# The informed performer : towards a bio-culturally informed performers' practice

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# Chapter 11: In a state of overload

Opening the borders of musical practice to extra-disciplinary fields of information can be a powerful way to increase and challenge our cognitive capacity by suggesting new points of reference and of departure. Yet, "while opened borders may increase our ability to dream, they can also overwhelm us with a deluge of information and experience that we are unaccustomed to processing" (Gregory, 2005, p. 21). We already interposed 'Image' and 'personal theory' as mediating buffers and guiding instruments between the galaxy of information and concrete actions; in the previous chapter, another facilitative element of negotiation was added by proposing to situate music-making in a consilient, bio-cultural framework. But even with these filters in place, querying the information galaxy will still result in a bombardment of input which presents itself as a huge interpretative, integrative and selective challenge. Every unit of information is encircled by a certain context of discovery, critique, justification, interpretation and application; add to that cocktail the proliferation of specialized languages, sub-disciplines and research-niches and one can easily lose track in overambitious expectations, naïve conclusions and an incohesive and randomly selected knowledge-base. Informing practice requires, next to an awareness about the role and potential impact of information, also coordinated, systematic and pragmatic action.

In Chapter 4, where a generic perspective on information behaviour was presented, we came across the notion of 'information systems' which act as filters between an abundant galaxy of information and a limited human info-digestive capacity. In this Chapter 11, the contours of a discipline-specific information system for music performers will be presented. The requirements of such a system are multiple; what we have in mind at the outset of this endeavour is an information system that

1. does not limit itself to be merely being receptive to information (assimilation) but is also generative in directing inquiry to pragmatic and imaginative solutions both in terms of beliefs (accommodation)[330] and changed situations;
2. operates within an action-oriented (and not work-focused) bio-cultural framework by identifying basic human (musical) capacities that have referents both in the personal theories of musicians as well as in *academia*, and that hold the potential to function as integrated attractors in a field of abundant information (Chapter 10);
3. is systematic, holistic, processual and intra-relational, facilitating the practice-specific interaction of information of previously unrelated facts (see the notion of 'consilience' – the 'jumping together' of isolated facts) (Chapter 10).

[330] We refer to Piaget's terminology here: in a process of adaption, 'assimilation' occurs when a new idea fits in with the already existing ideas while 'accommodation' implies that new information changes the already existing structures and ideas (see Chapter 4).

## 11.1 Generic perspectives: ontologies, topic modelling and boundary objects[331]

The task of streamlining a potential information overload into a proficient information base is a daunting challenge that is, evidently and fortunately, not unique to the context of score-based performers. We review three generic frameworks that address the challenges intrinsic to an information society.

### *11.1.1 IT-based ontologies*

The term 'ontology' has a longstanding pedigree in philosophy as a branch of metaphysics that concerns itself with 'what exists' (Blackburn, 1996). In the context of Artificial Intelligence, however, an ontology defines "a set of representational primitives with which to model a domain of knowledge or discourse. The representational primitives are typically classes (or sets), attributes (or properties), and relationships (or relations among class members)" (Gruber, 2009, p. 1963); an ontology is an "abstract, simplified view of the world that we wish to represent for some purpose" (Gruber, 1995, p. 908) that, once it is linked to a set of individual instances of classes, allows the instantiation of a systematic knowledge base. In fact, ontologies are no more than an explicit specification of the kind of conceptualizations that every knowledge system or agent of such a system is committed to, either explicitly or implicitly (see personal theory); the primary aim is to reach an agreement about a shared formal and explicit account of a domain of discourse and the concepts and relationships that are part of it. Since the stakeholders committed to a common ontology may use different representation languages and systems[332], the main challenge involved in such an operation is related to elements referred to as *translation*, *reusabilility*, *shareability*, *interoperability*, *portability*, and *genericity*; features that distinguish 'ontologies' from the more familiar 'data models' which are limited to representing "the structure and integrity of the data elements of the in principle single specific enterprise application(s) by which it will be used" (Spyns, Meersman, & Jarrar, 2002). The key-aspect of ontology-engineering then is concerned with making representational choices that capture the relevant distinctions of a domain at the highest, shareable level of abstraction while still being as clear as possible about the meanings of terms.

To make things more tangible, consider the example plotted in Fig. 11.1 which instantiates in a basic manner the main aspects of ontology-design.[333] Within the 'domain' of 'score-based performers', three 'classes' are considered: 'training institutions', 'repertoire', and 'instrumentalists'; the two latter classes could, for instance, be divided in the subclasses 'Beethoven compositions' and 'pianists'

[331] With special thanks to senior ontology designer Mariana Casella dos Santos for the discussion on this topic and the verification of contents of the text.

[332] See for instance the use of parallel languages in the humanities (Bernstein, 1999).

[333] The example is informed by Noy & McGuiness (2001).

respectively. The ‘Beethoven piano concerti’ are an instance of the subclass ‘Beethoven compositions’, ‘Murray Perahia’ is an ‘instance’ of the sub-class ‘pianists’, ‘Mannes college’ is an ‘instance’ of the class ‘training institutions’. ‘Attributes’ (also called ‘slots’) describe properties of classes or instances: Murray Perahia ‘recorded’ all Beethoven piano-concerti and ‘studied at’ Mannes College. The pianist in this example is now described by two attributes: the attribute ‘recorded repertoire’ with the value ‘Beethoven Concerti’ and the attribute ‘professional training in music’ with the value ‘Mannes College’ but this can easily be extended to classes such as ‘students’, ‘published books’.

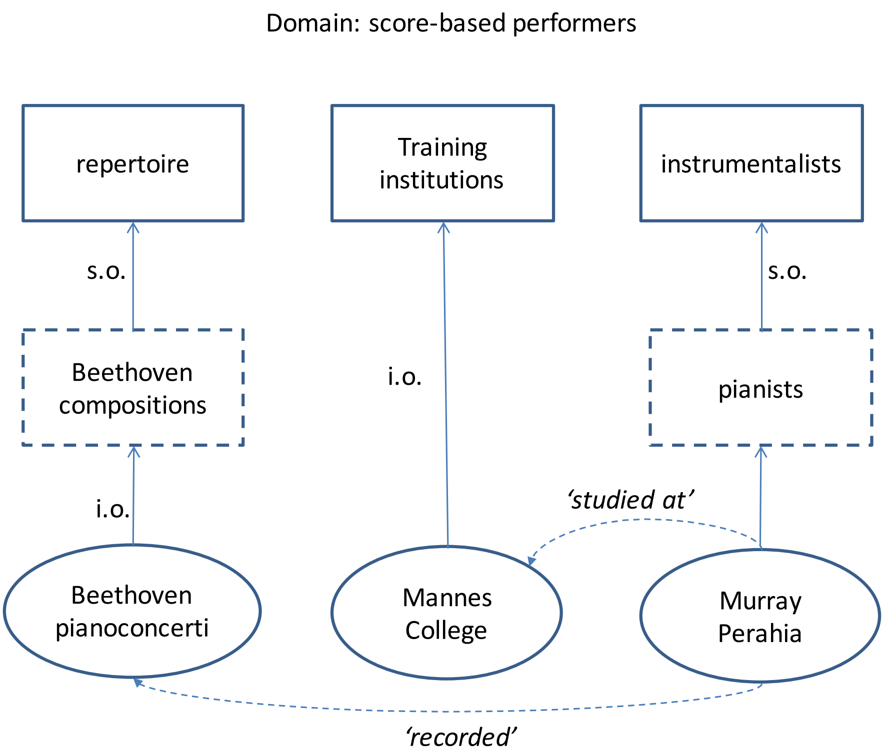


Figure 11.1. Ontology (example): some classes, instances, and relations implicated in the domain ‘score-based performers’. Classes are indicated by a square frame, subclasses by a square frame with a dotted line, ‘instances’ are marked within elliptical nodes. ‘i.o.’ means ‘instance of’, ‘s.o.’ means ‘subclass of’, the attributes or slots are presented in italics and by a dotted/curved line.

From this example, the inherent complexities become apparent related to ontology-engineering: How to determine and choose between a manageable quantity of classes and subclasses? Which labels to use for the various elements and relations? How to distinguish between subclasses and instances? Which slots to include? Uschold & Gruninger (1996, p. 107) propose three approaches in constructing class hierarchies and relational dependencies:

1. A top-down development process which starts with the definition of the most general concepts in the domain and subsequent specialization of the concepts.
2. A bottom-up development process which starts with the definition of the most specific classes, the leaves of the hierarchy, with subsequent grouping of these classes into more general

concepts.

3. A hybrid, middle-out approach which is a combination of the top-down and bottom-up approaches; that is, define the most fundamental terms in each work area before moving on to more abstract and more specific terms within a work area.

Ontology scientists Natalya Noy and Deborah McGuiness (Noy & McGuiness, 2001) further suggest three generic rules of thumb:

1. There is no one correct way to model a domain – there are always viable alternatives. The best solution almost always depends on the application that you have in mind and the extensions that you anticipate.
2. Ontology development is necessarily an iterative process.
3. Concepts in the ontology should be close to objects (physical or logical) and relationships in your domain of interest. These are most likely to be nouns (objects) or verbs (relationships) in sentences that describe your domain.

Once ontologies reach the status of an operational form, they can be used for different purposes: 1/ as a common vocabulary for communication among distributed agents; 2/ as a conceptual schema of a relational data-base; 3/ as backbone information for a user of a certain knowledge base; as a tool for answering competence questions; or 4/ in standardizing domain terminology (Mizoguchi & Ikeda, 1998). In a recent paper, choreographer and dancer Annabel Clarance outlines the project of creating an ontology for dancers.

> The function of the ontology would be thesaural, allowing dance scholars and enthusiasts to quickly link multiplicitous synonyms as a springboard for more well-informed inquiry. The ontology would be able to encapsulate and document a singular dance event simultaneously from multiple social and cultural perspectives. The ability to represent […] one event as both singular and as an array of elements is an aspect of scholarship that is as yet unrepresented in dance scholarship. Additionally, the ontology would allow for a quantitative analysis of dance patterns and correlations may lead to a specific and detailed understanding of unifying systems of dance. (Clarance, 2015, p. 90)

However – and probably due to the complexity of the area – the actual development of IT-based ontologies in the arts is yet to ignite.

### *11.1.2 Topic modelling*

Topic models are a new class of text analysis methods which provide an automated, algorithm-driven, and bottom-up procedure for coding the content of a corpus of texts (usually very large corpora) into a set of substantively meaningful coding categories called 'topics' (Mohr & Bogdanov, 2013, p. 546). Rather than starting with basic categories of meaning (as in ontology-engineering), the topic modeller starts off by specifying the number of topics for the algorithm to find. The program then identifies that specified number of topics and returns the probabilities of words being used in a topic, as well as an accounting of the distribution of those topics across the corpus of texts:

> Each document is treated as if it were a so-called ‘bag of words’. The goals of a topic model analysis are then to analyse these various word bags, to identify word co- occurrence patterns across the corpus of bags, and then to use these to produce a mapping of the distribution of words into the topics and of the topics into the bags. (Mohr & Bogdanov, 2013, p. 547)

The ‘bag of words’-assumption which disregards the order of words within a text poses the main challenge for topic-modellers; discarding all the critical information that encircles these words can easily lead to a severely deficient analysis of meaning. Topic models are indeed weak representations of natural language semantics and the extracted topics are often difficult to interpret due to incoherence and lack of background context and any grounded semantics. The inherent consequence is that in topic modelling well-informed hermeneutic work is still required in order to read and to interpret the meanings that operate within a textual corpus. Within a context of facilitating these processes of interpretation, attempts have been made to link topic-modelling to ontologies which contribute to meaningfully labelling the topics (Allahyari & Kochut, 2015), or to use existing knowledge bases as background (Hu, Luo, Sachan, Xing, & Nie, 2016).

### *11.1.3 Trans-disciplinary boundary objects*

Both ontologies and topic modelling systems are functional instruments primarily used for determining a conceptual or topical space within a particular domain of interest. The project of a bio-cultural informed performers practice, however, requires more than that. The inherent connection of practice with a broad array of extra-disciplinary fields necessitates trading zones which transcend domain boundaries. Unlike ‘multi-disciplinarity’ which draws on knowledge from different disciplines which each stay within their boundaries, or ‘inter-disciplinarity’ which analyses, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole, the concept and practice of ‘trans-disciplinarity’ integrates the natural, social and health sciences and transcends their traditional boundaries (Choi & Pak, 2006, p. 359).

Science and Technology Policy Researcher Michael Gibbons and his colleagues (Gibbons, 1994; Nowotny, Scott, & Gibbons, 2003) consider the production of disciplinary-based knowledge (mode 1) outdated and limiting and therefore advocate a (new) mode of knowledge production (mode 2) which transgresses disciplinary boundaries and promote contextual, problem oriented research that occurs at the site of application.

> [Mode 2 knowledge production] uses a range of theoretical perspectives and practical methodologies to solve problems. But unlike interdisciplinary or multidisciplinary knowledge production, transdisciplinary knowledge production is not necessarily derived from existing

> disciplines, nor does it always contribute to the formation of new disciplines. The creative act lies just as much in the capacity to mobilize and manage these perspectives and methodologies (their external orchestration so to speak) as in the development of new theories or conceptualizations or the refinement of research methods. (Nowotny, Scott, & Gibbons, 2003, p. 186)

Gibbons realises that interaction between disciplinary communities is not a new thing but observes that advances in information and communication technologies have now made these interactions unconstrained, instantaneous and free-for-all leading to a situation in which research communities have open frontiers allowing for a new dialogical research game (Gibbons, 2008, p. 2).

Within that context, 'boundary objects' are defined as the common objects or purpose that bring researchers from a variety of disciplines, and other stakeholders together, it is an object of shared interest that transcends the boundaries of academic and practical disciplines and allows experts and others, with their respective social and cultural backgrounds, "to interact effectively in transforming an issue or problem into a set of common activities" (Gibbons, 2008, p. 2). More concretely, boundary objects:

- refer to concepts or ideas that refer to scientific objects that both inhabit several intersecting social worlds and satisfy the informational requirements of each of them;
- are plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites;
- are weakly structured in common use and strongly structured in individual site use;
- have different meanings in different social worlds but have a structure common enough to more than one world to make them recognizable, a means of translation (Gibbons, 2008, p. 4–5).

Boundary objects are thus abstract or physical artefacts that exist in the liminal spaces between adjacent communities of people (Huvila, Anderson, Jansen, McKenzie, & Worrall, 2017). They are intersecting, plastic, adaptive, open (weakly structured), recognizable, and translatable and could well be the kind of building blocks needed for achieving a Bio-Culturally informed Performers' Practice.

## 11.2 Identifying boundary objects in score-based performership

The generic perspectives brought up above indicate the urgency with which our society is concerned with finding new *modi operandi* for managing information overload and for maximizing the benefits that can be drawn from cooperation and the sharing of information. The dominant strategy is one of extending common sense, personal theories, and implicit understanding into more systematic and ICT-driven tools that allow a pragmatic and shareable engagement with a wide spectrum of information. Considering the top-down relational logic of ontologies, the probabilistic bottom-up approach in topic modelling, and the notion of 'boundary objects', we will, in the remainder of this chapter present the contours of a proto-typical, conceptual information system for musical performers. It is called a *supra-disciplinary topical attractor model* of musical performership with a view to differentiate it from the IT-supported systems mentioned above.

By identifying and modelling basic human musical capacities that have referents both in the personal theories of musicians as well as in *academia* and hold the potential to function as integrated attractors in a field of abundant and chaotic information, a final operational step is proposed in the development of a framework for a *bio-culturally informed performership*. The methodology leading to the formulation of a first prototype of such a shared model of transdisciplinary boundary objects has been twofold: bottom-up and top-down.

### *11.2.1 Bottom-up strategy*

Within the context of our enquiry, a bottom-up and discovery-led approach gave rise to three source-documents.

The first is a *personal, semi-structured database* (excel-format) consisting of over 7000 informational units (articles, review, monographs, podcasts, handbooks, dictionaries, encyclopaedia). Since 2005, such a personal database has been set up by the author and maintained responding in a very general and broad-spectrum way to practical and meta-practical questions from the piano-studio – practice-room, teaching-room, rehearsal-room, stage (see Appendix 13). Whereas the database started off as an annotated bibliographic tool, at around 3000 entries certain 'topics' emerged as attractors in a chaos of information[334] and seemed to be able to cover a wide range of practice-related concerns (see Fig. 11.2).

[334] The term 'attractor' already figured in our treatment of the Information Age. As it was also mentioned there, it is borrowed from dynamic systems and chaos theory but used here in a generic and non-technical way. The technical definition of an attractor is "an equilibrium state (or collection of states) to which a system evolves over time. When the system gets close enough to an attractor, it will remain close even if slightly perturbed. A system may have multiple attractors, each with its own region of attraction" (Clapham & Nicholson, 2014). and a top-down enquiry countered the former by analysing, comparing and looking for convergences between several models of performance employed in psychology, sociology, philosophy, neurology and artistic practice.

| |
|---|
| Disposition, belief, knowledge (tacit, explicit, procedural, etc.), practice, talent, nature-nurture, biology-culture, evolution, universals, origins, development, identity, motivation, attention, focus (regulatory), habit, emotion, anxiety, intention, expression, perception (listening, seeing, reading), Gestalt, sensation, stimulus, cognition, mind, brain, musical text, interpretation, imagination, improvisation, fantasy, creativity, gesture, motion, movement, behaviour, action, anatomy, bio-mechanics, bio-dynamics, technique, craft, performance, learning (implicit, situational, explicit, sensory-motor), education (formal-informal), experience, method, feedback, expertise, skill, memory, automaticity, flow, (sub)consciousness, body, embodiment, communication (coded, non-verbal), inter- and co-subjectivity, pleasure, interaction, resonance, entrainment, mimesis, metaphor, narrativity, plot, expectation, meaning, form, habitat, scene analysis, affordances, information, research art, music. |

Figure 11.2. Topics emerging from the personal database of a pianist and teacher.

A second, more content-oriented element of a bottom-up strategy concerned the step-wise generation of a *personal encyclopaedia* (in word-format) which contains references to terms, people, opinion leaders, schools of thought, disciplinary fields, books, journals, quotations and audio-visual material.

Finally, a disciplinary compass has been created by means of sketching disciplinary knowledge maps that focus on the fields of philosophy, musicology and psychology with their subfield such as systematic musicology, behaviourist and cognitive psychology (see Appendix 14).

### *11.2.2 Top-down approach*

Accompanying the three-way bottom-up strategy, a top-down approach was instantiated by means of analysing models of performance employed in psychology, sociology, philosophy, neurology and artistic practice. This second stream of enquiry was primarily directed at locating suitable labels as well as to apply a systematic and relation logic to the various topics. From our considerations in the previous chapter on a processual bio-cultural perspective on music, already two central aspects could be inferred: music implies next to action also an interactive dimension (see Cross in 10.2.3).

Below a brief excursus is presented into basic and more specific approaches to both domains, with a view to collect elements that can converge into the identification of trans-disciplinary boundary objects.

#### *11.2.2.1 Action models*

a) Classic models of human behaviour and cognition

Modelling human behaviour in terms of movement is a recurring theme in the epistemic history of humankind and develops into three influential models in the twentieth century.

Behaviourism refers to a psychological orientation which emphasises scientific and objective methods of investigation. Behaviourism's scientific perspective implies that theories need to be supported by empirical data obtained through careful and controlled observation and measurement of observable behaviour. Because of their latent existence internal events like consciousness, thinking and emotion are not part of the behaviourist target domain. The basic assumptions are summarized by psychologist John B. Watson in 1913:

> The psychology which I should attempt to build up would take as a starting point, first, the observable fact that organisms, man and animal alike, do adjust themselves to their environment by means of hereditary and habit equipments. […]; secondly, that certain stimuli lead the organisms to make the responses. (Watson, 1913, p. 167)

All behaviour, no matter how complex, can be reduced to a simple stimulus–response association which is then subjected to habit-formation via conditioning procedures.[335]

> Under the influence of the outside conditions that form human nature, instincts and capacities grow into an almost countless multitude of habits of thought, feeling and action. On the basis of our many unlearned tendencies, we learn still more numerous acts and ideas. To original equipment is added the store of knowledge and skill we acquire. (Thorndike, 1905, p. 199)

Dissatisfied with the behaviourist approach in its simple emphasis on external behaviour rather than internal processes, cognitive psychology developed a research framework that focuses on the scientific study of the mind as an information processor. Unlike behaviourists, cognitive psychologists use experimental methods to build up cognitive models of the processing that goes on inside people's minds, including perception, attention, language, memory, thinking and consciousness.

Within the framework of cognitive theory, the introduction of feedback-loops constitutes a third model. Psychologist Jack A. Adams proposes the theory of closed-loops in the early seventies (Adams, 1971) and links it to two key neural components: a memory trace, which selects and initiates an

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[335] Classical conditioning (also known as Pavlovian conditioning) refers to a learning procedure in which a biologically stimulus (e.g. food) is paired with a previously neutral stimulus (e.g. a bell). Operant conditioning is a type of learning in which the potency of a behaviour is modified by the behaviour's consequences, such as reward or punishment. In this context Edward Thorndike formulated the law of effect and habit: "The line of least resistance is, other things being equal, that resulting in the greatest satisfaction to the animal; and the line of least resistance is, other things being equal, that oftenest traversed by the nervous impulse. We may call (1) the Law of Effect, and (2) the Law of Habit" (Thorndike, 1905, p. 166).

appropriate response; and a perceptual trace, which acts as a record of the movement made over many practices. During and after an attempt of the movement, feedback and knowledge of results enables the performer to compare the movement with the perceptual trace. The trace acts as a reference of correctness so that appropriate error adjustments can be made for subsequent attempts of the movement( see also: Schmidt & Lee, 2011, pp. 136, 438).

The essential components of the three models are represented in Fig. 11.3 and their impact on the scholarship related to musical performance is manifest in the generative performance model that music-psychologist Eric Clarke proposes by the end of the twentieth century (Clarke, 1993, p. 209, 1995, p. 112). Fig. 11.4 indicates how Clarke integrates the elements present in the classic models: information (notation or sound) is introduced to the system which parses the input into a structural representation which contains specific, punctual elements but also factors such as style[336]; from the structural model a motor program is activated which undergoes further expressive specification via an expressive motor program; finally, a timing-mechanism (clock) supplies information with regard to time and feeds back into the structural representation.

Models such as Clarke's do not pretend that all these structures have an actual place in the human brain, these models have the primary goal of offering a framework that can serve as a background for more punctual experiments and for understanding, predicting and possibly controlling certain behaviours.

[336] In other publications, Clarke typically represents this structure as an inverted tree diagram, especially in the case where the input has been fully memorized (Clarke, 2001, p. 3).

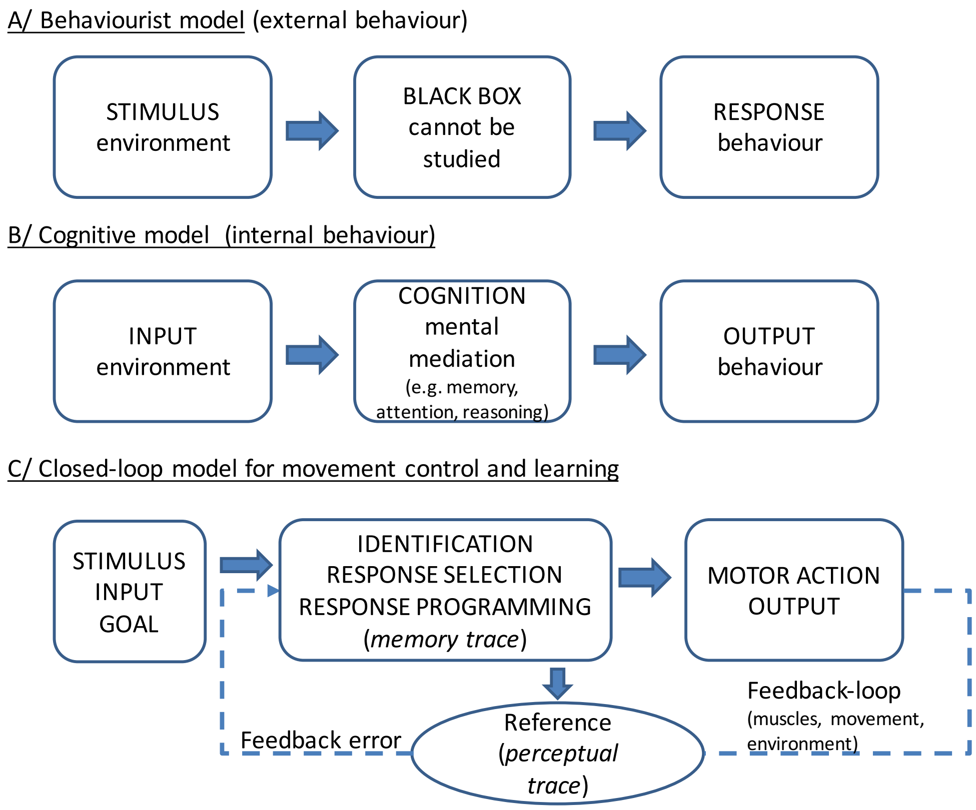


Figure 11.3. Summarizing 20th century models in motor behaviour and learning.

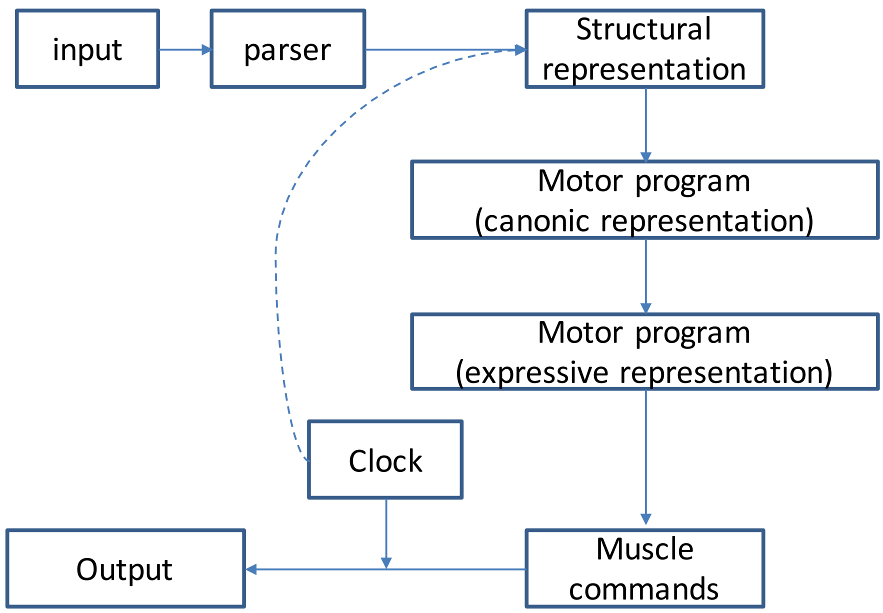


Figure 11.4. A generative musical performance model
(adapted from Clarke, 1993, p. 209, 1995, p. 112).

b) Emotions

The classic models plotted are very general in their field of application; a first 'add-on' that is pertinent in order to close the gap between the generality of classic behavioural models and the ecological reality of musical action is to stipulate the role of emotions.

*On the Motion of Animals* [Gr. Περὶ ζῴων κινήσεως[337]; Lt. *De Motu Animalium*) is one of Aristotle's major texts on biology where he sets out the general principles of animal locomotion. In chapter 5 of the book, Aristotle inquires how the soul [ψυχή] moves the body, and what is the origin of movement in a living creature [Arist.De Motu.700b10]. Aristotle asserts that the living creature is moved by intellect [διάνοιαν], imagination [φαντασίαν], purpose [προαίρεσιν], wish/will [βούλησιν], and appetite [ἐπιθυμίαν]. According to Aristotle all these are reducible to mind [νοῦν] and desire [ὄρεξιν].

> For both imagination and sensation [φαντασία καὶ ἡ αἴσθησις] are on common ground with mind, since all three are faculties of judgement [...]. Will [βούλησις], however, impulse [θυμὸς], and appetite [ἐπιθυμία], are all three forms of desire, while purpose belongs both to intellect and to desire. Therefore the object of desire or of intellect first initiates movement [...]. [Arist.De Motu.700b15-20]. (Aristotle, 1912)

The (implicit) model presented by Aristotle (see Fig. 11.5) is one in which purpose is generated either by the mind (imagination, sensation), or by desire.

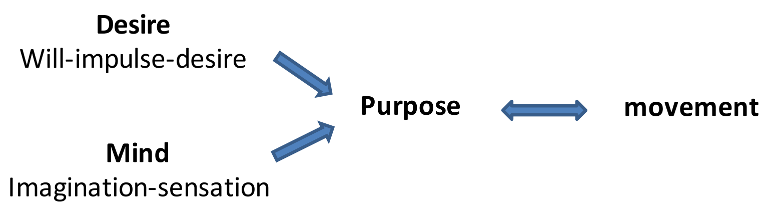


Figure 11.5. Aristotle's action model in *De Motu Animalium.*

Akin to Aristotle, but from a punctual neuro-physiological and -anatomical point of view, neurophysiologist Gert Holstege proposes the concept of a specific set of parallel motor pathways, governing somatic, autonomic, and endocrine motor responses. Holstege's parallelism is informed by pathologies where patients with lesions of voluntary motor control systems nevertheless maintain normal facial motor control during emotional display. To model such phenomena Holstege asserts an

[337] For the text in Greek see https://el.wikisource.org/wiki/Περί_ζώων_κινήσεως.

emotional motor system next to a voluntary one. Each of these systems have direct and indirect (via interneurons[338]) access to the motor neurons[339] that instigate movement.

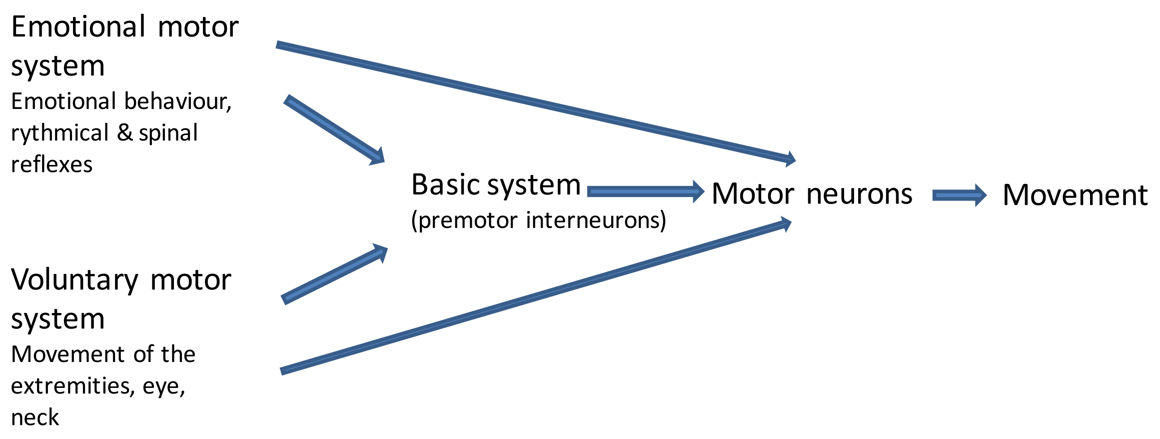


Figure 11.6. Holstege's model of a dual motor system (Holstege, 1992).

Both Aristotle's and Holstege's contribution offer a generic framework for experience-based observations such as the one's in *Freeing the Caged Bird: Developing Well-Coordinated, Injury-Preventive Piano Technique* (Lister-Sink, 1996) where unlocking the motor system from unwanted and acquired interferences is a crucial element.

c) Dual process theories – attention and automaticity

The idea of dual processing – by means of an emotional and voluntary motor system – can be further extended by postulating two archetypical processing modes that operate in forming judgements, solving problems, or making decisions and evolve around the factors attention and automaticity. The first system involves a quick and easy processing mode based on effort-conserving heuristics, the second concerns a slow and rule-based processing mode based on effort-consuming systematic reasoning. The first type of process evolved early in the course of human evolution, does not require working memory, is contextualized and often unconscious, and tends to involve automatic processing. The second type is an element of the 'new' mind, works decoupled and abstract, is invariably conscious and usually requires attention and working memory (Evans & Stanovich, 2013, p. 225).

[338] "a neuron in the central nervous system that acts as a link between the different neurons in a reflex arc. It usually possesses numerous branching processes (dendrites) that make possible extensive and complex circuits and pathways within the brain and spinal cord" (Martin, 2015).
[339] "one of the units (neurons) that goes to make up the nerve pathway between the brain and an effector organ, such as a skeletal muscle. An upper motor neuron has a cell body in the brain and an axon that extends into the spinal cord, where it ends in synapses. It is thus entirely within the central nervous system. A lower motor neuron, on the other hand, has a cell body in the spinal cord or brainstem and an axon that extends outwards in a cranial or spinal motor nerve to reach an effector" (Martin, 2015).

The foundations of dual process theory are seminally present in James' *Principles of Psychology* where he advances the idea two different kinds of thinking: associative and true reasoning.

> There are two stages in reasoned thought, one where similarity merely operates to call up cognate thoughts, and another farther stage, where the bond of identity between the cognate thoughts is noticed; so minds of genius may be divided into two main sorts, those who notice the bond and those who merely obey it. The first are the abstract reasoners, properly so called, the men of science, and philosophers – the analysts, in a word; the latter are the poets, the critics – the artists, in a word, the men of intuitions. These judge rightly, classify cases, characterize them by the most striking analogic epithets, but go no further. (James, 1890, vol. 2, p.361)

Psychologist Jonathan Evans' dual process theory from 1984 also suggests a two-stage theory and draws a distinction between heuristic processes which select items of task information as 'relevant', and analytic processes which operate on the selected items to generate inferences or judgements (Evans, 1984). Psychologist Daniel Kahneman, more recently, further differentiates between effortless intuition and deliberate reasoning. Intuition (or system 1), like associative reasoning, is determined to be fast and automatic, usually with strong emotional bonds included in the reasoning process; it is a kind of reasoning based on formed habits and very difficult to change or manipulate. Reasoning (or system 2) is slower and much more volatile, being subject to conscious judgments and attitudes (Kahneman, 2003, 2011).

The framework of dual processes transcends the traditional behaviourist and cognitive models by inherently involving references to powerful categories such as intuition (Atkinson & Claxton, 2000), attention (Pashler, 2004), habits (James, 1890, bk. 1, chapter 4), consciousness (Bargh & Morsella, 2008) and learning.

In motor control and learning studies the duality of the two systems is overcome by assuming a three-stage model of skill acquisition. During the initial, cognitive stage of motor learning (also called the verbal-motor stage), the goal is to develop an overall understanding of the skill. The learner must determine what the objective of the skill is and begin to process environmental factors that will affect their ability to produce the skill. The teacher provides an optimal environment for learning and the learner mostly relies on visual input and trial and error to guide learning. During the associative stage (also known as the motor stage), the learner begins to demonstrate a more refined movement through practice and moves from the 'what to do' in the first stage to the 'how to do it'. Here, the focus is more on proprioception than on visual cues. The more practice, the more proprioceptive input the learner receives to aid learning. During the final autonomous stage of learning, the motor skill becomes mostly automatic; the performer has progressed to a level of learning which allows him/her to perform the skill in any environment with very little cognitive involvement compared to the first stage. It is also in this stage that the single-channelled (Schmidt & Lee, 2011, p. 116) and therefore serial route of attention gives way to parallel processing (Schmidt & Lee, 2011, p. 58).

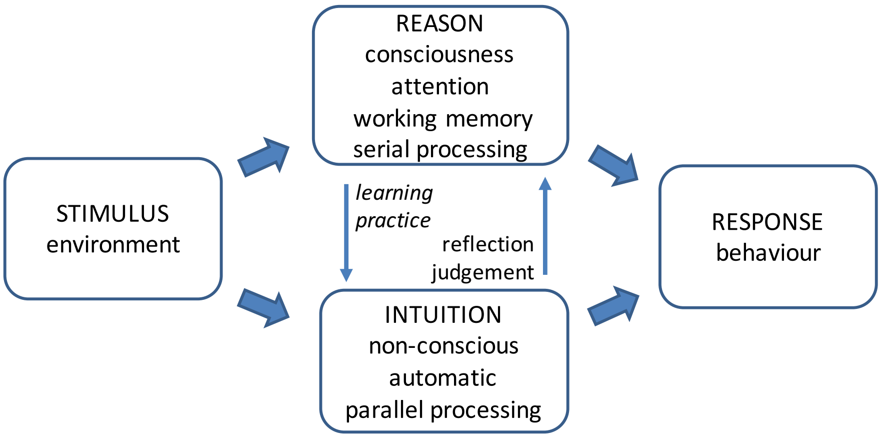


Figure 11.7. Dual process theory.

Dual process theories constitute a conceptual framework for practice-based insights such as present in for instance *The Inner Game of Music* (Green & Gallwey, 1987) where two 'selves' are postulated: *Self 1* is essentially verbal and conscious, the inner voice that interferes in natural behaviour, it contains our concepts about how things should be, our judgements and associations; *Self 2* is the reservoir of potential that contains our natural talents and abilities (Green & Gallwey, 1987, p. 28).

d) Attitudes, beliefs, and intentions

In the frameworks above, modelling starts invariably with a stimulus or more generally, an input component. In the *Theory of Planned Behaviour* psychologist Icek Ajzen aims at measuring behavioural dispositions that predict behaviour and which precede stimuli, intentions and particular circumstances.

> By assessing attitudes or personality traits we attempt to unveil the hidden factors that, as a result of past events, have come to predispose an individual to act in certain ways. (Ajzen, 2005, p. 142)

According to Ajzen, actions are controlled by intentions, but some of these intentions never come to fruition or are revised to fit changing circumstances; the factors that induce people to change their intentions, or prevent successful execution of the behaviour constitute the central focus of Ajzen's research (Ajzen, 1985, p. 11). Fig. 11.8 shows how volitional behaviour can be explained in terms of a limited number of concepts. At the initial level, behaviour is assumed to be determined by intention or the person's subjectively perceived likelihood that he or she will engage in a particular behaviour. At the next level – again according to the theory of planned behaviour – intentions (and the ensuing behaviours) are a function of three basic determinants, one personal in nature, one reflecting social influence, and a third dealing with issues of control. The personal factor constitutes the individual's attitude toward the behaviour – positive or negative – The second determinant of intention is termed 'subjective norm'; it deals with perceived normative prescriptions and concerns the person's perception of social pressure to perform or not perform the behaviour under consideration. Finally, the third determinant of intentions is perceived behavioural control or the ability to perform the behaviour of interest (also known as self-efficacy). In Ajzen's model perceived behavioural control can influence behaviour indirectly, via intentions, or it can also be used to predict behaviour directly.

In a next backward-engineering phase, people's behavioural attitudes and intentions are assumed to follow from their beliefs about performing the behaviour. These beliefs need not be veridical; they may be inaccurate, biased, or even irrational (Ajzen, 2005, p. 126). However, once a set of beliefs is formed it provides the cognitive basis from which attitudes, subjective norms, and perceptions of control – and, ultimately, intentions and behaviours – are assumed to follow in a reasonable and consistent fashion.

Finally, a multitude of variables may be related to or influence the beliefs people hold. Different cultural and social environments lead to the acquisition of differential information about a variety of issues and forms the basis for their beliefs about the consequences of a behaviour, about the normative social expectations, and about the obstacles that may prevent them from performing a behaviour. Similarly, gender, age, and temporary moods can influence the way we perceive things and can therefore affect our behavioural, normative, and control beliefs and, as a distal result, guide our intentions and actions (Ajzen, 2005, p. 134).

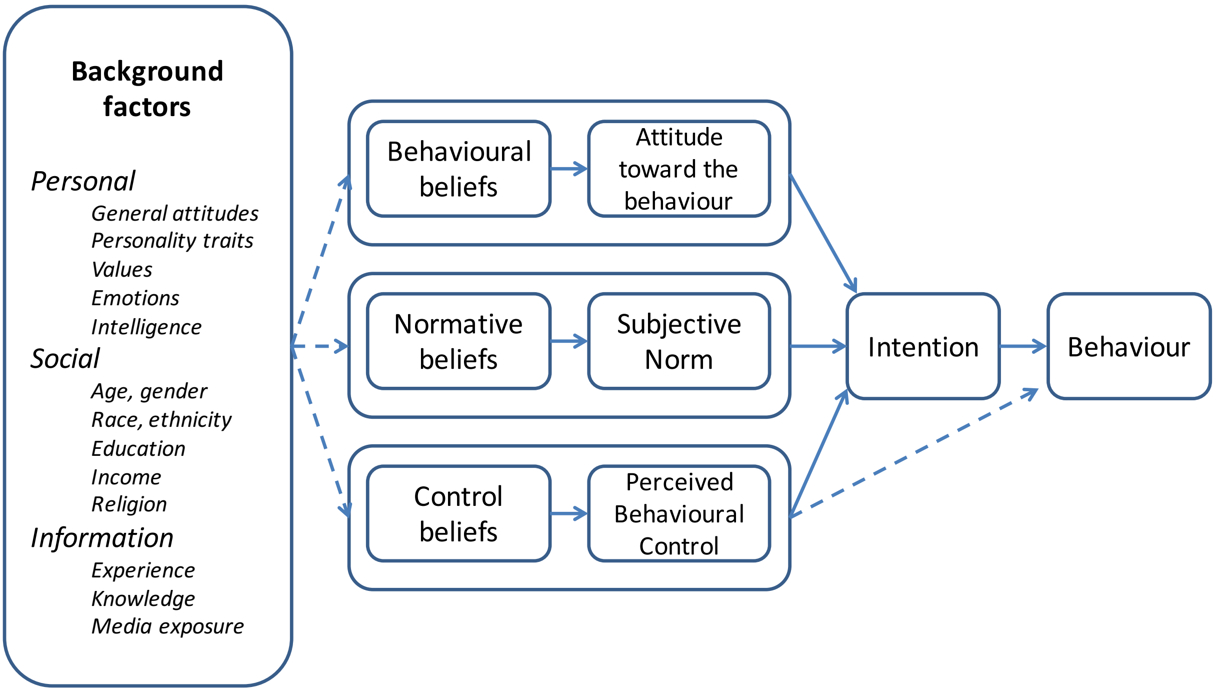


Figure 11.8. Ajzen's model of planned behaviour (Ajzen, 2005, p. 135).

Ajzen's extended behavioural model allows for the inclusion of background information and beliefs in modelling performance. These elements come close to the notion of *Image* that was at the centre of interest in PART I.

e) Relations between brain, body and environment

The unidirectional sequence of events (stimulus -> cognition -> movement), as asserted in the models above, is fundamentally challenged by empirical findings that indicate an intricate interdependency between environment, brain and body. The framework of *embodied cognition* is the most prominent cluster-term to represent the efforts to remodel the classical insights and add to their ecological validity.

> From the classical standpoint, human action is seen as an "output" of a high-level, centralized system that is much like a serial processor and is heavily involved in forming an accurate internal model of the world. To function adaptively within unpredictable environments, such centralized systems require tremendous computational power in order to continually update their internal, amodal model of the world. This error-prone and time-consuming translational process is not required in embodied systems, for information is already residing either in the environment or in mental representations that maintain properties of the sensorimotor states that gave rise to them. (Morsella, 2009, p. 5)

Embodied cognition challenges the classical paradigm based on the dualism as it was put forth by Rene Descartes in the 17th century claiming that the mind is a nonphysical — and therefore, non-spatial — substance entirely different from the body. The viewpoint of embodied cognition covers a vast semantic terrain (Wilson, 2002) but the most common definitions involve the claims that states of the body modify states of the mind (Wilson & Golonka, 2013, p. 1), that cognitive processes are deeply rooted in the body's interactions with the world and that unidirectional information-processing on the basis of representation of external states is an unsatisfactory model of human action. According to the logic of embodied cognition, behaviour emerges from the interaction between a nervous system in a body with particular capabilities on the one hand, and an environment that offers opportunities for behaviour and information about those opportunities on the other.

Embodied cognition has a relatively short history; its intellectual roots date back to early 20th century philosophers such as Heidegger, Merleau-Ponty and Dewey and it has only been studied empirically in the last few decades. In the field of cognitive linguistics, Lakoff and Johnson challenged Chomskyan information processing theory by asserting that semantics arise from the nature of the body and that humans really think metaphorically. Metaphor is considered to be a mostly latent but nevertheless fundamental mechanism of mind that provides more general understanding on the basis of physical and social experiences (Lakoff & Johnson, 1980, 1999).

In the domain of visual perception Gibson's account of vision critically addressed the problem of how to reconstruct a full-blown, three-dimensional world from the information specified in the two-dimensional image on the retina. Gibson asserts that vision does not begin with a static retinal array but with an organism actively moving through a visually rich environment. By his ecological approach to visual perception and by both emphasizing the role of the movement of a perceiver and the integration of that perceiver in a larger, visually rich environment, Gibson is at least a nascent proponent of embodied vision (Gibson, 1979/2015).

Biologist and philosopher Francisco J. Varela, psychologist Eleanor Rosch and philosopher Evan Thompson subsequently introduced the concept of *enaction* to present and develop a framework that places strong emphasis on the idea that the experienced world is portrayed and determined by mutual interactions between the physiology of the organism, its sensorimotor circuit and the environment (Varela, Thompson, & Rosch, 1991).

The idea that cognitive agents bring forth a world by means of the activity of their situated living bodies is also present in philosopher Alva Noë's *Action in Perception* (Noë, 2006) where he argues that the content of perception is not like the content of a picture; the world is not given to consciousness all at once but is gained gradually by active inquiry and exploration: "perceiving is a way of acting. Perception is not something that happens to us, or in us. It is something we do […] The central claim of what I call the enactive approach is that our ability to perceive not only depends on, but is constituted by, our possession of this sort of sensorimotor knowledge" (Noë, 2006, pp. 1–2).

From the perspective of decision making, neurologist Antonio Damasio advances in *Descartes' Error* (1994) the idea that when individuals face complex and conflicting choices, they may be unable to decide using only cognitive processes, which may become overloaded, but rely on emotions and *somatic markers* to guide decision-making. Emotions, as defined by Damasio, are changes in both body and brain states in response to stimuli. Physiological changes (such as muscle tone, heart rate, endocrine activity, posture, facial expression, and so forth) occur in the body and are relayed to the brain where they are transformed into an emotion that tells the individual something about the stimulus that they have encountered. Over time, emotions and their corresponding bodily changes, become associated with particular situations and their past outcomes. When making subsequent decisions, these somatic markers and their evoked emotions are consciously or unconsciously associated with their past outcomes, and influence decision-making in favour of some behaviours instead of others.

Although not strictly pertaining to the tradition of embodied cognition Ronald Friedman et al. report in a 2000 article in the *Journal of Personality and Social Psychology* on the effects of approach and avoidance motor actions on the elements of creative insight (Friedman & Förster, 2000). The authors propose that the non-affective bodily feedback produced by arm flexion and extension informs individuals about the processing requirements of the situation, leading to the adoption of differential processing styles and thereby influencing creativity. More concretely, they found that arm flexion facilitated insight-related processes and that arm extension facilitated analytical reasoning; by this an inverse link was forged between movement and affect, attitude-, and motivation-formation. This sequential relation between body and mind goes back to the *James-Lange Theory of Emotions* which holds that emotions are perceptions of bodily states and reactions which are evoked by perception of exciting situations in the environment[340], and to the *cognitive tuning model* (Schwarz, 1990; Schwarz & Bless, 1991) which essentially proposes that affective states function to inform individuals as to whether their current situations are safe or problematic and bring them in a state in which they will become more or less willing to take risks, adopting a relatively non-effortful, heuristic processing style.

A final element to consider under the heading of brain-body-environment interactions concerns the relation between actions and the effects that they resort in the environment. Action-effect coupling and the *theory of event coding* (Hommel, 2015) is rooted in the ideomotor approaches such as proposed by James (1890), and embraces the idea that human cognition emerges from sensorimotor processing.

> In contrast to behaviouristic or information-processing approaches, ideomotor theory considers humans as active agents that perform actions to reach particular goals. Accordingly, the theoretical analysis does not start with stimuli but with goals (intended action effects),

[340] The *James-Lange Theory* is classically opposed to the *Cannon-Bard Theory* in which it is supposed that emotions give rise to physiological reactions such as fight-flight behaviours.

> which are assumed to trigger the execution of movements suited to reach them. (Hommel, 2015, pp. 1–2)

Experiments have shown that the anticipation of forthcoming action effects can systematically affect response selection (Koch & Kunde, 2002; Kunde, 2001) and that repeated, contingent Action-Effect experiences result in lasting integrated representations of actions and effects (Elsner et al., 2002; Elsner & Hommel, 2001). At stage 1, associations between a motor pattern and its contingent effects are acquired, and repetition of these associations result in action-effect integrations which are bidirectional, that is, the activation of the motor representation will activate the associated representation of its effect, and vice versa. In stage 2, the representations can be employed for goal-directed behaviour: when a person intends to perform an action, there is a foregoing anticipation of the intended action effect, that is, the action goal.

What can be inferred from the elements resorting under the general framework of embodied cognition is that the sequence of events in human behaviour is not (always) unidirectional and stimulus-based, and that a case can be made for reciprocal influences between body-related elements (such as movement, motivation and emotion), cognitive processes and environmental effects. This perspective has gained currency in recent years, especially in circles of systematic musicology (Cox, 2016; Leman, 2008) and implies the inclusion of bidirectional arrows in modelling music performance.

From the overview above the following (boundary) topics and their relations can be inferred in relation to the treatment of action in *academia*:

- The elements that seem to be generically involved in action are: attitude, belief, motivation, emotion, input (environment, stimulus, image, effect), a processor (cognition, imagination), forms of output (behaviour, effect);
- The processes that are set out to connect these elements are linear/serial, parallel, body-first, effect-first, fast-slow, instinct-automatism-attention, learning.

#### *11.2.2.2 Patterns of interaction*

In Chapter 10 we noted that one of the strategies to arrive at an understanding of music as bio-cultural phenomenon is to identify proto-musical behaviours from on phylogenetic (evolutionary) and ontogenetic (developmental) perspective. In order to locate boundary objects in the field of musical interaction and communication we briefly discuss the central tenets and patterns present in these fields of inquiry.

a) Phylogenetic models

A powerful evolutionary framework that is proposed for explaining music in terms of interaction and communication is the *musilanguage*-model in which it is asserted that the structural features shared between music and language are the result of their emergence from a joint evolutionary precursor. In this context music and language are seen as "reciprocal specializations of a dual-natured referential emotive communicative precursor" (Brown, 1999, p. 271) whereby music is considered as a non-referential system of communication that emphasizes sound as emotive meaning and language emphasizes sound as referential meaning, telling us something about the world.[341] In *The Singing Neanderthals* (2005) Mithen explores the central characteristics of this protolanguage by reviewing selected aspects of monkey and ape communications. He comes to the following conclusions and characterizations:

- The vocalizations and gestures of protolanguage lack consistent meanings and are not elements to be connected via a grammatical system. They are composed of messages than words and are therefore <u>holistic.</u>[342]
- Unlike language which implies a referential capacity, proto-linguistic utterances of monkeys and apes are <u>manipulative</u>: "they are trying to generate some form of desired behaviour in another individual" (Mithen, 2005, p. 120).
- A third feature, only applicable to African apes is that their communication systems uses gesture as well as vocalization and is akin to human language <u>multi-modal</u>.
- Finally, some of the communication systems are essentially <u>musical</u> in nature: they make substantial use of melody, rhythm, synchronization and turn-taking.

With these common ingredients of ape communication systems as a point of departure, Mithen proceeds his inquiry by looking for evolutionary elements that contributed to the development of human language and music.

A first step in that direction is the extension and integration in *early hominids* (2 million years ago) of the differential aspects of protolanguage (holistic, manipulative, multi-modal, musical). The circumstances that facilitated such a process can be related to a new life-style in open landscapes and the necessity to create safety by living in larger groups. An increase in group size engenders the growth of social tensions and necessitates an extended emotional repertoire where emotions can be

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[341] The evolutionary schism between language and emotion can also be considered to be an obstacle for GIPP. Music is usually viewed as the language of emotion whereas scholarly inquiry is related to the language of reason. We have shown in PART I that compatibility can be reached in delineating specific functions for each capacity.

[342] Mithen adheres to the view championed by linguist Alison Wray (Wray, 1998, 2000) that language only evolved when holistic utterance were segmented and produced words which could then be composed together to create statements with novel meanings (Mithen, 2005, p. 4). This particular view on language development has it opponents in compositional theories of language which maintain the proto-language consisted primarily of words to which, in a later stage, syntax was added (Bickerton, 2000).

expressed and induced in others. The emotional instrumentarium, consisting of facial expressions, body language, actions and vocalizations that communicate feelings, facilitate appropriate social interactions and trigger the emergence of a *Theory of Mind* (Mithen, 2005, p. 128). It is in this general context of getting acquainted with the inner world of group-members that also mirror neurons develop; these neurons fire both when an animal acts and when the animal observes the same action performed by someone else; hence it can be used for imitating actions and for understanding them, and to use this information to act appropriately (Rizzolatti & Arbib, 1998, p. 119): "the result was a communication system more complex than that found among non-human primates, but one quite different from human language" (Mithen, 2005, p. 138).

The second element of protolanaguage-development is to be situated in *Homo Ergaster* (1.8 million years ago) and the raise of bipedalism. The changes in human mobility had a fundamental impact on the evolution of human musical abilities in terms of the synchronization to an external perceived rhythm (entrainment), emotional resonance, dance, or in short, the automatic movement of the body to music.

> Since this [musical] experience may often begin as a rhythmical stirring of the body, it may be possible for a performer to recapture the right feeling by finding the right movement […]to feel with the body is probably as close as anyone can ever get to resonating with another person. (Blacking, 2000, pp. 110–111)

A third element arises with the dispersal of Early Humans in northern directions. Entering unfamiliar landscapes lays pressure on the need for cooperation and the transmission of vital information to others about new types of animals and plants and new constellations of life-support resources (water, firewood). In the *Origins of the Modern Mind* (Donald, 1991), cognitive neuroscientist Merlin Donald proposes that within this pre-historical context, a system of *mimesis* developed that served as an instrument for communicating information about the environment. Whereas in the preceding culture, which Donald calls 'episodic culture', hominids could only react and point to the 'here and now', *mimesis* allows for representation and reflection. At the basis of this capacity for mimesis or action-metaphor is easy and independent access to voluntary motor memories; without this feature, even simple operations like self-cued rehearsal and refinement of one's own skill are impossible, because the cognitive system remains primarily reactive, designed to react to real-world situations as they occur.

> Mimetic action is basically a talent for using the whole body as a communication device, for translating event perceptions into action. lts underlying modelling principle is perceptual metaphor; thus, it might also be called action-metaphor. It is the most basic human thought-skill, and remains fundamentally independent of our truly linguistic modes of representation. Mimesis is based in a memory system that can rehearse and refine movement voluntarily and

> systematically, guided by a perceptual model of the body in its surrounding environment, and it can store and retrieve the products of that rehearsal. (Donald, 1993, p. 740)

A fourth and final transitionary element, that ultimately leads to the separation between music and language is the development of symbolic behaviour by the *Homo Sapiens* some 200,000 years ago. Mithen links the invention of symbols to the emergence of cognitive fluidity – the capacity to integrate previously separate functional domains (see Chapter 4) – and creativity. Donald situates the capacity for lexical invention in a gradual move from a *mimetic* into a *mythic culture* where stories constitute the collective memory and where the dualism between language and music is effectuated.[343]
Summarizing this evolutionary story that predates the separation between language leads to the identification of seven elements that can be attributed to musilanguage: holistic, manipulative, multi-modal, musical, expressive, entraining, mimetic.

b) Ontogenetic models

Looking into the ontogenetic development of interactive capacities, we encounter a field of expertise that focuses on the equivalent of proto-language in the development of early-stage intersubjectivity and communication in terms of *motherese* or Infant Directed Speech [IDS]. Based on systematic observation (using a spectrograph) and punctual analysis, psychologist Anne Fernald notes that:

> By the time infants develop the prerequisite cognitive skills for interpreting speech sounds as symbols, they have had a long experience responding to the mother's vocalizations as meaningful in other ways. The characteristic melodies of mothers' speech are used to elicit and maintain the infant's attention, to modulate arousal, to communicate emotions, and to facilitate speech segmentation, with a developmental progression from the more general attentional and affective functions in the early months to linguistic functions toward the end of the first year. (Fernald, 1992, p. 279)

The sequence of functions of IDS as presented by Fernald resembles those that we discussed from a phylogenetic perspective. For new-born and very young infants IDS has a non-representational character and is used in a context of attention and affect regulation: rising contours engage attention; bell-shaped contours maintain the infant's attention; and, intense sounds elicit an orienting response. With slightly older infants the functional domain of IDS shifts to the modulation of emotion and arousal: low pitched, falling contours have a soothing effect and rising contours increase the level of arousal. IDS gradually then develops into an instrument that communicates and expresses speaker's feelings and intentions. In all previous interactions the infant simply reacted positively to pleasurable

[343] This view on the development of music and language into separate functional fields can also be linked to the issues that we addressed in PART I with regard to the opposition between the realms of information and imagination: Information tells us in a discursive way something about the world whereas music is about communicating states of mind.

sounds and negatively to unpleasant sounds; the focus was on the intrinsic acoustic properties of the IDS. Now, the melodies and rhythms help the child appreciate the mother's feelings and intentions (Theory of Mind). In a final phase, specific patterns of intonation and pauses facilitate the acquisition of language itself.

A similar sequence of developments is found in psychologist Philippe Rochat's approach to early (social) cognition[344] (Rochat, 1999). Rochat describes three developmental periods which focus on two key transitions by 2 and 9 months of age (see Fig. 11.9 for a summary). At birth and during the first 6 weeks of life (the new-born period), infants show an essentially innate sensitivity to social stimuli and display social attunement; new-borns tap into fundamental environmental resources, and are especially sensitive to people who provide food, care, and the comfort they need to survive. At this initial stage of development, there is no evidence of an explicit awareness of self and others but there is an implicit attunement to others, responding to others in a differentiated way. Here the stance toward people and things in the environment is *attentional*. By the second month a first revolution takes place when infants manifest the first signs of shared experience or *primary intersubjectivity*. This manifestation of reciprocity within a dyadic context (mother/father-child) coincides with the emergence of a novel sense of self as intentional agent in the environment which in turn allows for a *contemplative stance*.

> Six-month-old infants interact dyadically with objects, grasping and manipulating them, and they interact dyadically with other people, expressing emotions back and forth in a turn-taking sequence. (Tomasello, 1999, p. 62)

By the end of the first year (9-month revolution) a new differentiation between the self and others develops when the infant starts to monitor others in relation to others and by this breaks out of a dyadic context in favour of a triadic one:

> Infants start to manifest a sense shared attention to the physical world, coordinating their own perspective and attentional focus on things with the perspective and attentional focus of others. Gestural communication, in particular pointing, joint attention, gaze following, and social referencing are all indexes of secondary intersubjectivity emerging by 9 months. (Rochat, 1999, p. 24)

This inclusion of others' perspective in dealing with them and the world changes the realm of communication fundamentally: from the attunement of feelings, affects, emotions during dyadic, face-to-face interaction, the possibility presents itself of learning through teaching and cooperation on things outside the dyadic relationship. "Infants' awareness that they can attend jointly, and that

[344] "Social cognition can be construed as the process by which individuals develop the ability to monitor, control, and predict the behaviour of others"(Rochat, 1999, p. 4).

others' facial expression and communicative efforts can inform them about the environment, makes teaching and learning with others possible" (Rochat, 1999, p. 25).

| Age | Intersubjectivity Level | Social-Cognitive Stance |
|---|---|---|
| 0 to 1 month | Sensorimotor attunement | Attentional |
| 2 to 7 months | Primary intersubjectivity: smiling, affective attunement, social expectations | Contemplative |
| 8 to 12 months | Secondary intersubjectivity: joint engagement, social referencing, attention following, gestural communication | Intentional |

Figure 11.9. The ontogenetic development of communication within the first year of life.

Rochat's overview implicitly and explicitly refers to concepts that are central in the vocabulary related to the developmental psychology: attunement, intersubjectivity, joint attention and shared intentionality.

In *The Interpersonal World of the Infant*, psychiatrist Daniel Stern introduces the term 'affect attunement' to refer to "the performance of behaviours that express the quality of feeling of a shared affect state without imitating the exact behavioural expression of the inner state" (Stern, 1985, p. 142). Stern considers attunement in the context of affects – whereas Rochat relates attunement to a sensorimotor interaction – and thus situates it later in the process of child development (secondary revolution – 9 months). Stern observes that whereas in the first months of life the mother-child interaction is based on unimodal imitative processes (with elements of variations and improvisation), this imitation-like behaviour is extended at the age of nine months; around that time, there is no faithful rendering of the infant's overt behaviour anymore, but rather some form of cross-modal matching that does not refer to the other person's behaviour *per se*, but rather some aspect of the behaviour that reflects the person's feeling state (Rochat, 1999, pp. 141–142). Examples of the phenomenon of affective attunement include the vocal matching of the parent of physical effort such as stretching for a toy, an explosive and intense 'YES' when the child is successful in a task.

Stern considers affect attunement as a particular form of 'intersubjectivity', a term articulated by Trevarthen to capture the ways in which neonatal selves coordinate the rhythms of their movements and senses in relation to other persons' movements, purposes and feelings.

> All voluntary actions are performed in such a way that their effects can be anticipated by the actor and then adjusted within the perceived situation to meet the criteria set in advance. Interpersonal communication is controlled by feedback of information, as is all voluntary behaviour. But there is an essential difference between a person doing things in relation to

> the physical world and the control of communication between persons. Two persons can *share* control, each can predict what the other will know and do. Physical objects cannot predict intentions and they have no social relationships. For infants to share mental control with other persons they must have two skills. First, they must be able to exhibit to others at least the rudiments of individual consciousness and intentionality. This attribute of acting agents I call *subjectivity.* In order to communicate, infants must also be able to adapt or fit this subjective control to the subjectivity of others: they must also demonstrate *intersubjectivity*. By subjectivity I mean the ability to *show* by coordinated acts that purpose are being consciously regulated. Subjectivity implies that infants master the difficulties of relating objects and situations to themselves and predict consequence, not merely in hidden cognitive processes but in manifest, intelligible actions. (Trevarthen, 1979, p. 322)

According to Trevarthen these powers of innate intersubjective sympathy that an infant can show shortly after birth is the primary motivator of cultural intelligence.[345]

The final pair of concepts 'joint attention' and 'shared intentionality' have been most extensively articulated by evolutionary anthropologist Michael Tomasello who uses them as quasi-synonyms referring to overt and covert elements of the same phenomenon respectively. According to Tomasello, also chimpanzees know what others see: they follow the gaze of others to external locations and then check back with the other to see is there is anything interesting to observe; young children, however, go beyond this initial gaze following stage:

> From before the first birthday, human infants do not just follow the gaze of others to external targets, and do not just want to know what the other sees, they also attempt to share attention with others. Importantly, joint attention is not just two people experiencing the same thing at the same time, but rather it is two people experiencing the same thing at the same time and knowing together that they are doing this. This is truly intersubjective sharing, and it is critical because it creates a shared space of common psychological ground that enables everything from collaborative activities with shared goals to human-style cooperative communication. (Tomasello & Carpenter, 2007, pp. 121–122)

According to Tomasello, the emergence of shared intentionality during human evolution did not create totally new cognitive skills but it took existing skills of, for example, gaze following, manipulative communication, group action, and social learning, and transformed them into their collectively based counterparts of joint attention, cooperative communication, collaborative action, and instructed learning – cornerstones of cultural living (Tomasello & Carpenter, 2007, p. 124). Shared intentionality is a small psychological difference that made a huge difference in human evolution in the way that humans conducted their lives. The unique motivation to share psychological states with others resulted in species-unique forms of cultural cognition and evolution, "enabling everything from the creation and use of linguistic symbols to the construction of social norms and individual beliefs to the establishment of social institutions" (Tomasello, Carpenter, Call, Behne, & Moll, 2005, p. 675).

[345] For more perspectives on the phenomenon of intersubjectivity see Zlatev (2008).

The link between music and the foregoing insights in relation to early social cognition has been explicitly forged in work by psychiatrist Mechthild and developmental psychologist Hanuš Papoušek, Colwyn Trevarthen and psycho-acousticus and psychologist Stephen Malloch. The Papoušek's describe the intra-modal, vocal interactions between mother and infant in great detail and in terms of leading, followings, highlighting, elaborations and turn taking; they consider these communications as the precursors of the musical arts (Papoušek & Papoušek, 1981). Malloch introduced the term 'communicative musicality' to establish a semantic link between IDS and musicality. The point of departure to the edited volume dedicated to this phenomenon (Malloch & Trevarthen, 2009a) is that communicative musicality is vital for companionable parent/infant communication and can be formulated in terms of pulse, quality and narrative:

> 'Pulse' is the regular succession of discrete behavioural events through time, vocal or gestural […] 'quality' refers to the modulated contours of expression moving through time. […] Pulse and quality combine to form 'narratives' of expression and intention. The 'musical' narratives allow adult and infant, and adult and adult, to share a sense of sympathy and situated meaning in a shared sense of passing time. (Malloch & Trevarthen, 2009b, p. 4)

With the inclusion of musical terms such as pulse, melody and narrative a trans-disciplinary link is forged between the fields of developmental psychology and musical practice.

From the overview above the following topics and their relations can be inferred and summarized in relation to the treatment of interaction in *academia*, from both a phylogenetic and an ontogenetic perspective:

- Intersubjective manipulation (alarm signals, mood regulation, attention modulation).
- Attunement (resonance, sharing states of vitality).
- Rhythmical synchronization via entrainment.
- The expression of feelings via emotion which allows for a Theory of Mind.
- Joint attention and shared intentionality (a look outward to elements of the surrounding and perceivable environment, breaking with dyadic intersubjectivity).
- Action-metaphor as a mimetic instrument allowing to present environmental elements that are as such not within perceptual reach.
- Forms of (proto-)narration allowing for the representation of environmental elements that are as such not within perceptual reach.

## 11.3 Designing a topical attractor model for score-based performers

The bottom-up and top-down elements presented above constitute a background from which a general model can be abstracted in terms of performers' informational interests. The model that is proposed hereafter is not primarily a scientific one; it does not aim at controlling, describing and predicting certain behaviours in an experimental setting; its first target is to create clusters of extra-disciplinary information that relate either proximally or distally to the interests of musicians. Inferring such a basic model from a bi-perspectival approach that represents a multitude of information and ways of systematic ordering crucial factors necessarily implies an imaginative leap that cannot be fully accounted for and depends to a critical extent on the personal knowledge and assessment of the modeller (see 11.1.1, the determination of classes and sub-classes in ontology design). The process that in our view captures this leap at best is the emergence of attractors in a chaotic field. Within dynamic systems and chaos theory the technical definition of an attractor is "an equilibrium state (or collection of states) to which a system evolves over time. When the system gets close enough to an attractor, it will remain close even if slightly perturbed. A system may have multiple attractors, each with its own region of attraction" (Clapham & Nicholson, 2014). In the process of arriving at a model as presented in Fig.11.10 such an organic process of attraction has been facilitated with modelling efforts that originate from extra-disciplinary terrains, with the aim of creating and anticipating convergence and transdisciplinary consilience from a biocultural and practical perspective. The result is not a model that predicts phenomena *per se* but rather one that represents a territory of central topics[346], is pragmatic in its field of application and open to revision and extension.

As a point of departure and at the most general level of context, the field of playing and performing music is considered as concerned with the intentional and directed creation of a sonic environment which allows for having an experience. Music is considered as being involved with the creation of a possible world, an environment that affords[347] experience and intersubjective resonance: "I should emphasize that [the concrete tools of piano playing] serve to achieve the most important goal: *the ability to create an illusion"* (Berman, 2000, p. 13). Experience does not represent external reality but relates to the subjective qualification of one's situated position. The choice for this open view on music making is informed by John Dewey's approach in *Art as Experience* (Dewey, 1934) and emphasizes

[346] The map is not the territory however.

[347] Affordance is borrowed from ecological psychology; it is "an environmental resource allowing or stimulating an organism to interact with the environment in a particular way. Thus a surface affords a person the opportunity to sit or to lay something down without its falling and an ice cream affords the opportunity to eat." (Matsumoto, 2009). In *The Senses Considered as Perceptual Systems* (1966), Gibson coins the term 'affordance' and defines it succinctly as "what things furnish, for good or ill" (Gibson, 1966/1968, p. 285). Affordances are the possibilities/opportunities for action in a particular animal-environment setting; they are what an arrangement of environmental elements means to an animal in terms of action ("Is the ball catch-able?"; "is the tree clime-able"; "can I pass through this opening?").

music as doing and undergoing rather than as a thing – the representation of a score; Music as having and creating experience is a notion that has strong references in musical practice and scholarship (Ratner, 1983; Reybrouck & Maeder, 2015, Chapter 3; Blacking, 1969; Bowman, 1998, Chapter 6; Hodges & Sebald, 2011).

Within this general context, a topical attractor model is developed where action, interaction and (re-) action operate as the main-attractors in a chaotic field of information (see Fig. 11.10). They represent the basic human capacities that enable musical experience and are situated at the top of an inverted tree-model that harbours various levels of sub-attractors and prolongations. A first line of sub-attractors related to 'action' consists of 'disposition', 'imagination', 'movement' and 'effect' and the attractor 'interaction' is in a first instance further developed in terms of 'affect regulation', 'entrainment', 'diegesis', and 'mimesis'. In its secondary level of attraction, the model can be read as follows (clockwise starting with disposition – bottom left).

- A performer acts within the context of a certain *disposition* (physical, mood, emotional, attitudes, belief-system, situation).
- An experience-affording sonic environment is *imagined*. In score-based performance, this is done in resonance with the image a composer has codified into a score (see Fig. 11.11 for an extended model, including compository action). The absence of a 'score' in the primary model relates to the bio-cultural perspective that we adopt and the focus of our information-base on creating an experience rather than on performing particular works.[348]
- *Movement* is generated and results in a visual and aural *effect*.
- The elements that belong to 'ACTION' are not sequentially ordered (see 11.2.2.1.e on embodied cognition).
- The *effect* is actively (via *movement*) sensed by a listener, (potentially) stimulates *imagination*, and (can) result in an altered *disposition* (mood).
- The link between 'performer' and 'listener'[349] is enabled via non-mutually exclusive, interactive procedures that allow the intersubjective creation of experience: 1/ *affect regulation* 'touches' the listener directly; 2/ *entrainment* allows for rhythmic coupling; 3/ *expression* enables inferences regarding a particular state of mind; 4/ *shared intentionality* reaches beyond dyadic communication and implies a shared focus on environmental aspects; 5/ *mimesis* refers to elements beyond the immediate environment via bodily presentation; and 6/ *diegesis* attracts the story-affiliated elements that re-present an event.

In the remainder of this chapter, the choice for these attractors is accounted for by describing their transdisciplinary playing fields.

[348] "To music is to take part, in any capacity, in a musical performance, whether by performing, by listening, by rehearsing or practicing, by providing material for performance (what is called composing), or by dancing" (Small, 1998, p. 9).

[349] We use the term 'listener', although 'watching' is as much part of the process.

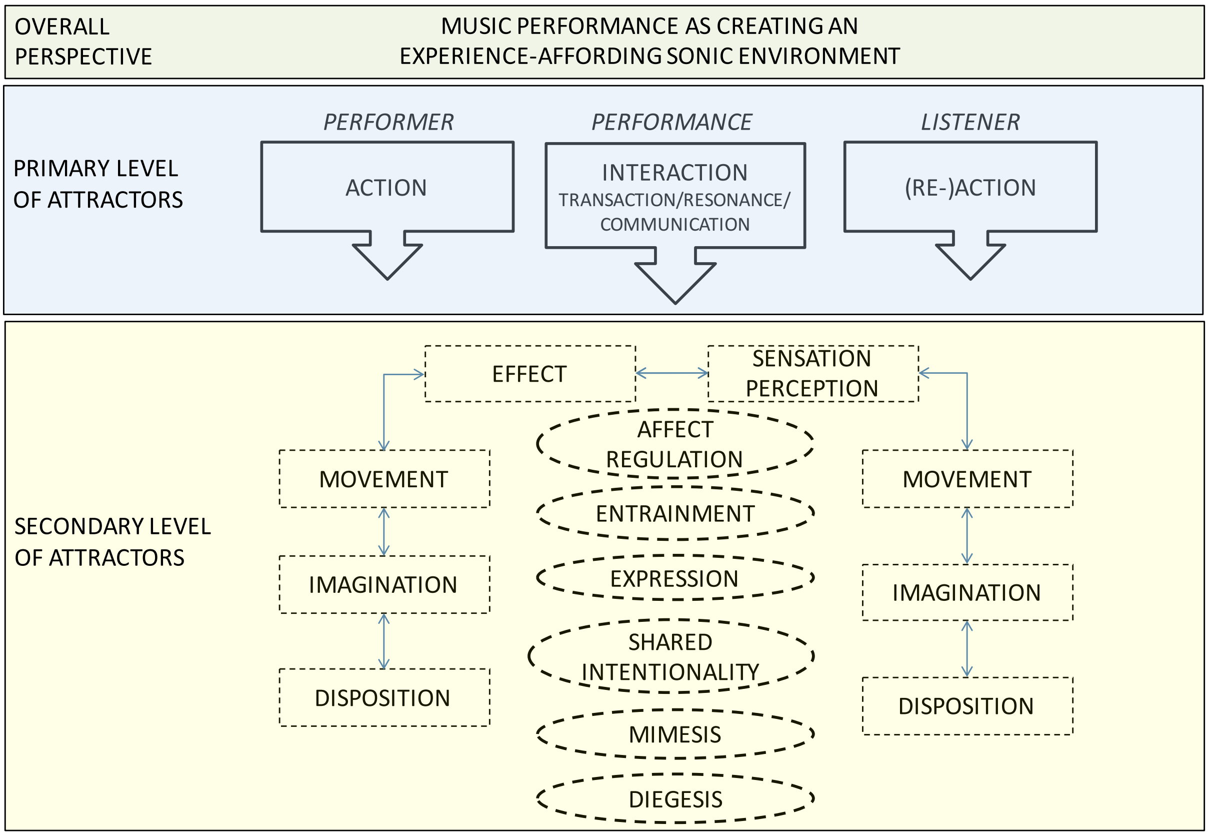


Figure 11.10. A topical attractor model for musical performance [primary model].

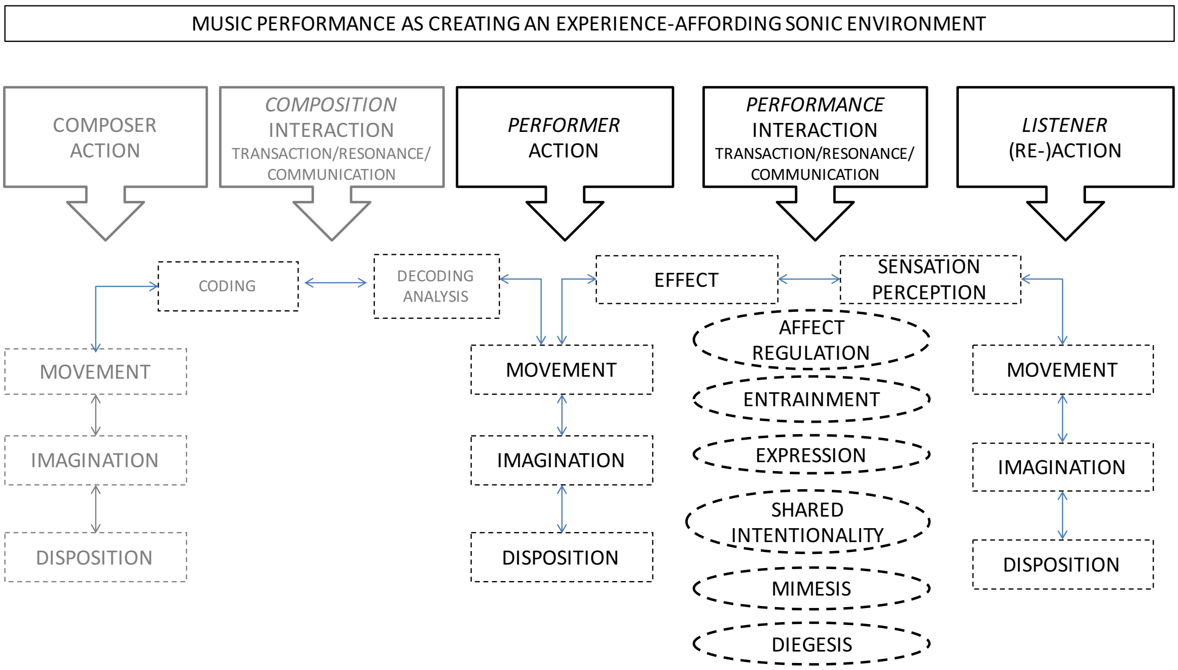


Figure 11.11. A topical attractor model for musical performance [extended version including the composer's action].

### *11.3.1 Primary attractors: action & interaction*

In Chapter 10 we already considered the pro's for taking music's action-side as a point of departure in crossing disciplinary borders, it allows for a bio-cultural discourse in music based on human capacities rather than cultural artefacts and enables the accommodation of a wide range of musical perspectives. 'Action' is a concept that is eminently present in the field of systematic musicology, philosophy and psychology and it is especially in the latter discipline that it has been presented as a unifying concept. In *The Psychology of Action* (Gollwitzer & Bargh, 1996), the authors take the schism that separates cognitive psychologists from social psychologists interested in motivation as a point of departure for establishing a superordinate goal.[350] In their view, a comprehensive psychology of action qualifies as such a superordinate goal since explaining when and how actions are initiated, sustained, disrupted, and resumed requires a multitude of theoretical perspectives. Central issues of a psychology of action then are: where do action goals come from? When and how do people prepare their actions? How do people control their ongoing goal pursuits (effortful or automatic)? How do goals affect people's interactions? (Gollwitzer & Bargh, 1996, p. x). In *The Handbook of Human Action*, neuroscientist and handbook-editor Ezequiel Morsella describes the extensive field covered by human action and the research questions that support it; these questions relate to how action are mentally represented, neurally encoded, controlled, acquired, activated and selected and socially embedded (Morsella, 2009, p. 3).

Next to 'action', 'Interaction' is the primary attractor used for the elements that allow for sharing or inducing an experience. Interaction is not limited here to its strictly technical and mechanical meaning but functions as a cluster-term for different forms of communication (Hauser, 1996; Hauser, 2010). Worthy alternatives and co-determinants of interaction are John Dewey's notion of 'transaction' and the term 'resonance' which has gained currency in musical epistemology in recent years. In *Knowing and the Known* Dewey distinguishes between: 1/ self-action as the pre-scientific concepts which situated the cause of action within humans, animals, and things; 2/ interaction as a Newtonian context where elements are balanced in a system of action and reaction; and 3/ transaction as system of descriptions that deals with multiple aspects and phases of action, without any attribution to ultimate, final, or independent entities, essences, or realities. In a transactional procedure seeing together prevails on composing separate elements. Systematic musicologist Marc Leman uses the term 'behavioural resonance'[351] to refer to a type of involvement with music which is direct in the sense

[350] For the relation between the motor behaviour paradigm and the one that focuses on action see Aune, Pedersen, & Ingvaldsen (2008).

[351] In physics, resonance refers to "the condition in which an object or system is subject to an oscillating signal having a frequency at or close to that of a natural vibration of the object or system" (Joaquin, 2013, p. 57). It is a

that it is "a matter of corporeal immersion in sound energy, which is a direct way of feeling musical reality. It is less concerned with cognitive reflection, evaluation, interpretation, and description" (Leman, 2008, p. 4). According to Leman, behavioural resonance is "something personal, experienced only by the subject. It does not require great skills to have direct involvement with musical reality, but if they are desired, great skills can be developed" (Leman, 2008, p. 4)[352].

### *11.3.2 Secondary attractors*

The next layer of the inverted-tree-like topical attractor model consist of prolongations[353] that specify the primary topical attractors and consist of secondary, sub-attractors and their connections. Within the field of 'action' four secondary topics (boundary objects) are identified which accommodate the bottom-up and top-down elements that we encountered in the previous sections.

#### *11.3.2.1 Sub-attractors related to action*

a) Disposition

Disposition is a term that is generally understood as a "natural tendency or bent of the mind" [OED.6], a "physical aptitude, tendency, or inclination (to something, or to do something)" [OED.9a], or a "physical condition or state; state of bodily health" [OED.10a]. We encountered the term in 10.1.2.2 where a differentiation was proposed between disposition as the collective for (culturally) acquired action tendencies, and pre-disposition as referring to tendencies that are given by nature. In our model the 'disposition' attracts biological and acquired elements that determine an embodied and situated state of mind. This implies the following aspects: 1/ emotion, feeling, affect[354]; 2/ motivation[355]; 3/ belief, attitude[356]; 4/ habit[357]; 5/ identity[358]; 6/ image[359] (personal theory, philosophy); 7/ knowledge

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tendency of one system to match the resonance frequency of another resonance system, as a result of forced vibration (see for instance resonance between tuning forks). Linguist John W. Du Bois (Du Bois, 2010) analogizes the resonance principle to the interaction between and among interlocutors.

[352] 2017 saw the publication of *The Routledge Companion to Embodied Music Interaction* (Leman, Lesaffre, & Maes, 2017); because of the recent date of publication (2017), it was not possible to include references to the articles published in this volume.

[353] The term 'prolongation' is borrowed from Schenkerian analysis where it designates a next level elaboration or composing-out of a basic (harmonic) *Ur-Linie* or structure (Schenker, 1935).

[354] Emotions as action tendencies (Frijda, 1986, pp. 69–93).

[355] See for instance Deci & Ryan (2008); Ryan (2012); Sorrentino & Higgins (1986).

[356] "If you want to change the way you play, you have to change the way you think about your playing" (Winspur & Wynn Parry, 1998, p. 18). See also *Emotions and Beliefs: How Feelings Influence Thoughts* (Frijda, Manstead, & Bem, 2000).

[357] See for instance Aarts & Dijksterhuis (2000).

[358] See for instance MacDonald, Hargreaves, & Miell (2002, 2016).

[359] See Boulding (1961).

(implicit, explicit, tacit); 8/ physical disposition[360]; 9/ consciousness[361]; 10/ attention; and 11/ the instrument.

b) Imagination

Imagination is an attractor that has been extensively discussed in PART I. The term 'cognition' could also have qualified as a secondary topic but given the quintessential role of imagination in the arts, the choice has been made to present 'imagination' as a pivotal attractor in this domain. Imagination attracts fields of interest such as: 1/ creativity as the overt manifestation of imagination; 2/ intention; 3/ memory[362]; 4/ information processing; and 5/ inspiration as fragments of the environment (both coded and analogue) that feed the imagination.

The absence of 'a score' in the representation of secondary topics is related to the bio-cultural view on music performance that we developed in Chapter 10 and the aspiration to sail away from a stimulus-response model. The model can be extended to include this particular aspect (see Fig 11.11).

c) Movement

The domain of 'movement' attracts scholarship related to motor control and learning and practice-led insights in relation to instrumental technique. It entails essential categories such as tone production, behaviour, automaticity, skill acquisition, the neurophysiology of movement and bio-mechanics (Mulder, 2002). An important topic within this field concerns the study of gesture. Gesture is an element that is in close connection and overlap with the domain of interaction; it is to be situated at the intersection of observable (and thus communicating) actions and images in the mind.

> Musical gesture is biologically and culturally grounded in communicative human movement. Gesture draws upon the close interaction (and intermodality) of a range of human perceptual and motor systems to synthesize the energetic shaping of motion through time into significant events with unique expressive force. The biological and cultural motivations of musical gesture are further negotiated within the conventions of a musical style, whose elements include both the discrete (pitch, rhythm, meter) and the analog (dynamics, articulation, temporal pacing). Musical gestures are emergent gestalts that convey affective motion, emotion, and agency by fusing otherwise separate elements into continuities of shape and force. (Robert Hatten cited in Jensenius, Wanderley, Godøy, & Leman, 2010, p. 18)

It has been suggested that gestures consist of three general movement types: sound-producing, whose direct action consequence is sound generation; sound-facilitating, which support sound-producing

[360] This category includes anatomy as an academic field but also applied approaches (Feldenkrais, Alexander-method).
[361] See for instance David & Eric Clarke (2011).
[362] See Snyder (2000).

motor movements but themselves do not generate sound directly; and ancillary, referred to by the authors as non-technical or concurrent movements, which are not involved with sound production or sound facilitation (Jensenius et al. 2010, p. 24).

d) Effect

The effect of musical instrument directed movement, sound, is intimately linked to the foregoing topics: movement, gesture and sound are intrinsically connected and in the context of action-effect coupling we have already noted that effect can be the initiator of a musical action. In our model 'effect' attracts information that relates to the properties of sound (physics, psychoacoustics) and its more distally anticipated effects on listeners' imagination and disposition.

e) Sensation/Perception

The domain of sensation relates primarily to the first stages of aural, visual or tactile connection, to *aesthesis* or sensational knowledge (Hahn, 2007). Sensations are uninterpreted sensory impressions created by the detection of environmental stimuli, whereas perception refers to the set of processes whereby we make sense of these sensations. Perception enables us to literally navigate through the world, avoiding danger, making decisions, and preparing for action.[363]
Within this domain two schools of psychology can be discerned: cognitive psychologists operate from a point of view where defective and unreliable input reaches the senses (the eye, the ear or the skin) and assume a representational and evaluative process to fix the input and add meaningful interpretations to it so that an inference can be made about what caused that input in the first place. Within the context of ecological perception, it is argued that the intermediary steps are not needed and that the input is already richly structured by the environment and the animal's own activities, allowing a direct perception mode based on attunement to information. Ecological psychology asserts that perception is not based upon discrete sensations, as commonly believed, but upon the 'pickup' of 'stimulus information', or simply 'information'.

The boundaries between sensation, perception, imagination, effect, movement and sensation are permeable; this domain will attract the informational elements that have the act of listening and observing in general (either as audience or in a feedback-scenario) as a focal point of interest.

[363] For the evolution from sensation into perception and consciousness see Humphrey (Humphrey, 2006).

#### *11.3.2.2 Sub-attractors related to interaction*

The basic question for a performer operating in a biocultural framework is: how does one create an environment or a condition that affords a musical experience? The choice of secondary attractors in the domain of interaction is informed by the phylo- and ontogenetic considerations in 11.2.2.2. and follows the sequence of strategies and instruments that can be used in order to convey or share an experience. The list develops from three dyadic approaches (affect regulation, entrainment, expression) into three triadic ways of inducing an experience (shared intentionality, *mimesi*s, *diegesis*).

Before presenting the sub-attractors, a note on terminology is necessary as far as differentiation between affect, emotion, mood, and feelings is concerned.

*Affect* is generally considered as an encompassing term which refers to a pre-personal and universal way in which the body prepares itself for action in a given circumstance (Deleuze & Guattari, 1987). Within the category of affect and within a musical context, at least four affective phenomena can be distinguished (Davidson, Scherer, & Goldsmith, 2003, p. viii):

- *Emotion* relates to a relatively brief episode of coordinated physiological changes that facilitate a response to an external or internal event of significance for the organism; emotions are the projection/display of a feeling – either genuine or feigned – which expresses our internal state or fulfils social expectations; emotion is often intertwined with mood, temperament, personality, disposition, and motivation. In the 20th century, psychologist Paul Ekman (Ekman, Friesen, & Ellsworth, 1972) identified six basic emotions on the basis of facial expressions (anger, disgust, fear, happiness, sadness, and surprise) and psychologist Robert Plutchik eight (Plutchik, 1980), which he grouped into four pairs of polar opposites (joy-sadness, anger-fear, trust-distrust, surprise-anticipation).
- *Feelings* are the subjective representation of emotions; feelings are personal and biographical; they are based on sensation which have been checked against previous experiences.
- *Mood* typically refers to a diffuse affective state that is often of lower intensity than emotion, but considerably longer in duration; moods are not usually associated with the patterned expressive signs that typically accompany emotion and sometimes occur without apparent cause.
- *Temperament* refers to particular affective dispositions that are apparent early in life, and thus may be determined by genetic factors.

The differentiation within the field of affect and the permeable boundaries that surface when emotion is used in a performative and musical context will be further assessed in Chapter 13. For now, and in the context of this attractor model it suffices to take into account that ‘affect’ is used to refer to a broad realm of affective phenomena, that ‘emotion’ refers to observable affective behaviour and that ‘feeling’ is the most latent and personal element of behaviour.

a) Affect regulation and attunement

A first mode of causing another person to have an experience is via manipulation and attunement in the context of affect regulation. If one person gives another one a push then a particular state of mind is instantiated in the receiver which is not necessarily convergent with the one of the receiver. In affect attunement the regulation is more connected to a process of imitation and sharing. The topic of 'affect regulation' attracts the proto-elements of musicking such as pulse, melodic contour, dynamics, repetition, variation, and proto-narrational elements (Malloch & Trevarthen, 2009b).

b) (Rhythmic) Entrainment

A particular mode of intersubjective regulation is the one that is caused via entrainment. Dynamical or complex systems theory describes and models the behaviour of interacting systems comprising autonomous agents and has proved a powerful tool in explaining how, through processes of self-organisation, the behaviour of a dynamical system amount to more that the some of its parts (Clayton, 2013, p. 16). Entrainment, broadly defined, is a phenomenon in which two or more independent rhythmic processes synchronize with each other in such a way that they adjust towards and eventually 'lock in' to a common phase and/or periodicity (Clayton, Sager, & Will, 2004, p. 2-4). In *Keeping Together in Time: Dance and Drill in Human History*, historian William H. McNeill addresses the biological and cultural evolution of this kind of muscular bounding and assumes that rhythmic stimuli may restore a simulacrum of foetal emotions to consciousness.

> It has occurred to me that rhythmic input from muscles and voice, after gradually suffusing through the entire nervous system, may provoke echoes of the foetal condition when a major and perhaps principal external stimulus to the developing brain was the mother's heartbeat. If so, one might suppose that adults when dancing or merely marching together might arouse something like the state of consciousness they left behind in infancy. (McNeill, 1995, p. 7)

In musical terms entrainment is closely related to rhythm, meter and groove but can also include non-cyclical engagements between bodies such as in the context of syncopation (Witek, Clarke, Wallentin, Kringelbach, & Vuust, 2014). In the latter case, the boundary between the domain of affect regulation and entrainment is pragmatic.

c) Expression

A third way of intersubjective interaction is via emotion or the expression of feeling. Expression and emotion are boundary topics with branches in a variety of academic disciplines and in musical practice. In *The Language of Music* (Cooke, 1959), musicologist Deryck Cooke attempts to identify the specific

emotions expressed by tonal tensions within a piece of music and how such emotions are moderated by volume, rhythm, tempo and pitch. More recently, 'emotion' and 'expression' have developed into key research topics in the field of the psychology of music (Juslin & Sloboda, 2001, 2010; Juslin, 2013). In score-based performance, the question presents itself with regard to whose emotion is expressed: is it the composer's, the performer's, the emotion of a *persona* (in which case it would be a matter of mimesis), or a universal affect (as it is implied in Mattheson's vision on Baroque Music)?
These questions indicate the permeability of the sub-attractor boundaries and will be more elaborately discussed in Chapter 13. However, within the context of this attractor-model which aims at attracting information rather than settling age-old problems of artistic expression, we consider this category as the homestead of research that inquires into the topics emotion, feeling and expression.

d) Shared intentionality, joined attention

Shared intentionality or shared attention offers the opportunity to get out of a direct and dyadic intersubjective context and to refer to shared intentional objects situated in a present environment (Tomasello & Carpenter, 2007). In the context of musical performance, the performer acts as a guide who points out the various places of interest within a composition via micro-timing, dynamics or an implicit listening-attitude. The metaphor of a performer as a guide is frequently used in musical practice.[364] In scholarly literature, joint attention is generally related to visual elements and is achieved when one individual alerts another to an object by means of eye-gazing, pointing or other verbal or non-verbal indications (Moore & Dunham, 1995). Creating a situation of joint-attention to a sonic environment by means of shared and intentional listening is an element that has received only limited attention (Cochrane, 2009), but the mechanics that have been inferred from the visual field are amenable to be transferred to a sound-situation in which the intentional listening of one person (the performer) is contagious vis-à-vis an audience.

e) Mimesis

Mimesis [*μίμησις*] and diegesis [*διήγησις*] have been contrasted since Plato's and Aristotle's times: mimesis shows by means of enactment and conveys an extra-contextual experience by using the body as a representational canvas; diegesis is the telling of the story by a narrator. The objects of mimesis and diegesis can be human actions (see Aristotle in the *Poetica*), affects (Mattheson, 1739), events, *persona*[365] (Levinson, 2006, p. 93), a plot (Seaton, 2014), fauna, flora or habitats in a more general

[364] In a recent interview, on the occasion of his 70th birthday, Philippe Herreweghe stated for example: "Conducting is leading people into a city that you are supposed to be more familiar with than the musicians themselves. With time, you know more cities and you become a better city-guide" (Herreweghe, 2017).
[365] 'persona' is a term used by philosopher Jerrold Levinson to account for expressivity in music: "a passage of

sense. In *The Language of Music* (1959), Cooke maintains that there are three ways in which music can represent physical objects.

> First, by direct imitation of something which emotes a sound of definite pitch, such as a cuckoo, a shepherd's pipe, or a hunting horn. […] The second way is by approximate imitation of something which emits a sound of indefinite pitch, such as a thunderstorm, a rippling brook, or rustling branches. […] The third way in which music can represent physical objects is by the suggestion of symbolization of a purely visual thing, such as lightning, clouds or mountains, using sounds which have an effect on the ear similar to that which the appearance of the object has on the eye. (Cooke, 1959, pp. 3–4)

With regard to the latter, most distal category, Cooke refers to the first of Debussy's *Trois Nocturnes* which is entitled *Nuages* and observes that, although we are persuaded into interpreting the shifting patterns of sound in terms of the visual imagination, we should have been uncertain what the composer intended to represent if Debussy had not given the *Nocturne* its title. Here, we hit upon the functional role of mimesis. Taking into account music's free-floating intentionality and aboutness, mimesis is not a tool to represent objects, events, or habitats but rather a means to present the feelings and experience that go along with particular elements of an environment.

Closely orbiting the notion of mimesis are 'action-metaphor' and Deleuze's notion of '*devenir*':

> To become [*devenir*] is not to progress or regress along a series. Above all, becoming does not occur in the imagination, even when the imagination reaches the highest cosmic or dynamic level, as in Jung or Bachelard. Becomings-animal are neither dreams nor phantasies. They are perfectly real. (Deleuze & Guattari, 1980/1987, p. 238)

f) Diegesis

In instrumental music, diegesis relates to the elements of narrative that characterize temporal development. Elements of 'telling a story' and representing a succession of events imply: 1/ starting at a given moment; 2/ being manifest for a certain amount of time; 3/ ending; 4/ moving forward; 5/ expectations; and 6/ unexpected events (Meelberg, 2006, p. 39, see also Bal, 1990, 1985/1997).

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music P is expressive of an emotion E if and only if P, in context, is readily heard, by a listener experienced in the genre in question, as an expression of E. Since expressing requires an expresser, this means that in so hearing the music the listener is in effect committed to hearing an agent in the music—what we can call the music's persona—or to at least imagining such an agent in a backgrounded manner. But this agent or persona, it must be stressed, is almost entirely indefinite, a sort of minimal person, characterized only by the emotion we hear it to be expressing and the musical gesture through which it does so. It is important to keep that in mind when entertaining skepticism as to whether understanding listeners normally hear or imagine personae when they apprehend expressiveness in music" (Levinson, 2006, p. 93).

Structural and form-related elements in a composition do not always have to refer to a diegetic process, they can also be of a mimetic nature by implying and presenting the developmental elements of an event. In his study on narratology in music, Meelberg illustrates this distinctive possibility as the difference between ‘presentation’ and ‘representation’: narrative comes into play if a succession of events is represented via a medium such as a video and a report; the succession of events as such is a presentative mode of temporal unfolding and does not fit the category of diegesis.  Thus, the most of drama is not narrative, it is a transformation from one state to another, but it is not a representation. Rather, it is a presentation, or a demonstration. Lyric poetry, on the other hand, can qualify for the label of diegesis because of its (mostly) representative character (Meelberg, 2006, pp. 39–40).

## 11.4 Chapter summary

In this chapter, we addressed the challenge of streamlining the information overload that surrounds musical performers. Based on established concepts in ontology-design and topic-modelling, a prototype of a topical attractor model was proposed as a pragmatic instrument that attracts intra- and extra-disciplinary information into topical boundary-objects. Identifying and determining fields of trans-disciplinary interest is an open-ended work-in-progress that is in need of constant dialogue with its stakeholders. Therefore, any model that is presented will always be of a proto-typical nature. The inconclusive character of modelling however does not prevent us from reaching an agreement on certain basic areas of convergence and the establishment of a vocabularium that allows for intra- and extra-practical communication. The process of topical delineation is reminiscent of the pioneering years of ‘new’ disciplines such as psychology where a research programme was constructed on the basis of establishing a limited number of topics. Consulting James’ *Principles of Psychology* (James, 1890) for example teaches us that more than a century later the discipline is still concerned with the topics coined by seminal authors such as James. It is evidently not pretended here that the topical approach presented above comes anywhere near to James’ seminal effort, rather it is an invitation to dialogue in bio-cultural terms on certain trans-disciplinary common interests and to permit the gradual accumulation of a practice-based and extra-disciplinary information base for musicians.

In PART IV, it will be shown how such a practice-based but open information system is not limited to collecting information but also allows for the generation of dialogical connections between various topical fields and units of information.