The magic wand of ethnomusicology.

Re-thinking notation and its application in music analyses.

English version of:

La baguette magique d'ethnomusicologie.

Re-penser la notation et lanalyse de la musique.

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> One cannot too earnestly warn the student against accepting printed transcriptions as gospel truth.
> (C.Sachs,1962 :23)
> To such a riot of subjectivity it is presumptuous indeed to ascribe the designation 'scientific'.
> (C.Seeger, 1958:187)

One of the striking features of music and speech, in fact of all sound events, is their behavior in time, their evanescence: they are gone the moment we perceive them, with nothing left but fainting memory traces. Repeated exposure and training may help to recognize, recall, and even reproduce them. It remains immensely difficult to 'talk about' them - oral cultures have no music theory. Things seem to be different in literate cultures, though. Through the very invention of writing systems man has acquired means to cope with the elusiveness of sounds: the transformation from an aural-temporal form into a visual-spatial one. Sounds seems to be tamed and time seems more under control if treated spatially, however, this is only seemingly so because the accomplishments of such a transformation are limited and can at times be deceiving. Nevertheless, once invented, writing systems create their own momentum for further development and dissemination of the way they are applied and how man 'thinks with' and 'thinks about' them. Invented for mnemonic and communicative purposes they were also to be used, sooner or later, to record and communicate aspects of musical practices. In the succession of essential changes and new developments of the writing system following the Greek invention of alphabetic writing we also see the emergence of new notational systems for music in the Occident, which after a long development came to be a major shaping force for western music. Considering the central role that music writing plays in western music, it is no wonder, that notation became an important object of musicological research, the scientific inquiries into the world of music. Moreover, as notation was thought to represent music, inferences about music on the basis of the written form turned into a central methodological approach in musicology as well as in one of its later off-springs, comparative musicology.

The problem

However, as Western music notation was created and developed in and with Western music, problems are bound to occur if it is used to record aspects of non-western musics. And so, since the early days of comparative musicology the deficiencies of western musical notation for transcriptions of non-western music have been noticed and improvements and additions to the standard notation have been proposed. Yet, the basic idea of using western musical notation as the core element for transcribing music for analytical purposes has never been seriously questioned – despite several telling insights of a number of musicologists into the basic problems.

There was always great hope that expansions of the standard notation would be able to solve the most important problems. In 1909 O.Abraham and E.M. von Hornbostel published 'Suggestions for the transcription of exotic melodies'. The authors proposed several additions to and adaptations of the symbol repertoire of musical notation, some of which raised objections and have been rejected (e.g. C.Sachs, 1962, pp.29-30). New recommendations have been issued , following the suggestions of a number of experts, by the Archives Internationales de Musique populaire in 1949 in the CIAP information and in 1952 in the Document du Conseil International de la Musique. Many researchers working on specific problems suggest specific amendments. For example, E. Alexeiev writes in his study on 'archaic intonations in folk melodies' (1986):

« Firmly associated, by its very origin, with the idea of European tonality, the five-line notation is far from being conducive to an adequate comprehension of the initial norms of melodic consciousness. Nevertheless it remains, in many respects, an irreplaceable instrument of analyzing the melodic material under consideration in terms of pitch, and needs, in this capacity, further improvement, in particular by dint of introducing into the system of music-writing a temperament based on a subdivision of the semitone, which would make for the formalization and operationalization of pitch-dimensional analysis. »

Mantle Hood (1982), in his 'The Ethnomusicologist', presents and discusses various aspects of notation, among others, the pros and cons of the different styles of notation, i.e. the 'essential' vs 'comprehensive' approaches. Herzog, for one, while not neglecting details which characterize a musical style, avoided including too many a detail as 'to make a song unintelligible to the eye'. Bartók, on the other hand, was eager to fix the smallest details in order to give as comprehensive as possible a transcription of performances. Hood also suggests a list of improvements and expansions, among others also the use of non-western notations. As important as these suggestions are for dealing with certain aspects of non-western literate musics, that is with musics that have developed their own notational systems, they do not solve the essential problems of inferring music from notation : the changes (loss of information) induced by the transfer from aural-temporal to visual-spatial 'space'. For instance, analyzing Chinese notations for the Gu-Zheng, a zither-type of instrument, I have shown that the distribution of tone inflections for various scale steps is a prominent feature of regional styles as well as individual compositions. However, there is no a priori guarantee that analyses of musical performances will obtain the same results. In fact, I have presented numerous cases where analyses from notation and musical performances obtain different results (Will, 1994).

The experience with all the proposed improvements and changes suggests that tinkering does not solve the problems we are having with notation, and I think that most writers on the subject would, in the end, admit the inadequacy of Western notation as descriptive notation. However, in going back to the reference books while preparing the present article, I must admit, I was completely stunned by the obvious contradictions between enlightened insight into the problems of using western musical notation for analytical purposes and the insistent adherence to this method by several authors. For example, Nettl (1964) writes :

« Transcribing music by hand and ear, as it were, is hindered by the situation in which the transcriber is a native of one musical culture trying to write down the music of another culture, a transcriber using a notation system devised for one culture and foreign to the styles in others. Thus a concept such as the note, which forms the basis of Western musical thinking, might be erroneously applied to another musical culture in which glides between notes are the essential

feature. Slight deviations from pitch, hardly audible to Western ears used to the tempered scale, might be essential distinctions in another music. .... The point is that human transcribers ..... might have great difficulties in first perceiving and then reproducing on paper the music of another culture in such a way that the essential distinctions are indicated in a way comparable to that which would be required by descriptive notation ». However, despite these valid descriptions, one page further he concludes: « Until electronic notation devices are readily available and perfected, transcription with some sort of manual notation system remains one of the indispensable tools of the ethnomusicologist ». Which leaves one wonder... However, for Nettl transcribing also has an educational function, and that probably justifies it's survival : « ... transcribing imposes on the student a kind of discipline which could hardly be exacted by mere listening to recordings. » ! And finally : « Although attempts at providing other notation systems have been made, the western system has traditionally been preferred. » - a justification already made by Abraham and von Hornbostel in their 1909 paper and an unsatisfactory one on top.

C. Seeger has pointedly characterized the situation: "In employing this mainly prescriptive notation as a descriptive sound-writing of any music other than the Occidental fine and popular arts, we do two things, both thoroughly unscientific. First we single out what appears to us to be structures in the other music that resemble structures familiar to us in the notation of the Occidental art and write these down, ignoring everything else for which we have no symbols. Second, we expect the resulting notation to be read by people who do not carry the tradition of the other music. .... To such a riot of subjectivity it is presumptuous indeed to ascribe the designation 'scientific" (Seeger, 1958: 186-187). Amazingly though, in the end even Seeger suggests the continued use, in combination with automatically transcribed graphs, of standard western notation for the time being.

Only very few scholars like C. Ellis or J. Blacking have been consequential enough to change their attitudes towards their use of notation. Ellis had demonstrated the inadequacies of this method within the context of Australian Aboriginal music and experimented with several modifications and expansions (combining time-frequency graphs with standard notation, using a staff-line system in which lines represent absolute frequencies, etc.). Finally, in the late 60's, in the face of the deficiencies of the standard notation and in want of a more suitable system, she completely abandoned the use of notation for analytical purposes. From a different perspective Blacking reached similar conclusions. He writes (Blacking, 1987): « I have come increasingly to doubt the merits of printing transcriptions of music of different cultural traditions without accompanying recordings that reveal their incompleteness: transcriptions can too easily be divorced from the reality of performance in context and the structure and meaning of the music that they portray can be grossly distorted in the cause of some academic enterprise. …. I have not provided musical transcriptions, since even the exceptionally accurate score ..... does not convey the reality of the performance to someone who is not acquainted with the sounds of the music » .

Summarizing the main points presented above, one can say that there has been due recognition that notation, distorts the structure and meaning of music, does not convey the reality of performance in context, implies 'note' and 'pitch' concepts that might not be adequate for non-western cultures, contributes nothing to the understanding of initial forms and the development of melodic thinking, and, finally, that there is no guarantee that transcribers are able to perceive and to reproduce on paper the music of another culture in any adequate way. Yet the very authors who so eloquently articulate these criticisms are at the same time insisting that it is a essential, necessary, and irreplaceable tool of comparative musicology. What appears to be quite a

contradictory position can also be taken as a reflection of the inability to conceive of any viable, alternative analytical tool. Especially after the attempts to integrate electronic devices into the research process have been virtually stalled it seems there is not the slightest possibility for a paradigmatic change in the methodological approach. In order to better understand this methodological blind-spot I suggest to take new look at some key aspects and implications of notation. Having a better understanding of what notation actually is and how it determines the way we think about music may help us to conceive of a different way of describing, analyzing, and finally understanding music, a way that may avoid many, if not all, the pitfalls of the current methodological approach.

Notation as a writing system

Two factors may help to explain the present situation and will put us into the right direction for a new exploration of notation. The first springs to mind if we recall that most comparative musicologists have learned their profession at the bosom of Western literate culture. Music in this culture is very much a literate music: Notation plays such an important role that musical reality has become mediated and transformed by notation, music often being equated with its written form. Dealing with written music is the classical musician's – and the musicologist's – ideal. As Nettl has put it: " 'Can you read music?' is the question used to separate musical sheep from goats, to establish minimum musical competence" (Nettl,1983:65). The musicological mind, it seems, is lacking the necessary mnemonic and analytical mental capabilities to cope with the evanescent acoustico-temporal form of music. However, the moment music is touched with/by the 'magic wand' of notation it acquires a form that essentially corresponds to the Western ideal. And it is then, in facing this transcribed visual-spatial form of music, that the musicologist suddenly finds himself equipped with all the necessary tools and aids to deal with it. The second, closely related factor concerns a considerable misconception of what notation actually is and of what the implications are of we using notation to draw inferences about music. I am going to recall some important points in the development of western notation and we will see that, even if we can say that in the beginning the notation was more descriptive than prescriptive, it seems hardly possible to consider the evolution of notation as an attempt to represent musical structures. Originally, the systems of musical notation and script were not invented to *represent* music or speech but to communicate information, and the relation between notation and music or speech was much more indirect. Unavoidably, problems are due to arise if a system of notation is understood as in fact representing the music it refers to - and this is the understanding of many a musicologist, as indicated in Nettl's 1980 summary of the standard methodological approach : "Ethnomusicologists agree on the whole that music can be written down and analyzed from the visible format" (B.Nettl, 1980:4). In order to explore why and where such a concept leads us astray let us start with taking a look at some essential features of writing systems and the implications their use has for our dealing with the aural-oral world.

There is no doubt that the dominant omni-presence of writing is one of the principal characteristics of modern societies and the prevalent view is, that writing is nothing else than speech written down. This is at least what we are used to think in the wake of ancient Greek philosophy and dominant Aristotelian influences that suggest a mapping of speech unto writing : writing represents speech. During the past few decades, however, a considerable number of studies have advanced a different concept in which writing, partly bypassing speech, emerges as a powerful force shaping our thoughts and strongly influencing speech and its use. These studies

also revealed profound changes in thought processes and cognitive capabilities that were brought about by the invention of writing and the ensuing transformations from oral cultures to literate ones. The interested reader is referred to the works of Drake (1986), Goody (1977), Harris (1986), Havelock (1992), Lord (1960), Olson (1994), and Ong (1988). In the present context I want to focus on some of the new insights which have bearing directly for our discussion of 'music writing', i.e. notation.

Writing systems in general are characterized by their use of permanent, discrete and de-contextualized symbols and spatial representations that are separable form the temporal sequences of sound events, be that oral language or music. Writing transforms aural-temporal events into visual-spatial structures. Spoken language is a flow of temporal events without context-free elements. The spatial and temporal arrangement of written language permits operations that cannot be performed within spoken language and that have no reality in the oral world. Ong (1967) points out that spoken words cannot be reversed, but the letters of a word can. The very notion of reversible sequences of elementary units is due to the spatialization involved in writing. Furthermore, writing allows for a structuring of communication and knowledge 'at distance'. The contrast between the temporal and the spatial mode is at the base of different communicative functions of oral and literate discourse. Writing allows for a communication at a distance, in space as well as in time. In the absence of elaborate analytic categories that depend on writing to structure knowledge at a distance from the lived experience (performance), oral cultures must conceptualize and verbalize all their knowledge with more or less close reference to the life-world and the immediate, familiar interaction of human beings. A chirographic culture and even more a typographic culture can distance and in a way denature even the human, itemizing things in an abstract, neutral list entirely devoid of a human action context

The introduction of writing systems had a considerable effect on cognitive processes and the development of cognitive capabilities due to the characteristics of written language. Lord(1960) has shown how learning to read and write somewhat disables the oral poet, as it introduces into his mind the concept of a text as controlling the narrative and thereby interferes with the process of oral composition. Amongst others, the capacity to distinguish between word-by-word repetitions and a paraphrase of an oral statement is strongly influenced by a script, which has to be considered an important factor for "fixing the text". Olson (1994) has reported that if one examines the capacity of young children to distinguish between exact repetitions (word-for-word) and paraphrases, they easily separate 'incorrect' paraphrases. However, children below the age of six years do not reject any paraphrases, even if they have explicitly been asked to accept only 'exact' repetitions. The written form of a language supplies a model, or a concept, in which the categories for the constituents of the spoken form, in combination with the familiarity of the written system, determine the possible awareness about the segmental structure of a language. This means that we think about languages – spoken languages, that is – in terms of concepts and categories derived from writing systems. There are, for example, several lines of support indicating that speech sound (phoneme) awareness only emerges in connection with writing systems. In contrast, oral segmentation is sensitive to first order parameters (sound pressure and frequency) whose time dependent variation produces prosody. Phonotactic regularities are used to locate syllable boundaries, syllables constituting the most elementary units of speech perception in primary orality. Oral language users do not hear phonemes, which are abstract units, phenomenally not represented, accessible only after the introduction of alphabetic writing. For example, Read, Zhang et Ding (1986) have shown that Chinese who only read the traditional character script are not able to detect the phonemic segments, whereas those

who know how to read Pinyin, an alphabetic Chinese script, are able to perform such segmentations.

We are studying spoken languages by making ample reference to terms imposed by our written systems. Therefore, those structures which are presented in the writing script offer us the necessary categories for exploring the implicit structures of a language. However, the structures of both script and speech not being identical, this means that categories offered by a script allow to explore only a sub-section of spoken language structures. Consequently, neither in their origin nor in their first stages, can writing systems be considered an attempt to achieve complete representations of spoken language, even not if the script is an alphabetic one. Havelock (1982) has shown how Aeschylus and Pindare considered the writing system primarily as an aide-mémoire that permits the recall of oral utterances. This idea persisted even throughout the Middle Ages when text were foremost conceived off and treated as memory aids and not as independent representations. For the elaboration of writing systems models of spoken language has never acted as a decisive factor and it was realized that for an effective script it is not necessary that all perceptible elements of a spoken language are represented. Hence, just as it is the case with music writing, often considerable elements of the spoken language were missing in the written form: for example, Larson (1989) showed that Sumerian texts were incapable of representing numerous morphological elements of the language, and that, on the other hand, their script even produced information that could not be lexicalized. All oral utterances have two components, that what is being said and an indication of the manner in which it should be understood. Writing systems generally only manage to deal with the first of these two components. They have considerable difficulties to capture the paralinguistic elements of speech, its first order parameters like amplitude and frequency, whose temporal variations constitute prosody. However, in order to establish a functioning script, it is not necessary that all orally perceptible elements of speech are represented in a writing system. Harris (1986) has demonstrated that the decisive force for the elaboration of sripts is not the model of the spoken language but the attempt of a functional representation with as few ambiguities as possible. Nevertheless, modern writing systems have managed to represent at least some prosodic elements of speech. They have achieved this with the help of punctuation signs that are not read, but indicate *how* that what has been written has to be read (e.g. signs like '?' or '!') If we can talk about writing systems as representing speech or musical notations as representing music, then this can only be meant in the sense that these systems actually create the proper categories in which we become aware of these modes of human expression and in which we have learned to listen and think about them. As Olson has put it, "writing is not a simple 'transcription' of speaking, it affords us a conceptual model for speech (Olson, 1994:108)

It could be argued that these differences between orality and literacy do not pertain to the objective structure of cognitive processes, but only to the subjective awareness of them. However, there is evidence to the contrary: The segmental structure of the spoken language is not there from the start. A child's first words are not represented as a sequence of independent phonemes, but holistically as a pattern of features such as articulatory routines or gestures. Speech awareness of pre-reading children can be seen as perfect knowledge of representations that are not phonological. Once the standard spelling is acquired, many people are no longer able to discriminate the phonetic features to which pre-schoolers are sensitive, e.g. allophones are no longer recognized as such. In this way, models offered by our writing systems are bound to make us insensitive for particularities of the spoken language that are not represented in the script.

Basic steps in the formation of Western notation

Most of what has been reported here concerning features and implication of writing systems in general also hold for music notation. Sure, there are differences, especially in what is 'written' down, but mainly of degree. Music notation, at least in its incipient stages, can be considered as sort of a complement to writing : it was tightly linked to written text and began as attempts to put down pitch and its variation in time – an aspect, as we have seen, writing did not capture. How the above characterizations of writing systems apply to music notation and how they influenced the way this notation evolved, I will show in the following sections in presenting a short review of the basic stages in the development of Western music notation, from its first appearance in Greek late antiquity until the Middle Ages, when the principal features of a prescriptive notation had been established. Interestingly and most telling, this period in the development of notation with its ensuing considerable transformation of music itself, parallels a most important period in the West in the transition from oral to literate society, a period in which, as Ong (1982 :117) has described as, 'hearing dominance yields to sight dominance'.

Ancient Greece not only invented alphabetic writing but also alphabetic musical notation. Unfortunately only a few documents have survived (according to Pöhlmann (1970) just about 40, with the oldest only dating from the 2nd century BC, well past the classical period) and nearly nothing is known about the relationship of notation and performed music – a fact leading e.g. Th. Georgiades (1958) to resist any attempts to transcribe ancient geek notation in forms of modern notation, an admirably honest though rare attitude. (The paucity of the number of ancient notation as compared with the rich heritage of other Greek writings suggests that the use of musical notation was not very wide spread.) From the little we know it can be said that there were two types of notation, one for vocal and one for instrumental music. Both used letters – vocal notation those of the Ionian alphabet - in upright and inverted position plus additional slash marks for the upper octave. There was no separate set of symbols for the notation of rhythms. Instead, melodic rhythms seem to have been determined by the rhythmic formulae of the text above which the alphabet notation was written in a linear manner. The Greek alphabet notation therefore was a relative pitch notation, however, pitch intervals indicated by it do not correspond to those of later alphabet notations. The segmentation of the the frequency space, as it is indicated by the notation, had strongly been influenced by Pythagorean music theorists, who with their modes were relating musical expression directly to tuning and temperament. Already Aristoxenos of Tarentum had severely criticized the 'non-empirical' (sic!) Pythagorean theory of music (see Will, 1996a), and indeed, this notation tells us nearly nothing about the actual segmentation in music performances: The discrete pitch steps depicted by the notation were the outcome of ancient theoretical reasoning based on Pythagorean number theory and experiments with vibrating strings (The influence of music theory and musical instruments on the incipient stages of music notation is also evident in other literate cultures. For Gongchepu and other traditional notations of China see e.g. Will 1994). According to these reasonings the basic unit of the tonal space was the interval of a perfect fourth, the 'tetracordon'. The two limiting notes were conceived as fixed and the two notes between them as movable. These movable notes could occupy various positions according to the three genera as well as being subject to subtle variations within these genera. There was no agreement among the ancient theorists in delineating the ratios for these moveable notes – most likely their actual realization depended much on time and place and local traditions of the performance. This obvious mismatch between musical practice and notation is a reflection on the 'theoretical bias' of notation: music was notated according to theory, not according to the

practice. Although the use of ancient Greek music notation was discontinued, its basic concepts did survive within the corpus of Greek philosophy and exerted certain influences on the development of medieval music notation in Europe.

Greek notation had been abandoned in late antiquity not least due to the new demands and ideals of early Christian liturgy. In 620 Isidor de Seville in writing his « Sententiae de musica » even claimed that 'tones can not be written'. During this period the clergy undertook great efforts to reorganize and unify liturgical rites and chant. Finally notation was taken up again, the idea being to preserve along with the written words a 'correct' form of intonation of sacred texts. It was the recognition of the importance of adherence to a given, strictly defined pattern of musical performance and execution to convey an authorized meaning. In contrast to ancient Greek notation, the new way of music writing was considerably rooted in musical practice. The neumatic notations of the ninth century have special cheironomic signs derived from the accent marks of the Greek and Roman grammarians, as well as dots grouped by superposition and conjunction. Raising and lowering of pitch and the general direction of the melodies could be sufficiently shown but intervals between the note signs could not. Although neumes introduced the convention of identifying height of pitch with height on the writing space they were still linear in character, indicating movement rather than points of fixed pitch. Notation was primarily a symbolization of action not a representation of abstract events. For the singers who had to learn the liturgical repertoire by heart, these notations were a combination of musical shorthand and aide-mémoire. Sachs (1918) and Seeger (1977) have already pointed out that neumes seem to have come into use to describe an existing practice of recitation. Authors like the Franco-Flemish monk Hucbald (840-930), who himself introduced a concise and workable method of pitch notation, explicitly described the task of notational symbols as 'rememorationis subsidium', that is 'an aid to recall and remember (music)'. The introduction (re-introduction) of notation created the role of 'music writers' with their specific knowledge of music performance and theory. It also changed the character of musical performances which in addition to relying on memory now had additional support through notation. Despite their dominant descriptive character, however, these notations permitted at the same time the control and discipline of performances in a way that was not possible before. For example, the Church gave clear instructions about which sections of the Mass and the Office might be elaborated by additional voice-parts. Elaboration of additional voices were done only with respect to the fixed tenor voice – there was not, as yet, consideration of the whole ensemble of additional voices. Notation was not a blue-print but an aid to ensure that performances corresponded to the tradition.

By the 12th and 13th century music notation had undergone several changes that considerably widened and decontextualized its use. Notational symbols started changing their character from indicating movement contours to indicating individual 'notes', i.e. points of fixed pitch. Concurrent with this we see the emergence of means for calibrating pitch distances, the staff lines. Starting with the use of a single line the development went towards the application of multiple lines with lines and spaces indicating principal pitch levels. However, the 'dissolution' of neumes into notes, the transition from notation of movement to that of pitch implies an abstraction from musical processes under the influence of theoretical considerations that had developed since late antiquity. Furthermore there were the incipient stages of a separate notation of durations and timing by means of different shapes for note symbols. These changes also reflect the growing importance of instruments in the music that was notated, i.e. religious ritual and liturgical music, as well as the increasing separation of music and text : As long as notation was tied to the chanted texts, there was little need to have a separate notation for melody rhythm as it

was directly controlled by the words of the text. Acceptance and propagation of the stave system is mainly attributed to the work of Guido of Arezzo (1000-1050). He perfected the four line stave system that is still in use for plainchant notation today, and also developed the sol-fa mnemonics for singers, a method for remembering pitch relations between notes on the stave by referring back to stave notes of a well known hymn. The introduction of the stave system with notes of fixed pitch not only had considerable effects on performance practices but also on the formation of singers. For example, it significantly reduced the time needed for training singers.

The advantages of this type of notation were soon recognized and the Church ordered all chants of the liturgy to be re-written in this new notational system. Here we see clearly how music writing secured a tradition and, at the same time, created a model of it – just as writing did for speech : The Church had realized that the notation with fixed, discrete pitch steps (notes) and stave system allowed for a more detailed fixation and better recreation of chants than it had been possible with neumes. Simultaneously the 'tradition' changed in the sense that the music became more fixed : with the new notation, it was unavoidable that new performances were better 'verbatim' recalls of previous performances than it had been possible without such a detailed notation. Considering also the associated changed in teaching and training of musicians it is evident that the notation gained more and more in importance for the performances whereas the significance of the oral musical practice was on the descent. Singing, just like speech, is not naturally performed in discrete pitch steps. Singers have to be trained to perform according to notation, to 'read' notation. Learning to read notation means listening to music in a new way. Learning a notation enables one to perceive a continuous melody in a new way, as if it had been composed from segmentable elements – and, of course, these segments are those suggested by the notation. Therefore, the standardization and rationalization tendencies of the notational system, as expressed e.g. by discrete pitch steps or discrete rhythmic values, exerted a normative force influencing musical behavior : After the Church had ordered all liturgical chants to be re-written in the new four-line stave system not all existing chants could easily be notated in that system. Hoppin (1978) has shown how several of these chants underwent considerable rewritings with ensuing transformations over a period of years until they found their final, accepted form.

The period between the 11th and 13th century is a period of urbanization with the invention of wheel-clocks at the end of the 13th century : This is the beginning of mechanical measurements of time and creation of mensural notation. During its long development until the 16th century this form of notation dealt with one central problem, that of time values and time relationships, the other core problem of notation - the indication of pitch – having already been solved satisfactorily, (for musical purposes, that is, not for analysis, though). « ..an intellectual struggle of many centuries was needed in order to find two devices of such utter simplicity, namely, the bar-line and the tie – devices which were unknown in earlier music but which, in connection with the principle of binary mensuration, free the modern musician from the intricacies of mensural notation and provide a simple and clear expression of almost every conceivable time value and rhythm »(Apel,1953,p.85). This was the development of a new concept of time, completely alien to non-literate cultures. It consists of abstract slices, time frames, symbolized by 'bars' that have to be 'filled' with musical events. The more or less abstract bar rhythm is not identical with the rhythm of the bar content. The bars can be subdivided into smaller, rationally proportioned units which in turn always sum up to complete the abstract frames : the concept of divisive time frame. It is no accident that this new time concept emerges concurrently with the growing separation between music and text and the increasing importance of the visual-spatial world, the latter being evidenced by the concurrent

changes taking place in writing and literature (Ong,1988 ;Olson,1994). The transformation of time into the space domain allows for a better control of time. Treated spatially on a calendar, the face of a clock, or a sheet of paper with stave lines, it no longer goes on relentlessly, we can make it appear divided into separate units next to each other. Transformed into space, time seems to become controllable. In the 'ancient concept', and that of many non-western cultures, however, time is created through the musical events, more specifically, in most cases, through the demands of speech, and this time is additive not divisive. Many a problem in understanding non-European rhythmic structures arise from a conflict between these two time concepts, one implied by the notation and the other by the music to be notated. The notational time concept ensued standardization and regulation of time values in connection with visualization – not with musical practice. If one says that notation specifies time, it is time on the basis of these abstract time slices, not the living time created through and in performances in oral cultures.

By now, notation had taken a definite turn towards a 'prescriptive notation' (Seeger,1977), however, it still had a long way to go to become as prescriptive a notation as we know it today. Clearly, as Toft (1992) reminds us, any sixteenth-century performer who had worked with contemporary vocal sources would have been familiar with the notational ambiguities that permeated the vast majority of manuscripts and printed books. For example, many of the required sharps and flats were not specified in these sources, the final shaping of the music being left to the performer, and as a result certain melodic details were rarely notated. Nevertheless, the advances of the notational system, the availability of a system to denote discrete fixed pitches and concise time values and time relationships, had been crucial for the development of western polyphony and instrumental music. As Escal (1979 :144) has rightly pointed out : « Polyphony emerged from notation, it is born from notation, it is notation. »

The spatial and linear arrangement of discrete pitch and time units allowed for the invention of musical structures on the basis of visuo-spatial considerations. « Sound ... exists only when it is going out of existence. I cannot have all of a word present at once : when I say 'existence', by the time I get to '-tence', the 'exis-' is gone » (Ong,1982). Writing, however, suggests that things are different. Written words or melodies are no longer events but have a permanent existence instead and are 'present' all at once. Hence they can be treated in very different ways from acoustical events : they can be split up into spatial or graphical segments that can even be pronounced or sung backwards. That way, the word « les » is transformed into « sel », but the word « non » stays « non » because of its spatial symmetry.

Reading a word backwards is, however, something essentially different from reversing a series of sound events in time. If we record the word ' les' onto a tape recorder and replay it backwards we do not hear anything resembling 'sel' but a completely different, unusual sound. This is because natural sound events are not time invariant, they do not show a symmetry in time. On the other hand, letters and notational symbols in general, are invariant with respect to spatial transformations. A letter 'n' remains a letter 'n' whether it occurs in the first or the last position of a word. It is exactly this non-equivalence of symmetrical behavior between sound events and their visuo-spatial representations that is at the root of the differences between oral and literate cultures, between oral and literate music. Notation itself creates the possibility of musical speculation of an abstract kind, or as Maconie (1990 :117) has put it : « ... notation could be said to have freed musical invention from the tyranny of the ear. »

The music that developed subsequently « could be planned on paper, visualized and developed like architecture simultaneously en gros et en détail. This led to the elaboration of aspects of musical design which were destined to remain permanently hidden from the performer or listener, inaccessible to mortal comprehension by any listening process experienced in time and following a predetermined path. » (Maconie,1990 :117). These new possibilities, made available through notation, enabled the construction of complex and lengthy forms un-thought off before and notation became more and more the representation of musical ideas instead of the construction of musical events. The increased influence of music theory and abstract thought created a wide range of musical forms that have an existence only in their visual-spatial form but not in the aural-oral domain. Contrapunctual forms like inversion, retrogression, inverted retrogression represent visual ideas that cannot as such be transformed into the time domain. This also holds for most principles of 12-tone and serial music. They are all based on properties of spatial symmetries of notation and can therefore only exist in a literate music culture. They have no reality whatsoever, they are 'un-thinkable', in an oral musical culture.

From what has been said so far it should have become clear how much Western notation and the music it influenced are inseparably linked to the developments of the western literate culture. Although we might be able to say that notation - at its beginning - was much more descriptive than prescriptive, it is not possible to consider the evolution of notation as a 'project' to develop the means for representing musical structures. These concepts arose together with the notation and did not exist before. Notation systems started to develop as memory aids and means of communication (transmission of knowledge of songs), but because they are « read » they also offer a model for music making and thinking about music. The segmentations of the pitch and time domains as indicated by the notation, are the result of theoretical rationalizations and abstractions. As singers and musicians were trained to put these segmentations into practice they ensured the creation of a new musical reality. The cognitive implications of notations are the product of new concepts invented for utilizing symbols and artifacts. In addition, principles originally constructed for reading notations are subsequently applied to the "reading" of music. The awareness of musical structures is the product of notational systems. The implications of our graphic systems go far beyond the mere conservation of information; the systems offer models that permit us to perceive our music, our world and our mind in a new light.

The co-evolution of music and notation in the western literate culture obviously makes notation rather unsuitable to be used for analyses of music from non-western cultures - even for Western music we have no clear idea as to what degree musical practice indeed corresponds to the 'music' implied by notation. The little we know we owe mainly to the group of scholars around the Seashores and their students. The reason why it was used as an analytical tool by comparative musicologists seems to be a sort of 'historical' misunderstanding. Comparative musicology developed as a side-branch or a sub-discipline of musicology. This in turn had its origin in the philosophical discipline of music theory which, as we have seen, was deeply involved in the formation of western music. Musicology, being primarily concerned with analysis and explication of this music, had its methodology efficiently adapted to this goal and, no wonder, analysis from notation ranked among one of its foremost methods. This was fine as long as studies dealt with western music, but it turned out to be extremely problematic when musicologists started to consider non-western music as one of their subjects – with the birth of comparative musicology, that means at that point where they were dealing with musics for which the existing Western music notation had not been adapted.

Such an approach must go asquint because concepts of music theory and notation are taken as those of the music which, as we have seen above, they are not. Even in its more 'descriptive' stages notation did not 'describe' music in terms of categories derived from performed music itself. It always only describes a limited selection of perceptible events, and it does this in terms of categories created through notation qua writing system in combination with abstract, theoretical considerations.

The problem with implicit categories

There is, I think, a direct link between the use of notation and the disappearance from or non-appearance of several essential issues on the agenda of comparative musicologists. This is because those implicit 'apriori' concepts on which western notation is based and the classificatory categories provided seem to preempt the answers already. These categories and concepts emerged mainly from classical theoretical reasoning but they have never been proven to be valid and relevant for describing musics and musical practices from different cultures, especially musical practice from oral cultures. Of these implicit categories the most pertinent for comparative musicology are the following :

Standard western notation implies that the frequency space is segmented into discrete steps of fixed pitches, a segmentation developed, as we have seen, under the guiding influence of music theory, and not as a result of music analysis. Although sets of discrete pitch steps may approximately describe the state of affairs of much of the music produced by fixed pitch instruments, this does not generally hold for vocal music. Alexeiev(1986) writes that « l'organisation de hauteur dans les airs archaïques est liée de façon syncretistique avec tous les autres aspects mélodique, notamment avec l'organisation temporelle (métrorhythmique et syntaxique), la pronociation de la parole, l'articulation, la gesticulation. C'est surtout dans les formes initiales du chant que la catégorie de hauteur est indissoluble des caractéristiques de timbre dont la signification sémantique est mise assez souvent au premier plan. Ceci dit, la fixation des airs archaïques par notation est assez problématique. » This goes to show that we have to expect a whole range of different principles of pitch segmentation in different cultures. Furthermore there are many musical cultures where the movement (glides, oscillation) between 'scale steps' are as important, if not more, than the 'scale steps' themselves, and segmentation on the basis of glide distances (glide widths) can be an important organizing principle of the frequency space. Hence, we cannot simply assume musical relevant sounds to have fixed pitches. Pitch movements, created according to context and meaning, attain musical significance in many cultures. For example, tone inflexions and their distribution within scales have been shown to be an significant feature of regional styles as well as individual pieces in Chinese instrumental music (Will, 1994). An analysis from notations based on fixed pitches has no means and no concepts to deal with these areas of musical 'semantics'.

Western pitch notation is based on the inherited Pythagorean idea that pitch relationships are governed by frequency ratios: intervals are considered the same when the ratios of their constituent frequencies are the same. For example, the interval of a perfect 'fifth' is formed by any two tones whose fundamental frequencies form a ratio of 2:3. There is however evidence that pitch production and perception on the basis of ratios is not a universal feature of the human auditory system. Hermes and van Gestel (1991) have shown that prominence lending pitch movements in speech intonation do not follow a logarithmic scale, i.e. speech pitch intervals are

not based on ratios. In the music of Central Australian Aboriginals two types of interval organizations have been identified (Will and Ellis, 1996; Will,1979a). One, which has been called 'proximity mode', organizes intervals on a linear scale, i.e. on the basis of frequency differences. These evidences suggest that pitch intervals are not independent from cultural factors. Hence, if in fact there is more than one mode of interval perception, standard notation cannot be a generally applicable method.

Standard western notation implies the existence of a generalized octave equivalence, that is, for each note sequence there exists another sequence which differs only in that the notes are one or more octaves apart from those of the first sequence. This is a necessary feature of any interval system exclusively based on frequency ratios. However, we now know that there is at least one culture, that of Central Australia, in which this principle of generalized octave equivalence does not hold (Will,1997a). Therefore, as there are pitch systems not or not exclusively based on frequency ratios we cannot apriori assume that all musical cultures know and apply the principle of generalized octave equivalence. Octave equivalence seems to be much more a culturally learned concept and not a natural condition of human auditory perception (Burns and Ward, 1982). To explore the cultural conditions of this phenomenon, I think, is an endeavor suitable for the ethnomusicologist's agenda but the obsession with western notation prevents us from putting it there.

Standard Western notation, as we have seen, assumes music to be organized on the basis of abstract time frames or slices (bars) in which rhythms are built up from combinations of different rational subdivisions of these basic units. The obvious impossibility of many musics to be adequately represented through such a system, has already lead numerous scholars to abandon the notation of bar-lines in their transcriptions. However, as we have seen above, also the idea of small integer rational subdivision of rhythmic units is a concept specific to literate societies, the regulation of durations in oral cultures follows different principles. There is, for instance, a un-even double-beat figure, found widely in Central Australian accompaniment, that has been notated by various researchers in strikingly different ways. Moyle (1995), in relating it to the human heart-beat, has suggested that this pattern actually represents a non-rational subdivision, and as such it can not be adequately represented in notation. In general, all indications of principles of rhythmic organization due to bodily actions and functions in oral cultures (see e.g. Jousse,1978) will be lost if presented in Western standard notation. Even in literate societies we might find rhythmic concepts that are not based on rational subdivisions. For example, Minnan music notation, an ancient court music of southern China, is the only traditional Chinese notation that has an elaborate set of symbols for notation of rhythmic configurations (Liu, 1953). However, these symbols refer foremost to performers actions necessary to achieve the desired musical results, not to durational values of the sounds produced, and the results are likely to be anything but small integer subdivisions of basic units. By transforming them into a rational divisive scheme, Western standard notation does not help the understanding of rhythms and their organizing principles. Furthermore, the transformation itself creates structures that have no relevance in oral cultures. Rhythmical symmetries, as well as symmetries of phrases, melodies and larger musical forms are spatial symmetries and products of notation. Interpretations and conclusions drawn from them have no relevance in oral cultures because these symmetries have no reality in oral-aural world.

The problem with automated analysis

Timbre perception, perception of the spectral composition of sounds and their change is essential in every day life for judging distances and directions, understanding speech, detecting sounds in motion and the like. However, its development in standard Western notation has suffered as much – if not more – as the visual aspects have flourished forcing aural considerations into the descendant. However the lack of means to deal with other aspects of music than pitch and rhythm has strongly been felt since long and many of the extension to Western standard notation and many electronic devices were specifically designed to capture and deal with these dimensions (see e.g. Hood, 1974; Nettl, 1964). The present century has actually seen an impressive development of electronic devices for analysis of acoustic signals, from early light oscillographs via phonophotography, automatic frequency/amplitude analyzers, and sonographs to present day sophisticated signal analysis software for computers. The way these new technological developments have been integrated into the musicological research process, however, has been strongly influenced by comparative musicologists preoccupation with 'visible forms' of music, by their 'notational bias', as I have discussed elsewhere (Will,1997b). Apart from the approach of the remarkable group of scholars around the Seashores, Harold and Carl, that is (Seashore, 1938,1947), there have been no paradigmatic changes in analytical methodology complementing and advancing the possibilities opened up by technological developments. Already in 1967 Bengtsson had drawn attention to the fact that the whole area of analysis of 'music as performed' has been, by and large, unaffected by these technological developments - and nothing much has changed since then due to the standard methodological approach of analysis from notation as is. New and different approaches of analyzing music by technical means were always conceived of as forms of 'notation', as is obvious from terms coined for those electronic devices like 'automatic music notator', 'objective music writer', etc. As Mantle Hood has put it, the application of this instrumentation was nearly exclusively determined by "a desire to make visible to the eye illusive refinements of sound readily perceived by the trained ear" (M.Hood, 1993, p.138), meaning that these instruments were not primarily conceived as new and different analytical tools but as means to complement standard notation through visualization of musical elements not notateable otherwise. Therefore, I would like to argue, that it is this preoccupation with the visible form of music and its ensuing conceptual bias that is primarily responsible for the stagnation and failure of the 'automated transcription movement', and not, as Jairazbhoy (1977) has it, "the enormous complexity of music". At the end of this century we have a considerable range of laboratory instruments that would, in principle, allow for analyses of music, not notation, but we are still lacking conceptual-analytical tools to do so. Musical analyses performed with the aid of the melograph or similar instruments are all confined to a more or less qualitative description of the automated graphic (!) output: fundamental frequencies are estimated by comparison with a grid of reference lines, frequencies of harmonics are generally estimated via the frequencies of fundamentals, durations are estimated via reference to a time scale, and if quantitative data are supplied they are estimations or theoretical calculations with no indication of the method by which they were obtained or their degree of accuracy (see e.g. the various contributions in vol.II, no.1 of the 'Selected Reports in Ethnomusicology' which focuses on analyses performed with the Melograph Model C). This limitation, however, was not imposed by the available state of technology as other disciplines had in fact developed means for quantitative evaluations of data from similar instruments.

Let us take a look for example at the area of spectral analysis which has become somewhat 'en vogue' lately due to the availability of reasonably low priced hard- and software to

perform it. What we are generally offered in studies dealing with musically relevant spectral analyses are graphical representations with accompanying descriptive comments. Mostly, the only numerical information available is that for the scaling of the plot axes. Other numerical values, if provided, are at best estimations on the basis of theoretical assumptions. Theoretical mechanics tells us that the frequency components of the vibrations of an ideal harmonic oscillator is a series of frequencies (partials) whose numeric values correspond to a series of small integers (i.e. 1:2:3:4:5:6 etc.), called a harmonic spectrum. So, if the fundamental frequency of a sound to be analyzed is found to be e.g. 200 Hz, it is generally concluded that the upper partials will have frequencies of 400, 600, 800, etc Hz. Now, unfortunately, musical instruments, including the human voice, are no 'ideal harmonic oscillators' and hence do not have ideal harmonic spectra. For example, strings have a certain thickness and their mass is not distributed exactly equal along their lengths. These factors cause larger or smaller deviations from the harmonic spectrum. Likewise, pipes for example have a certain fixed diameter, a factor that causes the problem of the 'blow fifth', the third partial (fifth above the octave) being markedly low pitched. If spectral considerations do have a relevance in explaining certain phenomena in a musical culture – certainly we do not need a sonograph to tell a clarinet from a flute, 'spectral analysis' is already performed by our inner ear – than we cannot simply assume that the actual partials of an instrumental or vocal sound are the same as those theoretically derived from the fundamental frequency. For example, very early in my analyses of Northern Australian Aboriginal music I had the idea that singers tend to adjust some of their pitches to partials of the accompanying didjeridoo. Initially, however, data did not seem to confirm the hypothesis, there was a disturbing gap between the fundamental frequency of the singer and the assumed frequency of the partials of the instrument. It was only after analyzing the frequencies of the actually produced didjeridoo partials that we were able to show that indeed singers adjusted certain pitches in a way to match the actual partials when the changed embouchure of the didjeridoo player created a slightly different fundamental frequency (McCardell and Will,1998; Will,1998). As helpful as graphic presentations of complex analyses might be for certain purposes – we are, after all, very much visually oriented beings - what is needed is specific numerical information, not guesses under unproven theoretical hypotheses. Only then can spectral analyses play any significant role in the musicological pursuit to understand processes and developments in musical cultures.

A way out of notation (?)

These examples, as well as many others I have reported in this presentation, indicate that there are in fact ways to avoid the pitfalls inherent in musical analysis from notation. I would maintain, that the most promising one is that paved for us through the availability of electronic music or sound analyzers. The point is, however, that we have to forget about seeing them as extensions or improvements of our notational systems. They should primarily be considered as basic devices to supply quantitative data sets on which to built analyses – nothing more and nothing less.

The use of notation for analytical purposes can be considered as a type of classification of perceived sound events according to a specific reference system. First, we are making classifications according to a specific reference system, e.g. Western standard notation. This is a selection process that introduces a system dependent bias: only those sound events or aspects thereof that are referenced by the applied symbol system can be notated. I have dealt in detail with various aspects of this in the present study. Secondly, as we are dealing with classification

of perceived sounds, which means that music has gone through a complex physiological and psychological filter and has correspondingly been transformed. That means that what is notated depends on the music produced, the auditory-perceptive system of the transcriber and the notational system used. Being confronted only with the notation, there is no way telling apart the contribution of each of these factors.

However the situation is different if we use electronic analyzing devices. These normally start from electronic recordings - analogue or digital – for which the loss of information is mainly, though not exclusively, determined by the state of technology available. The present state of technology is such that researchers can select whatever degree of resolution for their data is necessary to answer their questions. All the necessary temporal information will be preserved – there is no reduction due to transformations into spatial forms like it is in notation. These data will not be 'filtered' due to predetermined segmentations, neither of time nor pitch. Rather, these segmentations will have to be and can be explicitly established within the analysis, that is, we have to develop new analytical concepts that enable us to answer the above questions. How do we go about analyzing these data; what criteria are applied for data reduction; what are the criteria for grouping and segmentation of frequency and time measurements? Having examined these issues in some detail elsewhere (Will,1997b) I will only highlight again the two basic steps I deem essential in the analysis of these raw data sets. The first necessary step must be a data reduction on the basis of auditory physiology. Today psychophysics has accumulated a body of knowledge advanced enough to lead this step towards a perceptually meaningful reclassification of the original sound data. The reason why I consider this a task for comparative musicologist is that, unfortunately, most physiologist or psychologists have to vague an idea about the cultural dependencies of auditory perception. A subsequent second step has to aim at an analysis of the psychological-cognitive features in order to arrive at a musically (and culturally) significant description of the recorded musical behavior.

As just mentioned, this approach starts by making available recordings of the music we want to analyze. Bartók once wrote, « the only true notations are the sound tracks on the record itself » (Bartok and Lord,1951). Although I do not fully agree with equating notation and recordings, I think Bartók was right in pointing out that the closest we can probably get to the music, if we do have to 'preserve' it in some way, is a recording thereof. Furthermore he made a good point in reminding us that both, notation and recording, share some important features, and these we have to be aware of in order to prevent false ideas and expectations about what we are doing if we analyze from recordings. The differences between notations and recordings are obvious: A Recording is not a visual-spatial transform of music and it is not a transcription by means of a graphical symbol system. We are unable to see and interpret the engravings on a record or the digital bit marks on a CD. Despite the unavoidable transformation that takes place in the recording process, recordings can be re-transformed into audible events without essential losses. What recordings do have in common with notations is that like all script systems and musical notations, the recordings are not capable of fixing all the aspects of what had been said, sung or played. It does not succeed in reconstructing the context within which a musical event took place, its significance and the musicians attitude in regard to what has been recorded. Without any complementary information the way of listening resembles that typical for the postmodernists: a recording signifies what the listener thinks it signifies. Furthermore, recordings create quasi 'literate' traditions: Just like notations, recordings separate that which has been recorded from the living present of the musical world, thereby creating a new memory and reference medium. Performers can use the recordings as fixed references for rehearsals and

performances. In this way traditions can become fixed and tend to restrict further developments: that what is recorded and preserved becomes the 'correct' form, the 'thing' to refer to.

Obviously there is a wide range of topics on the agenda for comparative musicology that cannot be dealt with on the basis of recordings or analysis with the aid of electronic devices. However, there can hardly be any doubt that recordings are the best way available to 'document' music as performed, just as analyses, with the help of electronic laboratory devices, as outlined above, helps to solve the perennial problems involved in analysis from notation. Sure, a lot of efforts are still needed to bring such a program into full action and the output will not come in handy for the musician-musicologist so much accustomed to dealing with notation, but prospects are promising that we may be able to get rid of the 'riot of subjectivity' prevailing in the traditional methods.

References:

Abraham, O. und E.M. von Hornbostel 1909 Vorschläge für die Transkription exotischer Melodien. In: *Sammelbände der Internationalen Musikgesellschaft*, Vol.11, pp 1-25.

Alexeiev, E. 1986 L'Intonation archaïque dans les airs folkloriques (l'aspect de la formation de la hauteur des sons). Moskou, Sovietski Compositor.(Alekseev, Z.E. 1986 Rannefol¡klornoe intonirobanie, Zvuko[sotn[y aspekt. Moskva, Bseso]znoe izdatel¡stvo <Sovetskiy Kompozitor>)

Apel, W. 1953 *The Notation of polyphonic Music 900-1600*. The Mediaeval Academy of America, Cambridge, Mass.

Bartok, B. and A.B. Lord 1951 *Serbo-Croatian Folk Songs*. Columbia University Press, New York.

Bengtsson, I. 1967 On Melody registration and 'Mona'. in Heckmann, H. (ed) *Elektronische Datenverarbeitung in der Musikwissenschaft*. G.Bosse, Regensburg, pp. 136-174.

Blacking, J . 1987 *A commonsense view of all music. Reflections on Percy Grainger's contribution to ethnomusicology and music education*. Cambridge University Press, Cambridge.

Burns, E.M. and Ward, W.D. 1982 Intervals, Scales and Tuning. in: D. Deutsch (ed) *The Psychology of Music* , Academic Press, New York. pp. 241-269.

CIAP-Information (Commission Internationale des Arts populaire). 1949, No.15-16 (Nov.-Dec.)

Document du Conseil International de la Musique (UNESCO), 1952 , Notation of Folk Music; Recommendations of the Committees of Experts, Geneva.

Drake, S. 1986: Literacy and Scientific Notation. In:Wrolstad, M.E. and Fisher, D.F. (eds) *Towards a new understanding of literacy*. Praeger, New York, pp. 135-155

Escal, F. 1979 *Espaces sociaux, espaces musicaux*. Payot, Paris

Georgiades, Th. 1958 *Musik und Rhythmus bei den Griechen. Zum Ursprung der adendländischen Musik*. Rowohlt, Hamburg

Goody, J. 1977 *The Domestication of the Savage Mind*. Cambridge University Press, Cambridge,UK

Harris, R. 1986 *The origing of writing*. Duckworth, London

Havelock,E. 1982 *The literate revolution in Greece and ist cultural consequences*. Princeton, NJ; Princeton University Press.

Hermes, D.J. and J.C. van Gestel. 1991. The frequency scale of speech intonation. *J.Acoust.Soc.Am*. 90 (1), 1991, pp 97-102.

Hood,M. 1993 The untalkables of music. In: EM *Annuario degli Archivi di Etnomusicologie dell'Accademia Nazionale di S.Cecilia*, I, 1993, pp.137-142.

Hood, M. 1982 *The Ethnomusicologist*. Kent State University Press. Kent, Ohio

Hoppin, J.H. 1978 *Medieval Music*. Norton, New York

Jairazbhoy, N.A. 1977 The 'Objective' and Subjective View in Music Transcription. *Ethnomusicology*, May 1977, pp. 263-273.

Jousse, M. 1978 *Le parlant, las parole et le souffle*. Gallimard, Paris

Larsen, M.T. 1989 What they wrote on clay. In K.Schousboe and M.T.Larsen (eds) Literacy and Society. Copenhagen, Copenhagen University, CRH.

Liu, Hongguo 1953 *Minnan Yinyue. Zhipu Quanji* (Nanyin Music from Fujian. Collection with complete tabulature notation) Grosvenor Offset Press, Manila.

Lord, A.B. 1960 *The Singers of Tales*. Harward University Press, Cambridge,MA

Maconie, R. 1990 *The Concept of Music*. Claredon Press, Oxford.

McCardell, T. and U.Will 1998: Frequency production in an Arnhem Land song series. Paper presented at the annual meeting of the Musicological Society of Australia, Adelaide, November 1998.

Moore, M. 1974 The Seeger Melograph Model C. *Selected Reports in Ethnomusicology* Vol.II, No.1, pp. 3-13.

Morton, D. 1974 Vocal Tones in Traditional Thai Music. *Selected Reports in Ethnomusicology* Vol.II, No.1, pp. 89-99.

Moyle, R. 1995 Singing from the Heart? in: Barwick et al. (eds): The Essence of Singing and the substance of song. Sydney, Oceania Monographs No.46, pp.53-58.

Nettl, B. 1964 *Theory and Method in Ethnomusicology*. Collier-Macmillan Ltd, London

Nettl,B. 1983 Ethnomusicology: Definitions, Directions, and Problems. In: E.May (ed) *Musics of many cultures*. University of California Press, Berkeley, pp. 1-9.

Nettl, B. 1983 *The Study of ethnomusicology. Twenty-nine Issues and Concepts*.University of Illinois Press, Urbana.

Olson, D.R. 1994 *The World on Paper*. Cambridge, Cambridge University Press

Ong, W.J. 1988 *Orality and Literacy*. Routledge, London New York

Pöhlman, E. 1970 *Denkmäler altgriechischer Musik*. In: Erlanger Beiträge zur Sprach- und Kunstwissenschaft, Vol.31. Nürnberg

Read, C.A., Zhang, Y., Ding, B.Q. 1986 The ability to manipulate speech sounds depends on knowing alphabetic reading. *Cognition*, 24, 31-44.

Sachs, C. 1918 *Kunstgeschichtliche Wege zur Musikwissenschaft*. In: Archiv für Musikwissenschaft, Vol. 1. Leipzig.

Sachs, C. 1962 *The Wellsprings of Music*. The Hague, Martinus Nijhoff

Seashore,C. 1938: *Psychology of Music*. MacGraw-Hill.

Seashore, C. 1947 *In Search of Beauty in Music. A Scientific Approach to Musical Esthetics*. The Ronald Press Comp., New York.

Seeger, Ch. 1958 Prescriptive and descriptive music writing. *Musical Quarterly* 44, 2.

Seeger, Ch. 1977 *Studies in Musicology 1935-1975*. University of California Press, Berkeley

Toft, R. 1992 *Aural Images of lost traditions*. University of Toronto Press, Toronto

Will, U. 1994 *Die Zerstörung des Tiao*. P.Lang, Frankfurt a.M.

Will, U. 1996a Sounds from the Dreamtime and the Pythagorian Paradigm. A review of 'The Essence of Singing and the Substance of Song : Recent Responses to the Aboriginal Performing Arts and other Essays in Honour of Catherine Ellis', edited by L.Barwick, A.Marett and G.Tunstill. in: *World of Music*, No.2, 1996.

Will,U: 1996b: Language and Music.A new perspective.
in: Sintaksis muz[kal¡noy reqi (Syntax of the musical language)/ Teoretiqeskiy seminar po - tnomuz[kovedeni] (theoretical Seminar in Ethnomusicology) Ivanovo, Russia.

Will, U. 1997a: Two types of octave relationships in Central Australian Aboriginal Music. *Musicology Australia.* Vol. XX, pp3 - 13

Will, U. 1997b: A Musicologist's dilemma: Technology and the Analysis of Music. In: Finnish Yearbook of Ethnomusicology, Vol.10, 1998, *Proceedings of XIIIth European Seminar in Ethnomusicology, ESEM XIIIth, 1997*, Jyväskylä, Finnland, pp 5 - 12.

Will, U. 1998: Pitch-structure in Australian Aboriginal Music.
In: *Encyclopedia of World Music*. Vol: Oceania. Garland Publ. Inc. pp.192-194

Will,U. and Ellis,C.J. 1996 : A re-analyzed Australian Western Desert Song. *Ethnomusicology*, Vol.40/2, pp. 187-222.