Musical creativity between symbolic modeling and ecological constraints: The role of adaptive behaviour and epistemic autonomy

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This paper is programmatic in its claims. It raises some questions as to the nature of musical creativity and its underlying mechanisms. It brings together the symbolic and the ecological approach to music cognition, and stresses the operative character of knowledge acquisition and the role of imaginal and representational computations. A focal point is the tension between 'presentation' and 'representation' and the definition of symbolic modelling as an 'autonomous' or 'coperceptual' process.
Musical creativity and the concept of adaptation

The concept of musical creativity is appealing but is often ill-defined. Major questions are related to what and how? Is creativity related to imagery and representation? What is represented in the mind, and what is the representational format? Is it intime or outside of time? What is the role of memory and anticipation? Which operations can be applied to the represented elements? Can we treat them in terms of concrete and formal operations or in terms of algebraic structure and mathematical group theory? What is the relation with divergent and productive thinking?

In order to solve these problems we need a descriptive and explanatory vocabulary that brings together background theory and empirical findings (Reybrouck 1999). A possible starting point is the epistemic control system (input - central processing - output - feedback) which allows us to provide an operational definition of musical creativity by introducing the key concepts of adaptation and equilibrium.

The concept of adaptation is a biological concept which can be translated to the realm of cognition. Cognition helps us to cope with our experiential world, but it allows us also to transcend the material aspects of our environment. The same holds true for dealing with music. In order to fit the solicitations of the sonic environment we can make new distinctions, perform internal computations on the observables and change our semantic relations with the sonic world (Cariani 1989, 1998b). As such we measure and control the sonic environment rather than merely representing it.

Musical creativity, then, allows us to modify our perceptual and behavioural repertoires and change the cognitive and computational part as well. This calls for an ecological and symbolic approach to music cognition, which relies on sensory ‘realia’ as well as on their ‘symbolic’ counterparts (Reybrouck, 2001a, 2001b).

Symbolic modelling and ecological constraints

Dealing with music involves a bottom-up and a top-down approach. The former takes seriously the idiosyncrasies of the sonorous unfolding, the latter uses mental replicas of the sonic world and calls forth processes of abstraction and distillation from the experience proper. This higher-level processing leans upon cognitive economy as conceptual processing takes over from sensory processing. It allows us to handle music in a symbolic way, using mental images instead of sounds. Mental images, further, are not constrained by the
material aspects of the environment. They transcend time-bound reactivity and allow an internalization of mental operations in a kind of symbolic play. As such they call forth internal dialogues which are characterized by plasticity and reversibility of the operations.

Musical creativity is related primarily to this approach. It is characterized by modelling behaviour that substitutes anticipatory and reproductive behaviour for conservatory behaviour, allowing the brain to act as a simulator rather than as a reactive machinery (Reybrouck 2001b). As such it does not merely cope the solicitations of the sonic environment. It allows us to change the semantic relations with the world. What we perceive and what we act upon is not causally related in a stimulus-reaction chain. Rather than thinking in terms of lock-and-key with wired-in and closed programs of behaviour, we can stress the role of our subjectivity and our intentionality which determine the perceptual and functional triggers of the environment. What matters, then, is not the sounding environment as objectified but the environment as we construct it through functional relations.

As such it is possible to build an internal model of our sonic environment, which is not constrained by mappings between internal and external worlds. Creativity transcends the veridicality of perception and shapes our world. As such it goes beyond the ecological claims of realism and direct perception without the mind intervening in this process. What is meant is a kind of semiotization of the sonic world which allows us to maintain epistemic contact with the environment, not in terms of genetic adaptations but in terms of epistemic autonomy.

This higher-level processing, however, has its shortcomings. It uses signs instead of sounds, allowing us to manipulate and process them in a symbolic way. This calls for economy of abstraction rather than the subtleties of experience. It gives up auditory perception that stresses the acoustic properties of the sound, and substitutes a discrete-symbolic way of encoding for an analog-continuous way of coping with the sound.

Musical creativity and the representational format

The tension between the bottom-up and top-down approach bears upon the representational format of music cognition. Is music cognition autonomous or peripherally connected? Can we have music knowledge in the absence of sensory stimulation or must we rely on perceptual bonding? What is the role of imagery and representation, and what is the position of musical creativity in this?

Much depends on the definition of creativity. Is creativity a kind of productive behaviour which creates ‘ex nihilo’ or is it merely the elaboration and permutation of represented things? And what is the modality of the represented things? We can deal, in fact,
with actual and virtual sounds, which allow us to distinguish between presentation and representation. It calls forth perception, memory and imagery, not as isolated, but in a kind of dynamical and dialectical relationship. The role of imagery is of primary importance here. It provides the connecting structure which brings together the discrete successions of unfolding through time.

Creativity, as we see it, is concerned with the generative, rather than with the representational aspect of cognitive events. Iconic representation, in general, is the root of inflexibility of thought. Flexibility requires plasticity and reversibility of the operations, and this is possible only if we transcend the material aspects of the sensory ‘realia’ and the inexorable character of the articulation through time.

Imagery, further, can be largely autonomous, but it can be co-perceptual as well, depending on the information structure of the cognitive events. It is the old distinction between realism and nominalism. Are we concerned with real sounding things (‘realia’) or only with their symbolic counterparts (‘nomina’)? We believe that a mixed approach can be very fruitful as musical creativity deals with sounding material as well as with their encompassing structure. As such there are two major questions which are related to the what and how. What is represented and how is it represented? As to the former, we can think in terms of elements and relations. We can conceive of sonorous events or a framework for events, of temporal and metrical grids, of aspects of rhythm and meter, melodic envelopes, frames and tension building chains, and, more general, of open places or slots to be filled in.

As to the latter there are several representational formats. There is, first of all, the imaginary or propositionalist account, somewhat analogous to the discrete or analogous way of encoding. Further possibilities are the grain size of representation (atomistic or molar), the time window on representation (discrete particulars vs. relational continuity), the synoptic/simultaneous overview vs. successive/sequential scanning of the events, and finally, the representation in time or outside of time. The questions are numerous, the answers are not clear.
The concept of creativity: a formal and operational approach

As we have stated already, the concept of musical creativity is often ill-defined. Most definitions are intuitive rather than operational. In order to solve this problem we intend to offer some formal and operational tools which can be helpful in providing the very needed descriptive and explanatory vocabulary.

Our starting point is the control system and the epistemic rule system of Anochin (1978) which considers the human being to be a combination of several automatons. Besides the perceptual (homo sapiens) and the effector automaton (homo faber), the human being also is a playing automaton (homo ludens) which performs internal computations in a kind of symbolic play. The whole concept involves a kind of circularity between input and output and can be described in terms of functional cycles and in cybernetic terms. It is possible, however, to treat each moment of the rule system in isolation, and to relate it to the concept of creativity. We see two major distinctions here: the interaction with the environment (input and output) and the internal computations.

The former involves sensory and motor interfaces which we can take for granted but which we can change as well. The possibility of making new distinctions and to perform new actions increases our perceptual and behavioural repertoires, which, in turn, modify our creative behaviour. The role of central processing and internal representation must be considered here, as they influence the way we perceive or act upon our environment. Or to put in more operational terms: our stored data bases and cognitive routines influence our interactions with the outer world, as is clear from AI-applications such as expert systems and intelligent systems.

The role of internal computations is more appealing. What is of primary concern here is the symbolic play with elements, relations and operations. The elements can be numerous and of different format. The relations and operations are finite. We can lean upon the empirical findings of developmental psychology, with its distinction between concrete operations which are perceptual and formal operations, which involve symbolic computations. But there is also the whole repertoire of formal and logicomathematical operations such as combinations, permutations and transformations. We consider it important to conceive of musical creativity not only in terms of mechanical procedures (algorithms), but to include heuristics and aspects of problem solving as well, as in divergent and productive thinking.

Musical creativity can rely on these procedures. Especially the combination of concrete and formal operations seems to be fruitful for future research. Formal operations transcend the inexorable character of unfolding through time. As such they are not constrained by the material aspects of perception. They allow a formalization in terms of algebraic structure or...
Mathematical groups, as belonging to the class of algebraic structures, are essentially collections of finitary operations on a set. As logico-mathematical structures they allow the possibility of returning to the starting point (inverse operation) and of obtaining the same goal by different ways (associativity). As such the structure of group is an instrument of coherence which allows an internal regulation (Piaget 1968). The concept of *groupement*, on the contrary, is a mathematical structure which is less elaborate. It refers to the concrete operations as illustrated by the logic of the child (Piaget, 1949) with actions which are coordinated sufficiently to be conceived as an encompassing structure. The operations, however, are concrete as they are fulfilled in the presence of the concrete material, and this makes the difference with the mathematical concept of group.
References


