An experiential approach to musical semantics: deixis, denotation and cognitive maps.

Mark Reybrouck
Catholic University of Leuven

This paper is about knowledge construction in music listening. It argues for an experiential approach to music cognition, stressing the dynamic-vectorial field of meaning rather than the symbolic field. Starting from the conceptual framework of deixis and indexical devices, it elaborates on the concept of pointing as a heuristic guide for sense-making which allows the listener to conceive of perceptual elements in terms of salience, valence and semantical weight. As such, the act of (mental) pointing can be predicative, either in a nominalistic or processual way, giving a description of the temporal evolution of a situation as against episodic nominalizations that refer to just one single instance of the process. The latter, especially, are characterized by distancing and polarization between the listener and the music, allowing him/her to deal with the music also at a level of mental imagery and to construct a mental or cognitive map of its unfolding.

1 Introduction

This paper is about musical semantics. It has its focus on music listening and addresses two major questions: (i) what is the role of musical experience in the process of musical sense-making? and (ii) is it possible to provide a theoretical framework as well as operational tools for the assessment of this sense-making?

The questions challenge some established conceptions of musicological research in focussing not narrowly on historical studies, music analysis and performance studies but in introducing the music listener and the process of listening as well. There are, in fact, new paradigms evolving which claim an interdisciplinary approach which is related to the process of dealing with music. There are psychological studies, music reception and cognition studies, but musicology as a discipline is still waiting for a theoretical and comprehensive framework that explains the idiosyncrasies and commonalities of listening behavior (see Reybrouck 2005b). Some seminal writings, however, have dealt already extensively with the topic of having an experience (Dewey 1925, 1934 [1958]; James 1912 [1976]; 1842-1910). Central in these writings is the tension between *percept* and *concept* and between the particularities of the sensory experience and the conceptual labels that can be applied to

them. It is possible, in fact, to deal either with the sounding music in a continuous way and to follow the moment-to-moment history of the sonorous unfolding through time or to take distance from the sounding music and to conceive of it "out-of-time" at a level of mere mental representation. This is the level of *mental computations* and *symbolic play* which entails the basic idea of the *homo ludens* as a playing automaton (Reybrouck 2006). Mental computations, in this view, rely on the broader conception of computation that embraces the whole field of "mental operations" that can be performed on symbolic representations of the sounding music. As such they go beyond a narrow conception of computation from a mere symbol-processing point of view with formal symbol manipulation by axiomatic rules and a complete conceptual separation between the symbols and their physical embodiment as exemplified most typically in computer programs which handle "discrete symbols" and "discrete steps" by rewriting them to and from memory to a sequence of rules (Pattee 1995).

Mental operations allow the music user to have access to events which are stored in memory or which can be created *de novo* in imagery. As such they can achieve a level of epistemic autonomy in the music user's transactions with the sounding music. They allow the mind to operate at a level of virtual simultaneity through mechanisms of anticipation and memory and to handle these events in terms of *modelling* or *predictive computations* (Reybrouck 2006). This computational view, however, is in danger of not doing justice to the idiosyncrasies of the particularities of the sonorous articulation of the music through time. Hence, the desirability to conceive of music not merely in symbolic terms which describe the sounding events in an all-or-none fashion (discrete-symbolic) but in a continuous and analog way as well.

2 Dealing with music: experiential claims

The role of musical experience is a current topic in musicological research (Määttänen 1993; Reybrouck 2004b, 2005a 2005b; Westerlund 2002). It involves a shift from a mere structural description of the music as an artefact to a *processual* approach to dealing with music and states that music is only real music when it sounds. This is an *empiricist* claim that stresses the firsthand information in perception rather than relying on second-order stimuli such as conventional notational symbols (e.g. the notes of a score). It conceives of "music-as-listened-to" and "music-as-perceived" rather than thinking and conceptualizing of music at a mere symbolic level without any actual connection to the music as it sounds. The claim can not be overstated. It has been remolded several times and is actually a topic of major concern. What matters, according to Cusick (1994), are not practices of composer's minds for the sake of informing the practices of other minds, but the real and actually

sounding experience. As such, it challenges symbolic approaches which deal with music merely at a mental level.

The "experiential approach" holds another position. It takes as a starting point the interactions of the music user with the sounds—both at at the level of manifest and virtual interactions. As such, a "musical experience" is not basically different from an auditory experience at large. It is continuous with the ''natural experience'' or ''experience proper'' (see Dewey 1934 [1958]) with a difference in degree rather than in quality. This means that listeners should build their listening strategies on natural strategies of perception and listening and that the transition from a naive to an expert listener is a matter of learning rather than of innate faculties. Listening, in this view, is not passive registration but an active process of sense-making that involves mental activities such as exploring, selecting, modifying and focussing of attention. As such, it is related to the principles of perceptual learning and development with a corresponding shift from *ontological* (what is music?) to *epistemological* questions (what is music cognition and how can it be acquired?). What really counts in this approach is the "construction" of meaning out of the perceptual flux (Reybrouck 2001, 2005a). This is a *semiotization* of the sonic world with listeners not to be seen as passive recipients but as organisms that build up semiotic linkages with the world at large. Or put in other terms: listeners are observers who construct and organize their knowledge and bring with them their observational tools. What matters, in this view, is not merely the music in its objective qualities, but also the music as perceived. This is a more subjective view which stresses the importance of the musical experience besides the music as a structure or an artefact.

To provide a theoretical framework for these claims, it is arguable to rely on contributions from some other fields such as cognitive semantics, second order cybernetics, radical constructivism and ecosemiotics which may provide a lot of empirical support and theoretical grounding for the experiential approach. They have in common an emphasis on sense-making and having an experience but they differ in the focus of some of their major claims.

There is no space to go in detail here. I just mention the role of the cognizer and the role of subjectivity as stressed in *cognitive semantics* that accounts for what meaning is to human beings, rather than trying to replace humanly meaningful thought by reference to a metaphysical account of a reality external to human experience (Lakoff 1987: 120). Our cognition is not reducible to ''naive realism'' but to ''cognitive realism'' which has the mark of our cognizing with our minds. *Second order cybernetics* holds a related point of view in reintroducing of the role of the observer in science in general. Relying on the seminal work

of Bateson it typically conceives of the observer as a participant and as part of the observed system (see Reybrouck 2005a for an overview). The *constructivist* approach to cognition (von Glasersfeld 1995), finally, claims that knowledge is the result of a learner's activity rather than the passive reception of information or instruction. It formulates the conceptual structure of knowledge as the product of active knowers who shape their thinking to fit the constraints they experience. To quote von Glasersfeld:

[radical constructivism] is an unconventional approach to the problems of knowledge and knowing. It starts from the assumption that knowledge, no matter how it be defined, is in the heads of the persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience. What we make of experience constitutes the only world we consciously live in. (1995: 1)

Translated to the realm of music, this means that we should consider the role of the listener/observer. Depending on his or her listening skills he or she can focus at will, but there are perceptual-auditory triggers which are more salient and which impinge upon our perceptual and cognitive dispositions with more pregnancy.

3 Theoretical grounding and conceptual tools: deixis, route-description and cognitive maps

Starting from the distinction between a conception of music as structure and a processual approach to dealing with sounding music, it is possible to introduce a combined dynamic-vectorial and symbolic approach to musical experience. This is a position that attempts to go beyond some basic tensions and dichotomies, such as the conception of dealing with music "in time" and "out-of-time": the first is coperceptual with the sounding music being presented to the senses, the second relies on memory and representation with the music being present only at a representational level of virtuality (see Reybrouck 2001b). It is the basic distinction between an "experiential" and a "conceptual-symbolic" approach to musical sense-making which goes back to the theoretical and conceptual work of pragmatic philosophers such as Dewey and James. Dewey (1934 [1958]) in particular has stressed the role of action and perception and the reciprocity of doing and undergoing in what he called "the experience proper''. James (1912 [1976]), in turn, has introduced his doctrine of radical empiricism, which is an original epistemology that deals with the tension between *concept* and *percept*. It stresses the role of knowledge-by-acquaintance – as the kind of knowledge we have of a thing by its presentation to the senses – rather than conceptual knowledge. What matters in this ''empiricist'' approach, is the fulness of reality which we become aware of only in the

perceptual flux (James 1911 [Mc Dermott 1968]). Conceptual knowledge, however, is needed as well, but only in order to manage information in a more economical way. As such, it is related to the principle of cognitive economy.

There are, further, contributions that stem from both pragmatics and linguistics and that bring together the orientational features of the human languages which refer to points in time, space and speaking events between interlocutors. This is the field of *deixis* and *indexical devices* which provides another source of theoretical grounding and operational terminology to describe the process of sense-making out of sounding music. Relying basically on the act of pointing, as a means for singling out the things that are denotable as being meaningful, it holds a dynamic-vectorial approach to the world which is directive in nature, rather than relying on distancing and polarization between the cognizer and the world as in symbolic approaches to cognition.

There is, however, a lot of freedom in the things that are eligible for denotation, both with respect to what they are (the categories), their features and their temporal extension. Much depends here on the processes of focal attention which can be modified at will.

3.1 Deixis and deictic elements

The concept of "deixis" goes back to Bühler (1934) who drew an explicit analogy between gestural and linguistic means for showing direction or place. He presented as a main thesis that deictic expressions refer to a deictic field of language whose zero point is fixed by the person who is speaking, the place of utterance, and the time of utterance. Deictic procedures, as a source of reference, locate individual elements in context, rather than simply tagging them. They focus the hearer's attention towards a specific element of the deictic space (Ehlich 1982). As such they realize a form of joint attention, the sharing of overlap in the focal attention of the parties of a referential exchange. The means for doing so comprise a set of procedures, varying from such evolved linguistic devices as anaphora (referring back to text) and deixis (referring back to context) to simple ostentive pointing.

Deixis thus has its origin within the speaking situation, with the meaning of deictic expressions depending crucially on when, where and by whom they are used. As such, these expressions "pick out" or "point to" things in relation to the participants in a speech situation (Clark 1978) somewhat related to Peirce's notion of indexicality. They are used in the same way as Bühler (1934) talks about pointing words as opposed to naming words (Lyons 1982: 106), which is basically the distinction between the field of pointing and the

symbolic field of meaning (Bühler 1934). The former holds a dynamic-vectorial approach to the world and is directive in nature, the latter relies on distancing and polarization between the cognizer and the world.

Deictic expressions, therefore, have to be defined with reference to the speech event, its participants and its settings in order to allow an operational description of space/time moments and their relations to the position and time of utterance. Or in more operational terms: an ordinary speech situation can be systematized in terms of personal, spatial and temporal deixis, which, in turn can be operationalized in terms of socio-spatio-temporal axes (Fillmore 1982).

3.2 Indexicality and reference

The deictic framework has proven to be fruitful in linguistics. It is arguable, however, to translate it also to the realm of music. Deictic devices, in fact, stress the role of the actual situation and the typical context of utterance in providing socio-spatio-temporal anchoring. Applied to music listening, this should mean that the experience proper is considered in terms of a referential exchange between the music and the listener. Two notions are of major importance here: the concept of indexicality and the concept of reference.

The concept of *indexicality* is related to the notion of pointing as a primitive marking system for singling out the elements that are eligible for denotation. It can emancipate itself from an object-oriented movement (merely grasping) to an act of pointing as an internal reconstruction of an external operation. This process of internalization can go so far as to "mentally point to things" that are not physically present. Such an act of pointing—externally or internally reconstructed—mostly begins with the emergence of a kind of quality in combination with an insistant particularity, e.g. "this is important", "that is difficult". As such it presents a heuristic guide for sense-making which allows the listener to conceive of perceptual elements in terms of salience, valence and semantic weight. The multiplicity of elements, however, requires a selection with respect to the possible objects of denotation and this entails the notion of relative importance and the elevation of some entities to a special level of prominence. This designation, further, is essential for all constructivist claims of reality. To quote Varela:

… all of these items [...] must, at some point, have been isolated and "individuated" in the field of our experience. This isolating and individuating necessarily had to be achieved by us, for it is we who say that we are aware of them. That is, we must have differentiated them and cut them out from the rest

of our experiential field - and by that very act the rest of our experiential field became their environment.   (1979: 273)

The concept of *reference*, on the other hand, makes it possible to conceive of space/time moments and their relations to a reference point. Deixis, in fact, is centered with the position of utterance as the centre of the act of communication and the time of utterence as the time of coding (Fillmore 1982).

Listeners, accordingly, may experience the music as a sequence of sounds which are presented to the senses through a temporal window that constitutes the centre of a system of coordinates. Like speakers in an act of communications, they can use their current situation for anchoring referential acts in space and time. As such, they should be able to hold step with the temporal unfolding of the sounding music and to give an adequate identification of the place and time in its unfolding. This is the *identification problem* in deictic reference with as major issues the setting up of a common deictic space, the fixation of a basic reference point (the Origo) and the coordination of the perspectives of the speaker and the hearer (Klein 1982).

The fixation of a reference point is a major topic of concern. It is related to the conception of music as a temporal art, with its sonorous unfolding being presented as a sequence of instantaneous states which may be perceived by the listener at each moment through the windows of acts of focal attention. In order to have access to the music as a whole, however, the listener must have access also to the flow of the musical discourse as a whole, where parts may be re-taken up and anticipated. To do this, he/she must be able to refer back and forward in the musical unfolding, somewhat analogous to the use of *anaphora* in a text— referring back (catadeixis) to things just treated (this, that...) or to things that are to be treated immediately (anadeixis) (Ehlich 1982). This brings us to the problem of virtual simultaneity and of synoptic overview.

3.3 Deictic space and route-description

The problem of virtual simultaneity can be handled appropriately by relying on the concept of *deictic space*. Such a space is set up mostly by summing up all possible denotata of local "deictics" or localities (rooms, apartments, streets, cities, countries). But the denotata need not be localities. They can be abstract places in a train of thought as well, allowing the concept of deictic space to be broadened to give it a more abstract definition. To quote Klein:

In its most general sense, a deictic space is nothing but a set of elements provided with some structure (an order or a topology); its subsets or some of them, are the possible denotata. (Klein 1982: 163)

Deictic spaces, further, may differ in several of their characteristics, such as their elements or minimally discriminable units of perception, their subsets which are possible denotata, the kind of structure that characterizes the deictic space, the number of dimensions—one-dimensional (e.g. a train of thought), two-dimensional (e.g. a map) or three-dimensional (the space of visual perception)—and a kind of metric (most deictic spaces have a concept of distance) (Klein 1982).

It is arguable, further, to conceive of music in terms of deictic space. Music, in fact, can be considered as a sonorous unfolding through time, with the listener going from one place to another, or, as it commonly called in the typical jargon of route-description: "from here to there" (Klein 1982). The basic idea is simply to describe how to go from starting point to destination. The listener, in this view, can enhance his or her referential exchange by working out *route-descriptions* of different kinds. Route-based techniques, in fact, allow the listener to navigate mentally through the music and to perform a number of mental operations: to retrace or infer a route, to estimate the distance between the start and end nodes of the route or of the segments that make it up, and to estimate the direction between the start and end nodes of the route or between a number of locations along its length (Kitchin & Jacobson 1997). To do so, the listener should have access to a kind of cognitive representation of the area in question, which is the outcome of the structuring of previous and actual experiences which can be used as a guiding tool for dealing with the sounding music. It is a procedure which is somewhat reminiscent of Tolman's method of *cognitive map* formation (1946), which is sufficiently general for being applied to listening to music as well.

3.4 Cognitive maps

The concept of *cognitive mapping* is an interesting conceptual tool (Tolman 1948). It can be defined as the mental structuring process that leads to the creation of an overall mental image or representation of the space and layout of a setting (Arthur & Passini 1992). It involves a tentative map, which indicates routes and paths and environmental relationships. Cognitive mapping research, further, focuses upon how individuals acquire, learn, develop, think about and store data relating to the everyday geographic environment and the actual

knowledge acquired (Downs and Stea 1973). This information is useful to planners, mobility specialists and navigation aid designers but it can be helpful for the development of listening strategies as well.

Two options are possible, somewhat analogous to the distinction between primary and secondary plans in providing route descriptions: the primary plan involves the localization of a starting point and destination (Klein 1982). Building up this primary plan may be done in advance, or step by step (advance or stepwise planning) but it is a first condition for each successful route description. The organizing principle of the secondary plan, on the other hand, is that of an "imaginary journey" through the primary plan from the starting point to some destination. During this journey certain points of the primary plan are selected and marked. They provide a series of "fixed points" which form the skeleton of the final description (Klein 1982).

Cognitive maps, further, are interpretative frameworks of the world. They exist in human minds and affect actions and decisions as well as knowledge structures. The cognitive map of space, e.g., is a structure of information which is physically unobservable and which is held in the mind to represent the spatial knowledge that refers to it (Kuipers 1978). Such a spatial map can be defined as the body of knowledge of a large-scale environment which is constructed by integrating observations gathered over time, in order to find routes and to determine the relative position of individual places (Downs & Stea 1977). It is possible, however, to conceive of cognitive maps for listening as well. These maps may be differently structured for different listeners, but even if they are vague, incomplete, or even wrong in some respects, they may be very informative as to the way how individual listeners structure their own routes and how their attention may be focused on different points in the time-line. As such, they allow a factual description of actual hearing strategies, but they provide operational tools for intervening in these strategies as well.

Building up cognitive maps, in fact, entails the extraction of *hallmarks* and putting them together in some coherent way. Their utility is best exemplified through tasks that demonstrate the map in action, such as *wayfinding* in a complex environment. Two strategies are possible here: an individual can use his/her cognitive map knowledge to guide the actions or he/she can use the cues in the environment in order to construct his/her knowledge (Kitchin & Jacobson 1997).

The whole domain of cognitive map construction, further, can be applied rather easily to the realm of music. It is related to the domain of data collection and analysis techniques, from

simple (e.g. a sketch map) to complex (e.g. multidimensional scaling) with the listener being considered as a navigator who is trying to find his/her way in a sounding environment. It is known also that fewer landmarks are selected by bad navigators than by good ones and that a navigator's bad performance can be attributed to the inability to acquire enough information from the environment. Listening strategies, therefore, are related to the problem of acquisition of a cognitive map and its application in the process of navigation. In order to make these claims operational, however, we should consider the cues the listener extracts from his or her sounding environment.

4 Operational tools for the assessment of sense-making

The conceptual tools of *deixis* and *map construction* provide useful theoretical grounding for an operational description of the acts of focal attention and their embedding in a more encompassing relational framework. Taking as a starting point the act of pointing, it is possible to focus on discrete particulars which can be allocated at specific points in the temporal unfolding as well as on more extended temporal windows on the time-line. Both modes of processing are time-bound and coperceptual: they proceed in real-time with the sounding music being presented to the senses. It is possible, however, to go beyond this time-bound reactivity and to process the sounding music also in imagery at a mere symbolic level and at a level of virtual simultaneity. As such, there are two basic modes of processing of the music: the first is coperceptual — proceeding in real-time — and is experiential in its claims; the second is characterized by distancing and polarization between the music and the listener and proceeds out of the time of actual unfolding. This is the mentalistic approach which is related to the symbolic rather than to the pointing or deictic field of meaning. It brings us to the concept of pointing as a *predication process.*

The act of (mental) pointing, in fact, has descriptive power. It enables the listener to single out the noteworthy and to delimit those entities which can be isolated and individuated in the field of experience. It is possible, however, to go beyond these acts of delimitation and denotation and to assign some general description to the particular things that are pointed at. As such, there is a tension between the particularities of the sounding elements and the economy of labeling and representation. There are three major possibilities to deal with this problem: the level of abstraction, the scope of predication and the perspective and resolution of the listener.

As to the *level of abstraction*, it is possible, to conceive of sounding elements as "signs" rather than as sensory realia by stripping down the idiosyncrasies and particularities of

sounding and to conceive of them in terms of a propositional approach (Reybrouck 2004). This is the symbolic approach which involves a rather high level of abstraction. It is also the more economical way of processing which comes closest to the conceptual framework which was oulined in James' distinction between percept and concept. As such, it refers to the symbolic rather than to the deictic field of meaning.

The *scope of predication*, second, is directly related to the gestural approach of pointing which tries to capture the unfolding of time in a kind of snapshot as against a continuous gesture that keeps step with the sonorous articulation through time. An interesting starting point in this regard is the distinction Langacker draws between "processual predication" as against "episodic nominalizations" (1987). The conceptualization of the former follows the temporal evolution of a situation, and involves a continuous series of states representing different phases of the process as occupying a continuous series of points in conceived time. They have a positive *temporal profile*, which means that the evolution through conceived time is scanned and tracked in sequential fashion. Processual predications, thus, involve "sequential" rather than "summary scanning". To quote Langacker:

Summary scanning is basically additive, and the processing of conceptual components proceeds roughly in parallel. All the facets of the complex scene are simultaneously available, and through their coactivation [...]; they constitute a coherent gestalt. This is the mode of processing of things and atemporal relations [...]. Sequential scanning, on the other hand, involves the successive transformations of one configuration into another. The component states are processed in series rather that in parallel, and though a coherent experience requires a certain amount of continuity from one state to the next, they are construed as neither coexistent nor simultaneously available. This is the mode of processing that characterizes processual predications and defines what it means to follow the evolution of a situation through time. (1987: 248)

Episodic nominalisations, on the other hand, refer to just one single instance of the process.

The scope of predication, finally, is also related to the perspective which the listener takes on the time-line. Taking the actual unfolding of music through time, the listener can select and (mentally) point to delimited segments of this unfolding, extending the position in a time-series from discrete slices of time to larger temporal spans. Or as Godøy puts it, it is possible to establish means of obtaining knowledge at different temporal levels (a single tone, a phrase, an entire movement) and

… to move between different musical objects of different sizes, to "zoom " and "pan " both in and out and sideways and "filter out" different kinds of information. (1997: 40).

The distinction is related to the observer's listening strategies with, on the one hand, a kind of "panoramic" listening with the music unfolding and the listener as a stationary centre and, on the other hand, a kind of "focused scanning" of the temporal unfolding. The former represents the music at a glance, reducing its sequential aspects to a simultaneous image, the latter keeps step with the discrete particulars and idiosyncrasies of its unfolding.

Both modalities can be treated in an operational way by relying on the concept of "resolution", which, according to Godøy, offers the possibility of

… thinking a musical object in different temporal representations, from "real time" versions to extremely compressed, i.e. "instantaneous" or "synoptic" kinds of representations, which have also been called "outside time" representations of musical objects. (1997: 11)

What matters in this approach, is the emergence of relatively stable forms on the basis of a rather unstable, complex and distributed substrate, allowing a "quantal orientation" of meaning (1997: 54). It brings us to the grasping of a meaning out of a flux with the possibility to interpret "something as something" and to give it some semantic weight. It is a powerful epistemological tool which allows us to conceive of the act of mental pointing as a tool for sense-making in the act of listening.

References

ARTHUR, Paul, and Romedi PASSINI.
	1992	*Wayfinding: People, Signs, and Architecture* (Toronto: McGraw-Hill Ryerson).

BÜHLER, Karl.
	1934	*Sprachtheorie: Die Darstellungsfunktion der Sprache* (Fischer: Jena).

CLARK, Eve.
	1978	"From Gesture to Word: On the Natural History of Deixis in Language Acquisition" in *Human Growth and Development,* eds. J.Bruner and A.Garton (Oxford: Clarendon Press), 85-120.

CUSICK, Suzanne.
	1994	"Feminist Theory, Music Theory, and the Mind/Body Problem", *Perspectives of New Music* 32, 1, 8-27.

DEWEY, John.

    1925   *Experience and nature* (Chicago - London: Open Court publishing Company).

    1934 [1958]) *Art as Experience* (New York: Capricorn Books).

DOWNS, Roger, and David STEA.

    1973   "Cognitive Maps and Spatial Behaviour: Process and Products" in *Image and Environment*, eds. R.Downs and D.Stea (Aldine: Chicago), 8-26.

EHLICH, Konrad.

    1982   "Anaphora and Deixis: Same, Similar, of Different?" in *Speech, Place, and Action. Studies in Deixis and Related Topics,* eds*.* R.Jarvella and W.Klein (Chichester - New York: John Wiley), 315-338.

FILLMORE, Charles.

    1982   "Towards a Descriptive Framework for Spatial Deixis" in *Speech, Place, and Action. Studies in Deixis and Related Topics,* eds*.* R.Jarvella and W.Klein (Chichester - New York: John Wiley), 31-59.

GODøY, Rolf Inge.

    1997   *Formalization and Epistemology* (Oslo: Scandinavian University Press).

JAMES, William.

    i. 1842-1910. *The Writings of William James. A Comprehensive Edition*, ed. John McDermott (New York: Random House, 1968).

    1912 [1976] *Essays in Radical Empiricism* (Cambridge (Ma) – London: Harvard University Press).

JARVELLA, Robert, and Wolfgang KLEIN. (Eds.).

    1982   *Speech, Place, and Action. Studies in Deixis and Related Topics* (Chichester - New York: John Wiley).

KITCHIN, Robert, and Dan JACOBSON.

    1997   "Techniques to collect and analyze the cognitive map knowledge of people with visual impairments or blindness: Issues of validity", *Journal of Visual Impairment and Blindness,* 91, 4, 393-400.

KLEIN, Wolfgang.

    1982   "Local Deixis in Route Directions" in *Speech, Place, and Action. Studies in Deixis and Related Topics,* eds*.* R.Jarvella and W.Klein (Chichester - New York: John Wiley), 161-182.

KUIPERS, Benjamin.

  1978 "Modelling spatial knowledge", *Cognitive Science,* 2, 129-153.

LAKOFF, George.

  1987 *Women, Fire, and Dangerous Things: What categories reveal About the Mind*
    (Chicago: University of Chicago Press).

LANGACKER, Ronald.

  1987 *Foundations of cognitive grammar, Vol. 1* (Stanford CA: Stanford University Press).

LASKE, Otto.

  1977 *Music, Memory and Thought. Explorations in Cognitive Musicology* (Ann Arbor,
    Profess MI: University Microfilms International).

LYONS, John.

  1982 "Deixis and subjectivity: Loquor, ergo sum", in *Speech, Place, and Action. Studies in
    Deixis and Related Topics,* eds*.* R.Jarvella and W.Klein (Chichester - New York: John
    Wiley), 101-124.

MÄÄTÄNEN, Pentti.

  1993 *Action and Experience. A Naturalistic Approach to Cognition* (Helsinki: Academia
    Scientiarum Fennica).

McADAMS, Stephen.

  1993 Recognition of sound sources and events in *Thinking in sound. The cognitive
    psychology of human audition,* eds. S.McAdams and E.Bigand (Oxford: Clarendon
    Press), 146-198.

PATTEE, Howard.

  1995 "Artificial life needs a real epistemology" in *Advances in Artificial Life. Lecture notes in
    artificial intelligence*, eds. F. Moran, A. Moreno, J.Merelo, and P.Chacon, P. (Berlin:
    Springer). 23-38.

PINETTE, Brian.

  1994 *Image-based Navigation through Large-scale Environments. PhD thesis* (University
    of Massachussetts Amherst, Department of Computer Science, May 1994).

REYBROUCK, MARK

2001a   "Biological roots of musical epistemology: Functional Cycles, Umwelt, and enactive listening", *Semiotica*, 134, 1-4, 599-633.

2001b   "Musical Imagery between Sensory Processing and Ideomotor Simulation" in *Musical Imagery*, edS. R.I.Godøy & H.Jörgensen (Lisse: Swets & Zeitlinger), 117-136.

2004   "Music Cognition, Semiotics and the Experience of Time. Ontosemantical and Epistemologic Claims", *Journal of New Music Research,* 33, 4, 411-428.

2005a   "A Biosemiotic and Ecological Approach to Music Cognition: Event Perception between Auditory Listening and Cognitive Economy", *Axiomathes. An International Journal in Ontology and Cognitive Systems,* 15, 2, 229-266.

2005b   "Body, mind and music: musical semantics between experiential cognition and cognitive economy", *Trans,* 9 http://www.sibetrans.com/trans/

2006   "Musical Creativity between Symbolic Modelling and Perceptual Constraints: the Role of Adaptive Behaviour and Epistemic Autonomy" in *Musical Creativity: Multidisciplinary Research in Theory and Practice*, eds. I.Deliège and G.Wiggins (Oxford: Psychology Press), 42-59).

TOLMAN, Edward.

1948   "Cognitive maps in rats and men", *The Psychological Review,* 55, 4, 189-208.

VARELA, Francisco.

1979   *Principles of Biological Autonomy* (New York - Oxford: North Holland).

VARELA, Francisco, Evan THOMPSON & Eleanor ROSCH.

1991   *The Embodied Mind. Cognitive science and Human Experience* (Cambridge (Ma)-London: MIT Press).

von GLASERSFELD, Ernst.

1995   Radical Constructivism: A Way of Knowing and Learning (London - Washington: The Falmer Press).

WESTERLUND, Heidi.

2002   *Bridging Experience, Action, and Culture in Music Education.* Studia Musica 16 (Helsinki: Sibelius Academy).