What is a musical instrument?

By Tellef Kvifte

Introduction

The development of new electronic and computer-based music-making tools is a challenge to traditional concepts of musical instruments. We hear new sounds, we see familiar sounds coming out of unfamiliar devices, and unfamiliar sounds coming out of familiar interfaces. Also, the relations between composing, improvising, performing and playing recordings are being blurred: scores can be made to sound without human musicians, and sound can (to a certain extent) be made into score without a human transcriber. In this situation, one may want to call for new definitions of several of the basic concepts connected to music and music-making.

In this paper, I will focus on the concept of *musical instrument*. I will, however, not suggest new definitions. I want to show that the concept has never been well defined, and has been understood in many ways. I will argue that there is no need for new definitions, but rather for a more detailed understanding of the many aspects of the concept.

Definitions of musical instruments

The literature on musical instruments, including works on classification, seldom goes deeply into basic definitions of the core concept of 'instrument'. A basic definition like 'device made to play music' seems to be taken more or less for granted. Such a definition will usually suffice in most situations, but all concepts mentioned — 'device', 'play' and 'music' — may be questioned, clarified or confused. While there are some explicit definitions in the literature, Grove's online dictionary of music tries to evade the question with the following:

> 'Musical instrument' is a self-explanatory term for an observer in his own society; it is less easy to apply on a worldwide scale because the notion of music itself in such a wide context escapes definition. (2008)

This definition ties the concept of instrument to the concept of music in a general way, and not explicitly to musical activity. But the main point is that if we cannot agree on what music is, then we cannot agree on what a musical instrument is either. What is not obvious from this observation, however, is that it is equally difficult to agree on 'instrument' as it is to agree on 'music'.

One of the most frequently cited definitions is Hornbostel's formulation "...For purposes of research everything must count as a musical instrument with which sound can be produced intentionally." (Hornbostel 1933 p. 129). This points to one of the difficulties: Even if we agree on 'music', we still might want to include devices that can produce also other kinds of sounds, like in the Lysloff and Matson defintion: "any device or human behavior constructed or carried out for the primary purpose of producing sound, whether musical or otherwise." (Lysloff and Matson 1985 p. 217). In contrast to Hornbostel, Lysloff and Matson tie the intentionality to the *construction* rather than to the actual or potential *use* of the device.

The relation 'device-music' has several dimensions, and the use of 'non-musical' devices in music is but one; others are the reference to non-musical devices in music, and the use of non-musical recorded ('sampled') sounds, as is common in several contemporary genres. Leroy Anderson's well-known composition "The Typewriter" is also an illustration: here, the solo part is made up of typewriter-like percussion sounds. As typewriters are not constructed for the purpose of making sound, they fall outside the Lysloff and Mattson definition, and typewriter makers have in fact put considerable effort into making them sound as soft as possible. But because they *can* be used to produce sound intentionally, as in Anderson's composition, they will count as musical instruments under the Hornbostel definition. Whether they — with reference to this composition — should really be regarded as instruments is not obvious after all, as the composition is usually performed not with actual typewriters but with percussion instruments that sound (almost) like typewriters.

Bielawski's definition however escapes this problem and gives a quite different focus. He regards the instrument as a *transformer*, transforming bodily gestures in physical time and space into musical gestures in musical time and space (Bielawski 1979 p. 27[1]).

Bielawski does not mention intentionality at all. In this definition, both the bodily gestures and the artifacts involved may have been produced with intentions other than making music, though I doubt this was an important point for Bielawski. His connection of bodily gestures and musical sound is rather unique among the definitions, and, in the light of the recent rich literature on computer-based new instruments, ahead of its time.

The relation name–artifact

Another possible source of confusion is found in examples like the concept pair fiddle/violin. The two concepts may under certain circumstances denote different

1 Musikinstrument – ist ein Transformator der immer in einer Zeit und in einem wirklichen Raum zustandekommenden Bewegungsgesten in musikalische Gesten, die in einer musikalischen Zeit und einem musikalischen Raum ausgetragen werden.

instruments; in others, they may not, but simply be terms from the two separate contexts of art music and folk or traditional music, respectively. Fiddlers that happen to also be members of a symphony orchestra may very well use the same instrument in the two different musical contexts.

Another example, also from traditional music, is found in the following description of the so-called *sjøfløyte* – literally 'sea flute':

> The Norwegian 'national recorder' is the Sjøfløyte. Its name indicates that it may have come across the sea, which again points to Germany from the Hanseatic period. Although the recorder has evolved from baroque recorders to the sjøfløyte, its way of playing is entirely Norwegian. (Saers 2008).

In fact, as hinted at in this text, many of the older extant instruments were imported from German factories, where they were made as baroque recorders. In other words, these instruments got their identity as '*sjøfløyte*' a long time after they left their maker, and in this case the style of music is a decisive factor to establish the identity of an instrument.

Conversely, there are also instances where one name covers several different artifacts, as is the case with the *taragot* (or *tárogató*). The instrument is associated with Hungarian music, and the first mention of the instrument under that name dates from 1533 (Fontana 2008). At the time it was a version of the double-reed, conical shawm found in many varieties over a large geographical area, with the rather sharp and loud sound which is typical of these instruments. At the end of the 1800s, Wenzel Josef Schunda (1845–1923) constructed a new version of the taragot, larger in size than the previous version. Later he made a single-reed, conical instrument that he patented under the same name. It was made in several sizes, and the one in b-flat is quite similar to a wooden soprano saxophone.

Interesting in this connection is how a concept of a Hungarian national instrument is transferred from one class of instrument (double-reed, conical) to another (single-reed conical) with a quite different sound. Even more interesting is how the two artifacts seem to be regarded as really 'the same' also in the Grove entry for the taragoto: after explaining the invention of the single-reed version as an instrument suited to orchestral use, invented at the end of the century and patented by Schunda in 1897, the entry informs us that "The first known use of the tárogató in symphonic music was in Károly Thern's incidental music to *Szvatopluk* (1839)." As this is more than half a century before the development of the single-reed tarogato, it is obvious that this must relate to the double-reed version. The importance of the Hungarian national aspect of the instrument somehow overrides the actual sound quality in this case.

These last examples may be taken as illustrations of the many dimensions usually included in the concept of instrument when used in a real-life setting. This is summed up in Racy's description of instruments as 'interactive entities':

> they are not mere reflections of their cultural contexts, nor are they fixed organologi-

> cal artifacts that can be studied in isolation from other social and artistic domains. Instead, instruments interact dialectically with surrounding physical and cultural realities, and as such, they perpetually negotiate or renegotiate their roles, physical structures, performance modes, sound ideals, and symbolic meanings. (Racy 1994 p. 38)

In other words, reference to an instrument is always done in a context, where the instrument is understood as a part of a cultural setting. And the reference can include any or all of the implications mentioned (roles, physical structure, etc.).

Physical boundary and agency

So far, even given the uncertainties of what objects to include, we have talked about instruments as well defined, at least physically. We have assumed that it is unproblematic to define the physical boundaries of the objects in question. Intuitively, we might say that the instrument is what is left behind when the performer is no longer present. But the distinction between a physical object and the body of the performer is not so obvious. The human voice is but one example; another is whistling — a behaviour that is explicitly recognized as an instrument by Lysloff and Mattson. Here, the possible distinction between the instrument and its surroundings is a question of distinction between different parts of a human body.

Consider also the trump (jew's harp, jaw's harp, guimbarde, maultrommel...), where the mouth cavity is a necessary part of the working instrument, as the size of the cavity is used to control pitch. So where does the instrument end? In the throat? Or should we include the lungs, as they supply the system with an air stream that can be used to influence the sound?

Herbert Heyde has made such considerations part of his descriptions of musical instruments (Heyde 1975) to a greater extent than is usual, and makes a distinction between *technopomorphic* and *anthropomorphic* elements of instruments, that is, mechanical and human elements respectively. Further, he makes a distinction between *prototypical* instruments with only anthropomorphic elements, *typical* instruments with both kinds of elements, and, finally, *exotypical* instruments with exclusively technopomorphic elements such as music boxes and other automatic instruments.

The illustration in fig 1 shows an analysis of a *langeleik*, a Norwegian type of dulcimer, with the symbols of Heyde. The box to the right is the resonating body of the instrument; the trapezoids to the left of the body are the strings. The hatched parts are the anthropomorphic parts of the instrument. There are several such elements here, and nearest to the technopomorphic parts of the instrument we find the fingers of the performer. The question here, as was the case with the trump, is where it is sensible to draw the line. It is possible to continue the chain ad absurdum: the fingers are moved by muscles, the muscles get their energy from the metabolism

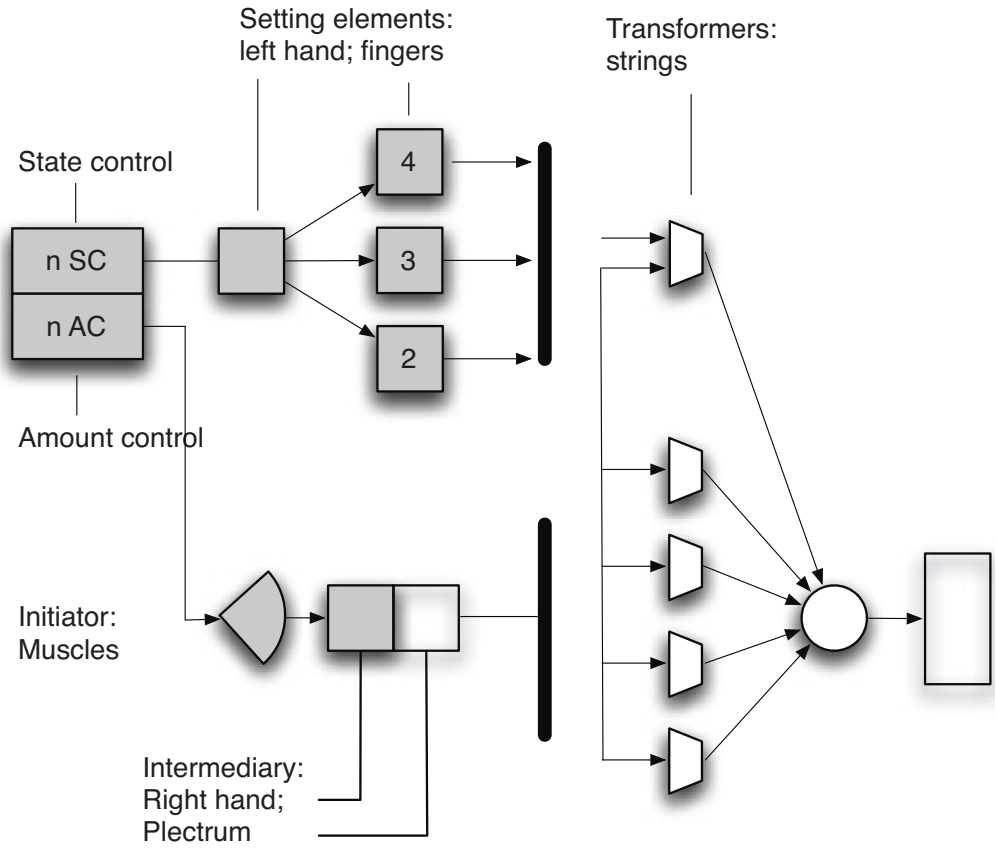

Fig 1: *Langeleik,* analysis with the symbols of Heyde

that depends on the food consumed; the production of the food relies on the energy from the sun — and very soon, we are back to the Big Bang as an integral part of the instrument.

There is really no simple solution to this problem. It is sensible to think of the mouth cavity as an integral part of the trump, and if we do, it does not really make sense to exclude the fingers from the *langeleik* either. Obviously it is not practical to follow the chain of effects very long, but if we give up the intuitive distinction between the human body and a physical device as the defining border between an instrument and a performer, there is really no obvious break in the cause-and-effect chain leading to the production of the sound that can act as a demarcation of the instrument.

Further, there are situations where the very physicality of the instrument is even more problematic. When the name of an instrument is used in a score, the focus is neither the musician nor the device, but what kind of sound we are supposed to associate with the notes on the corresponding staff. This is even more obvious from the way instrument names are used in many kinds of music software. Here, too, the instrument name indicates the kind of sound to be expected, but in this case, there

is no corresponding physical device in the real world, nor necessarily a living musician to play it — everything is in the software, and the software may also control the instrument-sound-producing software. And *if* the instrument is controlled by a living musician the instrument interface will normally be independent of the instrument sound, in the sense that both violins, oboes, trump and grand pianos can all be controlled by the same keyboard interface. In such a case, it is difficult to connect the instrument sound to a well-defined physical device. In this context, 'clarinet' is more a concept of timbre than an instrument in the traditional sense.

It is tempting to see the problems of definition and demarcation discussed so far in the light of an underlying cause-and-effect paradigm that is sometimes made explicit in communication chains similar to that in fig 2[2]. What is discussed is more or less how to keep these boxes separate and distinct from each other and from the rest of the world. The initial discussion of the definitions of Hornbostel, Lysloff and Mattson in this paper concerned how to keep the instrument box separate from the other objects in the world; the following discussion on names considered how to keep different instrument objects separate; this was followed by a discussion of the relationship between instrument and performer; and finally the relationship between instrument and musical sound was considered. Even if the discussion so far questions the validity of a model like in fig. 2, it takes such a model as its point of departure.

Fig 2: Communication chain.

If we consider modern music software, several modifications of this model are possible. In a situation where a composer is programming a sequencer that is used to produce the sound, one could make a model like in fig. 3, with a slight rearrangement of the functions in fig. 2. Both models contain the same functions, and the same unidirectional arrows.

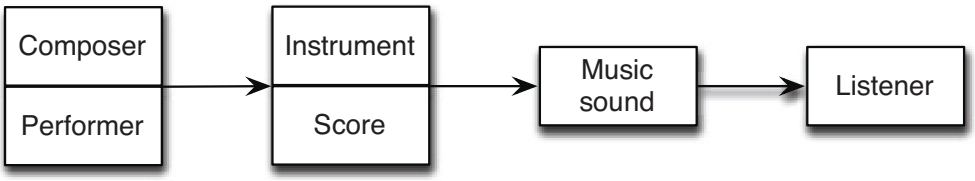

Fig. 3: Alternative model

2 See e.g. Bengtsson (1973). Fig. 2 is an adaption of Bengtsson's illustration (p. 16).

But there is of course the question of the performer: Is the programming of the sequencer the actual performance, as indicated in fig. 3, as this is the last human intervention in the chain before the sound is produced, or should we regard the sequencer (the software and hardware of a machine) as the performer? This is the modern version of the question that has been discussed in connection with music 'automatas' of different kinds, among them the pianola, and it is also implicit in the Heyde-type analysis in fig. 1: To the far left in that diagram there are two *control elements*, responsible for the control of fingers of the two hands. The function of the elements are described as 'neural control', and even if nothing is said about intentionality by Heyde in this connection, one might ask if it is sensible to include the intentionality of the performer as part of the control, and, accordingly, see the performer and instrument as one continuous entity.

If we on the other hand choose to see the machine as a performer, we may perhaps also expect the term 'performer' to change connotation and meaning in a similar way as the term 'computer' has over the last decades. Today, the term is a clear reference to a machine. In Turing's seminal paper on "Computable numbers" (1936) however, it denotes a human being who is computing, and computing *machines* are referred to as such. Yet in his 1950 paper, 'computer' can denote both machines and human beings:

> The idea behind digital computers may be explained by saying that these machines are intended to carry out any operations which could be done by a human computer. (p. 436).

A similar usage is found for 'performer' when sequencer software packages get names like 'Professional Performer' or 'Digital Performer'. However, there is no reason to believe that 'performer' is eventually going to exclusively denote machinery. Computing is not a performing art, and as Chadabe points out in a discussion on new types of instruments:

> …as a general rule, the most important requirement of an instrument for a professional performer is that the instrument demonstrates for the audience that the performer is necessary and is in fact controlling the music; and this requirement assumes a strong degree of determinism at least in certain aspects of the instrument's behavior. (Chadabe 2002 p. 03).

This is a central point in several contexts, among them the discussions of the relative merits of different instruments: which instruments are difficult to play and which are easy, with the more or less unspoken premise of a proportional relationship between difficulty of operation and expressive potential. Chadabe takes the discussion a bit further, and explores a wider concept of instrument than the traditional. Bielawski's definition of instrument as a transformer opens for a study of what is usually called *mapping*, the relation between a performer's input and the resulting sound, that in traditional instruments is a rather stable relation. Chadabe is interested in instruments where this relation is less stable, and creates a taxonomy with traditional

instruments at one end of an axis and so-called 'indeterministic instruments' at the other:

> At the rightmost extreme, an indeterministic instrument outputs a substantial amount of unpredictable information relative to a performer's controls. In working with such an instrument, a performer shares control of the music with algorithms as virtual co-performers such that the instrument generates unpredictable information to which the performer reacts, the performer generates control information to which the instrument reacts, and the performer and instrument seem to engage in a conversation. Interaction means 'mutually influential'. Since the instrument is influenced by the performer's controls, and the performer is influenced by the instrument's output, I have called such instruments 'interactive instruments'. (Chadabe 2002 p.2).

Here, the instrument is seen as an agent in its own right, as it is described as interacting with a (human) performer. The way he describes the interaction, one might as well term both entities 'performers' as they are described symmetrically: both produce information for the other to react upon.

Chadabe describes an interactive loop including a human being and a device. This is also a relevant perspective for traditional instruments, and may be an alternative to the models indicated in figs 2 and 3. Instead of a cause-and-effect chain, we focus on the totality of the perception-action-loop where — to use the terminology of Bielawski — the bodily gestures of a musician are transformed into musical gestures, that in turn are perceived by the performer (fig 4).

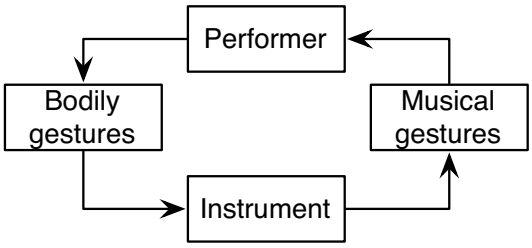

Fig 4.: The loop model

The boxes in fig 4 are not quite obvious, though, if we are to distinguish between the physical objects involved. The bodily gestures are clearly part of the performer, and could be included in the same box. The 'musical gestures' box is also doubtful. If we change it into 'physical sound', it is sensible to keep it as a separate entity. But a 'musical gesture', however, is really the performer's (or any other listener's) perception and interpretation of the physical sound, and should therefore also be included in the performer box, as in fig 5:

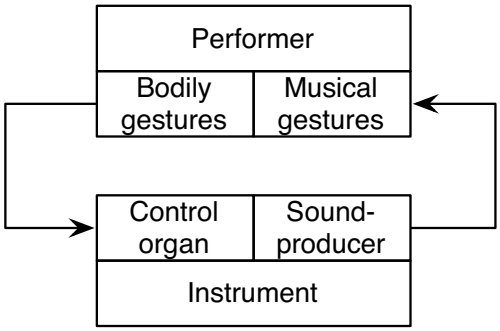

Fig 5: Modified loop model

Here, the gestures are seen as part of the performer. In this model, we do not pay attention to the instrument as a whole, only to the parts used to control and produce the sound. Decor and painting is irrelevant, as are actual physical features that does not influence control behaviour or sound. Also, only the musically relevant behaviour of the performer is of interest. In this way, it may be easier to delimit the entities under consideration than it seemed to be in the earlier discussions. Given this loop, there is less danger of following the chain of cause-and-effect back to the Big Bang. On the other hand, the conventional concept of 'instrument' is more or less lost here, as the perspective is restricted to control and sound[3].

The loop-type model may be less suited in a conventional music history setting, but may be helpful to explore possible research questions of playing technique and new music technology, including computer software and recording studios. For example, as soon as the loop concept is introduced, the question of 'what forms of feedback other than the sound are used by performers?' is close at hand, prompting studies of how visual and haptic feedback from instruments are used by performers. And these studies in turn may be relevant both for construction of new — computer-based or other — instruments, as well as for discussing the acceptance or non-acceptance of alternative interfaces like the Janko keyboard (fig 6), where the visual and technical advantages of a symmetrical layout were not accepted. The main reason usually given for this is conservatism on the part of the pianists of the time; given the wide-spread acceptance of a similar layout for accordion keyboards, one would believe more reasons are needed, like the touch and feel of the actual keyboards (Cranmer 2008).

But the concept of loop may also be useful in situations where the conventional instrument concept is less obvious, like in a recording studio. Seen from the music producer's point of view, everything in the studio, including the recording room, microphones, cables, pedals, instruments (in the narrow sense), mixing desk, recording software and loudspeakers, will be used in the process of making music, and there are many points where bodily gestures are transformed into musical gestures

3 See Kvifte and Jensenius (2006) for more examples of instrument-performer-loops

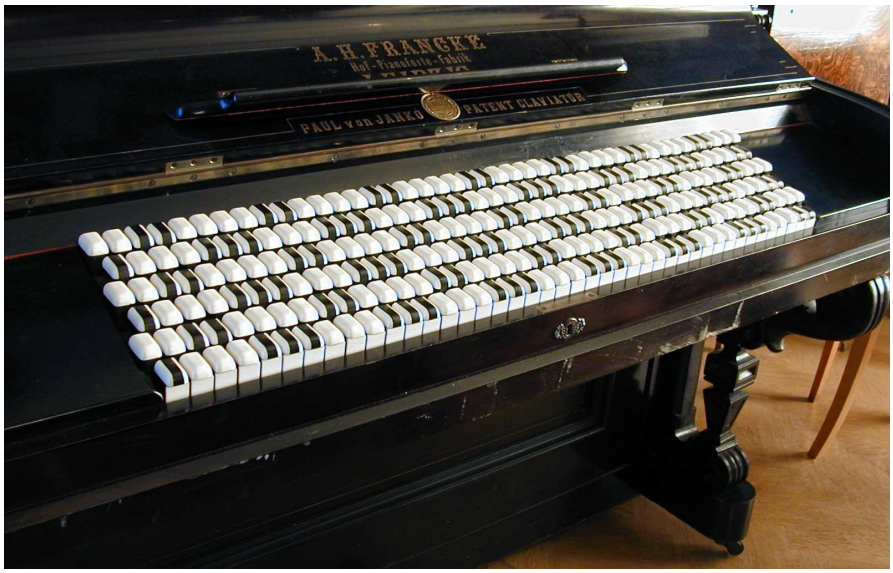

Fig 6: Janko keyboard

in some sense of the word. To break this multitude of persons, devices and processes down to sensible and manageable units, a loop concept may be helpful. Thus, from such a perspective, a microphone may very well be seen as a relevant part of instruments used in the studio in several ways: The performers rely on the microphones to get the sound they want *and* the kind of aural feedback they need to play in time and tune with the other musicians (a performer-microphone-mixing desk-amplifier-headphone-loop); the sound engineer uses the microphone together with the controls of the mixing desk to control the sound of the recording, and the setting up and subsequent adjustment of a microphone on the basis of how it actually sounds (an engineer-performer-microphone-mixing desk-mixing controls-loudspeaker-loop). Several other loops may be identified, studied, and seen in relation to each other.

Concluding remarks

As said in the introduction: I will not try to make a new definition of musical instruments where I make distinctions between different uses, gestures, artifacts, styles or whatever one might want to include in the definition efforts. Neither will I take the one of the two models indicated as being better than the other, but only point out the advantage of having more than one model. Different people have different interests in the concept, and 'musical instrument' takes on a variety of meanings depending on cultural context, economic interest and power relationships.

A person writing the history of the flute may not see the tin whistle as a 'flute' in the same way as would a person writing on Irish music practice. A musician's union has different interests than recording and broadcasting companies, and a conserva-

tive conservatory will probably have different ideas from a rock, jazz, or traditional music scene concerning what proper musical instruments are. And on the other hand, producers making music with sampling, playing, cutting and pasting probably don't care.

'Instrument' is, as discussed, a concept with many dimensions. The usefulness of the concept is rooted in the combination of dimensions, and, at the same time, the multi-dimensionality of the concept is a problem if one tries to make precise definitions. But the usefulness of a concept is not necessarily proportional to its precision. Concepts are tools for grasping the world around us, and their utility in research is measured by their ability to let us make new and relevant questions. If a traditional and relatively precise definition of 'instrument' excludes large areas of contemporary musical practice from our field of study, we might be better off with less precise alternatives.

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Summary

In this paper, the concept of 'musical instrument' is explored, and it is shown that the concept is quite difficult to define in a precise way. Some existing definitions are discussed in relation to different themes, such as how to define the limits of the instrument object in relation to other objects and to the performer, and how to handle the relation between object and agent.

Instead of offering new definitions of the concept of instrument, it is argued that different perspectives and interests call for different definitions. Finally, an alternative perspective inspired by the perception-action-loop concept is introduced.

Key-words

musical instruments, definitions, agency, man-machine relationship, music technology

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Tellef Kvifte is professor at the Dept. of musicology at the University of Oslo, where he has been since 1980. His professional interest include Scandinavian traditional music, musical instruments and music technology. He is also performing in various contexts of world music, traditional Norwegian music and contemporary jazz.