock-Nannestad:
"How is discography related to the physical object?"
Hand-out at the seminar "Dokumentation av 78-varvsepoken i Skandinavien", SLBA, Stockholm 12-13 February 2005
- available as a pdf-file:
http://www.ljudochbildarkivet.se/slba/PSUser/archives/document/203/1374/1426/123.pdf?objectId=1698

- the properties of sound reproducing equipment

ability to collect the information on the sound carrier, compensating any deliberate measures taken at recording: the 'systems' approach

Slide: HMV test records: the frequency characteristic of the output is measured

using such test records it is possible to compare the quality of various pickups and preamplifiers in absolute terms

Slide: wear of steel needles [Courtney-Bryson 1935]

the reality in the days before light-weight pickups was that the steel needles used gradually increased their dimensions, thereby making them more and more unsuitable for the reproduction of short wavelenghts (high frequencies) as they wore down. A minimum wear was necessary to protect the record against a sharp steel point, and for this reason an abrasive was part of the record material.

Recommended Reading:
Stephen F. Temmer (Editor):
"Disk Recording Vol. 2 Playback and Testing - An anthology of articles on disk recordings from the pages of the Journal of the Audio Engineering Society Vol. 1- Vol. 28 (1953-1980)"
Audio Engineering Society, New York 1981

- source-critical approaches to our recordings

validation of the signal, primary and secondary sources, transparency of recording system. First of all, *listen to the treble* - that is where destructive manipulation is most easily discernible. Filter out the loud bass and concentrate on the treble. Are there non-musical noises that should not be there? Are there peculiar delays in fricatives and other signals with a naturally high noise content?

Identification of duration, the influence of noise on precision, calibration of time axis

Sound:
the announcement "Pathé Record" from six records in a Finnish re-issue on CD

there is a difference in pitch!

- even if the announcer's voice after a long day of recording may be tired, the discrepancy is too large.

The speed, key, and standard pitch complex

Slide: Speed, Key and Pitch Problem [GBN 1989]

In acoustic recording we have a speed-invariant fingerprint: *the horn noise*

Slide: noise spectra from EMI LP (producer Bryan Crimp) Adelina Patti

These curves ought to overlap to a large degree, but they are individually shifted along the frequency axis, which means that the reproduced speeds are not corrected relative to each other. The odd one out was a dubbing.

Slide: noise spectra from silent grooves; 120 and 240 Hz prominent

The silent groove noise in one particular electrical record displayed these peaks, which correspond to mains frequency harmonics from the US

Back to speed variation:

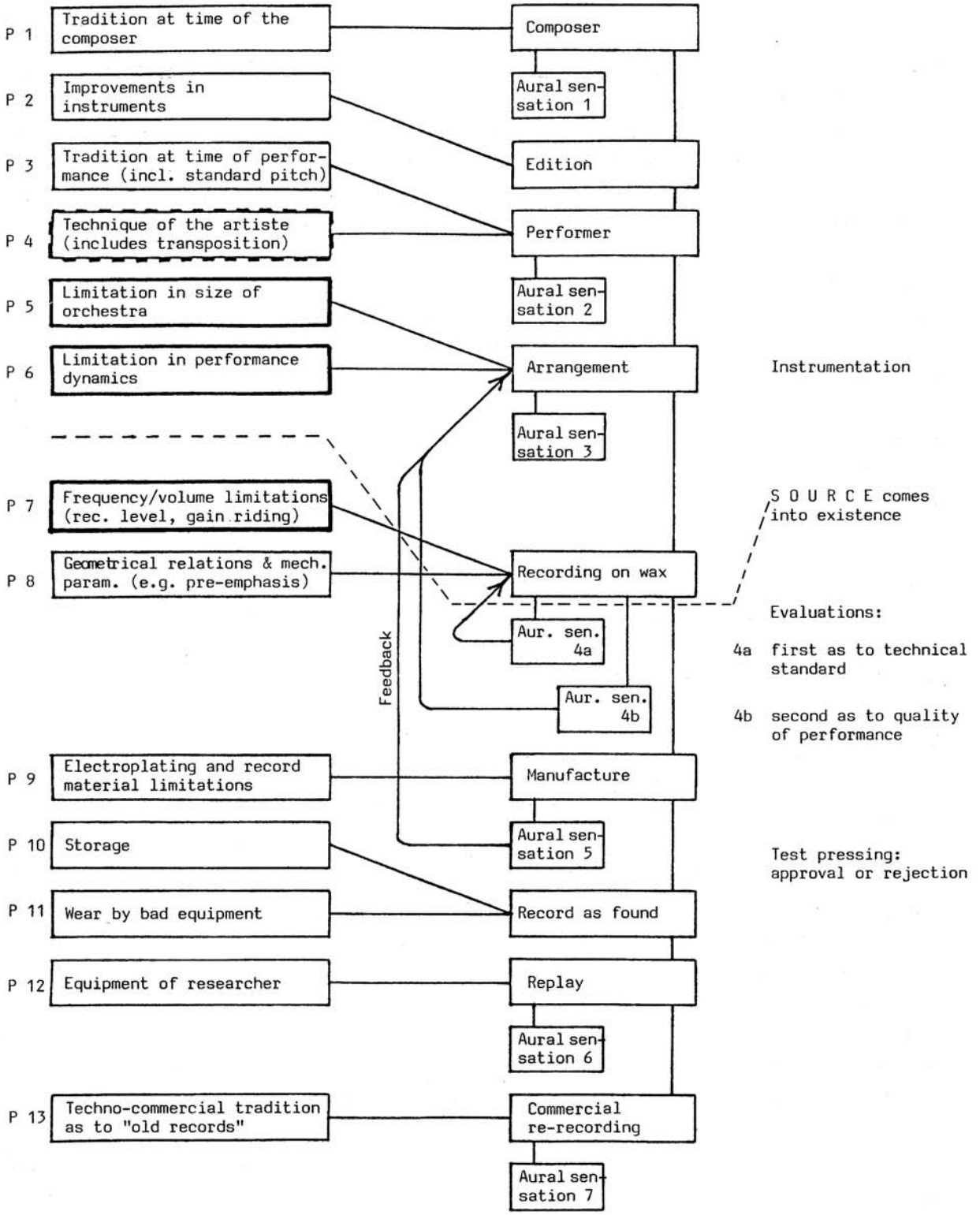
Slide: principle of perception of quality in dependence on slotting with keys

Slide: Strauss: 'Traum durch die Dämmerung' performed by Friedrich Schorr, HMV black label

Sounds:
Schorr reproduced at various speeds

- which one is correct? Is any one really bad?

Slide: Sur les Flots, label of acoustic French Gramophone



The complete input-to-output chain from composer to different sonic impressions in connection with the process of recording and reproduction, dependent on the stage of the process, including feedback paths that determine the final result. The parameters that influence result are numbered P1-P13, and they may be controlled to some degree. Heavy lines show media-dependent parameters

Sound:
Musique de la Garde Republicaine

Slide: Over the Waves [Barlow & Morgenstern 1949: Juventino Rosas]

We know that the Musique de la Garde Republicaine (like the Paris opera) had to obey a standard pitch of 870 'vibrations doubles', i.e. a4=435 Hz.

Now, the open string of the violin is an absolute calibration with respect to key

Slide: Svendsen, Violin Romance, Fini Henriques Gramophone 087900 (1911), label

Sound:
Henriques, *open G*

- and because the standard pitch of the Royal Opera Orchestra members was a4=435 Hz, we get a speed of 82 rpm

In general, the interaction of speed, key, and standard pitch may be shown graphically this way:

Slide: indicating how the standard pitch influences perceived pitch at various speeds

Slide: ±cents vs. frequencies re a4=440 Hz

-- calibration record plus KORG Chromatic Tuner demonstrated

Slide: Film and Tape media: speeds vs. timings

It had been noted that many orchestras world-wide did not adhere to the Vienna pitch of a4=435 Hz, and a revision of the international standard pitch was carried out in the 1930s. Hundreds of radio broadcasts were monitored and analyzed statistically before a4=440 was settled in 1938-39.

Slide: Mittelwerte [from Akustische Zeitschrift]

Slide: Prozentuale Verteilung [from Akustische Zeitschrift]

However, even with a standard pitch, we still have the problem of recording machines run by synchronous motors, because the mains frequency was not constant.

Slide: drift of hydroelectric power plants and picking up speed during the night

Now that we are armed with some knowledge, what shall we do about the intentions of record companies. I am thinking in particular about the Victor Talking Machine Company, who wrote the Gramophone Company: "we record our records at 76 rpm, although we tell our customers to play them at 78. We find that they last longer that way". How is that for authenticity in period replay on the original Victrola?

To end this part, let us look at the standard pitch situation in England about 1900:

Sound:
Gramophone "Melba" Record 3615 'Old Lang Syne' w. Coldstream Guards re a=452

The Philharmonic pitch was in reality a4=452 Hz, and opera singers protested ca. 1900. There was a revision to a4=439 as 'New Philharmonic Pitch', but the military bands retained the 'Old Philharmonic Pitch' until 1928.

Slide: Elsie Southgate Mustel organ Zonophone

in 1917 the Gramophone Co. acquired Miss Southgate's Mustel organ and converted it to New Philharmonic pitch. Hence we know the standard pitch of her records.

Recommended Reading:

George Brock-Nannestad:
"Zur Entwicklung einer Quellenkritik bei Schallplattenaufnahmen", 'MUSICA',Vol. 35, No. 1, pp. 76-81 (January, 1981)

idem:
"A Concerted Approach to Historical Recordings", 'Gramophone' (London), Vol. 61, No. 728 pp. 925-27 (January, 1984).

idem:
"The Critical Approach to Sound Recordings as Musicological Sources", in "Proceedings from the Nordic Musicological Congress, Åbo 1988", 'MUSIIKKI', 1-4/1989
pp. 423-435

idem:
"A Knowledge of the Content of Material as a Pre-Condition for Restoration", 'Proceedings of the Joint Technical Symposium IASA-FIAF-FIAT Ottawa May 1990', Milton Keynes 1992
pp. 149-154

- the restoration and manipulation of sound recordings

physical restoration
Slide: manual tools to be used under the microscope

identification of noises and irritants, choices for remedy, risk of removal of important signal features

clicks, crackle, hiss, hum, modulation (fading in radio), spectral imbalance/time delay distortion, nonlinear distortion (various causes). Horn noise vs. plating and shellac noise

the types of equipment available and their misuse

Slide: Virtual Gramophone Technology: an advertising ploy

Sound:
Beethoven: 5th Symphony, cond. Nikisch: correction of frequency response

Sound:
George Barrère Little Symphony: only bass lift: a natural sound, Columbia 1916

Sound:
Yradier: la Calasera, Patti: horn transfer function spectrally corrected

Sound:
Shakespeare: acoustic recording in German: Bernhard Baumeister (Austrian actor)
1) as reissued without surface noise, but huge spectral distortion
2) the spectral distortion compensated: speech understandable

Recommended Reading:
George Brock-Nannestad
"What Are the Sources of the Noises We Remove?" Proceedings of AES 20th Int. Conf. 'Archiving, Restoration, and New Methods of Recording', Eds. Z. Vajda, H. Pichler, Budapest 5-7 October 2001 pp. 175-182.

- the performance practice movement

the desire to re-create sounds as they were,
learn from the philosophical discussions of the concept of the "authentic",
translating knowledge gained from the interaction with early instruments into knowledge about interacting with records

Recommended Reading:
Michael Kenyon (Editor):
"Authenticity and Early Music. A Symposium"
Oxford University Press 1988

Alfred Mann and George J. Buelow (Editors):
Paul Henry Lang: "Musicology and Performance" (posthumous)
Yale University Press 1997

- a general knowledge of recorded repertoire

a general knowledge of the history of sound recording, commercial demands for various types of music, discography, expected label-artist combinations

Discography may be aided by the physical markings I mentioned above

Recommended Reading:
Robert & Celia Dearling with Brian Rust:
"The Guiness Book of Recorded Sound"
Guiness Books, Enfield 1984

Alan Ward:
"A Manual of Sound Archive Administration"
Gower, Aldershot 1990

- a general knowledge of ethnomusicology

the contrast to commercial recording, better documentation, better chances of objective measurements, comparison to phonology

NB: *absolute sound level* not recorded in electrical recording, but it is available in acoustic recording with well-documented equipment

Recommended Reading:
Gabriele Berlin and Artur Simon (Editors):
"Music Archiving in the World. Papers Presented at the Conference on the Occasion of the 100th Anniversary of the Berlin Phonogramm-Archiv"
Verlag für Wissenschaft und Bildung, Berlin 2002
(Table of Musical Examples on the Accompanying CD pp. 491-497)

- how has academic work in the field coped until now?

First let us take some advice from an old gentleman:

Sound:
George Bernhard Shaw: 'Spoken English and Broken English' (intro.)

I have looked at a number of recent treatises (see Recommended Reading, below), and the immedate impression is that there is a distinct lack of precision when dealing with the sonic sources, which are in most cases commercial re-issues. I cannot say yet whether the conclusions drawn suffer from this, but certainly the retracing of the steps of the researcher is very, very difficult. I would compare the present standard to attempting to analyze the pen pressure in Mozart's handwriting from this:

Slide: Mozart manuscript (as reproduced on a tourist postcard from Salzburg)

All-in-all I find this situation very unsatisfactory.

Recommended Reading:

David Milsom:
"Theory and Practice in Late Nineteenth-Century Violin Performance: An Examination of Style in Performance 1850-1900"
Ashgate, Aldershot 2003
(discussion pp. 150-151)
(Discography: pp.271-274
(CD contents pp. 275-277)

Gage Averill:
"Four Parts, No Waiting: A social History of American Barbershop Harmony"2
Oxford University Press 2003
(CD contents pp. 229-234)

Michael Musgrave and Bernard D. Sherman (Editors):
"Performing Brahms: Early Evidence of Performance Style"
Cambridge University Press 2003
(discussion Note 34, p. 301)
(CD contents pp. 382-384)

Martin Elste:
"Meilensteine der Bach-Interpretation 1750-2000: Eine Werkgeschichte im Wandel"
J.Metzler.Bärenreiter, Stuttgart, Weimar 2000
(Klangbeispielen CD: pp. 422-427)

Timothy Day:
"A Century of Recorded Music: Listening to Musical History"
Yale University Press 2000

Robert T. Philip:
"Early Recordings and Musical Style: Changing Tastes in Instrumental Performance 1900-1950"
Cambridge Univesity Press 1992
(Discography pp. 254-266)

Conclusion:

there is no single person who can possess sufficient knowledge in all these fields in order to obtain the maximum information from a sound recording. Collaboration between specialists is necessary and a common language must be found.

Sound:
Berlioz: Hungarian March, Philharmonic Orchestra, Cond. Rafael Kubelik, HMV 78 rpm 1951

Useful handbooks:

Harold Barlow and Sam Morgenstern:
"A Dictionary of Musical Themes"
Williams & Norgate Ltd, London 1949

Harold Barlow and Sam Morgenstern:
"A Dictionary of Vocal Themes"
Ernest Benn Limited, London 1956