Poiesis and the performance practice of physically polyphonic notations

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3. Embodied Cognition and Physical Polyphony

3.0 Situating Cognition

> By the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs. The cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality … This chapter is an argument for *pleasure* in the confusion of boundaries and for *responsibility* in their construction. (Haraway, 1991, p. 150)

Donna Haraway's cyborg is an embrace of transient and peripheral existence, of an identity that exists in intersections and superpositions rather than in the enclosed, constructed spaces ensconced in traditions, cultures, and functions. She advocates a cyborgian space between human and animal, between human and machine, inside and outside of all of these designations. The cyborg, she argues, offers a particular alternative to dualism and a way out of the dichotomous identity and performance strictures that we inherit from the long history of Western philosophy and science. For Haraway, these traditions take solace in reducing the world to dualisms; they define the world in spaces of inside and outside, leading inevitably to value systems where good or bad become binary choices with little to no room for interpretation. These boundary-drawing exercises impose a false sense of logic, smuggling a sense of normalcy into an act of incision, by which a multi-dimensional world is sliced in two, with "claims for an organic or natural standpoint" (Haraway, 1991, p. 157) arrayed against their inversion: everything else. This sort of binary logic "attempts to present itself as a spatial construction[, but its] closure is not the stable effect of representation but rather the unstable effect of representation. [It] divides an inside from an outside, but since the 'outside' is constitutive it can never really be excluded, only domesticated or enclosed" (Deutsche, 1996, p. 228). Haraway responds to this enclosure in the labyrinth of binaried, gendered compartmentalization by signaling an escape route through the liminal borderlands of the cyborg. In this sense, peripherality celebrates localization: everything is peripheral and the logic of centralization (or the appeal to an 'inside' of tradition) ceases to hold a monopoly on discourse. This opens up avenues for partiality that are not constrained by the dichotomy of objectivity and subjectivity but are instead liberated by an acknowledgment of situated and embodied epistemologies. "We do not seek partiality for its own sake, but for the sake of the connections and unexpected openings situated knowledges make possible" (Haraway, 1991, p. 196).

As musicians approaching physically polyphonic works, these considerations are neither trivial nor impertinent. The previous reflections have explored the porous boundaries between composers and performers, performers and instruments, and even parts of the performer. Dualistic hermeneutics that trace hierarchically rigid paths from composer to performer to listener are taken quite literally in much of the standard practice, but have no greater or lesser claim to validity than any other more heterarchical strategies. With respect to the repertoire under discussion here, the urgency of embracing alternative strategies and finding the liminal, cyborgian spaces that Haraway reveals becomes increasingly obvious as one invests time into the learning of such a piece. It is my hope that the previous chapters have laid some framework for that urgency, and that the theoretical gratings explored show some of the alternative conceptions that allow for the absolutely critical task of disorientation that precedes a reorientation into a new system of knowledge. Recognizing the partiality of one's position and accepting the possibility of finding new frames of reference and vantage points from which to approach a piece can be the most difficult step, and it has been the task of the previous material to offer a series of possible guideposts towards this requisite disorientation.

However, at that point, there must still be some personal orientation as one attempts to learn one of these pieces of music. Assuming one has accepted the necessity of pluralistic and variable practices that adapt to individual pieces and local situations, the discovery or construction of those practices

commences. How this learning process emerges in the body will comprise the purview of the following chapter. In focusing on this situated process and the pragmatic tools and methodologies that best serve the performer confronted with this task, I would like to recall the poietic methodology previously posited. The work by which a performer constructs a practice for a piece involves building a capacity to respond to the variable demands of the piece and to engage with the composer and the notation osmotically, thus allowing the physical work of the performer to respond to (and contribute to) the emergence of the piece over time. As shall be seen, this learning process is elucidated very effectively by research on embodied cognition that has developed and proliferated over the past decades. In particular, following a discussion of the general principles and discoveries of the field, I will look at the development of research involving embodied cognition in the field of anthropology, where its effective incorporation into studies of learning and enskilment will inform an examination of musical learning and embodied communication as mediated by the performer, the notation, and the composer. Thereafter, recent developments within experimental approaches to research on embodied cognition will be used as a lens to examine the actual physical process of learning a piece of music. Ultimately, we hope to see a version of Haraway's 'monstrosity' coalesce that can inform an ecological, situated approach to poiesis and enskilment in music.

3.1 Embodied Cognition, Enactive Learning, and Enskilment

Varela, Thompson and Rosch (1991) proposed the term *enactive* to encompass a variety of hypotheses and theories about cognition that were unified by their commitment to the idea that cognition unfolds over time and in space, and moreover that it is both contingent on and inseparable from this enaction in temporally and spatially situated contexts. The ideas and trends they included under that umbrella—from connectionism and neural networks to embodied cognition and societies of mind—were often quite divergent and at times even in conflict with one another. They were unified, though, in their acceptance of this basic formulation of cognition (whether implicitly or explicitly) and their reliance on embodied and situated explanations of the processual existence of cognizing agents in the world. The inextricability of perception and cognition undergirded this proliferation of new approaches. The spatial and, in particular, the temporal constraints of this understanding was (and remains) in direct contradiction to the long and influential tradition of Cartesian dualism, which understood representation to be the fundamental component of both perception and cognition. It is impossible to discuss or understand embodied cognition and situated knowledge without confronting the specter of representation against which they rebel.

This tradition of representational understandings monopolized work in cognitive science from the 1950's onwards, despite a large body of more diverse work from many disciplines in the preceding decade. This representational bias manifested itself in the influential idea that cognition mimicked computation. Decades of research (and funding) were predicated on the tenets of cognitivism, which stated that "the mind is a special kind of computer and cognitive processes are the rule-governed manipulation of internal symbolic representations" (Van Gelder, 1995, p. 345). The mind was trapped in a framework of cognition that assumed symbolic manipulation as the only possible mediation of the world, leaving cognition isolated in its neural cage.

Unfortunately, this idea did not lead to much tangible success, especially in the field of artificial intelligence, which proliferated in the post-World War II era, driven by dreams of successfully "replicating human intelligence in a machine" (Brooks, 1991, p. 1). As this lofty ambition slowly evaporated and more modest proficiencies were instead targeted, the limitations of computational symbolic representation as a means to mediate the environment were increasingly exposed. In the field of robotics, this was exceptionally clear. Even a robot that had been programmed very intricately to respond to a particular environment could be rendered utterly useless by the simplest changes in that environment, let alone the actual transplantation of the robot to a completely new environment. This is, of course, completely at odds with the way that cognizing organisms respond to their environment. Slight changes are, in fact, quite easily adapted to—by babies, by insects, by any organism. The inability of a computational system of representation, replete with requisite, pre-existing syntactical codes that govern these mediations, to cope with these constraints suggested to some that it was not a viable model for biological cognition, either. "[I]t makes no sense to speak of brains as though they manufacture thoughts the way factories make cars. The difference is that brains use *processes that change themselves*—and this means we cannot separate such processes from the products they produce. In particular, brains make memories, which change the ways we'll subsequently think. *The principal activities of brains are making changes in themselves*" (Minsky, 1985, p. 288, emphasis in original).

What does it mean for a robot to interact with an environment in this way? What does a shift from computation and representation to processual self-adaptation look like? Rodney Brooks noted that "explicit representations and models of the world simply get in the way. It turns out to be better to use the world as its own model" (Brooks, 1991, p. 1). His mobile robots, christened Creatures, give an idea of how this works: lacking any sort of centralized program with *a priori* codes to manipulate

symbolic representations accrued through perceptions of the environment over time, the Creatures were instead built with capacities for dissociated actions that could be performed in parallel with one another. These uncoordinated layers of activity could still lead to predictable, coordinated action. "Each activity producing layer connects perception to action directly. It is only the observer of the Creature who imputes a central representation or central control. The Creature itself has none; it is a collection of competing behaviors. Out of the local chaos of their interactions there emerges, in the eye of an observer, a coherent pattern of behavior. There is no central purposeful locus of control" (Brooks, 1991, p. 6).

Taking the world itself as a model is not so easy, though. The capacity to transform a sea of undifferentiated sensory data into coherency is quite difficult. "It is necessary to invert the expert and the child in the scale of performances … the deeper and more fundamental kind of intelligence is that of a baby who can acquire language from dispersed daily utterances and can constitute meaningful objects from what seems to be a sea of lights" (Varela et al., 1991, p. 86). Cognition, then, is not an externalized phenomenon that reacts *to* the environment, but is inextricably intertwined with the perception of it. *Ex post facto* teleological representations of that complex embodiment fail to acknowledge the immanent nature of cognitive coming-into-being as creatures capable of perceiving. Enactive embodied cognition entails the same processual interaction for humans as it does for Brooks's Creatures, both endowed with the capacity for dissociated, perceptually-guided activity that is coordinated *actively* rather than reflectively or representationally.

The body is a crucial agent in these processes. The vantage points from which we encounter and approach these experiences are not neutral spaces. Understanding that all knowledge is situated and perceptually contingent allows for this process to be elucidated. Lave and Wenger demonstrated that all learning is situated and, in music, we must realize that the notation and the composers are a part of "communities of practice" (Lave and Wenger, 1991, p. 49). They are agents just as the performers are, and their presence in the space of learning is, similarly, neither neutral nor passive. There is no empty space in which learning may occur; Haraway reminds of this proximity: "Situated knowledges require that the object of knowledge be pictured as an actor and agent, not a screen or a ground or a resource, never finally as slave to the master that closes off the dialectic in his unique agency and authorship of 'objective' knowledge" (Haraway, 1991, p. 198). Far from some glorification of subjective interpretation, this conception of situated knowledge and learning is instead a rejection of just such dualistic dichotomies, opposing the myths of objective and subjective knowledge. In place of that, we recognize the way in which active, ongoing perception and embodiment have an extremely tangible role in the act of learning. It is worth quoting Varela, Thompson and Rosch at length:

> Cognition depends upon the kinds of experience that come from having a body with various sensorimotor capacities, and second, that these individual sensorimotor capacities are themselves embedded in a more encompassing biological, psychological, and cultural context. By using the term *action* we mean to emphasize once again that sensory and motor processes, perception and action, are fundamentally inseparable in lived cognition … Thus the overall concern of an enactive approach to perception is not to determine how some perceiver-independent world is to be recovered; it is, rather, to determine the common principles or lawful linkages between sensory and motor systems that explain how action can be perceptually guided in a perceiver-dependent world. (Varela et al., 1991, p. 173)

Cognition is not merely affected by but depends upon its embodied presence in the world, and the construction of that mutual dependence is essential to understanding the enactive processes by which cognition emerges from sensorimotor participation in the world.

The tradition of notation in music encourages a representational, computational bias to interpretation. The temporal removal of the music reading stage from the music writing one reinforces this. Students are encouraged to think of the notation as a text. Learning music, though, is a communicative act. The notation serves as an orientational device, providing stimuli that allow one to construct a situated knowledge in the local, specific context of that piece. This distinction is crucial because a representational understanding of notation dissolves in the face of the same paradoxes that plagued artificial intelligence. It relies on a computational processing of notational stimuli with the aid of pre-existing, codified interpretive structures that mediate the cognitive process externally from the act of creating and perceiving sound and tactile instruments. But these *a priori* representational understandings of information cannot adapt in situations. The entrainment processes by which musicians coordinate activities within their own sound-producing bodies and between multiple performers exemplify the enactive processes that Varela et al. describe and the way that sensorimotor engagement leads and in fact engenders cognition and learning. The unfolding of musical perception over time and in space is a crucial part of the entire process of reading a notation, learning a piece, and transforming that communication with the notation into a performance. Representational approaches transform the performer into a computational machine, a device for translating code into program. Musicians are not computers, though, nor are they trapped in the objective/subjective schema by which their work is merely a consequence of notation. They are a part of the process and their bodies enact learned and being-learned skills. It is for these reasons that a cyborgian identity is most pertinent.

The way that learning is embodied has been explored in great detail by many anthropologists and their contributions to the study of learning and enskilment offer much to musical discourse. It is no surprise that learning—especially by imitation, observation, and engagement—play such a central role in a discipline that studies externalized cultures by way of situated observation and involvement. Anthropological discourse has increasingly embraced and acknowledged the power of situated learning as it influences the construction of bodies of knowledge within the discipline. “In their various roles as perceivers, learners, recorders, communicators, and theorists of knowledge, anthropologists have long recognized the central importance of bodily experience in human knowledge” (Cohen in Marchand, 2011, p. 183). A proliferation of autoethnographies and studies through apprenticeship, in particular, attest to this. Consequently, a discourse has emerged that attempts to “effectually chronicle manifestations of human knowledge that ‘exceed language’, including bodily and perceptual practices” (Marchand, 2011, p. xi).

Situated learning engenders knowledge, skill and their artifacts, including, of course, music-making and the musical artifacts of performance: “The more that objects are removed from the contexts of life-activity in which they are produced and used—the more they appear as static objects of disinterested contemplation as in museums and galleries—the more, too, the process disappears or is hidden behind the product, the finished object. Thus we are inclined to look for the meaning of the object in the idea it expresses rather than in the current of activity to which it properly and originally belongs” (Ingold, 2000, p. 346). By abdicating the search for meaning in results, we can come closer to seeing the true nature of practices based in the temporal unfolding of form. From this perspective, “practice is a form of *use*, of tools and of the body” (Ingold, 2000, p. 352) and skill, then, “is a property not of the individual human body as a biophysical entity, a thing-in-itself, but of the total field of relations constituted by the presence of the organism-person, indissolubly body and mind, in a richly situated environment” (Ingold, 2000, p. 353). This is an enactive approach that accepts the poietic process of tool-building and the idea that actions unfold the practices of performance over time. Poiesis develops skills as an intrinsic element of learning a piece of music and an embodied understanding of this enactment can “place the emphasis on the skilled character of the form-

generating process rather than upon the final form of the object produced" (Ingold, 2000, p. 290).

In espousing this reconception of skill and knowledge production, Tim Ingold proposes supplanting the idea of making with that of weaving in an attempt to foreground the emergent aspects of form creation that lie in the action as opposed to the results. Weaving is a powerful way to conceptualize the tactile qualities that are embedded in any practice. Enactive learning is not goal-oriented, but "continues for as long as life goes on—punctuated but not terminated by the appearance of the pieces that it successively brings into being" (Ingold, 2000, p. 348). This sense of weaving, which he compares to Heideggerian dwelling, is an emergent and unending practice. It embraces the poietic role of enskilment and the processual, continuous and non-teleological application of those skills through the enactment of practice(s). Embodiment, then becomes a natural, inevitable foundation for any discussion of learning and enskilment. The emergence of knowledge as a byproduct of an organism's experience of and with the world mirrors the way that Brooks's Creatures coordinated dissociated perceptual tasks to create behavioral patterns that appeared predictable, orderly, and purposeful in the eye of the beholder. Humans are not such different creatures themselves. "Intentionality and functionality, then, are not pre-existing properties of the user and the used, but rather immanent in the activity itself, in the gestural synergy of human being, tool and raw material" (Ingold 2000: 352).

Musicians, as it seems in this light, have much to learn from the child who can extract meaning from a sea of lights. And, just as with the child, the body's perceptual participation in the world guides this process as it unfolds. Grafting teleological structures onto this process from a manufactured, imaginary position of observation only hinders the process and obscures the "durational qualities of knowledge formation" (Marchand 2011). By opening ourselves to the immanent emergence of embodied existence, the practical details of enactive learning begin to crystallize.

Embodied Communication and Notation

> Cyborg politics is the struggle for language and the struggle against perfect communication, against the one code that translates all meaning perfectly.
> (Haraway, 1991, p. 176)

Let me reiterate: learning music is a communicative act. Notation serves as an agent within this communicative tapestry, a network that is anything but a simple background for the transmission of static information. Notation facilitates this process of "co-ordinated interaction between interlocutors and practitioners with their total environment" (Marchand, 2011, p. 2). Lave reminds us that "transmission and internalization [are not] the primary mechanisms by which culture and individual come together" (Lave, 1988, p. 177). On the contrary, the process of "knowledge formation" is "a dialogical and constructive engagement between people, and between people, things, and environment" (Marchand, 2011, p. xii). Notation is not a passive stand-in for the composer but a dynamic element within this social environment. And as both an agent itself and as an envoy from the compositional process, notation serves an active presence in the communicative texture that backgrounds any process of embodied enskilment. It is for this reason that Ingold insists that "the study of skill, in my view, not only benefits from, but *demands* an ecological approach" (Ingold, 2000, p. 353).

Maturana and Varela argued that communication is orientational, a succession of interactions rather than a vessel of content or information.[30] Viewing communication as a representational medium

30 See 2.3 Autopoiesis and Sehyung Kim's *Sijo_241015.*

gives a false impression of neutrality, suggesting as it does that there is some sort of neutral or objective information to be transmitted in the first place. Communication as orientation necessitates the active participation of communicating agents, including notation, in the immanent unfolding of knowledge across and between agents in a state of "constant flux, update, and transformation" (Marchand, 2011, p. 12). As Nicolette Makovicky remarks, notation "is not simply a neutral tool for the recording, exchange, and dissemination of information. Indeed, precisely because notation affords procedure to be separated from practice and disembeds craft knowledge from its geographical, social, and historical context, its use has concrete consequences for … understandings of skill [and] proficiency (Makovicky in Marchand, 2011, p. 76). Makovicky's crucial point is one often overlooked in discussions of music notation, namely, that notation is communicating craft knowledge rather than semantic content. Musical notation is the disembodiment of a particular embodied (or embody-able) skill and its primary function is to be an aid to subsequent reembodiments of that skill in new performers.

If we accept this premise, then we must note further that the dissemination of craft knowledge can never be achieved purely through written language. Apprenticeships and vocational training rely on learning through "legitimate peripheral participation," so that through the "indivisible character of learning and work practices," the apprentice can come to reembody expertise originally demonstrated by the master (Lave and Wenger, 1991, p. 61). In comparing the physical (re) embodiment of a notated piece of music to craftsmanship, the relationship of the performer to the notation and the composer is placed in an analogous context of "learning-in-practice" (Lave and Wenger, 1991, p. 61). In a master-apprentice relationship, the communication of knowledge and skills requires both observation and imitation. While specific linguistic interventions may also be occasionally necessary (or even irreplaceable) pedagogically, they ultimately provide scaffolding to other motor and gestural information. The primary transmission (or weaving) of knowledge, though, occurs in the sensorimotor realms of observation and imitation. "Language loses the 'simultaneity' of practice that vision can capture. Arguably more effective than vision for learning skill and acquiring practice is to have one's positions, postures and movements physically manipulated and guided by another person" (Marchand, 2011, p. 107). In accepting the dispersal of learning across various visual and tactile senses, Marchand highlights this simultaneity of information that is both unified and dissociated, describing it thus:

> [T]he actions, gestures, and postures that constitute a skilled movement unfold in time and in an orderly fashion, but not in a strictly linear sense like the word-by-word sequence of an utterance. Several co-ordinated actions and positions may be simultaneously enacted by different parts of the body at any point during a complex movement, and thus the construction and compositional properties of corresponding representations must be conceived of in a multi-dimensional way, reflecting the nature of physical movement itself in space. (Marchand, 2011, p. 104)

In examining this "interesting difference between parsing natural language and parsing movement," Marchand underlies the importance of the fact "that understanding action and movement *from* the body is achieved neither by constructing fully specified imagistic representations of what has been seen, nor by formulating linguistic propositions that describe what has been done," but is instead "arrived at in motor cognition and expressed as incrementally and in the real time of the observed performance" (Marchand, 2011, p. 104). Physical practice has essentially asynchronous elements that are inextricably related in the contextual realization of a task or act. These simultaneous elements are quite intuitive in many ways, comprising sensorimotor experiences within the fabric of enacting or imitating a task.

> [This] kinaesthetic information represents the corporeal sensation associated with that action: the feeling of muscular extension and contraction; the feeling of muscular relaxation and tension; the feeling of flow, disruption, and vibration in action; and the feeling of applying force or exerting pressure. The proprioceptive content represents an embodied sense of balance and an interior sense of the relational positioning of digits, limbs, and other body parts to each other. (Marchand, 2010, p. 110)

Marchand's understanding of "embodied communication" is supported by his use of dynamic syntax (Cann et al., 2005; Kempson et al., 2001). Dynamic syntax accommodates contextual information and layers of activity into the semantic content of language, thus allowing for the listener's full experience of both "time-*linear*" and "time-*ordered*" linguistic utterances aided by the inferences of their full array of sensorimotor perception. Dynamic syntax is a way for Marchand to attempt to build a more useful "syntax" out of what is quite obviously the "context-dependence of action interpretation" (Marchand, 2010, p. 102). This comes down to the way that sensorimotor perception and imitation come to bear on the organization of perception. I return once more to the child extracting meaning from the sea of lights: there is a huge amount of information available when information transmission is properly considered in its context-dependent, enacted situation. However, the parsing of that information is something that must be developed, and therein lies the importance of imitation.

Marchand demonstrates this by noting that visual observation of a physical task is not enough to properly parse meaningful guidance towards imitation, remarking quite pertinently, "Visualize a trapeze artist in motion, and then try it!" (Marchand, 2010, p. 104). What is lacking in most people's ability to visually watch a trapeze artist and then imitate it is not their ability to notice all of the little details of the trapeze artist's actions, but rather their ability to parse the hierarchy of importance of those actions—which are most relevant, which irrelevant and purely idiosyncratic or personal to the trapeze artist—and their ability to relate that visual information to their own kinaesthetic experience. Lave and Wenger refer to a "way-in" learning process in apprenticeships (Lave and Wenger, 1991, p. 72). In their example, of a tailor's apprentice, they note that the apprentices often begin by working on objects very close to completion, for example, with tasks such as ironing, then later hemming, and so forth. By working with nearly-finished pieces, they build their physical and kinaesthetic relationship to these objects, so that as they slowly move backward in the process, gradually to sewing and eventually all the way to cutting cloth, they minimize the risk of simple but costly mistakes that derive from a lack of contextual understanding for their actions. This "way-in" approach allows the apprentice to build extremely valuable first-hand embodied knowledge in relatively low-stakes situations, and only later reinforces that with the slow accrual of additional practical knowledge in incrementally higher-stakes situations. This is precisely why the example of the trapeze artist is so revealing: there is a limit to the low-stakes situations that would enable a "way-in" approach, thereby making explicit the need for precisely such embodied stores of knowledge that are necessary to parse the relevant information from observation of the trapeze artist.

Ingold reveals yet another crucial aspect of "way-in" learning in arguing that the novice's enskilment results in what he terms "a process of guided rediscovery" (Ingold, 2000, p. 356). Although potentially directed or curated by the master, it is the novice's pre-existing embodied knowledge of the objects on which they work that results in an intimacy that exceeds learning merely by discovery, but is in fact a deeper completion of the act, a *re*discovery. Marchand's engagement with dynamic syntax examines this rediscovery more closely by exposing the embodied, contextual linguistic elements that contribute to understanding in this mode. Maturana and Varela described the creation of a linguistic domain as one in which the successive orientations offered by two (or more) agents to each were in some way mutually intelligible—that is, that they both consider the responses from the other relevant enough to their own expressions that the interaction can continue with a satisfactory

fulfilment of their respective expectations. Marchand describes a similar effect in discussing dynamic syntax, noting, "The hearer's task involves parsing the information made available by an utterance in natural language, and progressively assigning interpretation with the goal of constructing a mental representation with propositional content that closely matches that of the speaker's intent" (Marchand, 2011, p. 103). Essential to this, at least in a dialogic context, is the explicit or tacit agreement of the speaker that the hearer has aptly hypothesized their intent. This tacit agreement can occur in many ways; certainly, in quotidian settings, it rarely occurs with any explicit confirmation, but rather emerges tacitly as the interaction continues. However, this does not mean that in every case of continued, mutually intelligible interaction, the hearer has accurately parsed the intent of the speaker. In transposing these theories of linguistic and information parsing from contextual and embodied situations, Marchand proposes as a particularly useful model the linguistic event known as a "shared utterance."

A shared utterance occurs when "participants shift between the roles of parser and producer" (Purver and Kempson, 2004, p. 151), or in more general terminology, when one person completes the sentence of another. In a shared utterance, the speaker and the hearer are able to align themselves and to mirror each other both in terms of "lexical content and syntactical structures" (Purver and Kempson, 2004, p. 151). The hearer is then able to make an "abduction" step, interjecting to complete the thought and "thus hijacking the speaker's role and making the original speaker the parser" (Marchand, 2011, p. 111). The means by which the hearer is able to mirror the content and context of the speaker ably enough to interject constructively can also be replicated in non-verbal settings (Marchand, 2011, pp. 111-112). The mirroring processes of the parser in language are reproduced by parsers of visual and embodied observation. The observer's task involves "the disarticulation of a movement into its constituent actions, gestures, and postures, and mapping these to motor representations" (Marchand, 2011, p. 111). In other words, the observer mirrors the motoric activity of the actor mentally. As previously noted, the ability to parse this information effectively and to truly be able to mirror the physical motions and gestural syntax mentally requires a particular contextual familiarity and embodied knowledge from the observer. Marchand contends that such "shared performance" occurs "frequently" and "in an equally straightforward manner" and offers a selection of examples from both master/apprentice and collegial relationships in a woodworking school (Marchand, 2011, p. 111).

Marchand points toward another key part of this relationship by remarking not only on the ease with which such shared utterances and performances are executed, but also on the ease with which the parser's abduction step incorrectly predicts the producer's next contribution. What is most interesting in these examples is not the phasing between the mirroring of the two actors' mental experiences of the interaction, but rather the ease with which the incorrect abduction can continue the interaction effectively to the extent that the original producer never corrects the mistake or offers the originally-intended content. In some cases, in fact, this "hijacking" of the performance can be more productive than the intended version, as in an example of Marchand's, wherein a colleague interjected in the assembly of a cabinet with the use of a clamp more suited to the task than the one Marchand had intended when initiating the gesture to utilize it (Marchand, 2011, p. 110).

While Marchand's work demonstrates quite compellingly embodied mirroring of physical tasks and the straightforward manner in which they can be parsed and shared, the question remains how these shared performances are affected by the intervention of notation. The role of abduction both in successfully predicting intent and also in "hijacking" is essential to this process. Notation disembeds embodied knowledge, thereby adding (often but not always insuperable) temporal and spatial distance between the initial knowledge and the performer who rediscovers it. Even more dramatically, the notation can even be a stand-in for the initial embedding of knowledge, such that

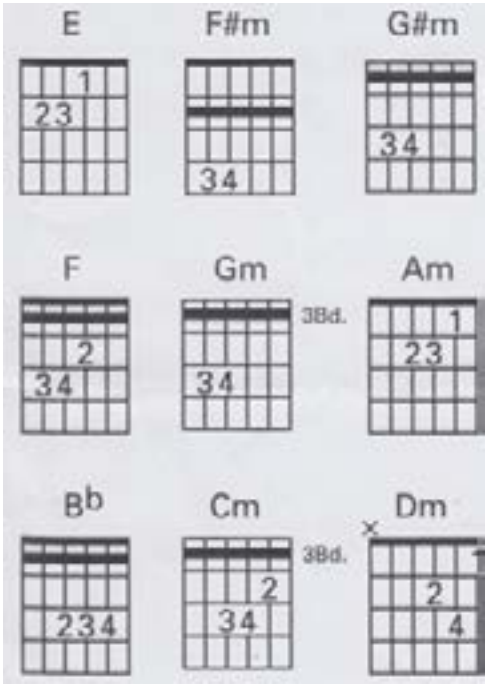
it has never been embodied at all until the point at which it is *re*embodied, post-notation, in the performer. Even (or especially) in the absence of a pre-existing body of knowledge, the performer is, nevertheless, engaged in an apprentice-like relationship to the embodied knowledge being developed. This point is worth reiterating before exploring its application to a real piece of music: the reembodiment of craft knowledge by a performer occurs analogously to the reembodiment of craft knowledge by an apprentice as described heretofore; however, whereas the apprentice is often in quite close temporal and spatial proximity to the master who demonstrates and guides this enskilment, the performer is communicating rather with a notation that has disembedded the embodied knowledge, which must then be rediscovered and reembodied by the performer at a temporal and spatial remove from the source.

To demonstrate this, I will look at an early example of tablature notation for the trombone, Klaus K. Hübler's *Cercar* from 1983. In observing the intervening role of notation in communicating embodied tasks, I will explore the role of shared performances in constructively predicting and rediscovering actions and syntax from a perspective that acknowledges that there are actors on both sides of the notational divide. I will also examine the means by which the enactions on either side of this divide mirror and align the (re)embodiment of the notation and the critical role of abduction in weaving these two strands together. "Way-in" learning will be presented as a potential model for effectively creating a situation that enables this type of shared performance and abduction to occur.

3.2 Tablature, Shared Performance, and Klaus K. Hübler's *Cercar*

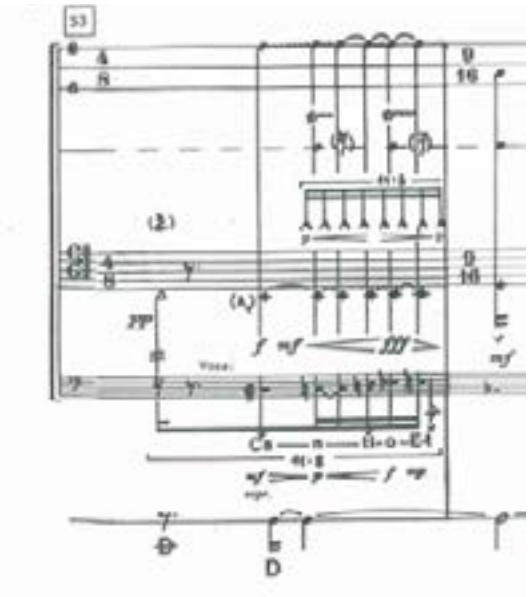
Tablature notation offers a conundrum for interpretation. On the surface, a tablature appears to micro-manage the performer, extending the reach of compositional intent to small, isolated components of the performer's body. Even as it exerts this control, though, through an increased incidence of one-to-one relationships between notated actions and performer gestures, it simultaneously elides transmission of resultant sounds. Seen within a tradition of representational music notation, tablature can be experienced as an apotheosis of textual fidelity, wherein the composer's dictation of precisely predetermined musical gestures is taken to an invasive extreme. Alternatively, however, this elision of traditional Western representational values—such as pitch—mean tablature can also be interpreted as a communication of primarily embodied cues, which is to say, as a codification of craft knowledge rather than as a codification of musical semantics.

In its simplest form, a tablature notates a few physical actions that allow a performer to reproduce a musical gesture with a semblance of accuracy, but without any requisite knowledge of traditional harmonic or rhythmic notation. The classic example would be pedagogical guitar tablature, in which a prerequisite understanding of traditional Western music notation is rendered superfluous by the organization of pitches and harmonies based on the fingerboard (fret) positions and strings used to play them.



Guitar tablature for a series of chords, indicating string, finger, and fret position (Antonelli and Etterlin, 2009, p. 19)

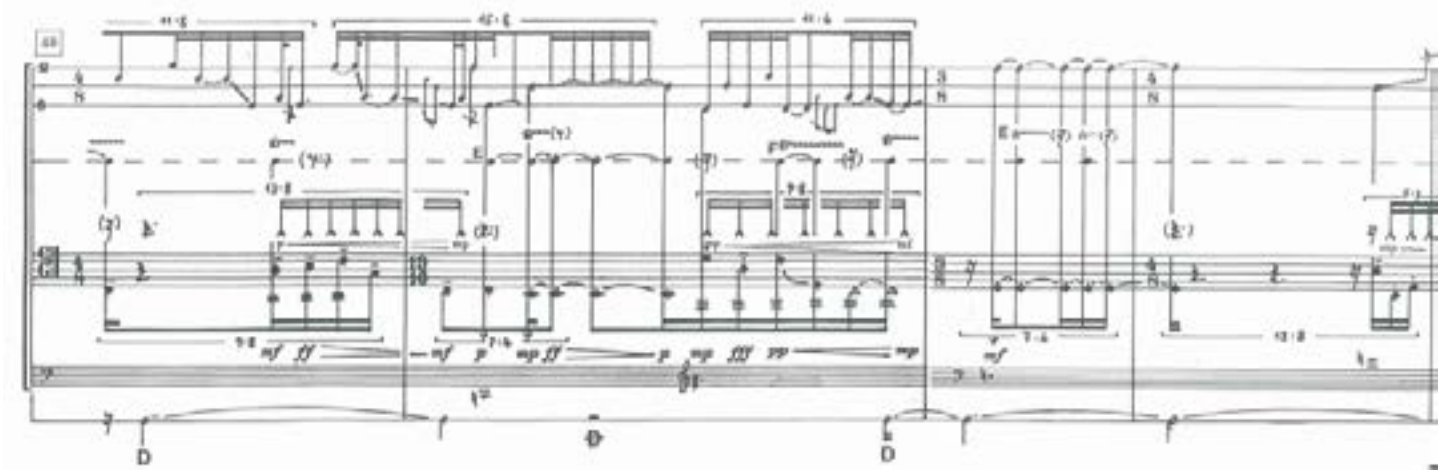
Taken to a greater extreme, though, tablature can become more involved, even intrusive, as in Klaus K. Hübler's *Cercar*, wherein the trombonist is given separately notated staves for a catalogue of physical components of trombone playing: slide position (right hand), valve action (left hand), overtone series (lips and oral cavity), diaphragm vibrato, vocal actions, and mute.



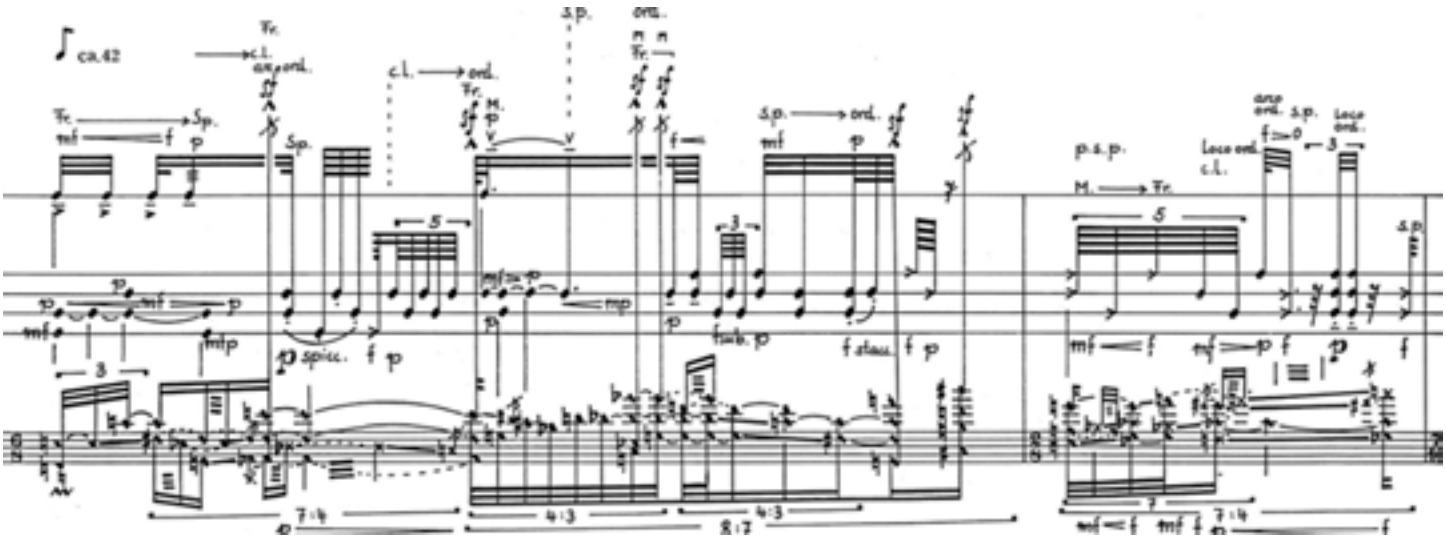
Klaus K. Hübler: *Cercar*, m. 53
systems indicate (top to bottom): slide position (right hand), valve action (left hand), diaphragm vibrato, overtone series (lips and oral cavity), vocal actions, and mute

Hübler was a pioneer of such notations, and his work in the 1980s helped to revolutionize the potential for physically polyphonic notations as means for reimagining and reinventing instrumental practice. His influence can be felt across the decades since then (cf. Rutherford-Johnson 2010; Cummings 2012), although, notably, no composer since has attempted quite such an extensive dissociation of trombone technique. Despite much and varied work in this direction, much of it addressed in this dissertation, *Cercar* still stands as a limit of extremity in the tablaturization of the trombonist's physicality, and thereby exposes most clearly which aspects of learning and performing are problematized therein.

As previously stated, the conventional wisdom is that tablaturization accentuates compositional control over the performer's body. It is indeed quite easy to arrive at that conclusion from even a cursory glance at certain passages of Hübler's work, where the polyrhythmic intricacy of dissociated physical actions can easily provoke despair in an aspiring performer, as seen in two of his works for solo instrument:



Klaus K. Hübler: *Cercar*, mm. 40-43



Klaus K. Hübler: *Opus Breve* for solo cello, mm. 1-2

This impression—of the composer micro-managing instrumental practice—is contingent on a series of assumptions implicitly handed down by the Western conservatory tradition. The enshrinement of the composer as genius in the 19th-century development of the classical canon handed future generations an obligation to textual fidelity couched in a strict hierarchy of composer-performer-listener. This is itself an implicit assumption that music consists of what is explicitly included in the text, that is, that it consists of that which has been chosen for inclusion. Nicholas Cook describes the Western tradition as a "musical culture [whose] basic identity lies in its mechanism for constituting sounds as intentional objects" (Cook, 1990, p. 223). Music is seen as a series of intentionalities. Ancillary or accompanying gestures and physical actions that are necessary or helpful in executing the notated musical gestures are effectively effaced. What the composer decides to include is all that is properly allowed to exist in the music. The composer's intention is religiously guarded, and religiously disputed, such that much of the discourse surrounding Western classical art music is an endless stream of bickering over composers' intentions. The thrall of the performer's interpretation follows naturally, as a paean to the cult of compositional intention and the hierarchical deference to the composer's mythical intentionality. This ideology fetishizes inclusion: the assumption that composition and notation entail the choosing of that which is included in the artistic product, a right naturally reserved for those higher in this hierarchy. Within this framework, music entails only what has been put into it by the composer: this note, in this moment, on this instrument. Seen through this lens, tablature is naturally interpreted as a vehicle for ever finer distinctions of intentionality transmitted from the composer to the performer, and by logical extension, of ever greater degrees of control exercised by the composer's mind over the performer's body. It is a necessarily hierarchical interpretation of the composer-performer relationship as mediated by notation.

Tablature and Craftsmanship

This impression is, as noted, heavily influenced by the aesthetic and intellectual ideologies of the Western classical music tradition, and it obscures other aspects of tablature notations that provoke alternative interpretations of the composer-notation-performer entanglement. Notably, tablature notations are not confined to music. In fact, they are far more prevalent outside of music, and can be found in many disciplines of craftsmanship. In this case, tablature becomes a means of communicating embodied knowledge and instruction in order to provoke replication of the expression of a particular craft skill. As Nicolette Makovicky notes, "Behind these issues [of notation] lies the unresolved questions of whether craft knowledge is best understood as context-dependent and performative or whether it is based on rules and laws which can be abstracted from practice"

(Makovicky in Marchand, 2011, p. 77). Makovicky, studying the role of notation in the codification and preservation of lace-making designs in Slovakia, details the fault lines that run between efforts to preserve traditions (and therefore to codify for the sake of posterity) and the everyday practices of craftsmanship that are "generative" while still continuous with tradition (in contrast to "imitative" craft targeting fidelity to tradition). Slovakian lace-makers from the city, who painstakingly preserved discrete designs and trends from different villages, were not accepted by lace-makers from those same villages, who recognized the designs and patterns but not the hands that had woven them (Makovicky in Marchand, 2011, p. 91). The village practitioners saw the notational diagrams not as codifications but as orientations: "In other words, drawings and diagrams are not created at the beginning of the design process, but emerge at the end of the production process … they are as much part of the material outcome of the lace-maker's practice as the lace" (Makovicky in Marchand, 2011, p. 92).

In learning from such tablaturized craft notations, it is also instructive to examine how these notations effectively influence craftsmanship in the act of production. Makovicky describes the orientation of the lace-maker in this moment: "With her eyes on the pillow, she watches the intertwining of threads below the pins that results from her manual manipulation of the bobbins. Hence a lace-maker becomes aware of mistakes made by her hands only when a problem appears to her in the weave. In short, a lace-maker monitors the effect - the weave - rather than her movements used in creating it" (Makovicky in Marchand, 2011, p. 80). This description resonates with my own personal experience as a craftsperson, having apprenticed and worked over many years as a brass instrument maker. I have experienced firsthand the interplay of tablaturized instructions and embodied craftsmanship within a brass instrument workshop, and can attest to the interplay between codification and the vast array of inter-related and -dependent actions that are imbricated in the physical production of a piece. When working on a lathe or at the drawbench, orientations to pre-determined measurements and physical actions transpire in the context of the rhythms of work as it breathes and unfolds. They develop very literally in time and space, with the craftsperson's attention trained on the piece of metal that emerges in and through their intertwining physical actions—in dialogue with, rather than subordinate to, codified design stipulations.

This returns us to the theory of communication advocated by Humberto Maturana and Francisco J. Varela, already examined in the previous chapter, in which communication is orientational rather than informational. We can see that for a craftsperson engaged with the unfolding of their task in relationship to a tablature, communication is indeed primarily orientational. It provides context-dependent cues to the emergence of action, guiding but not pre-determining the trajectory of work. Rather than providing a set of physical prescriptions that could, in theory, guide even a layperson in the accomplishment of the task, even very rigorous and micro-managing tablatures become, in the hands of the craftsperson, orientations towards particular engagements with the body and its tools (themselves instruments and cyborgian extensions of the craftsperson's body). The expression of a particular measurement for cutting a piece of brass on the lathe becomes, in my embodiment of the task, a much more engaged and temporally-unfolding set of actions based on the resilience of the alloy, the speed and direction of the machine (variable in relation to both the metal and myself), and the depths of cut that I employ (which change progressively as the terminus of the work approaches). The tablature does not dictate the piece which will emerge from the work, but coexists with it, as an orientational stimulus within the dialogue of actions that will ultimately provoke the piece from its material.

This is part of what Ingold references with his term "guided rediscovery," the manner in which the craftsperson rediscovers their body and the piece upon which they work, with the aid of a notational stimulus, but not in thrall to it. It is not a discovery of a piece designed and fabricated *a priori*, but

the rediscovery of a piece through the interplay of embodied knowledge both notated in the design and already present in the craftsperson. Thus, Ingold's insistence on enskilment as "weaving" not "making" becomes a radically literal formulation, directly analogous to Makovicky's real-life lace-makers as they follow the finished weave more than the tools that produce it. The processual and unending process of weaving crafts into existence stretches both ways in time, provoking an understanding of notation and tablature that renders aspects of intentionality thought-provoking but less directly relevant. The information recorded is orientational and actively engaged with embodied practice, rather than purely antecedent and instructional. In viewing musical notations this way, aspects of craftsmanship and the building of contextual frameworks for actual physicality become more useful than exegeses of textual fidelity.

The "way-in learning" described by Lave and Wenger offers a useful case in point. To return to their example of the tailor's apprentice (Lave and Wenger, 1991, p. 72), the process of learning upstream in the creative process is an exercise in building context for localized craft practices. By ironing garments first, a context for the feel of the stitch and the dimensions of the garment and the hem are slowly entrained into the body. As the apprentice moves slowly upstream, to actually hemming stitching, and cutting cloth, this embodied knowledge becomes a necessary context for working in the interstice between design documents and finished products. In Marchand's conception of shared utterance and shared performance, way-in learning provides the necessary entrainment of context that allows for the emergence of the abductive step.

Shared Performance and Abduction as Embodied Knowledge

Marchand identifies astutely the slow accrual of embodied, situated knowledge that builds context for the execution of craft knowledge. In parsing a situation before performing an abductive step, in either utterance or performance, the parser must have a deep enough understanding of the situation to predict the course of action. In shared performance in craft situations, that knowledge is largely tacit and embodied. In order to understand which tool might be needed, and to then prepare or provide it in anticipation of its need in the developing situation, the parser must have a strong grasp not only of the workpiece and its trajectory towards completion, but also of any potential complications that may arise and the subtle, complex, and rich tapestry of cues provided by the craftsperson's body.

The embodied knowledge stored in a craftsperson is crucial to the orientation towards potentialities rather than actualities. Marchand describes a situation in which his need for a particular clamp in a time-sensitive moment is not only predicted but, in fact, better fulfilled than he himself had envisioned. This orientation towards potentialities, as demonstrated by Marchand's colleague, reveals the difference between a slew of possible parsings: having no idea what is going on at all; being able to recognize that *something* is going wrong; being able to identify that some sort of clamp is needed; or being able to predict that a particular clamp is needed before it is even required. This knowledge is typically built actively and cannot be relayed effectively in language. This is due largely to the types of skills learned incrementally through the interaction of the craftsperson's body with the resistances and cooperations of the materials they use. Only experience and imitation, not observation, can build this body of knowledge. In some ways, this is also down to temporal constraints, though, as in Marchand's examples, where the act of gluing provides a time limit to the actions. The alacrity and efficiency of abductive predictions become imperative, given that the time lost in verbal explication would render many such needs moot.

In my own expertise, working with brass instruments, quite a lot of work is done with flame, which provides a similar temporal constraint to the gluing in Marchand's woodworking example. All joints

of a brass instrument are joined by melted metal, either brazed or soldered.[31] This work unfolds in a very specific time frame: the metal, the joint, and the solder have to be hot enough for the solder to melt, but not too hot, or the other metals threaten seizing and constricting, prohibiting further work and forcing the piece to be discarded. This time constraint means that, despite lengthy and meticulous preparation, the final act of soldering must occur in a very particular time span and with a particular efficiency, neither too quick nor too slow. Being able to parse this situation and react appropriately in time is crucial. When I build trombone slides, the final and most critical soldered joints must be extremely precise, and yet each slide will contract or expand slightly differently depending on the situation. This is unpredictable, and yet has a huge impact on the functionality of the resulting slide. Being able to read the situation as it unfolds in time and respond abductively can be the difference between rebuilding the same slide four times (at the expense of its quality) or producing it quickly, efficiently, and with optimal functionality.

Marchand notes, as has been implied already here, that this sort of embodied knowledge is typically built through long periods of alternating observation and imitation (Marchand 2011). This protracted period of enskilment has, in my own experience as an apprentice, been typified by a long progression from extremely slow, inefficient work to a gradual assimilation of new skills into the habits of the body. Way-in learning, in which the apprentice works on finished pieces and slowly learns backwards into the process, is one way to realize this enskilment. It builds progressive responsiveness to subtle cues within the material, but is still often dependent upon observation and imitation. Aspects of fine motor control, appropriate bracing of the body, understanding of and proper use of the secondary hands and tools: all of these make the primary skill possible, and their discovery—or guided rediscovery—is enabled through this interaction between master and apprentice. Such periods of observation and imitation build the body of situated knowledge that makes possible the abductive leap that Marchand describes in a shared performance.

This raises the question, though, of whether such spatial and temporal proximity is always necessary. Perhaps language alone is incapable of relaying this slow accrual of embodied knowledge, but can it then only be relayed through physical proximity? Makovicky's work seems to suggest that notated diagrams can contribute to the deprioritization of such physical and temporal proximity, albeit in contexts rich with shared situated knowledge. By examining tablature notations such as Hübler's, it is possible to explore the way in which notations can encourage learning beyond proximity. They construct situations of way-in learning and provoke the accrual of situated knowledge necessary for enskilment. Notations build specific practices of craftsmanlike embodiment within a piece of music, establishing the context by which the instrumentalist can abductively complete a shared performance with the composer.

Kompositorik des Tuns

Interpreting tablatures as orientations towards specific embodied enskilments seems, at first glance, contrary to Hübler's own conception of his tablaturized notations. He described his work as a *Kompositorik des Tuns*, a composition of doing, in contrast to a *Kompositorik des Tons*, a composition of tones (Hübler, 1987, p. 147). He subjects the interplay of gesture within instrumental technique to rhythmic and polyphonic procedures analogous to traditional harmonic and melodic polyphony. He places these procedures squarely within the trajectory of Western classical music, framing them as a "dialectic" and making frequent reference to the classical canon (Hübler, 1987). In *Cercar* alone, there are references to the traditional form of *ricercare*, quotations of Bach's *Musikalischen Opfer* (both in the

31 Both braze and solder are alloys of metal that melt at lower temperatures, thus allowing them to be melted into a joint formed by brass or nickel silver pieces, where they then harden and hold the joint in place.

vocal text and the melodic material), and a retrograde in the entire harmonic material of the piece (Hübler, 1983b; Rutherford-Johnson, 2010). This self-styled dialectic composition is expressed even more overtly in the later incarnation of *Cercar*, a trombone and organ duet titled *Am Ende des Kanons* (At the End of the Canon).

Such self-aware engagement with the traditional Western canon would seem to belie the radical reimagining of notational agency that I have begun to sketch here, but Hübler himself rejected any teleological directionality in Western music and said of his notational developments that they were rather more "alterations" than "advances" (Hübler in Nyffeler, 1987, p. 7).[32] Similarly, in describing the impetus for his experiments with physically polyphonic notations, he places his work in contrast to movements like serialism that mine the acoustic and intellectual aspects of music for new material (Hübler in Nyffeler, 1987, p. 5), and remarks that his own methods seek "a return to an 'instrument-oriented writing style'" (Hübler in Nyffeler, 1987, p. 4).[33] By resituating "the instrument itself as a factor" (Hübler in Nyffeler, 1987, p. 5),[34] he places his tablature notations immediately into the realm of craft knowledge and implicitly acknowledges that the information transfer effected is practical rather than intellectual. His notations from this period resonate quite strongly with embodied craft knowledge, both in dialogue with and as an alternative to the rich history of centuries' worth of accrued technique and craft knowledge that are alive in contemporary classical performers (Hübler in Nyffeler, 1987, p. 5). The dialectics of his *Kompositorik des Tuns* concerns itself overwhelmingly with precisely this dichotomy—that which emerges between these two sets of accrued versus freshly imagined idiomaticisms.

Hübler's dialectic composition finds form in the polyphonic entanglement of physical actions, what Wieland Hoban identifies as a "methodology of the pairings of concentration/elongation and sharpness/blurriness" (Hoban 2005, 21).[35] In pursuing the parametric stratification of instrumental practice, Hübler eschews the performative aspects that arise logically from this prioritization of the physical over the sonic. For example, in his Third String Quartet, there occur passages in which the permutations of gestural polyphony leave the bow unactivated, thereby stranding other, continuing actions silent, unvoiced. It would be easy to exaggerate this gesturality, taking advantage of the moment to underline to the audience the dissociation of actions by theatrically miming the suddenly inaudible instrumental technique. Hübler, though, expressly forbids this, indicating that such passages should receive no augmentation or diminution of effort, but should rather be performed precisely as any other passage. In doing so, he places himself firmly outside of the context of performativity, neither confronting nor challenging the criterion of audibility as an aspect of music, but merely disregarding it as his physical dialectic orients itself in relation to instrumental practice and embodiment. This commitment to maintaining neither diminished nor amplified theatrical energy in the mute passages underlines Hübler's commitment to action over intellection: the polyphonization of gesture that leads to these moments emerges because the physically situated presence of "the instrument itself as a factor" (Hübler in Nyffeler, 1987, p. 5) takes precedence over the instrument's role as a medium for the intellectual threads of aural counterpoint.

32 "Ich weiß nicht, ob das nun 'Fortschritt' ist oder nicht, doch vielmehr als 'Veränderung' bezeichnet werden kann" (Hübler in Nyffeler, 1987, p. 7; trans. mine).

33 "Das andere, was mich interessiert, ist die Idee des Wiederaufgreifens einer 'instrumentengerechten Schreibweise'" (Hübler in Nyffeler, 1987, p. 4; trans. mine).

34 "Wenn ich für Streicher schreibe, zum Beispiel im 3. Streichquartett, versuche ich aus dem Instrument heraus zu denken, d.h. das Instrument selbst als einen Faktor in den Kompositionsprozeß einzubeziehen" (Hübler in Nyffeler, 1987, p. 5; trans. mine)

35 "Hüblers Methodik von den Paarungen Dichte/Dehnung und Schärfe/Unschärfe" (Hoban, 2005, p. 21, trans. mine)

Hübler's turn to physical parameters can easily be construed as composing action at the expense of more traditional compositional parameters (e.g. pitch, duration, dynamic, timbre). What is striking, though, is that his music is neither congruent nor incongruous with those parameters. This lack of aurally iconoclastic performativity has been described at times as a potential weakness of his music (Forisdal, 2017, p. 129): that his radical deconstruction of technique is not always audible (Baldwin, 2011, p. 4), that it could have been achieved equally through more traditional notation (Cassidy, 2008), that "the complex writing is intended only for the eye" (Orning, 2015, p. 304), or that it forces the performer "to work against their habits of learned musical expression" (Tsao, 2016, p. 85). These types of criticism, though, presuppose the expectations of standard classical musical experiences, demanding as it were that any such disassembly of technique or reappraisal of parametric construction present itself—and implicitly justify its existence—within a customary concert (i.e. listening public) setting. Predecessors' use of tablaturized 'silent' actions have often taken advantage of precisely these classical music concert expectations, such as in Mauricio Kagel's *Match* (1966), Luciano Berio's *Sequenza V* (1966), or Dieter Schnebel's *Zeichen-Sprache* (1987/89). Hübler's *Kompositorik des Tuns* markedly eschews that impulse, neither justifying itself by catering to a superficially deconstructive aural result nor caving to the theatricality of actions divorced from sound.

In effectively abstaining from this issue altogether, Hübler orients his work instead towards instrumental practice as the embodiment of tool-building, neither at the expense of nor in service to traditional musical expression. His devotion to the polyphonic treatment of instrumental technique opens itself to the poietic process in the Arendtian sense: the act of tool-building as a means to both creative expression and technical proficiency.[36] By subjecting easily discernible discrete actions to parametric, polyphonic treatment, Hübler reveals not the disassembly of instrumental technique, but the inherent multi-dimensionality of all technique, that is, the choreography of superposed actions that contribute to the execution of any traditional musical gesture. His dialectic engagement with the Western canon is revealing more of the canon than of himself: his polyphony renders visible the complex actions that are considered intuitive but that require a great degree of superposed physical coordination.[37] By reimagining "the polyphonic trombonist" (Hübler, 1984, p. 31), Hübler does not demand radical de- or re-constructions of technique, but merely establishes situations that compel the performer to orient their pre-existing bodies in new ways, developing new tools and skill sets, and thus instigating a renewed process of embodied enskilment unique to the context of *Cercar*.[38]

This compositional strategy—curating situational demands and provoking tool-building and enskilment—distinguishes Hübler's music. His pursuit of a dialectic of action places him, perhaps inadvertently, in the realms of poeitic crafstmanship and opens up space for the abductive relationships requisite for a shared utterance, or shared performance in Marchand's sense. By confronting the performer with his tablature notation, Hübler demarcates the situational context for a local enskilment to occur, and curates the context in which the performer and the composer can build rapport. This paves the way for the abductive step. When viewed through a lens of craftsmanship, as in a tablaturized diagram for lace-making or a design for a brass instrument that implicitly demands a unique tool,[39] Hübler's tablature places itself outside of a context of traditional music-reading and

36 See 1.1 Poiesis: *Vita Activa* and Theories of Value.

37 See 2.1 *Haecceitas* and Aaron Cassidy's *Because they mark the zone where the force is in the process of striking (Or, Second Study for Figures at the Base of a Crucifixion).*

38 Renewed in the sense that traditional classical performance practice positions technique as a tool to be developed and then deployed (and only in that order of operations), rather than one continually reimagined and reinvented

39 In making unique instruments, it can often occur that in order to produce a relatively simple and straightforward piece, the unique dimensions may dictate the fabrication of an entirely new tool, a process requiring far more time and engineering than the production of the piece itself. This is a major factor behind the tendency for research and development work to prolong as such necessities surface, as I have discovered to my own chagrin on numerous occasions.

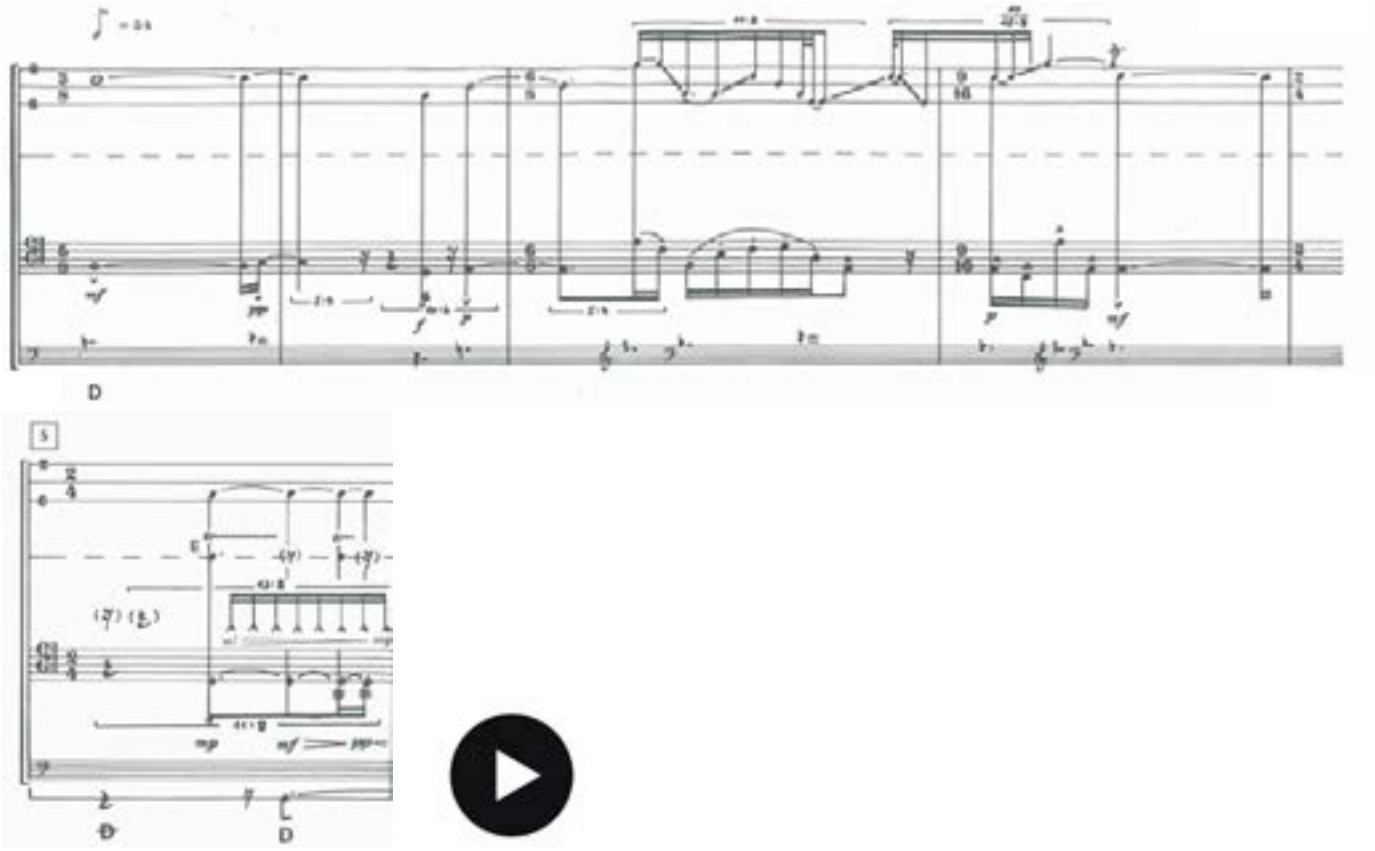
execution and firmly within the craft world of context- and tool-building. Inasmuch as this sets up a quasi master-apprentice relationship between the notation and instrumental practice, aspects of Lave and Wenger's way-in learning and Ingold's guided rediscovery emerge as extremely pertinent frameworks for learning a piece such as *Cercar*.

Before delving into the specifics of practicing *Cercar*, it is perhaps worth commenting that Hübler's title intentionally references, in addition to *ricercare*, also *carcer* (prison) (Hübler, 1983b). However, viewing his tablature as a context for creativity within a deployal of craftsmanship repositions that prison as a rather more liberating phenomenon. It drives the performer towards an inevitable fluidity of *re*assembly rather than towards a dogmatic fixation on *dis*assembly. It allows a "straitjacket" (Hoban, 2000, p. 27) of technique to be recontextualized as the poietic distillation of creativity through a crucible of localized stricture, rather more in the spirit of a traditional *ricercare*. Hübler's notational straitjacket provides the material media of the craft—the flame, the solder, the metal joints—but only the craftsperson enacting the fabrication of the piece can react to the unpredictable vagaries of the moment, manipulating bodies and instruments to embody the notation in a specific space and time.

Learning and Enskilment in Context

In the case of *Cercar*, the context for entraining new skills occurs chiefly with respect to rhythmic differentiation. Unlike some pieces previously addressed in this dissertation, Hübler's polyphony is rooted firmly in a Western tradition of vertical, multi-staff, rhythmic heterogeneity. As will be seen, this dissociation does not survive the learning process. In performing these polyphonic gestures simultaneously with a single body, they are inevitably embodied holistically in the performing body of the instrumentalist, superposed and entangled—decoupled no more. In fact, the ultimate commingling of these lines in a single body leads to a very fluid resulting sound, monophonic and at times even melodic. In contrast to some of Hübler's later physically polyphonic pieces, *Cercar* does not devolve into noisiness or broken technique, but maintains at all times a concrete, sounding pitch. The rhythmic polyphony of body parts introduces a high degree of microtonality and a number of glissandi, but maintains a sense of melodic contour, however complicated.

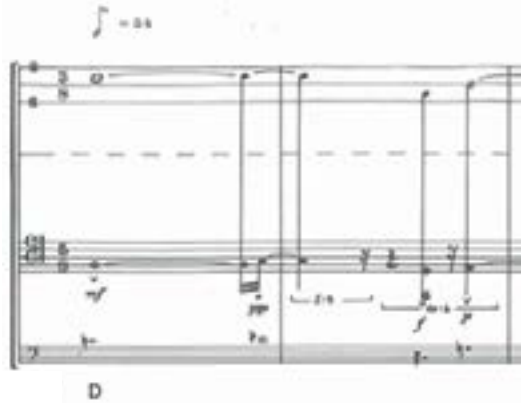
For the performer learning *Cercar*, this presents a conundrum. The notation presents such an extreme degree of dissociation, with almost every element of playing notated distinctly and in its own system. The resultant sound is, though, paradoxically quite monophonic, despite even the modulations of the mute and the valve. The passage below, the opening statement of the piece, demonstrates this melodic character, first presented in homophonic rhythm in measures 1-2, but then maintained even through the early dissociations of slide and lip in m. 3 and the interpolations of valve, diaphragm and mute in m. 5.



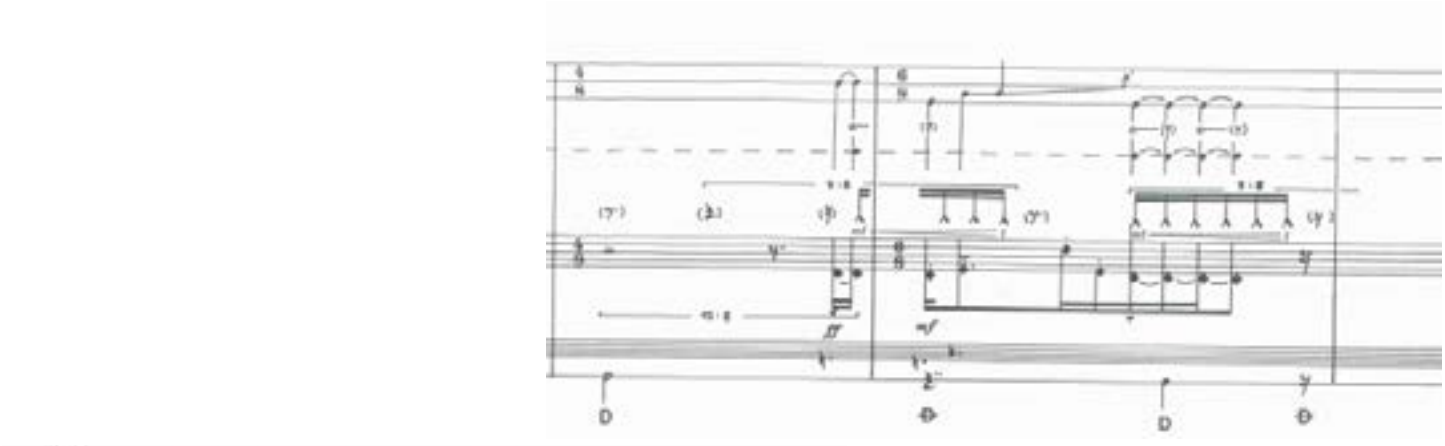
Klaus K. Hübler: *Cercar*, mm. 1-5

What is this tablature notation communicating, then? If it seems incongruous with the musical character of the resultant sound, and yet demands such a high level of engagement for a performer accustomed to traditional Western notation, how can one effectively parse the score to guide an efficient and productive learning process?

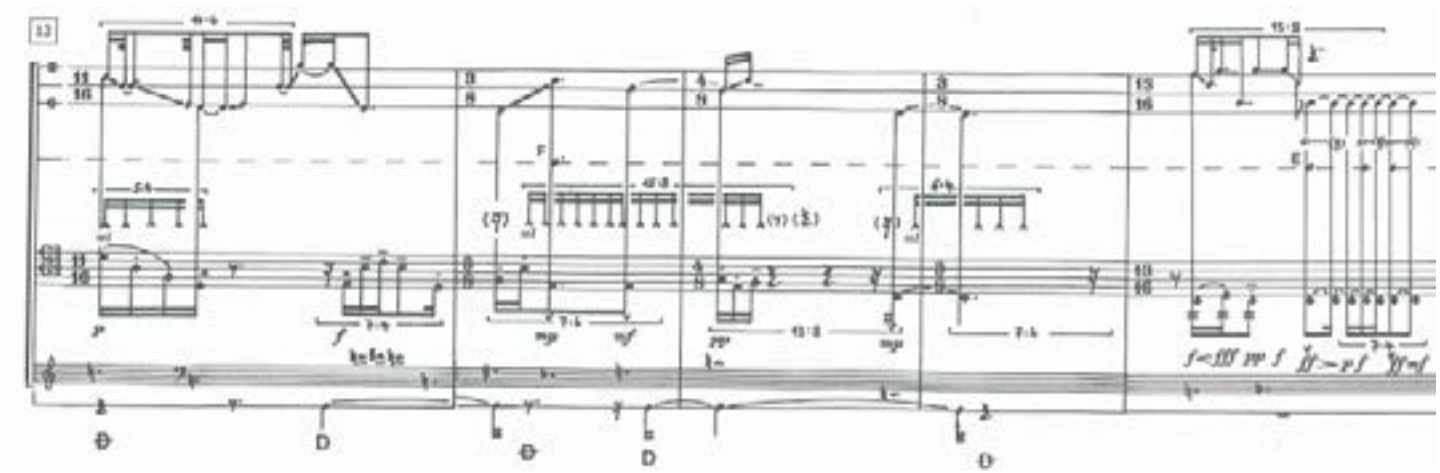
I approach this as an impulse to craftsman-like enskilment. The rhythmic polyphony can be interpreted as embodied cues, indicating orientational directions to a practiced craftsperson. In *Cercar*, rhythmic polyphony occurs in many varying degrees (see below): passages of simple, homophonic rhythms; passages with rhythmic homophony in more than one parameter accompanied by other rhythmically distinct strands; passages with relatively few parameters overlaid but with high degrees of rhythmic dissociation; occasional passages of high density and completely distinct rhythmic lines; and passages with many parameters layered together but largely or completely homorhythmic unison.



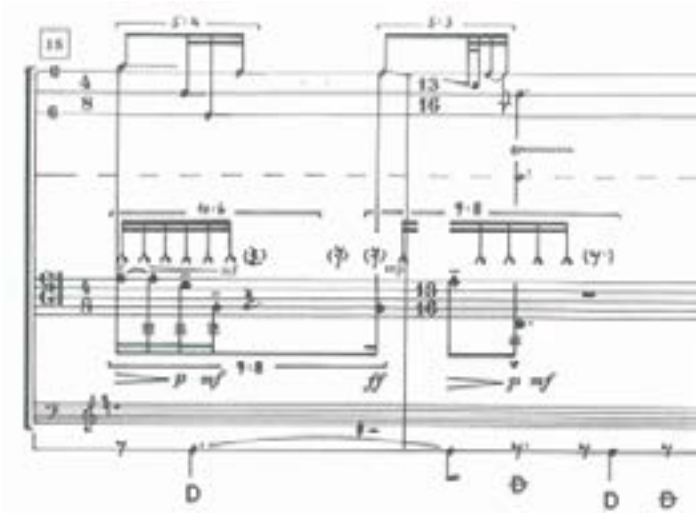
Passage 1: mm. 1-2
simple, homophonic rhythms



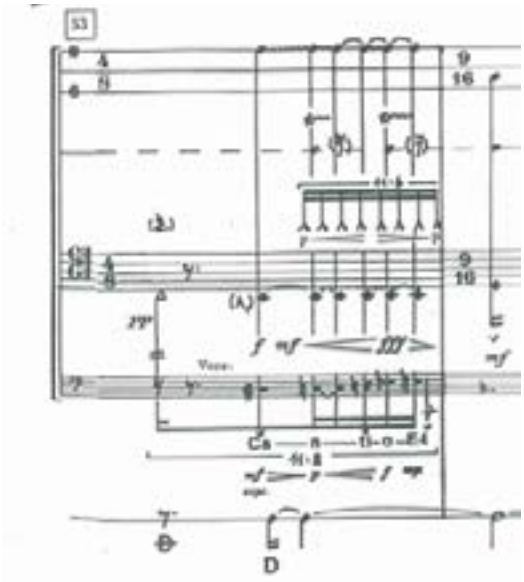
Passage 2: mm. 27-30
rhythmic homophony in more than one parameter accompanied by other rhythmically distinct strands



Passage 3: mm. 13-17
relatively few parameters overlaid but with high degrees of rhythmic dissociation



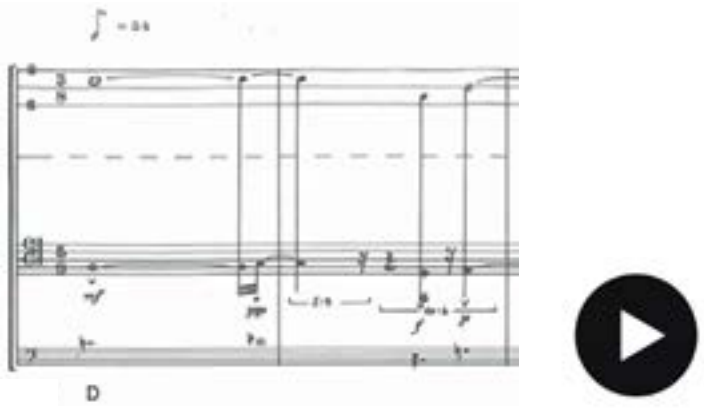
Passage 4: mm. 18-19
high density and completely distinct rhythmic lines



Passage 5: m. 53
many parameters layered together but largely or completely homorhythmic unison

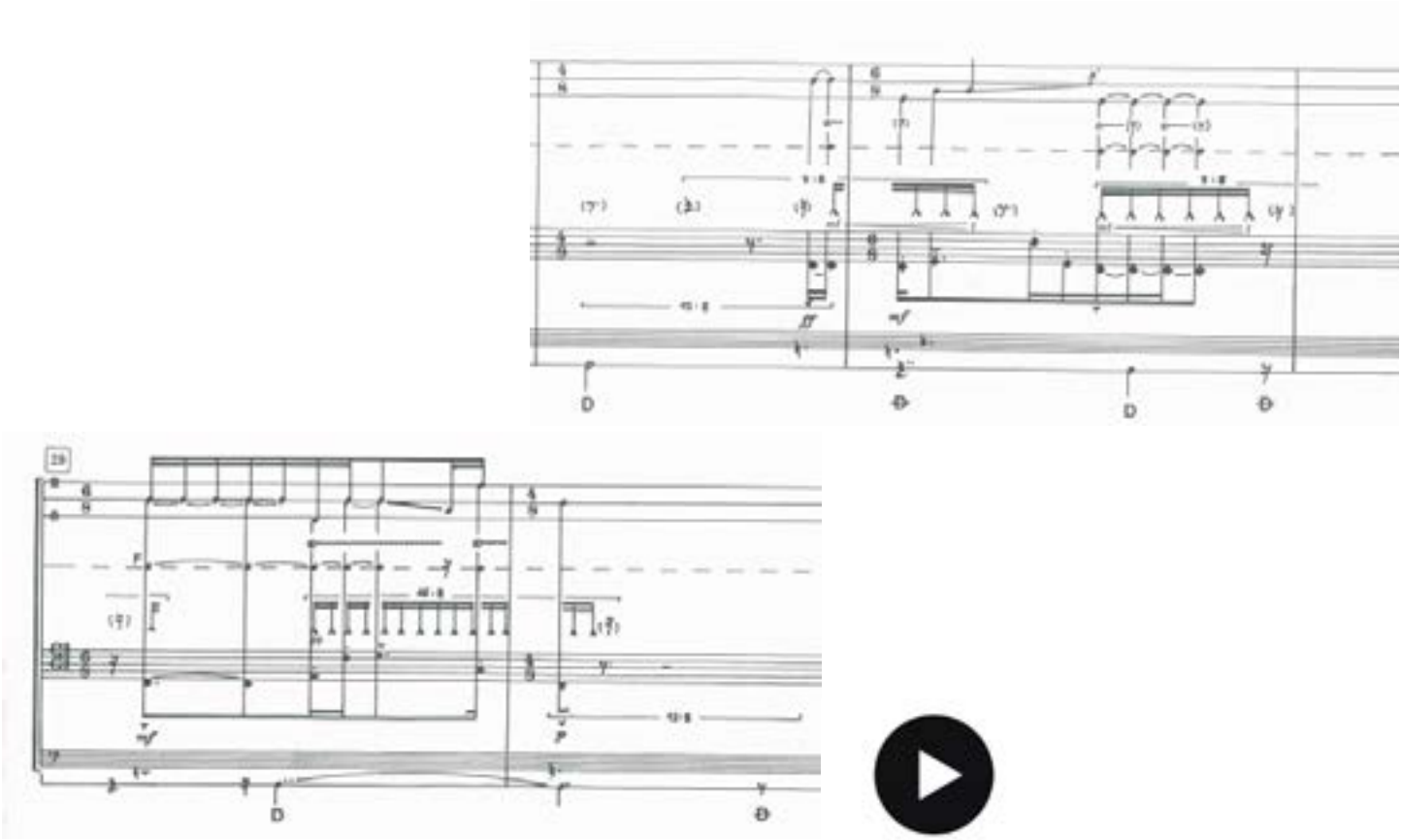
The fact that many of the most complicated accumulations of parameters contain many homorhythmic or rhythmically-related material is quite useful information. The piece itself offers a gradation of difficulties that allow performers to accustom themselves to these types of rhythmic association and dissociation gradually and carefully. In this sense, the extreme visual dissociation of each parameter gives a type of physical information which is directly orientational with respect to traditional technique. In comparing this type of tablature to wood-working or instrument-making, the analogy of bracing is extremely useful. In many ways, Hübler's notation is orienting the performer's body towards particular bracing strategies within the body, which shift often from one side to the other, in varying combinations. Like a craftsperson careful to understand a new tool and learning when to brace with legs, or when to brace with a secondary arm, or when with several fingers resting on the workpiece, these choreographies of corporeal orientation can change quickly and fluidly while maintaining global balance and stability.

In passage 1, I allow the homorhythmic character of the opening two measures to establish a context for a basic tempo in the embouchure, so that when the slide breaks apart rhythmically in m. 3, I am able to anchor myself to the simple rhythms in the embouchure staff and shift my concentration to the more complex and variable rhythms in the slide. This passage is fairly simple and allows the performer to easily establish this rhythmic transition from complete homophony to the physical bracing of the embouchure rhythm that enables the layering of the slide rhythms thereupon. Though at first this can be difficult and disorienting for a more traditionally trained classical musician, as I can attest from my own early experiences with the piece, a passage such as this one provides an invaluable opportunity to build this type of orientational awareness. Learning to actually, physically brace oneself with these rhythms, and to utilize them as a foundation to the gestural fluidity that emerges, becomes even more crucial in the progressively complicated passages that follow.



Passage 1: mm. 1-2
simple, homophonic rhythms

This strategy can then be carried into more difficult passages, such as in passage 2. Here, the slide and embouchure material revert to homorhythmic unison as the diaphragm accents and mute actions superpose unrelated rhythmic material onto the more continuous, homophonic material. The rhythmic unison of the more or less primary material in the slide and embouchure provide a very stable context by which the performer can brace themselves to a particular tempo and rhythmic character, allowing the other voices to then unfold more naturally and with more conscious concentration within that relatively stable context. Given the primacy of slide and embouchure within traditional trombone technique, Hübler's orientation of the body towards these gestures as structurally stable anchors for more complex polyrhythmic action can be relatively easily internalized in the instrumentalist's embodied practice. Even as the additional, polyrhythmic challenges posed by the diaphragm and mute actions require the entrainment of radically non-traditional sensory orientation, the structuring of Hübler's frames of reference within the slide and embouchure here provide a useful medium for building this new embodied knowledge within a manageable context.



Passage 2: mm. 27-30
rhythmic homophony in more than one parameteraccompanied by other rhythmically distinct strands

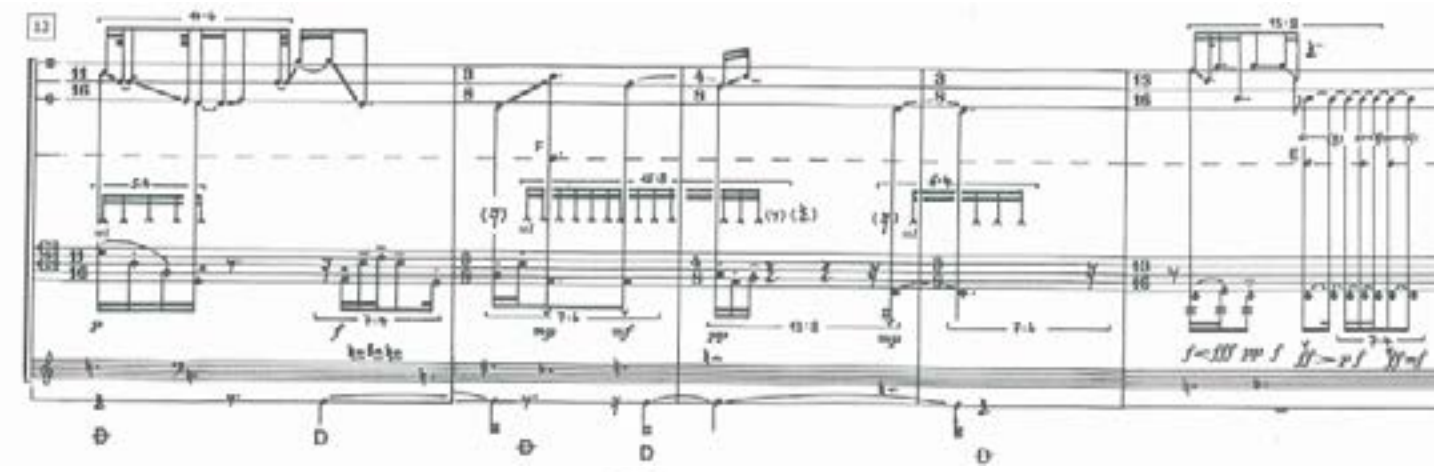
Although learning passages in this order removes the performer from the strict chronological progression of the piece, it does allow slow and progressive learning while maintaining a connection to the holistic embodiment of parameters, all without separating strands of rhythmic material. This order of practice moves from passages with least rhythmic complexity through others in order of roughly increasing rhythmic complexity and parametric density. In effect, this is way-in learning, in the sense of Lave and Wenger's tailor's apprentice. By beginning with these comparably less dense passages, the instrumentalist is able to carefully and slowly entrain the necessary embodied context for these polyrhythmic parametricizations. This can be accomplished while maintaining a holistic embodiment of gesture and keeping close to the resultant sound, which emerges as very fluid and monophonic.

When I first learned *Cercar*, I did not work this way. I spent many hours working on individual rhythmic lines, both with and often without the instrument, before slowly attempting to integrate them, layer by painstaking layer. Speaking only for myself, I must sadly report that my diligence in this respect was poorly rewarded, if at all. The time- and energy-consuming drilling of separate rhythmic strands and the progressive incorporation of them into the instrument could work, but slowly, and with an ever-present risk of mental saturation and overload in complex passages. Moreover, I found that progress made in this way was easily lost by the following day. Only later did I begin working in the manner described above, maintaining a very careful proximity to the holistic, simultaneous performance of all parameters (a proximity to the final product, however rough, uneven, and inaccurate). I would work through progressively complex passages and entrain orientations to frames of reference for rhythm and tempo. These orientations would operate beneath the embodied context of gestural unity that emerged from the superposed, discretely notated strands of physical action. Only by working in this way did I find myself making substantive progress with

the piece, and even more notably, only with this method did I find myself able to effectively replicate progress from day to day without repeating long hours of entrainment. This latter advantage, which allows progress to be more easily internalized and depended upon, became the crucial factor in preparing the piece and effectively learning the volume of material it contains.

Hübler's notation actually supports this style of learning, counter-intuitive though that may seem from a first glance at its intimidatingly dissociated parameters. As should be more clear after examining these first two excerpts, Hübler's notation allows for a high degree of orientational communication to occur with respect to the instrumentalist's body. Rather than truly dissociating actions, and allowing them to occur independently of each other, the superposition of these actions becomes an integral part of the corporeal tactility of the piece, and becomes, in fact, an aid to the entrainment of the musical passages that must so painstakingly be learned.

This reliance on the bodily sensation of the superposition of these actions becomes increasingly useful as the passages become progressively more difficult. In passage 3, for example, there are relatively few parameters active at any given moment. With only rare exceptions, there are only two or three strands of material active at a time. Each local superposition, though, contains quite difficult polyrhythmic material. Moreover, the performer is confronted with the difficulty of rapidly switching from one parameter and one polyrhythmic superposition to another. The work done in the previous passages, which entrain the skill of identifying and orienting to variable frames of reference, lays the groundwork for turning this difficult passage into something achievable. Each localized segment is quite manageable given the low density of parameters, but the challenge of re-orienting one's bodily rhythmic relationship with such rapidity can only be entrained through holistic, physical work—that is, through way-in learning that embraces the contextual superposition of actions and learns to rely on that information as a tool rather than as an obstruction. By processing the above passages in the way described, this can be arrived at naturally and intuitively.

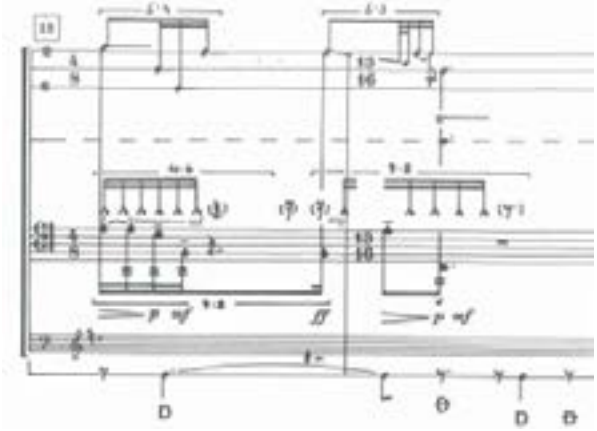


Passage 3: mm. 13-17
relatively few parameters overlaid but with high degrees of rhythmic dissociation

Hübler's tablature becomes, then, a source of embodied information—a legend to systems of orientation within the unified activity of the body. It is a diagram of trade skills, of situated knowledge in relation to craft and practice. Neither divorced from nor directly relevant to an aurally-teleological notation, Hübler's score embraces the communication from his own corporeal understanding of the instrument to the performer, and vice versa, as well. In this light, tablature notation is an effective and useful document of situated knowledge that builds context for the entrainment of new skills. This is the poietic act of learning a piece like *Cercar*, the embrace of this

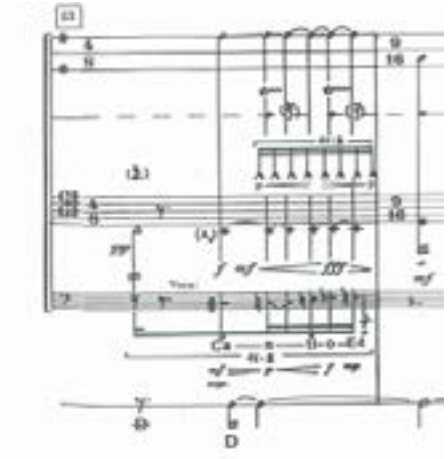
localized, situated knowledge to develop new tools of embodied craft, thus liberating the body for communication with the composer, the audience, and their own musicality.

I was only able to learn passage 4 (below) by relying on this sense of careful tool-building, of orientation to new embodied senses of myself and my trombone. It is a frighteningly difficult superposition of polyrhythmic material and instrumental virtuosity, and yet, as noted previously, some of these difficulties become advantages even, as the reliance on challenging fragments creates a context and structure around which the other parameters come to be housed. This potential benefit depends on the careful entrainment of this new skill, namely, to pivot rapidly from bracing rhythmically in one part of the body to bracing in another.



Passage 4: mm. 18-19
high density and completely distinct rhythmic lines

Hübler seems to be aware of this, and the only passages with maximum density of parameters contain, in fact, relatively simple rhythmic dissociation, as in passage 5 (below). This passage presents huge challenges to a performer with its saturation of actions and virtuosic demands of embouchure, voice, and body. Nonetheless, a careful learning process leading up to this moment can ensure that the passage itself is difficult simply as an expression of instrumental virtuosity, and occurs within a more comfortably parameterized context. By building situated knowledge of the piece and a poietic toolset individualized to *Cercar*, this passage becomes simply a difficult passage, analogous to facile scalar passages in more traditional Western notation. It is by embracing the embodied knowledge contained in this tablature that *Cercar* becomes an intuitive expression of musical virtuosity, thereby avoiding the trap of becoming a monolithic obstacle to scale with a toolset better designed to other situations.



Passage 5: m. 53
many parameters layered together but largely or completely homorhythmic unison

This poietic strategy prioritizes the slow building of tool sets tailored to local situations and individual pieces. This is, in effect, the building of context that Marchand refers to as the tacit body of embodied knowledge that enables abduction to occur between two agents. In this case, in place of a master and apprentice or two craftsmen in spatial and temporal proximity to one another, the tablature notation enables this body of shared knowledge to develop external to local space and time, as with the lace-making diagrams studied by Makovicky. By viewing Hübler's notation as a framework for poiesis rather than as a static document transmitting prescribed rhythmic and harmonic information, the space for establishing this shared situated knowledge becomes open and fertile.

Hübler works within this space by way of his prior exploration and development of new embodied techniques with the trombone. The performer accesses it through the portal of the notation. Between them, this shared space allows for the abductive step to occur, and both Hübler's notation of specific passages and the performer's subsequent learning of those passages are forms of abduction in this same space. Both the act of notation and of learning are shared performances, communicating on a plane of orientational embodiment that makes possible this congealing of agency, itself the materialization of a poietic act equally creative and craftsmanlike.

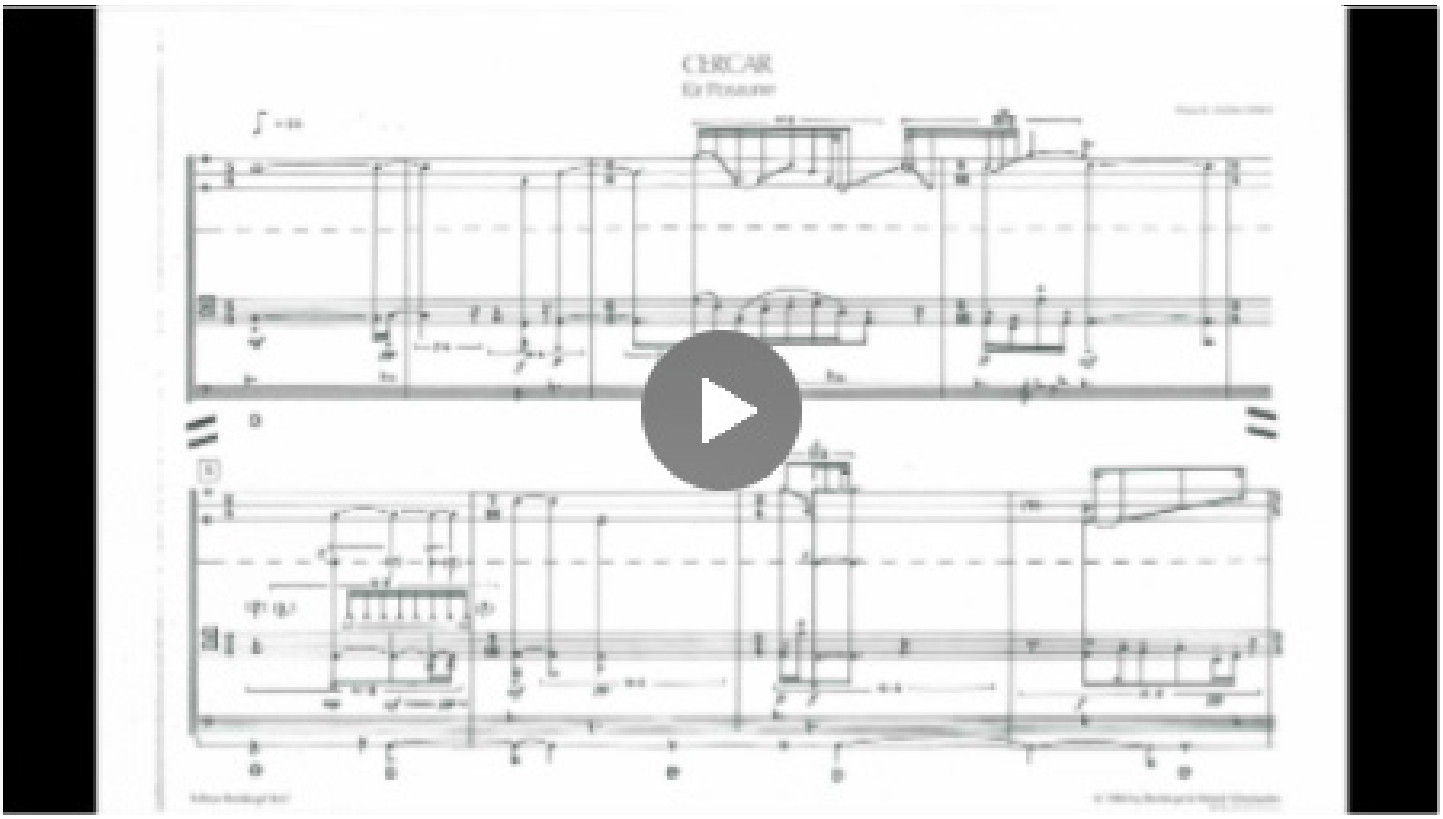
A Final Note: Varieties of Learning and Alternate Approaches

It is perhaps redundant but nonetheless necessary to note that this is not the only way to learn *Cercar*, or any other tablature notation. In my own experience, I did once learn the piece with a different method, and I present this conception of situated knowledge, embodied enskilment, and shared performance as a reflection of my own search for accuracy and efficiency with this piece and many others. Over many years, I have developed a methodology and embodied artistic practice that allows me to learn without becoming trapped in prisons of notation, but by embracing tablatures as tools for growth rather than rigidity. *Cercar*, though, has a long performance history, and almost certainly has as many effective learning strategies as there have been performances, if not more. As others have noted, it is possible to examine the notation of Hübler's trombone tablature and work out exactly what pitches will sound in each moment (Cassidy, 2008; Baldwin, 2011). Personally, I disagree, finding the fluidity of motion reified by the superposition of slide and embouchure produces a much more variable and colourful catalogue of microtonality than could effectively be communicated in traditional Western notation. Nonetheless, one early (and successful) performance of the work proceeded in precisely this fashion. Mike Svoboda, when performing one of the first iterations of *Cercar* in the early 1980s, transcribed the entire piece into traditional notation (personal communication with the author, 21 September, 2018). Some performers argue that this type of engagement with a piece, in which one builds a communication with the notation through transcription, is a useful if not necessary means to deepening understanding of the piece. Translators of literature have described this in countless ways. The act of translation engenders an intimate relationship between author and translator, in which "translation is as much an act of creativity as the original writing" (Shahane, 1983, p. 5). Svoboda's understanding of *Cercar* can easily be seen as a poietic engagement in its own right, producing a completely different body of shared, situated knowledge completely irrespective of the working process I have elaborated here.

Benjamin Marks, a major proponent of the piece in recent years, has also recorded some brief remarks about his learning process with *Cercar*. He describes a three-fold process: "i) reading the piece (a general feel, shapes, phrases, landmarks) ii) detailed work (in this case 'working out' most of the desired result combination by combination, finding all the interesting 'cracks' between the layers) iii) putting it all back with a sense of both (you then start to 'read' the notation as perhaps Hübler

intended, rather than rely so much on the 'workings out') (sic)" (Marks in Rutherford-Johnson, 2010). This approach is far more similar to my own, although perhaps less polemically described. In particular, if one reserves Marks's second step of learning as an act decidedly subsequent and supportive to his first step, then it is easy to maintain a relationship of contextualized, way-in learning. Isolated spot-checking occurs only within a more holistic context. This would be very similar to my own descriptions of poietic tool-building, although I tend to find the most personal success by maintaining a dogged, even dogmatic, commitment to careful practice devoted to holistic superpositions of parameters, however slow or fragmented that progress may then be.

All of these methods are, of course, equally valid, and in fact, their variety helps to demonstrate the poietic principle of approaching each situation variably: each performer is necessarily forced to construct their own shared, embodied relationship to the notation, and so also to Hübler. This leads to precisely the sort of abductive relationship that I have attempted to elucidate. As intimidating as a tablature notation like Hübler's can seem at first acquaintance, it is ultimately the perfect vessel for disorienting performers from their habitual practices and inviting them to engage with their craft in new, creative, poietic ways. In eschewing rather than confronting traditional performativity, Hübler opens up the space for a non-teleological craft to emerge, a cyborgian exploration of peripheries and entanglements that transcends the presumption of universal technique and revels in the liminal lacunae of individual instrumental practice.



3.3 Radical Embodied Cognition, Guides to Discovery, and Richard Barrett's *basalt*

An enactive approach to learning music means building practice tools that instigate the organic emergence of new, embodied skills. In examining Klaus K. Hübler's tablature notations, I have sketched an outline of how viewing notation as a form of embodied communication can help to construct these methodologies. However, in delving deeper into the personal practice strategies of a performer faced with these issues, a closer look at the scientific discourse around embodied cognition is merited. By exploring further the implications of radical embodied cognition, or radical enactive cognition (Chemero, 2009; Hutto and Myin, 2012), we can begin to see how a musician might construct an enactive learning process--rooted in radical embodied cognition—that is able to serve as an effective guide to discovery. In doing so, I will diffract these embodied approaches through Richard Barrett's long engagement with notation, improvisation, decoupled performance practices and practice-building in music, culminating in a discussion about the learning of his trombone solo *basalt*.

Radicalizing Cognition

Although the role of the body and the environment in shaping cognition has become increasingly impossible to ignore in the last half century, the exact nature of their influence on cognition remains hotly contested. What exactly is the relationship of the body to the brain? And how can we understand the kinds and degrees of reliance that they have on each other? Research on embodied cognition has proliferated incredibly since the advent of its relevance in the 1980s (through the work of Brooks, Minsky, Thompson, Varela, and Rosch, et al.). But this research has also progressed along many different and not always compatible trajectories (Chemero, 2009; Wilson and Golonka, 2013). Two major camps of embodied cognition, themselves extremely diverse, split fairly cleanly along issues of representationalism: "There are those who think the main business of cognition is … *mental gymnastics*, the construction, manipulation, and uses of representation of the world, and there are those who believe that the business of cognition is to do something else" (Chemero, 2009, p. 18).

Following the heavy influence of cognitivism and computationalism in the late twentieth century, the basic understanding of representational cognition was that "the form of behavior is that it reflects the content and operation of an internal algorithm (implemented as a mental representation) designed to produce that behavior on demand" (Wilson and Golonka, 2013, p. 2). In introducing embodiment to that description, a large body of research began to address how an agent's perceptual grounding in a body impacts its cognition. An easy example is an experiment on people's physical orientation when they conceptualize time. The study found that when thinking about the past or the future, people tend to lean slightly backward or forward (respectively), concluding that "mental time travel may be grounded in the embodiment of spatiotemporal information" (Miles et al.; 2010). Such experiments date back at least to 1970, when the role of embodiment in conceptualizing a mental number line was first hypothesized (Restle, 1970), and the intervening years have seen a number of creative experiments appear to reinforce this idea of bodily-influenced cognition. This approach accepts that the body can exert a heavy, perhaps even overbearing, influence on the brain's manipulation of internal algorithms and mental representations. However, despite the influences of this corporeal container, this view of cognition retains all of the representational attributes of computationalism.

Within this approach to embodied cognition, even as ever more interesting embodied biases are found to muddy representational mental gymnastics, the basic framework of representational cognition is never called into question. Consequently, other parallel lines of inquiry attempted to explore a completely antirepresentational conception of cognition. Although also extremely diverse, those working in this vein generally accept "the idea that cognitive processes emerge from the unique

manner in which an animal's morphological structure and its sensory and motor capacities enable it to engage successfully with its environment to produce adaptive, flexible behavior" (Barrett, 2015, p. 6). Some argue even further, then, that this line of inquiry will "lead *inevitably* to a radical shift … away from tweaking underlying competences and toward understanding how our behavior emerges from the real-time interplay of task-specific resources distributed across the brain, body, and environment, coupled together via our perceptual systems" (Wilson and Golonka, 2013, p. 1). This has been given many names, from radical embodied cognition (Clark, 1997; Chemero, 2009) to radical enactive cognition (Hutto and Myin, 2012) to 4E cognition (embodied, embedded, enacted, extended) (Menary, 2010). The radicalism of these approaches lies in the idea that embodiment does not just supplement representational manipulation, but in fact supplants it entirely—thereby also earning the epithet "eliminativist" from detractors (Fodor and Pylyshyn, 1988, p. 7).

Chemero notes that one of the primary factors in the success of computationalism is its efficient generation of testable hypotheses. Without the same conceptual stability or unity, he questions whether radical embodied cognition can generate a "guide to discovery, a way to predict new phenomena and generate new experiments" (Chemero, 2009, p. 85). He is not alone in searching for a way to transform the powerful analytical elements of radical embodied cognition towards the goals of directing energy into productive new directions. While Chemero advocates for what he calls the "dynamical stance" (Chemero, 2009, p. 67) or Gibsonian ecological psychology (Chemero, 2009, p. 83), others have posited similar potential guides to discovery, from Pfeifer and Bongard's design principles for artificial intelligence and robotics (Pfeifer and Bongard, 2007, p. 89) to Wilson and Golonka's "task analysis" (Wilson and Golonka, 2013, p. 2). All of them, both from the biological and the artificial intelligence perspectives, would seem to rely on the awareness of and exploitation of an agent's ecological niche:

> Instead of an animal's ability to produce flexible, reliable perceptually-guided action being seen as independent of its physical embodiment, with the environment viewed simply as the stage on which behavior is played out, the embodied, embedded, enactive view considers the animal's body, and how it engages with the environment, to be a crucial resource that can be exploited in ways that actively contribute to the animal's problem-solving abilities. (Barrett, 2015, p. 7)

These turns to the ecological niche are far from new, and resonate particularly strongly with such variably ignored or lionized theorists as Jakob von Uexküll and James Gibson, whose investigations of the *Umwelt* and affordances (respectively) pioneered the ideas that are now being more systematically developed. All of this proliferation of activity circles around the essential Rodney Brooks dictum, that the world is its own best model (Brooks, 1987).

In terms of focusing on specific, localized actions, as in performing a particular piece of music, I will rely here on the task analysis proposed by Wilson and Golonka:

> 1. What is the task to be solved? Embodied cognition solutions solve specific tasks, not general problems, so identifying how an organism produces a given behavior means accurately identifying the task it is trying to solve at the time …
>
> 2. What are the resources that the organism has access to in order to solve the task? Embodied cognition implies that there are resources, plural, available to the organism. These resources include the brain but also the body, the environment, and the relations between these things (e.g., the motion of our bodies through the environment) …

> 3. How can these resources be assembled so as to solve the task? Solving a specific task means creating a smart, task-specific device that can do the job (Bingham, 1988) … Remember, these resources can be distributed over brain, body, and environment …
>
> 4. Does the organism, in fact, assemble, and use these resources? It is always an empirical question whether the dynamical system hypothesized in step 3 is, in fact, an accurate description of the system the organism has assembled to solve the task. (Wilson and Golonka, 2013, p. 2-3)

These four questions present a positive framework both for generating research questions and for evaluating the results, which is to say, they serve as an effective guide to discovery. By filtering engagements with embodiment through these questions, one can begin to see that research into both biological embodied cognition and its applications to artificial intelligence do indeed offer promising answers to the questions: can embodiment truly guide complex or high-risk tasks, structure goal-oriented behavior, or coordinate wildly disparate actions?[40]

An early (and now classic) paper in this respect is Lee and Redish's aptly titled "Plummeting gannets: a paradigm of ecological optics." The paper examines the diving patterns of the gannet, which, upon spotting a fish, plummets down from heights of 30 meters at breathtaking speeds, waiting until the final instant to retract their wings before arrowing into the water to catch its prey. The gannet "has to time its streamlining very precisely to avoid injury and so needs to keep track of its time-to-contact with the water" (Lee and Redish, 1981, p. 293). This could be accomplished by several means, and in their succinct paper, Lee and Reddish compare the actual trajectories of gannet dives to those predicted by either computational cognition (calculation on the part of the gannet, charting its progress) or direct perception-action response (i.e. to the particular way in which the surface of the water rises to meet the bird in its visual field). Their analysis showed a strong preference for an embodied solution, and satisfies the questions of the task analysis, particularly in relation to the final, key question: is this embodied solution simply plausible, or does it reflect, in fact, what the organism actually does?

The study of this particular optical parameter did turn out to be paradigmatic. Further study of birds and humans in other situations of visual perception have continued to favor their embodied hypothesis. Wilson and Golonka, for example, assess different studies of the "outfielder problem," in which the path of a baseball player tracking a fly ball is analyzed in an attempt to determine if the player predicts the flight of the ball by calculation, or by some other method of direct perception. Again, as with the gannets, results favor the embodied solution, since in this case, the outfielder does not run in a straight line to a point that the laws of physics would predict as a likely landing spot for the flyball, but instead runs in a curve such that the ball itself, in flight, maintains a straight trajectory in their visual field (Wilson and Golonka, 2013, p. 5-6). As with the gannets, the embodied solution not only seems to fit the data, but it describes the means by which "the relation between perceptual information (about the motion of the ball) and an organism (the outfielder) *replaces* the need for internal simulation of the physics of projectile motion" (Wilson and Golonka, 2013, p. 6).

These examples demonstrate ways in which the computational capacities of the brain, though available and relevant, appear to be both unnecessary and ultimately unused in the context of real-

40 Although it will not be examined in the present context, one further question, which would indeed be relevant to musical discourse, would be: can embodiment truly generate abstract thought? At this point in time, no discussion of this can really expect to be conclusive, given the still developing field of research. Nonetheless, on either side of the debate over representationalism, there are very compelling arguments that embodiment, can, in fact generate abstract concepts and language (e.g. Chemero, 2007; Wilson and Golonka, 2013).

world action. This is particularly relevant with respect to music; a computational or representational approach is certainly valid or possible, but whether it is the most functional method, or even a commonly used one, is more open for debate. Several further examples will illustrate the applicability of the embodied alternative.

In discussing their design principles for embodied artificial intelligence, Pfeifer and Bongard detail, among others, two key factors: redundancy and ecological balance. Redundancy describes factors of overlap within a system; it can mean almost anything, from very small overlaps between the visual field of two eyes, to the rather broad overlap between completely different perceptual systems (e.g. vision and touch). "In general, biological systems are extremely redundant because redundancy makes them more adaptive: if one part or process fails, another, similar part or process can take over. Brains also contain a lot of redundancy; they continue to function even if parts are destroyed" (Pfeifer and Bongard, 2007, p. 115). It can also refer to the complete redundancy of the brain when its responsibilities are taken over by the environment. A terrific example is the way that neither the muscles of the leg nor the brain's instructions to them control the whole motion of walking, but become redundant in certain moments as gravity and momentum—the basic laws of physics—take over and accomplish portions of the task. These environmental agencies are then seamlessly integrated with the muscles again when they, in turn, resume control. This mix of elements, both in the organism and its ecological niche, are in a constant dance of alternating agency and redundancy.

A typical humanoid robot tends to model muscles in a completely different way, exerting control over the entire action, and thus leading to a much more intensive action. Pfeifer and Bongard describe a few examples of robotics that seek to learn from this example of embodied and ecological redundancy to develop alternative imitations of walking. Denise, a robot that has a muscle system modelled on this ability to take advantage of its ecological niche, can walk down an incline with only a slight impulse at the beginning. From that impulse, its natural muscular motion with the help of a little gravity and momentum carry it down the incline without further control from any central or computational operating systems. Puppy, a more canine robot, operates in a similar way, although in its case, it is able to adjust its gait to an uneven surface in only a few steps. Puppy's joints and limbs adapt to the environmental stimulus and settle into a stable gait through fully embodied and unmediated actions, built into the limbs of the robot rather than into a computational operating system that perceives, analyzes, and then reacts to the situation. Both of these robots demonstrate the potential benefits of pursuing a balanced, organic network of redundancies. They are true examples of direct perception controlling action and give only a hint of the fruits of a radical embodied cognition approach to design and discovery (Pfeifer and Bongard, 2007, pp. 109-117, 126-128).

Such an approach, though, must go hand in hand with ecological balance, another of Pfeifer and Bongard's design principles. This implies that, for such an approach to work, there must naturally be a relation between the kinds and degrees of perceptive organs and the environment. Sensors that sense too much or too little are equally irrelevant or useless (Pfeifer and Bongard, 2007, p. 123). In their words, "given a particular task environment, there must be a certain balance or task distribution between morphology, materials, control, and environment" (Pfeifer and Bongard, 2007, p. 123). When the perceptive organs and the patterns of redundancy are in tune with the environment, a balance they call scaffolding, then the relations between direct perception and embodied action develop and evolve as a matter of course. Work with these robotic designs can demonstrate this very aptly, since their existence in controlled domains allows a clearer view into how these embodiments come to be. Similar situations are rampant, though, in the real world, as well, and become glaring once one begins to become aware of the vast tier of non-computational, embodied cognition that surrounds us in our everyday life.

This phenomenon—of skills developing in balance to an organism's ecological niche—was described very neatly by the eminent cognitive psychologist Sverker Runeson as "'smart' perceptual mechanisms" (Runeson, 1977, p. 172). He makes a distinction between "rote" and "smart" perceptions: rote perceptions are very analog, one-to-one perceptions of a stimulus (what we might compare to the perceptions of a classical, computational robot); smart perceptions are those which "directly register complex variables" (Runeson, 1977, p. 172). To elucidate this, he presents the analogy of a polar planimeter, a device that, when used to trace a shape, measures area rather than perimeter. What makes it such an attractive analogy is that it is a very simple device—two small arms and a roller—which does not do any calculation. It simply registers a complex variable (area) rather than a simple one (length, i.e. perimeter). Runeson extrapolates the analogy much further, demonstrating that if one were to then study a person with a planimeter, seeking to assess their ability to measure perimeter, they would of course fail. Much of computational cognitive science falls into this trap: in attempting to measure discrete perceptions of small, controlled variables, they inadvertently impede the already-present network of evolved, "smart" perceptual mechanisms, which are actually more adept at direct perception of complex variables, rather than at the calculation or coordination of simple ones. As the embodied perceptions and actions of gannets, baseball players, and walking robots demonstrate, these "smart" perceptual mechanisms are real and, moreover, are all around us.

"We should not think of bodies as fixed and stable, but as more fluid entities that are constantly constructed and reconstructed into different kinds of 'task-specific' devices" (Barrett, 2015, p. 10). The body, with all of its redundancy and scaffolding, demonstrates an innate ability for adaptation, which makes humans more adept at developing perception of complex variables than developing computational skills. Hutto and Myin describe this inversion of representational conceptions of enskilment by noting that "coupled activities are the ultimate basis of the decoupled ones, not the other way around" (Hutto and Myin, 2013, p. 153). The radicalization of embodied cognition entails precisely this turn, a dynamic reappraisal of perception and the distribution of cognition through the perception-action capabilities of the body for enskilment and interaction. Radical embodied cognition means embracing this form of embodiment as a fundament of cognition, not as a localized, external influence on the mental manipulation of representations.

This body of research suggests that people naturally perform actions holistically—that is, coupled—as a result of our embodied orientation to our ecological niche. Decoupling those actions and reducing them to an accumulation of rote perceptions is not a simplification but an additional layer of complication. This idea, borne out in the examples presented above, will guide the following discussion of decoupled instrumental technique. It opens up avenues for organizing the perceptive and active processes of learning and performing music, thus enabling alternative and variable approaches to enacting musical complexity.

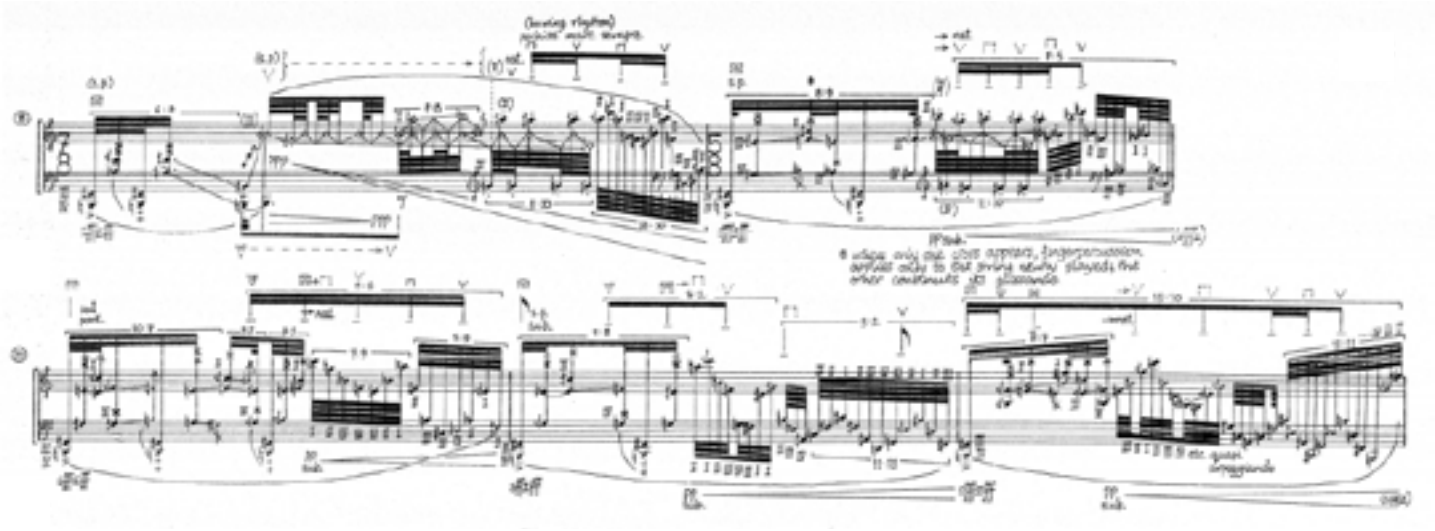
Richard Barrett, Ecological Niches, and the Radically Idiomatic

Richard Barrett's compositional priorities have altered very little over the course of his career. Beginning in the 1980s, he explored the intersections of performer, instrument, and corporeality, emerging from a milieu of young composers including also Klaus K. Hübler, whose work (and decoupled notations) he encountered at Darmstadt in 1984. Though affected by his exposure to Hübler's work and notations—"At the time I found it very thought-provoking, one of those things one has to make one's mind up about one way or the other" (Barrett in Rutherford-Johnson, 2010, n.p.)—Barrett's own notations and compositions found other avenues into embodiment, less strictly corporeal than Hübler's but rather more situated.

Barrett's cello solo *Ne songe plus à fuir* (1985-86) was an early foray in this direction, notable not only as his first exploration with decoupled actions, but also because it was one of the first pieces in which his own published interviews and writings begin to sketch the compositional philosophy that would develop over the coming decades. In speaking to Richard Toop at the time, Barrett describes the piece as having a "cellistic basis" (Toop, 1988, p. 34), in that the piece's pitch groups and vectors were evolved more topographically than harmonically from the "anatomy of the cello" (Førisdal, 2015, p. 22). Barrett would reflect on this himself some years later, writing:

> In *Ne songe plus à fuir* I made a first attempt to make a composition purely out of the encounter between an expressive/structural "vision" and the instrument itself, without mediation by an abstract concept of musical materials and relationships. Thus it makes less sense to speak of 'pitches' in such music than 'locations' on the instrument - locations which in themselves are special cases of the *movements* which excite it and generate its sounds. (Barrett, 2002, n.p.)

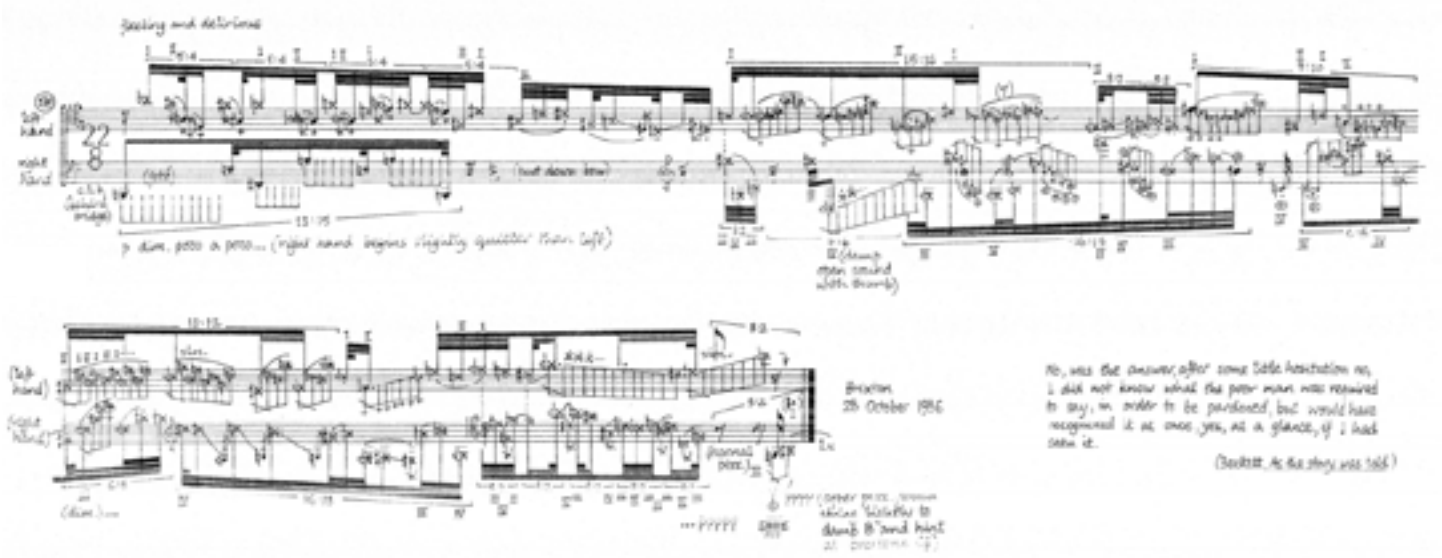
This idea of provoking the instrument proves vital to his music. From *Ne songe plus à fuir* onwards, his works, and in particular his works for solo instrument,[41] begin to engage more and more with this idea that the confluence of performer and instrument can "excite" the technique itself. This is apparent from the very opening of *Ne songe plus à fuir*. Continually, an impulse stimulates a new action, which action is repeated, serving as the stimulus for another, consequent action, and so on (notationally, this is also mirrored in the metric structure). Early in the piece, this systematic excitation of effects leads to the first decoupled action, in which the left hand continues a characteristic, complex gesture, while the right arm literally decouples itself rhythmically during the phrase and begins articulating a more simple, regular back-and-forth motion overlaid on the left-hand material.



Richard Barrett: *Ne songe plus à fuir* for solo cello, mm. 18-22

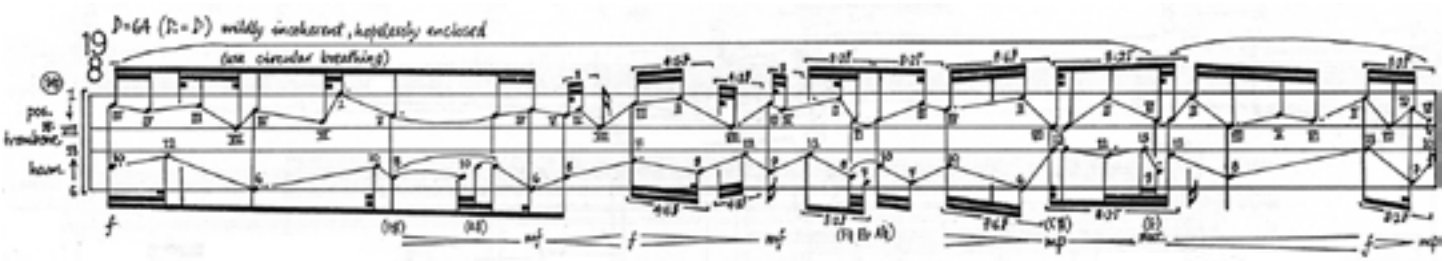
Later, the division of left and right hand is taken to even greater extremes, as the bow's decoupled actions become far more complex and rhythmically intricate.

41 "A group of instruments or even a single instrument could also be described in the same kind of terms, as a multidimensional field of possibilities through which a musical composition traces a pathway, and my own soloistic compositions have often been explicitly concerned with this kind of approach" (Barrett, 2017, p. 6).



Richard Barrett: *Ne songe plus à fuir* for solo cello, m. 134

It is a vision of instrumentalism that prioritizes the continual coming-into-being of practice, the continuously enactive nature of composing and performing, and the way in which those categories bleed into each other. Shortly after *Ne songe plus à fuir*, Barrett's duo *EARTH* for trombone and percussion (1987-88) would provoke the trombone in a similar way. After almost ten minutes of virtuosic demands—from the subterranean, rumbling depths of the trombone register; to violent, percussive hocketings with the percussion; to facile, microtonal acrobatics in the muted, upper register—the trombone itself seems in a single moment to fracture, as though technique has reached a terminus and disintegrates into an inevitable decoupled polyphony:



Richard Barrett: *EARTH* (1987-1988), m. 243
The trombone notation here is split into two staves, the top staff (roman numerals) indicates slide positions, and the bottom staff (Arabic numerals) indicates harmonic partials.

This and the following passages, which drift seamlessly from traditional notation to decoupled notation, excite a locative resonance from the instrument reminiscent of *Ne songe plus à fuir*. The trombone part ripples continually across partials, producing complex microtonal harmonic glissandi, completely dissimilar to the glissando- and slur-heavy sonic world of Klaus K. Hübler's decoupled notation from *Cercar*. This type of microtonality is rooted firmly in the "anatomy" of the instrument and appears, in so doing, to almost invert the traditional Western composer-instrument hierarchy (which has been addressed in more detail in chapter 2).

This ought not to be surprising in Barrett's music, though, because this period of composition was concurrent with a related evolution in his performance practice of improvised, electroacoustic music. In his duo with Paul Obermayer, FURT, Barrett was inventing whole instruments and techniques in these years. Having begun in the late 1980's with a whole array of "electric guitars, trombone,

percussion, crumhorn, synthesisers, voices, cracklebox, vacuum cleaner, effects pedals, cassette recorders, and anything else within reach … overlaid in various extremely lowtech ways" (Barrett and Obermayer, 2000, n.p.), by 1993, FURT would discover the Casio SK-1 sampler, which drastically altered the course of their development (Barrett and Obermayer, 2000, n.p.). By shifting from a pan-instrumental landscape of instruments to a more fluid exploration of sampling in real-time (before later in their career progressing to extensive catalogs of pre-recorded samples), FURT were able to accelerate the invention of both a new instrument and its own idiomatic practice, and so demonstrate "an approach nurtured and developed in response to limited technical resources which, when those limitations are removed, unfolds into something more like virtuosity" (Barrett, 2017, p. 21).

By streamlining their equipment and building an instrument more consistent from performance to performance, FURT were able to make drastic leaps forward in their development as a duo, as well as in the evolution of their purely instrumental practice. Observing their performances reveals a startlingly singular performative identity, all the more apparent in their larger projects, such as their fORCH constellations, in which their engagements with other musicians display a strikingly unitary voice. These literal inventions of new instruments and composite identities plumbed the potential offered by exploring sampled sounds—from the quotidian to the exotic—as raw, sonic material to be confronted on its own terms. Barrett has described reencountering these alienated sounds that become, in their transformed states, intimate participants in the aural world of FURT:

> Once a sampled sound has found its way into a FURT performance we seldom have any idea ourselves as to its origin. Sometimes we sit around at home listening to a CD and are shocked by the surprise appearance of a FURT sound in somewhat unfamiliar (ie [sic] original) form. (Barrett and Obermayer, 2000, n.p.)

FURT's drastic reconstructions of samples based on their sonically material attributes and superpositions must inform any investigation of Barrett's related compositional provocations of instruments in this period. He describes this as an interrogative act:

> Every musical score embodies a question, to be answered by its performer(s) … What I am trying to do here is put that question in the musical foreground, in the hope that when the performer makes his/her music in response to it, some opening-out of the imagination comes into being which might not have occurred in other circumstances, and in the hope that this process communicates itself to activate the imagination of the listener. (Barrett, 2002, n.p.)

In examining his personal history of practice-building with both limiting and progressively cooperative electroacoustic instruments, as well as his locative excitations of instruments like the cello in *Ne songe plus à fuir* and the trombone in *EARTH*, Barrett's engagement with the ontogenic (and decidedly not phylogenic) morphologies of instruments and instrumental practice come into focus. His explorations of these instruments embark not from their traditional contextualization or sedimented practice, but from their purely morphological relationship to their environment (i.e., their environmental niche and the scaffolding it provides). This approach is typified by his remark about confronting the cello, in which he was forced to reject it as a *violoncello* per se and reimagine it as "a resonant box with four strings on it" (Deforce and Barrett, 2014, p. 4). In so doing, he reveals a conception of the instrument that is first and foremost embodied: it accepts an instrument as existing *only* as situated within its ecological niche.[42]

42 A similar--and also oft-cited--distinction has been made by the composer Timothy McCormack: "An instrument must first be held by a human being before it is that instrument" (McCormack, 2010, p. 5).

To return to Pfeifer and Bongard's principle of ecological balance, there must be a "certain balance or task distribution between morphology, materials, control, and environment" (Pfeifer and Bongard, 2007, p. 123). In adapting these concerns to the design of robotics, the pursuit of this balance between an agent and its ecological niche leads to the idea of "designing for emergence" (Pfeifer and Bongard, 2007, p. 87). Because of the difficulty in decoupling the entangled aspects of agent and environment and their web of mutual dependencies as they act in the world, it is impossible to truly separate an organism from its niche, and in fact, attempting to "decompose a problem or system into simple subsystems … create[s] unnecessary problems" (Pfeifer and Bongard, 2007, p. 104). Taking this seriously, it is not only the agent itself that must be viewed holistically (what they call the "complete-agent principle" (Pfeifer and Bongard, 2007, p. 104)), but also the agent within its niche. The two are inseparable, which becomes both a restriction and a source of potential: the environmental niche exponentially increases the scaffolding that surrounds and supports the agent, such as in humans, "leveraging our intellectual abilities far beyond those of our ancestors two thousand years ago, even though our brains have not grown in the meantime" (Pfeifer and Bongard, 2007, p. 103). This confluence of agent and niche necessitates an approach that provokes a behavior to develop from this entanglement. "Because of the fact that behavior itself cannot be preprogrammed but is always the result of an agent-environment interaction, we must design for emergence rather than directly for a specific behavior" (Pfeifer and Bongard, 2007, p. 87).

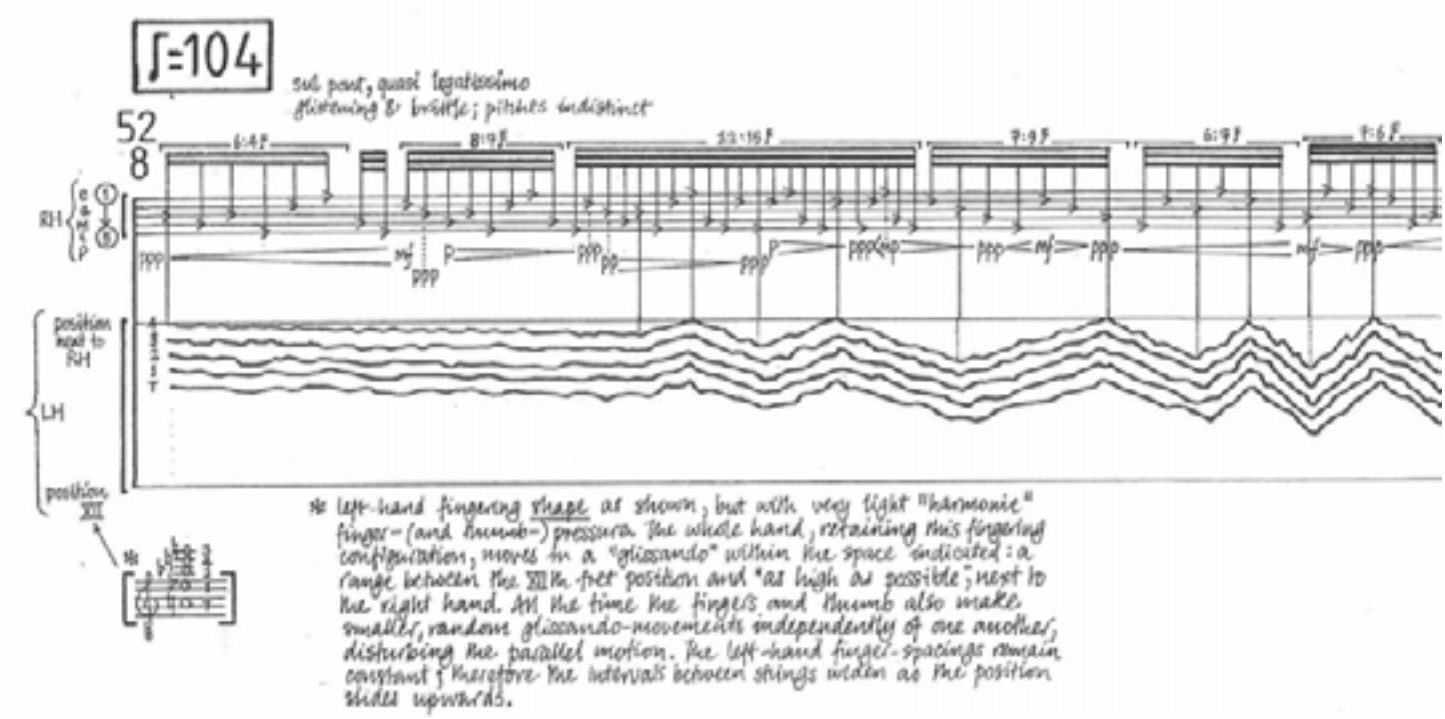
Emergence is a tricky concept, and one that Pfeifer and Bongard admit is "an art rather than a hard-core engineering discipline" (Pfeifer and Bongard, 2007, p. 87). The right balance of perceptive capabilities will provoke the emergence of a skill or seemingly organized, goal-oriented behavior, as was the case with the tidying of Rodney Brooks's Creatures.[43] With sensors appropriately balanced to the room and the size of obstacles, this behavior emerges itself ateleologically and without centralized control. With sensors too sensitive or too weak, this behavior would never emerge. The same is true, of course, of the mobile robots, Denise and Puppy, which have perceptive and reactive mechanisms balanced to the forces of gravity, momentum, and resistance that they encounter in a typical real-world situation. Embracing emergence, though tricky, can also trigger the development of smart perceptual mechanisms, allowing for the rapid evolution of capabilities that directly perceive and assimilate complex variables without the need to decompose a behavior into endlessly smaller sub-components, *à la* Zeno's Achilles paradox.

In the period from the late 1980s to the early 1990s, Barrett's work with both electroacoustic instrument-building and composition for traditional instruments demonstrates precisely these same preoccupations. In designing for emergence, Barrett was forced to confront the agents (instrument and performer) and their niches, examining the scaffolding that they provide each other irrespective of their phylogenic performance practices, remarking that "[t]o this extent my music could be described as 'experimental' - it's concerned with possibilities rather than outcomes - although a better word for this might be 'realistic'" (Deforce and Barrett, 2014, p. 3). The word "experimental" quite aptly evokes the sense of research and preparation that precedes the focused provocation of an experimental apparatus, which then registers the result dispassionately—good results, bad results, interesting results, failed results, all results. Nonetheless, "realistic" goes one step further, removing this emergent process from the confines of the controlled experimental context and letting it unfold in the fabric of the rich, honest tapestry of the actual world, which is, after all, its own best model.

Barrett's composition towards emergent instrumental practices in balance with their ecological niches developed throughout this period. The trajectories from works like *Ne songe plus à fuir* and *EARTH*

43 This emergent cleaning behavior, as demonstrated by Brooks's Creatures, is quite similar to the now famous "Swiss Robots," on which Pfeifer was a member of the design team (Pfeifer and Bongard, 2007).

continued to radiate outwards, producing further explorations of emergent, embodied practices in works such as *colloid* for ten-string guitar (1988-91), in which traditional elements of pitch and harmony become submerged in the ecological texture of the instrument itself, "always conditioned by the limitations imposed by the practical elements … always conceived as a node in the network of practical relations" (Forisdal, 2017, p. 72).



Richard Barrett: *colloid* (1988-91), m. 1, excerpt
Note the left hand glissandi, which are independent but marginally still tethered to the right hand actions (as indicated by the stems), and within which "the fingers and thumb also make smaller, random glissando-movements independently of one another, disturbing the parallel motion" (Barrett, 1988-91, p. 1).

colloid is closely linked to the trombone solo, *basalt* (1990-91), which will be examined in more detail hereafter, as both solos also exist in versions with ensemble (*colloid-E* and *basalt-E)* in the cycle *negatives*. *basalt* itself would not be premiered until November of 1995, by which point Barrett had already formulated this compositional approach as "radically idiomatic," described as "'a plunge into the instrument', an attempt to engage as intimately as possible with the musical resources at the conjunction between performer and instrument, an engagement which attempts to dissolve the boundaries between instrumentalism and compositional materials" (Barrett in Polaschegg, Richsteig and Hager, 1996, p. 26-27). This conception of "radically idiomatic instrumentalism" has informed decades' worth of Barrett's instrumental writing and even now remains central to his compositional strategies:

> This idea has been developing in my work and thinking since the mid-1980s. It began as a way of describing a way of composing which would attempt to derive the musical material of a work from a contemplation of the instrument or instruments in question, the mechanics of playing and the physical relationship between player and instrument, and, last but not least, the history of all those things, how they came to be as they are, recognising a perspective between the central and marginal zones of the space of sound-form-possibilities offered by the instrument but without setting up distinctions between 'traditional' and 'extended' instrumental techniques. (Barrett, 2017, p. 17)

This interrogation of the physical apparatuses of playing and the composite and fluid cyborgian relationships between performer and instrument are very suggestive of the kind of decoupled and parametric notations pioneered by Hübler. Although Barrett has and continues to utilize such decoupled notations from time to time, the express decomposition of the performer-instrument into its sub-components has never alone become a critical component of his work, but has remained present as a powerful tool for investigating the radically idiomatic potential of particular instrumental situations. Barrett describes this relationship to the compositional strategy of decoupling performative parameters:

> One possibility from this starting point could be to leave the instrument/performer complex in this state of disassembly and to compose with the disassembled fragments, perhaps developing a system of notation which expresses the situation in terms of independent layers of activity, with their sonic result occurring to the unstable confluence of these actions. While I find this an interesting approach, particularly in its clear relationship to strategies which might be used by improvising performers, it is not generally the path I have taken. The main reason is that I find it limiting and eventually somewhat one-dimensional, in so far as there are many possible aspects of musical sound-forms that it tends to suppress: pitch- and rhythmical structures for example, and in particular the opportunities these present for composing systematically *between* as well as *within* instruments. At least as important for me is the process of resynthesis, which could be described in terms of reassembling the instrument or instruments (and their techniques, etc.) *in the sonic-structural shape of the envisioned composition* … so that the conception of the composition and the *re*conception of the instrument should be one and the same thing. (Barrett, 2017, p. 17, emphasis in original)

The consubstantiality of composition and instrument that Barrett describes outlines the emergent qualities of an approach predicated on the ecological niche, effecting a balanced relationship between the perception-action composites that emerge from the notation-performer-instrument entanglement. Radically idiomatic composition works analogously to the principles of radical embodied cognition. It takes advantage of pre-existing scaffolding to build new smart perceptual mechanisms. In many ways, radically idiomatic composition is not a textual prescription at all; it is an impetus to the organic evolution of these smart perceptual mechanisms, provoking new patterns of enskilment from the bodies of the performer and the instrument. Barrett writes that, with his music, he hopes to "*activate* the senses and intellect of the listener, not saturate it with pedantry" (Barrett, 2017, p. 6). The same, of course, is equally true to the performer and the instrument. The sensory arousal of their bodies is an emergent phenomenon, a radicalization of intention that embraces the potentiality of these relationships at the expense of some types of pre-determination. As with Pfeifer and Bongard's engineering for emergence, this depends on proposition not prescription, liberating notation as a vehicle to "suggest possible directions or possible points of focus" (Barrett, 2014, n.p.).

In eschewing this certain type of prescription, a staple of the Western conservatory tradition, Barrett invokes the inherent mixture of intelligibility and misinterpretation in communication (reminiscent of Maturana and Varela's orientational communication and Marchand's abductive step). Barrett writes of the notation in a later work, *Blattwerk*, "I have always considered notation first and foremost as a means of communication between composer and performer(s), that is to say neither as a set of instructions or demands, nor as some kind of end in itself … *Blattwerk* is, in a certain way, an attempt to make structural/dramatic 'sense' out of the various modalities of communication which can exist between musicians, between musical materials, between musicians, instruments and sounds" (Barrett, 2002, n.p.). This vision of notational communication entails that, as Marcel Cobussen observes, "structural inconsistency becomes a compositional variable in the notated parts" (Cobussen, 2017, p. 190).

Radically idiomatic composition chooses the physical composite of performer and instrument as the locus where this structural inconsistency comes to bear. However, in provoking an organic process of learning from the gestural and sonic potential of the performer and instrument, Barrett does not abdicate his own agency. He establishes rigorous consistencies in each piece, moments of control that come to bear on the process, much as the organic patterns of a snail building its shell both constrict possibility and enable iterations of infinite diversity. At the same time, Barrett is extremely conscious that part of the creative process is to provoke creativity from situations that cannot be predicted, striving to inhabit the transitory boundaries between predetermined, curated creativity and an indeterminate fascination with the momentary.

Although he introduced the term radically idiomatic in the mid-1990s, a decade after his first major breakthroughs as a composer, this commitment to provoking creative processes through the material constraints and possibilities of local situations has been a primary thread throughout all of his work. His early pieces, especially *Ne songe plus à fuir* as described above, demonstrate all of the major characteristics that would later be viewed under the umbrella of the radically idiomatic. Since the late 1990s, Barrett has also concerned himself increasingly with the integration of pre-composed and improvised music,[44] developing his own style of "seeded improvisation" (Barrett, 2002, n.p.) that facilitates the entangling of composition and improvisation. Seeded improvisation displaces the discussion from a single performer-instrument's idiomatic qualities and shifts the frame of reference to the relationship of composition and improvisation. Nonetheless, the issues that present themselves extend directly from the preoccupation that gave rise to radically idiomatic composition, namely, Barrett's desire to take advantage of specific and ephemeral confluences of creative forces, both physical and intellectual, and provoke carefully poised but ultimately not completely predictable creative expressions.

Throughout this progression from radical idiomaticism to seeded improvisation to their inevitable entanglement, Barrett returns repeatedly to the word "imagination."[45] For him, imagination evokes this balance between consciously imaginative endeavor (curated creativity, as previously formulated) and unpredictable, organic developments that flow from the openness that remains in these consciously-crafted situations. In describing his personal systematic compositional system, Barrett begins by noting:

> What concerns me about systematic composition is principally to capture an envisioned glimpse of something, and then to generalise and realise it. That 'something' is not a system of abstract relationships, but a product of the aural imagination, and a principal reason for the systematic generalisation is to design procedures that might illuminate regions or implications of the original vision which exceed the current limits of my imagination and thus expand them … I am concerned throughout with *what can (potentially) be perceived* by the aural imagination of the listener, based on my own understanding, such as it is, derived from musical experiences encompassing listening, performing and creating, even while at the same time attempting to widen the horizons of what can be perceived. (Barrett, 2017, p. 4)

For Barrett, radically idiomatic composition is one means to provoke this imagination (seeded improvisation being another), which then manifests itself in the creative expression afforded by the grains of sound that become perceivable as the performer and instrument diffract through each

44 Barrett has challenged this dichotomy of composition and improvisation, both defending the advantages that each approach can uniquely contribute, but also underlining the fact that they share the same basic creative characteristics (cf. Barrett 2013; 2017).

45 In his thesis (Barrett, 2017), for example, the word imagination occurs almost as frequently as the word idiomatic.

other, amplifying the intertwined structural intentions and inconsistencies in the score. Idiomaticism harnesses the natural and organic forces that inhere in the physical, ontogenic relationship of performer and instrument. Imagination evokes these twin creativities, of the systematic composer provoking certain courses of learning, and of the subsequent embodiment that diffracts the composition through the living, learning bodies that make it sound.

Barrett notes, interestingly, that this is not a directional or teleological process. Rather than being a purely linear relationship in which the composer's genius is distilled through the enacting bodies of performers, Barrett perceives the whole process rather more organically:

> As time goes on it becomes clearer to me that my development as a musician is not linear but concentric. As with the ideas about notation and improvisation I have been discussing, I am interested in finding ways to bring into being a point of focus, a centre of gravity, which renders unnecessary any restrictions on what might happen. Composers often speak of restrictions as being a necessary prerequisite for creativity, which I think is an idea that needs to be questioned when possibly the most important contribution we have to make in the world is to express the possibility of freeing the imagination. (Barrett, 2017, p. 42)

It is this formulation of the imaginative that underlines most firmly the relationship of radicalism in both radically idiomatic composition and radical embodied cognition. Radicalism is transformative imagination. In the case of embodied cognition, it means rejecting the restraints of representationalism to allow embodiment and direct perception-action relationships to build smart perceptual mechanisms and cognitive actions. In musical composition, it means provoking the performers and instruments into revealing the grain of their inherent physicality, and then following that grain to discover a relation beyond those imposed by tradition and expectation. Radicalism means, further, accepting that there are not neutral positions in these spectra. Each action, in these cases of research or composition, for example, reinforces either a prescriptive approach or an embodied one (i.e. non-representational, situated, idiomatic). There may be some natural ebb and flow between these two approaches, but when one approach begins to foreclose the possibility of another, then the imaginative faculty and its potential for radical interaction is also foreclosed.

The word radicalism also carries an unavoidable tinge of the political, and, in particular, of the revolutionary. The radical imagination present in these views of cognition and composition is also inherently revolutionary; nor can it be otherwise. In questioning the foundational precepts of an intellectual, creative, or research tradition, there is no space for neutral skepticism. One of Chemero's chief disagreements with non-radical embodied cognition (which, as has been stated, folds embodied biases into computational, representational cognition) is that it attempts to walk just such a line, continually recalibrating computational paradigms to fit the ever greater evidence that embodiment plays a major role in cognition. Barrett also seems to find that, in investigating the idiomatic qualities of an instrument's physicality, it is not enough to serve as a compositional cartographer of the instrumental topography; one must also allow the instrument's terrain to chart its own course through the composition. The imaginative act cannot be curated in advance; it must unfold organically in the act of creation.

Barrett has been a vocal Marxist throughout his career, and Marx knew very well that any revolutionary act must embody precisely the imaginative capacities that Barrett describes, principally emergence. A revolution cannot be calibrated like clockwork, decided in advance, and seen through according to plan, and the evolution of a new society cannot be predicted in advance. Marx kept his analytical tools trained firmly on the social and economic systems that existed in his time, rather than turning them on the utopian ideals that might one day exist. In fact, his disdain for utopian

contemplation more or less foreclosed that impulse in socialism, which would only resurface much later. In contrast to utopianism, Marx offered the outline of an imaginative impulse that carries society forward enactively, emergently. "When [Marx] speaks of social creativity it is almost always in terms of revolution, but here, he insists that imagining something and then trying to bring it into being is precisely what we should never do. That would be utopianism, and for utopianism, he had only withering contempt" (Graeber, 2015, p. 62). Revolutionary creativity, then, is opposed to predetermination and requires the processual gradation of temporal unfolding.

This conception of revolution as social creativity is the natural extension of Marx's views on human imagination in labor, wherein he contrasts this sense of emergent social creativity with a more localized conception of material creativity. "When Marx speaks of material creativity, he speaks of 'production', and here he insists … that the defining feature of humanity is that we first imagine things, and then try to bring them into being" (Graeber, 2015, p. 62). In material production, Marx offers many examples of this creativity by preconceived design,[46] but in social production, he either resists or refuses the temptation to do so. The reason for that resistance lies in the aforementioned capacities of emergence, that one can design for emergence, but cannot predict or prescribe what will emerge. Marx implicitly recognizes that social creativity does not differ from material creativity purely by scale, but by kind, as well. This dynamic, enactive quality of creativity may be present at any level of scalability, though, and may also serve to unify these conceptions of imagination ranging from the social revolutionary to the craftsperson to the fundamental cognitive level. Barrett's conception of imagination mirrors this radical emergence, embracing the fact that emergent creativity can scale down from the social level and contaminate other forms of personal, local, or material creativity. Emergent creativity can be provoked, even guided, as in the design principles for emergence in radical embodied cognition, but they must nonetheless be emergent in practice.

Revolutionaries have long known that the imaginative reassembly of social situations cannot be curated in this way. Consider the neo-situationist call to arms of CrimethInc[47]: "We must make our freedom by cutting holes in the fabric of this reality, by forging new realities which will, in turn, fashion us. Putting yourself in new situations constantly is the only way to ensure that you make your decisions unencumbered by the inertia of habit, custom, law, or prejudice" (quoted in Graeber, 2015, p. 57-58). Here, revolution itself, in a social sense, is an act of imagination that is creative and imaginative analogously to material production in Marx's sense, but it extends telescopically from the social to the personal, involving even the act of non-verbalized cognition (what they call crimethink). By extension, then, this means that smaller radicalisms (such as crimethink, the situationist disorientation from custom, or the anti-representationalism of radical embodied cognition) contain within their radical imaginations the kernel of revolution.

Once identified, particularly in this way, the radical imaginative act quickly comes to seem a responsibility, as for CrimethInc above. An extensive discussion considering whether there is any argument for an ethical imperative to cognition or musical performance does not belong (or fit) in the present context, but nor can this inevitable impulse be ignored completely, elided in the interest of a more focused musicological/artistic goal. The idea that there might be some responsibility to this arises inexorably precisely *because* these larger revolutionary implications emerge organically in even the smallest, mildest acts of (re)imagination. As with radical embodied cognition, the implications of Barrett's radical idiomatic composition do not allow space for complacency. If the cello is to be reimagined, then it necessarily precipitates the forging of a new reality which can refashion not

46 These comparisons include the famous and oft-cited comparison of a bee and an architect, the latter of whom possesses a plan before building, the former not—an idea that would surely be challenged by some of the radical embodied cognitive scientists referenced here (cf. Barrett, 2015).

47 After the neologism crimethink.

only the instrument, but the composer, performer, and listener, as well. These are the "horizons of what can be perceived" (Barrett, 2017, p. 4). One could easily imagine the CrimethInc manifesto quoted above slipping unnoticed into a passage describing Barrett's compositional strategies: the reimagination of the cello as a resonant box with four strings is not an idle compositional ploy to absolve the composer of her responsibility to understanding traditional performance practice; it is an urgently decisive impulse to cut holes in the fabric of the *violoncello*'s reality and escape the inertia of habit and custom.

It is important to recognize the role of habit in all of this. Custom may be social, epochal, general, but habit is local and personal. It is something carried in the muscles and tendons of the body and continually reenacted in patterns of behavior. Composition may seem subject to the laws of custom, but the learning process of the performer is very much subject to habit. Habit, though, given its personal localization, is crucially very malleable, and thus both capable of and adept at embracing emergences and liminalities. This chapter began with a passage from Donna Haraway's *Cyborg Manifesto*, a plea to inhabit the liminal spaces of our identities, where individualities merge, coalesce, and cohabitate more fluid embodiments of being and interacting. She advocates the living of the radical imagination, exposing the need to imagine new modes of relation in each new situation, to embody processes of learning and living that make the constant reactivation and reenactment of imagination inevitable. She doesn't suggest pursuing a single, alternative cyborgian identity that only supplants a more traditional, individualistic one. Everything about the cyborgian alternative demands accepting that each new situation in the infinitely dynamic planes of life and the world demand new imaginations and entanglements. The cyborgian identity is a constant reappraisal, a form of situated knowledge that, like radical embodied cognition, acknowledges the dynamic, never static nature of situatedness. It is this embrace of the radical imagination that Haraway describes as "*pleasure* in the confusion of boundaries and … *responsibility* in their construction" (Haraway, 1991, p. 150, emphasis in original).

Borrowing from Haraway, Karen Barad describes this act of collaborative, imaginative interpretation as a form of diffraction. She contrasts diffractive reading to critique, which she positions as "all too often not a deconstructive practice, that is, a practice of reading for the constitutive exclusions of those ideas we can not do without, but a destructive practice meant to dismiss, to turn aside, to put someone or something down—another scholar, another feminist, a discipline, an approach, et cetera" (Barad et al., 2012, p. 49). Diffractive interpretation, on the other hand, entails "reading diffractively for patterns of differences that make a difference," which practice avoids the demaraction or isolation of ideas and instead revels in the "suggestive, creative and visionary" (Barad et al. ,2012, pp. 49-50). The apparent opposition of prescriptive and embodied approaches, as I have introduced them here, only exists if they are placed in dialectic conflict. A diffractive approach seeks the entanglement and subsequent branchings that the confrontation of these approaches can produce. Avoiding a neutral space (that is, one that assumes an accepted form of interpretation at the expense of others) allows for both composition and performance to engage these branchings imaginatively, embracing the liminalities as dialogic entanglements rather than oppositional schools of thought.[48]

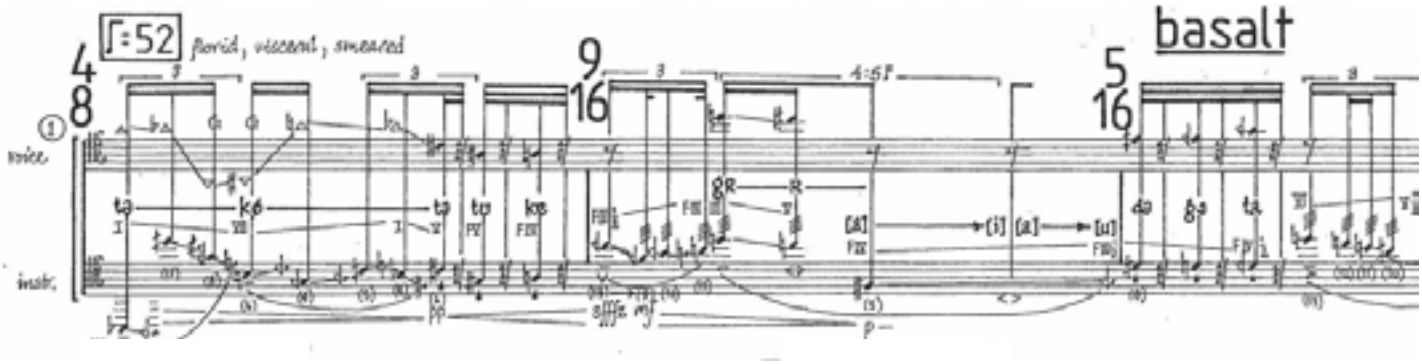
When learning music, then, these liminalities must also be explored if any hint of the imagination is to survive. To accept in any way the reimagination of the instrument and its idiomatic qualities means accepting that there can be even more, other forms of idiomaticism, as well. It means accepting that the physical body of the instrument contains more varieties of idiomatic gesture than are contained in

48 The present chapter explores the ways in which Barrett's radically idiomatic composition creates the space for a more embodied approach to learning. For further discussion of how the apparent opposition between these two learning styles can be mediated and more diffractive entanglements subsequently developed, please see the Appendix, in which various other performers' approaches are examined to demonstrate the diversity of ways by which this continuum of learning styles can be effectively bridged.

the Western conservatory tradition. What Rosalyn Deutsche called the logic of enclosure is precisely the enclosure of traditional classical technique. As a performer—as a learner of music—one must either imagine an instrumental practice completely inside this enclosure, or accept that there are further vistas of imagination that can resonate within the bodies of performer and instrument. To accept the latter possibility at all means stepping outside of this enclosure. If one is to acknowledge the idiomatic possibilities posed by music such as Barrett's, then that path demands the disassembly of this enclosure and the embrace of other, more liminal trajectories of embodiment. Haraway's cyborgian reality is a concrete, realistic portrayal of the performer's struggle, realistic in the sense that Barrett uses it, as an extension to experimentalism that accounts for the situatedness of idiomatic practice-building. To embody the situated demands of a radically idiomatic score, an enactive learning approach must be predicated on the performer's cooperation and collaboration in the radically imaginative act.

Learning *basalt*

Barrett's *basalt* is an exercise in just such imaginative provocation, demanding emergent embodiments in the learning process. Composed shortly before *colloid*, it forms part of the cycle *negatives* and is, alongside *colloid*, one of the two solo compositions in the cycle. Composed well into his career, but before his more fully-formed enunciation of radical idiomatic composition, it serves as a fitting laboratory for the techniques of radical imagination and technical experimentation that have come to be his stylistic hallmarks. *basalt* also flirts with parametric decouplings of physical actions, but as in *Ne songe plus a fuir*, it never completely supplants more traditional notation. In fact, in the case of *basalt*, the only obvious, visual parametricization is the separation of the voice from the notation of all of the other material.



Richard Barrett: *basalt* (1990-91), mm. 1-3

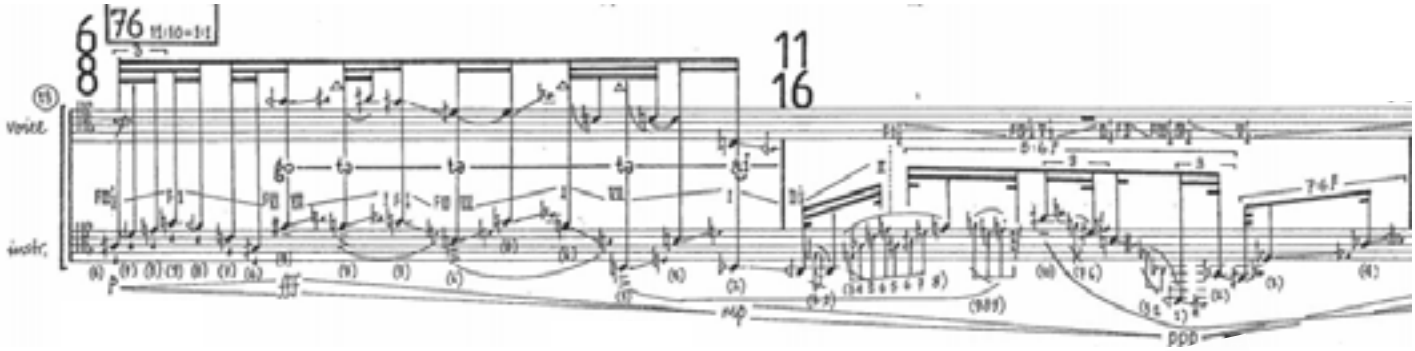
In *basalt*, though, this actually never becomes polyphonic. The notation of the voice on a separate stave seems to be dictated by the complexity of actions and the crossing of voices. If they were all to be notated on one staff, the overlapping information would be almost illegible. Displacing the vocal line to the upper staff seems to be primarily a matter of legibility, then, and in fact, it is never rhythmically polyphonic with the lower staff during the whole piece. Despite the virtuosic demands of the vocal line, in particular in combination with the demands of the more traditional instrumental part, the physical polyphony in *basalt* (and therefore its radical idiomaticism) lies elsewhere.

In the notation of *basalt*, as can be seen in the previous example, a large amount of information is notated around the marked pitches. These extra markings, in fact, are part of the visual confusion that necessitates displacing the voice part to make it more easily understood. These markings show the slide positions (roman numerals: I to VII, and on the valve, FI to FVI) and the harmonic partials (arabic numerals). Normally, this information is not completely necessary. A trombonist can only

play notes in certain positions, normally with fairly limited options, and even so, the choice of which slide position or partial to choose is typically left to the discretion of the player. (In fact, any attempt by the composer *not* to leave that to the discretion of the player is almost always met with hostility, often open.) Furthermore, the inclusion of both slide position and partial are redundant if the pitch is also notated, since if the pitch and one of those values are prescribed, than the other value is given automatically. That Barrett chooses, then, to notate all of this information—including both slide and partial parameters--for the duration of the piece (with the exception of one passage, which will be examined forthwith) is a huge departure from tradition, and so also a clear signal to the performer of its importance to the fabric of the piece. Barrett writes in the performance notes:

> [T]he notated pitches are an <u>approximation</u> to the values generated by the given (changing) slide/harmonic combinations - slide movement is always <u>smooth</u> between the (instantaneous) notated reference-points. No attempt should be made to 'correct' non-tempered harmonics; a shifting 'just intonation' is intended, although pitch-values are frequently more or less obscured. (Barrett, 1990-91, p. i, emphasis in original).

The notated pitches are not an extra value in combination with the other information, and certainly not in preference to it. The pitches are simply an homage to traditional technique and an aid to learning (similar to the lowest staff in Hübler's *Cercar*). The numerals indicating slide and partial information are actually the only salient indications of pitch. This performance note, theoretically read and understood well before picking up the instrument and diving into the score, is the first cue that there is a radical reimagination of the trombonist's embodiment; the second and even more critical cue is in the usage of these parameters.



Richard Barrett: *basalt* (1990-91), mm. 13-14

The slide motion is always continuous. As can be seen in the example, although it shifts from the open instrument (in Bb) to the F side of the instrument (on the valve), and although the partial and rhythmic notation fragment and obscure it, the slide is always moving up and down in very continuous strokes, or is stationary. Occasionally more quickly, often more slowly, sometimes even static, the slide and the arm that controls it move very fluidly and organically in the natural course of the physical instrument. (Again, there is one extended passage in which this does not occur, which will be examined in due course.) As with the decoupled bowing in *Ne songe plus à fuir*, when the bow arm seems to dissociate itself from the complex rhythmic and harmonic demands of the left hand and drift languidly off into its own, organic course, the slide motion in *basalt* seems to exist entirely outside of the time and space of the other actions—and entirely within an idiomatic motion of the trombone slide as reimagined outside of the context of traditional trombone notation.[49]

49 In fact, most trombone players tend to move the slide back and forth silently directly before they play. This languid motion is very similar to some of the motions in *basalt*, if one ignores the virtuosic articulations that apply a strobe effect to this motion.

This already implies that there is a radical reimagination of idiomaticism in the instrument. The entire trombone has been reconceived along a grain that is normally subordinated to extra-physical harmonic and rhythmic decisions. Here, that hierarchy is reversed, and the physical gestures of the slide guide the development of the harmonic material. Although many pitches are notated, approximated to the nearest quarter-tone, taking Barrett at his word and following the slide motion colors the harmonic material rather more drastically. Although many gestures begin and end in normal positions (or half-positions), and therefore on more or less normal tones and quarter-tones, the internal permutations within each gesture produce a much richer variety of microtones than only 24-pitch equal temperament. Barrett notes that "the notated pitches are … the *result* of the musical processes going on, and therefore often involve an approximation" (personal correspondence with the author, 30 May 2015, emphasis in original). It can be hard to ignore the notated pitches, but Barrett's desire that the slide and partial information maintain priority can be evidenced by the one note where these notations do not align with the notated pitch. In this instance, Barrett advises that the slide information take precedence, and therefore that the notated pitch be ignored (to be modified by one half-step, that is), thus rendering visible the reversal of hierarchy sketched in the notes and the notation (personal correspondence with the author, 30 May 2015).

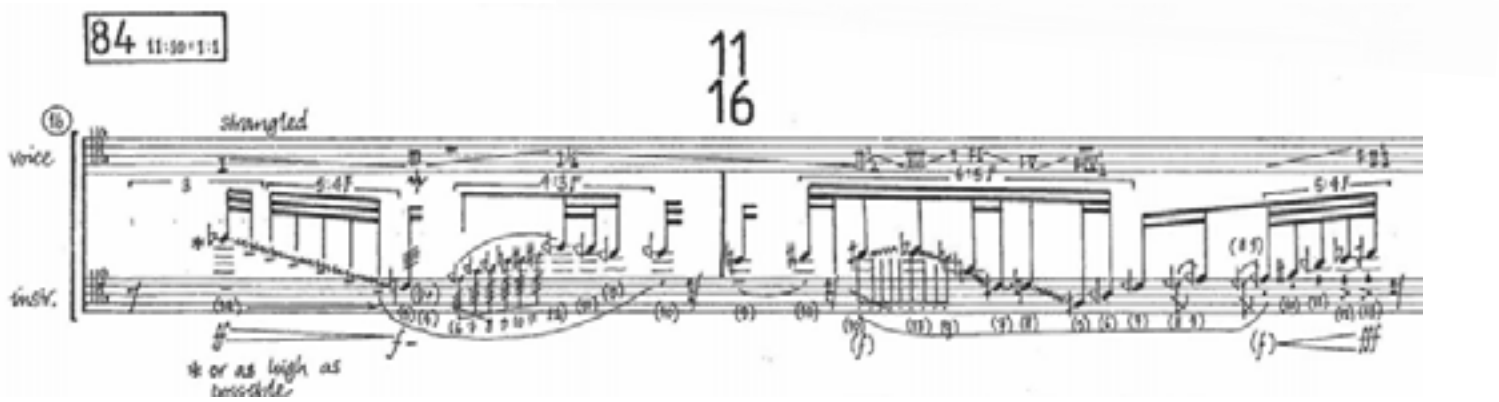
Even so, one might be forgiven for thinking that, given the plethora of information on the page, a radically embodied learning style may not really be necessary or advantageous. After all, if there is only one discrepancy, and that one now knows to correct, how much difference can there be between a normal learning style (i.e. that which one learns to apply to traditional classical music in the conservatory tradition) and a radical embodied one? In order to ascertain its efficacy, then, let us return to the guides to discovery from the more rigorous experimental tradition of radical embodied cognition. In their task analysis, quoted at greater length previously, Wilson and Golonka identify four key questions with respect to embodied cognition in research:

> 1. What is the task to be solved? …
>
> 2. What are the resources that the organism has access to in order to solve the task? …
>
> 3. How can these resources be assembled so as to solve the task? …
>
> 4. Does the organism, in fact, assemble, and use these resources? (Wilson and Golonka, 2013, p. 2-3)

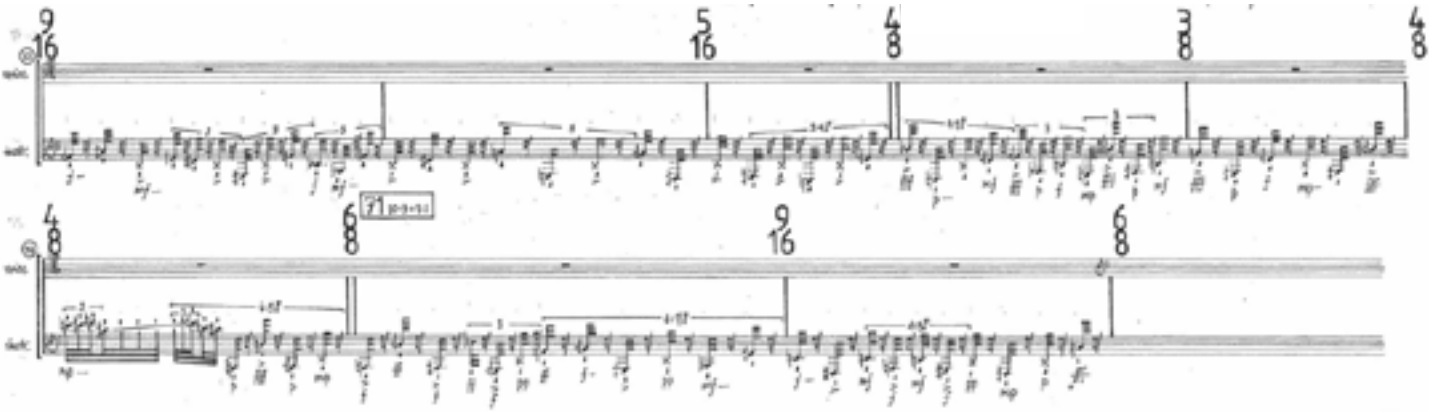
In applying this task analysis to music, the first three questions translate fairly easily. The fourth question is less straightforward. In laboratory experimentation, there will never be as many active variables as in the learning process of virtuosic music like Barrett's. It is impossible to verify through the personal, anecdotal experience of learning a piece of music whether any general considerations about cognition can be made. However, it can still be worthwhile to examine this empirical process to determine, if, in fact, it is viable to assemble and use these embodied or situated resources. The fourth question, then, becomes less general and more specific: in the act of learning music, *can* a methodology based in radical embodied cognition prove viable, and to what extent?

basalt provides us with ample material to apply these four questions to the embodied questions posed by Barrett's radically idiomatic notation. There are three basic types of material that occur in the piece, each of which poses distinctly different challenges to the performer, demanding not only a virtuosity of execution but also a virtuosity of learning. Three representative passages are presented here and will be examined in more detail in order: passage 1 is characterized by primarily slow slide

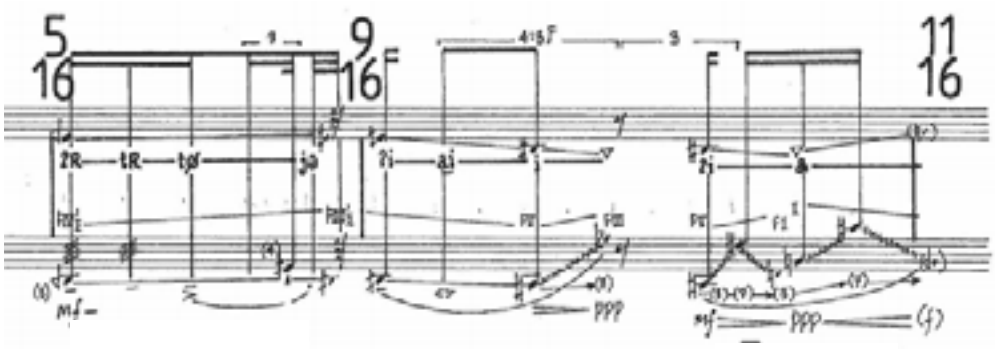
motions overlaid with a filigree of rapid articulation, complex rhythmic structures, and leaps across the register; passage 2 is notable for the repetition of short, *staccato* articulations in the low register occasionally interrupted by material redolent of passage 1; passage 3 is notated similarly to passage 1, but is characterized by many long notes with very close sung multiphonics, normally accompanied by slow *glissandi* in both the sung and the played pitches.

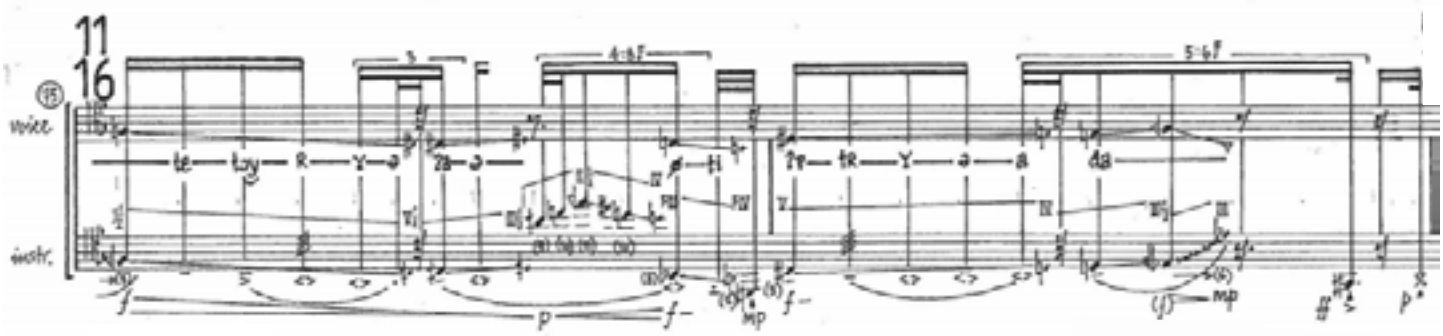


Passage 1: mm. 16-17



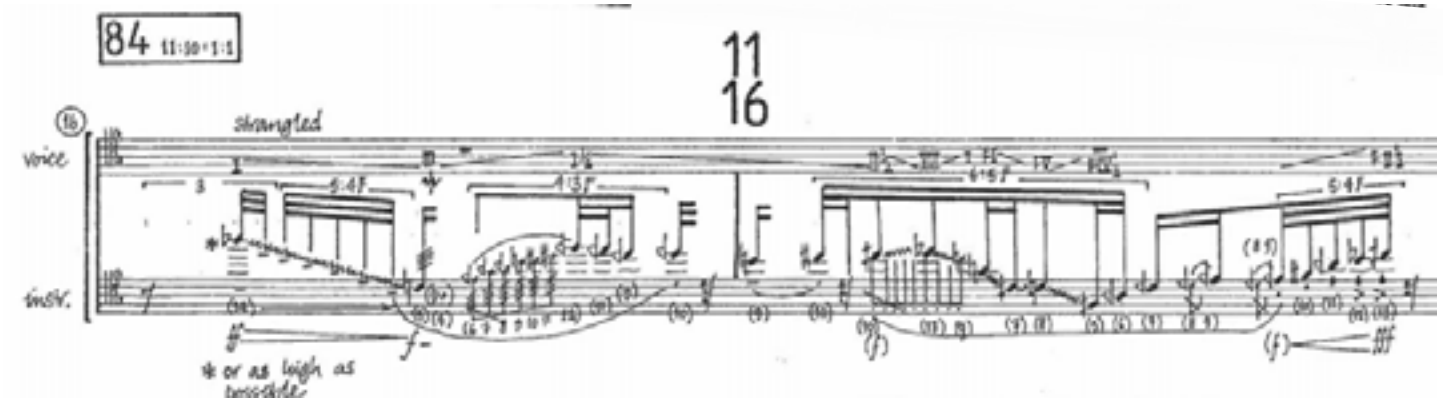
Passage 2: mm. 32-39





Passage 3: mm. 73-76

Passage 1 (mm. 16-17) is characteristic of the opening minute of the piece, a flurry of virtuosic activity. As has been detailed above, the slide motion in all of this is surprisingly stable. The right arm moves in graceful, fluid motions up and down the slide. The hectic virtuosity emerges as the tongue and lips articulate acrobatic, rhythmically complex gestures that are overlaid on this slide motion. As has been noted, Barrett's use of the slide to shade these gestures with rich microtonal shifts exemplifies the burgeoning conception of the radically idiomatic. He has identified the slide motion as a physical and harmonic grain of motion within the body of the performer-instrument composite, and takes advantage of this to enrich the music. In terms of the task analysis of Wilson and Golonka, though, it remains to be seen whether accepting this can, in fact, aid the performer in learning the piece.



Passage 1: mm. 16-17

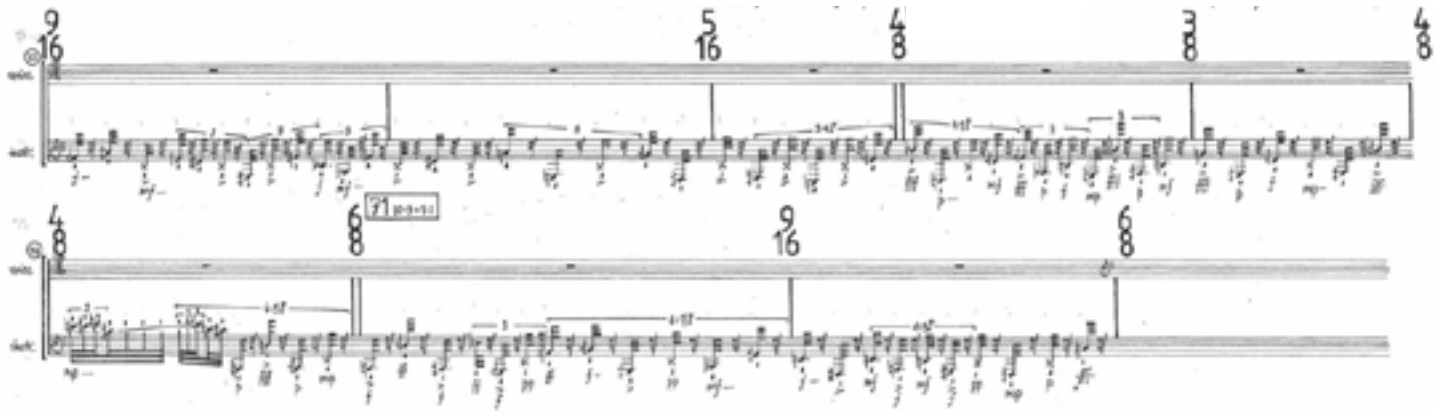
The task, as it were, is the execution of one of the most highly detailed, complex, and virtuosic passages in all of the trombone literature. For me, personally, I rate the first page of this piece as one of the hardest I have ever encountered, due to a combination of the virtuosity of each individual parameter and the complexities that arise in their superposition. Its difficulty lies, further, in the tempo, both in the velocity of activity and of change. In approaching this task from an embodied perspective, the resources available for the distribution of cognition comprise primarily the slide and slide arm (right arm), the left hand (engaged with the valve), the diaphragm and lungs (air), the tongue (articulation), and the instrument itself (resistances both to arm and to air, scaffolding for gesture, and reinforcement of harmonic overtones). How can these be assembled to solve the task? After so much attention to the slide motion, it should not be surprising that, in this passage, the slide arm seems the most relevant repository for embodied cognition. If it leads the other material figuratively, it is not unreasonable to think that it may also be able to lead the learning of the piece physically and intellectually, as well.

The fourth question remains: is this even possible, and if so, is it viable as a learning strategy? Put more plainly, is it possible for the slide arm to requisition control of certain aspects of the cognitive process of learning and then performing this passage? Conscious brain power is quite expensive for an organism, and the more that one has to consciously control, the slower the whole process becomes. This is certainly true of music. In trying to consciously control all of these movements, microtones, and rhythms, I was personally unable to learn the passage at a speed even approximating the tempos given in the score. To process everything required too much brain power; although I could get very close to an accurate reading of the notes and rhythms, the proper tempo and metric relationships were always slow or late. Furthermore, and perhaps even more troubling, I found that my retention of passages learned the previous day was sorely lacking. I was constantly relearning material that I had already learned.

In contrast, by embracing the physicality of the slide arm as a principle of thinking, not as just one more act to consciously control, I found that my learning of the piece accelerated dramatically. The slide motion is not regular, but is fluid, and the arm can learn to operate very autonomously using its own natural motions—those afforded by its own morphological balance to the instrument's resistance. Although the eyes are still reading the score, with a little bit of entrainment, I found it was quite easy to execute the slide material through a more direct perception-action relationship, using the scaffolding of natural arm movement to build a 'smart' perceptual mechanism geared specifically to *basalt*. This freed up my brainpower for controlling the constant harmonic partial and articulation acrobatics required, and also allowed for the complex rhythms to be fit into a framework that facilitated their rapidity rather than impeding it. I used my arm's natural 'smart' perception-action as the principal actor and thinker, and then folded all of my other physical and mental activity into that motion. This experience is mine alone, and is purely anecdotal and empirical, but the speed with which I learned the piece increased exponentially—and even that was only a secondary advantage. The primary leap in learning that occurred was that in embracing an embodied, enactive approach to the notation and allowing my brain to cede hierarchy to my slide arm, my retention exploded. I was finally able to learn and replicate these unique and fiendishly difficult passages without having to re-entrain them over and over.

The learning process indicates then, in at least my case, that the resources available in the body and environment can, in fact, be manipulated to disperse cognition away from the brain and into other avenues, and that doing so is not only viable but advantageous. This effect ought to seem intuitive, especially given the dynamically embodied nature of the notation (and the performance notes which nudge the performer to embrace that embodiment). Unfortunately, in a world where complex rhythms and microtones are often the unquestioned purview of conservatory-trained classical musicians, this intuitive step can very easily be missed or actively avoided.

Passage 2 (mm. 32-39) provides a whole different array of challenges, though, and therefore poses an interesting and complementary challenge to the embodied learning strategies so far examined. After all, here, the slide motion is not notated, and in the course of picking out the microtones in the low register, the slide must jump hither and thither with remarkable alacrity. This passage is, gesturally, completely antithetical to passage 1. What does this mean for a task analysis? The challenges of articulating and tuning these notes in the low register are completely different, and the slide motion is no longer viable as an organizing principle or cognitive aid. As this carpet is pulled out from under the performer, though, a different source of physicality appears to take its place, in this case the diaphragm.



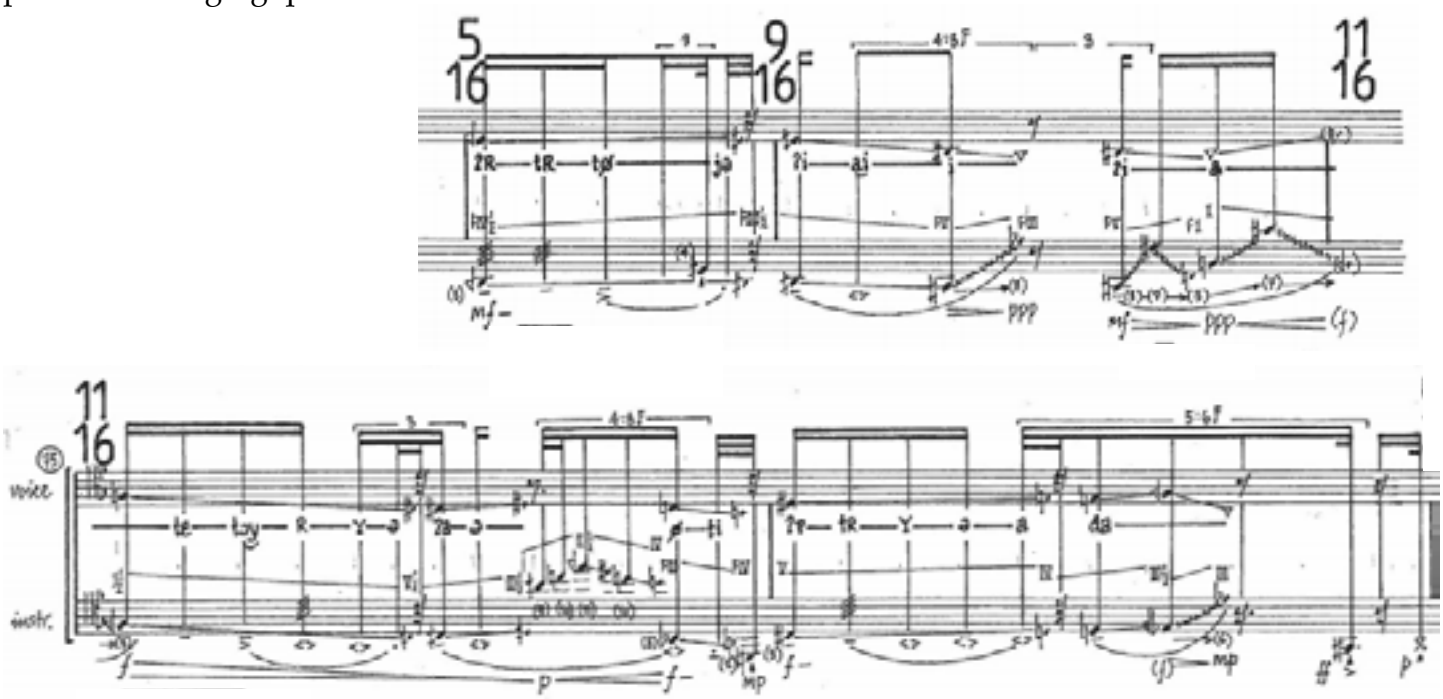
Passage 2: mm. 32-39

In examining passage 2, and if one looks at this whole section in *basalt* (mm. 29-54), it is interesting that at no point are there fewer than three notes in one pulse (excluding, of course, the interpolations of passage 1-style material). Although the rhythms are constantly changing, and often challenging, with respect to the pulse of the notated tempo, within that internal rhythm there is always a short, local regularity, some pulse momentarily predictable before the piece quickly pivots to some other pulse. This serves to function very much like the slide motion in passage 1; the diaphragm, which pulses the air and provides the framework for tempo and articulation in this passage, is shifting frequently but is always able to function within a localized framework of regularity. As with the slide motion in passage 1, the performer still has to read and react to the shifting tempos and internal rhythms, and yet there is always a local organizing pulse that allows the diaphragm and the body to engage with and execute one of the most basic musical—and, for that matter, human—acts: rhythmic repetition of a short, steady pulse. Because the articulated patterns are actually so simple, it is potentially possible to distribute the cognitive control of the rhythm and to reserve the "expensive" conscious brainpower for the microtones that have, in this section, lost the underlying support of the slide motion for their internal logic.

The embodied resources for passage 2 become clear: diaphragm and breath-oriented regular pulse. The potential means of distributing cognitive control and relying on the breath and diaphragm to streamline the learning process is also clear. Question 4—whether this can actually be viable—can again only be answered empirically, but in my own experience, has been answered emphatically in the affirmative. This passage seems to defy physical logic in so many ways, with acrobatic leaps occurring now in both the lips (harmonic partial) and slide arm gestures. It is, for example, the section of the piece that is for me most resistant to memorization, largely due to this fracturing of physical relationships that exist elsewhere in the piece. Although it is less demanding virtuosically, especially with respect to the absence of the vocal component, I found it always much harder to learn than the previous passage. However, in embracing an embodied approach and seeking to actively distribute cognitive control elsewhere in the body, I found that I was also able to effect a *de facto* hierarchical reversal of diaphragm and brain, and once again, it proved startlingly effective in both accelerating the learning process and facilitating short- and long-term retention.

Passage 3 (mm. 73-76) poses yet new constraints. Although much of the material, and its relation to the slide motion, are very similar to passage 1, here, the vocal component begins to exert its influence more perceptibly. Although the vocal material is present and arguably more virtuosic in the opening section of the piece, from this section onwards, the voice is more noticeable and foregrounded, threatening more and more to break through and perforate the constriction of the normally played

material.[50] Technically, this comes from the increasing prevalence of long notes and slow *glissandi* with very close harmonic intervals of sung multiphonics. The task that presents itself, then, pertains largely to the accuracy of the intervals, which come in many varieties and microtonal inflections. Catching the played notes alone is tricky with this level of complexity, especially at tempo, but layering the difficulties of simultaneously picking out the microtonal vocal material on top of that raises the stakes exponentially. Let us not forget, trombonists are not typically renowned for their prowess at singing quarter-tones.



Passage 3: mm. 73-76

The resources of the slide motion continue to be useful in organizing, learning, and executing the basic material, but the vocal material demands other additional embodied resources. Sung multiphonics are an interesting phenomenon, since the two seemingly polyphonic actions occur not only in the same body, but are projected into the same metal tube and resonate together. In fact, the relationship of the sung note to the resonance of the tube (changing based on slide position) actually affects the resonance and projection of the sung pitch, an effect only perceivable in very delicate situations and certainly not in this passage, but pertinent nonetheless to the performer. It is this resonance of the superposed pitches that is most relevant. The sung and played pitches interact, and the physical sensation of their resonance is quite palpable in the body of the performer. The difference in feeling of a close, dissonant interval such as a minor second is almost incommensurable with the feeling of an open, consonant interval such as a perfect fifth. In normal circumstances, this is a secondary effect, or at most a confirmation of intonation, but in the context of an embodied approach to *basalt*, the physical vibration of these intervals in the body of the performer becomes a crucial resource to the fulfilment of the task.

In learning this passage, I found these sung multiphonic intervals incredibly resistant to accurate learning. When attempting to play both a major second and a major second one quarter tone wide by consciously judging and maintaining their harmonic relationship, I learned slowly, I retained that learning very poorly, and I performed drastically under tempo. I could work slowly and

50 Later in the piece, this perforation becomes complete as the voice is finally used alone, outside of the instrument and without any other techniques superposed.

carefully over many months, but I still found that every time I came to these passages, I would have to re-entrain the intervals and, still, always found myself drastically under tempo. Switching to an embodied approach and attempting to take advantage of off-loading some of this cognitive load changed everything. The placement of a major second one quarter tone wide in my vocal cords is wildly difficult for me to judge in this context. The physical sensation of this interval, though, is equally as distinct as the former is difficult. The difference between a minor second, a minor second one quarter tone narrow, a major second, and a major second one quarter tone wide are immediately palpable in the performer's body. The beatings that they produce are readily accessible to direct sensory perception, and provide an even more efficient platform for direct perception-action than either the slide arm or diaphragm actions examined heretofore.

This provided the key for me in learning this passage. I began to entrain physical sensations of intervals instead of consciously picking them out using my training in harmony and relative pitch. This redistribution of cognitive control made the passage drastically more intuitive and much easier to learn and perform. What before felt like unpredictable fluctuations in intervals and *glissandi* variably converging and diverging became sensations and gestures. The difference between converging and diverging intervals, between very similar but slightly narrower or wider microtonal intervals—all of these took on a physical logic at the expense of an intellectual one. As before, this greatly improved both my speed of learning and retention, but had an even more drastic effect on accuracy than in the previous examples. I was entraining the direct perception-action execution of palpable multiphonic intervals, directly relevant to the bodily resonance of myself and my instrument.

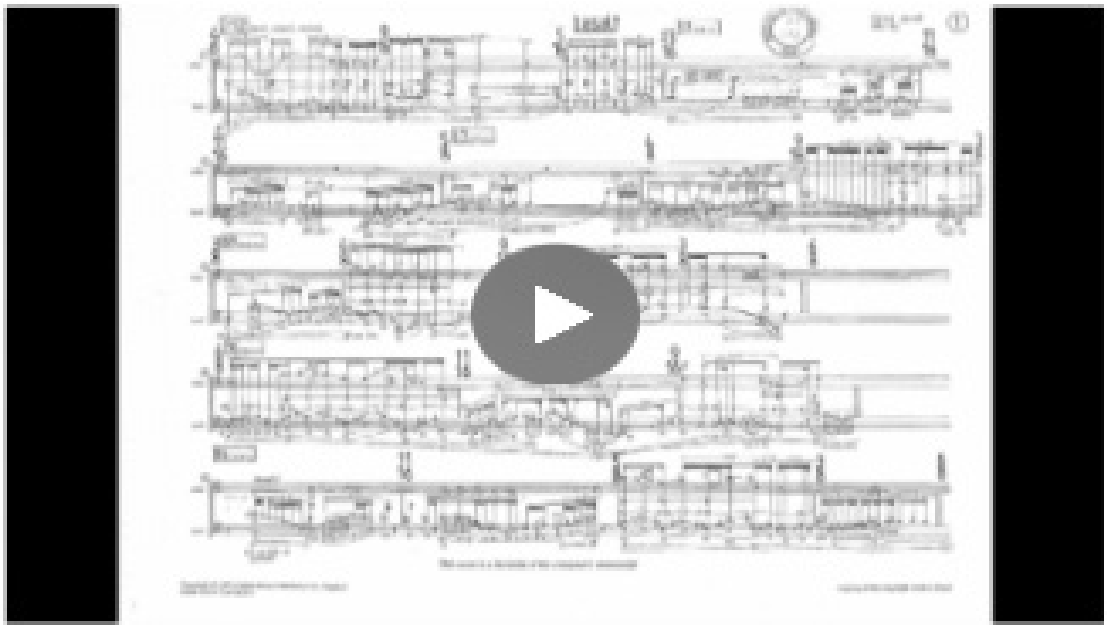
In all of these examples, the task analysis can never be completely accurate, and all of this is purely anecdotal. And yet, in the scheme of artistic research, these personal experiments are invaluable. It is only by doing so, by engaging personally with the methods hinted at by radical embodied cognition, that one can begin to craft a style of learning that is not driven by habit, but by the situated knowledges germaine to each piece. The task analysis questions help to show how this can be done, and Barrett's *basalt* shows how a radicalized learning process can welcome the body as an agent and progenitor of creativity, not as a tool in the hands of the performer or at the mercy of the composer. By taking a clear look at the musical tasks to be accomplished, the bodily and environmental resources available,[51] and how they can be used effectively, the performer can radicalize their learning and their embodiment of the music analogously to Barrett's radicalization of idiomatic instrumental writing. Unlike Hübler's *Cercar*, in which the dynamic, ceaseless pivoting of resources posed the primary challenge, Barrett's notation and composition follow much longer threads of physicality, allowing the performer to take advantage of the roles of the slide arm, breath, or bodily resonance to generate new spaces for musical—and human—perception and imagination.

This becomes something far more powerful than entraining muscle memory. Muscle memory, as a term, seems to exist purely to distract from the role of the muscles in cognition and to posit that they are always subordinate to the brain. Any work that the muscles do must, after all, be just a memory of some command previously entrained by conscious control, mustn't it? This term, like much representational embodied cognition, actually hampers the development of these embodied resources as true guides to discovery. In approaching the body and the instrument as sites of research, the methods suggested by Wilson and Golonka's task analysis sketch a way to generate and test new learning processes in the context of new pieces, taking advantage of the performer-instrument ecological balance and exploiting that scaffolding to build new, smart perceptual mechanisms. Barrett's *basalt* is ultimately just one example. The tasks, resources, and respective assemblies of

51 In *basalt*, I have examined environmental resources that are primarily notational and instrumental, but broader interpretations of environmental resources could be included in a different task analysis.

those resources will vary in every piece. This discussion has endeavored to examine the creative and imaginative work required to craft these resources into smart perceptual mechanisms that can assume responsibility in the cognitive and creative acts of learning music. From that point on, with both *basalt* and any other piece, the experimental work of engaging poietically with these resources and crafting new, varied, and enactive learning strategies begins.

If one accepts any part of this argument about embodiment and radicalized cognition and instrumental technique, then some confrontation with the traditional Western notions of intentionality are inevitable. The fetishization of musical virtuosity as consciously cognized executions of skill cannot survive unperturbed. If these traditional learning and interpretive tools are to retain any of their usefulness in the context of a piece like basalt, it can only be by relinquishing any perceived authority as an established practice and diffracting through the imaginative and embodied potential embedded in the notation. In discussing a later piece, Barrett writes, "Delirium is what lies outside whatever boundaries of 'reason' one cares to set up: one must be prepared to exceed these boundaries rather than try to colonise them" (Barrett, 2002, n.p.). The types of enclosure that I have described are precisely such colonizations. The West-centric, Cartesian mythologies of compositional genius and performative control accept new notations, techniques, and practices in a quasi-imperialist way; that is to say, they do not meet these new ideas open to their mutual osmosis, but insist on their subordination to a previously-existing, autonomous artistic practice. The term "extended techniques," is a case in point: even the nomenclature presumes, from first utterance, that these techniques stand outside of *something* normal or established. Everything about Barrett's compositions and writings in the past decades has challenged this, but while musicology has changed drastically in accommodating these concerns, the learning strategies inculcated in new generations of conservatory and university students is still firmly planted in this old, 19th-century discourse. Students are taught to learn a specific and focused technique, and to then approach new pieces as colonizations, areas to be subsumed under the technical control they already possess. Barrett suggests otherwise: we must exceed these boundaries. We must not only look outside the enclosure, or acknowledge an outside, but must actually step outside or disassemble it altogether, thus enabling an enactive learning that is answerable to the individual, local concerns of each piece rather than the comfortable home territory of the performer. The composer and performer both move and learn in relation to this liminal, ever-shifting situated knowledge, enacting the radical imagination that stretches and invents new vistas of perception.



3.4 On Nonrepresentational Notation

> The mimetic sound of man, the human sound, does not explain, it transmits emotions, it suggests exchanges, affective communications; it does not state precisely, it is precise. And I would say well that the act of love of a couple is precise, is voluntary, if it does not explain! What then is the function of the Word, which has the pretension to affirm that such and such a thing is clear? I defy that Word.
> (Chopin, 1967, n.p.)

Music notation in the Western art music tradition is representational. It is fundamentally communicative, relaying and hierarchizing particular elements intended to facilitate temporal organization and coordination. In order to do so, notation must, then, translate these relevant kernels of information into a legible system. Modern Western musical notation exists as a communicative gesture between an inscriber and an interpreter. Consequently, parameters such as rhythm, pitch, and dynamic are subjected to a reading contract, whether "anthropological (legibility-perception), intellectual (understanding-assimilation) [or] social (sociability-integration)" (Pedauque, 2003, p. 24).

Representationality is necessarily and unavoidably restrictive. In assuming a certain reading contract for rhythmic information, a rather strict hierarchy emerges:

> The 'note' prioritises attack. Its primary rhythmic identity is where and when its indicated sound starts and, from a purely proportional standpoint, how long it lasts. In traditional Western musical notation, even its actual duration relies on secondary notational cues—time signatures, tempo indications, metronome markings. The rhythmic symbol system indicates the number of beats for which a given note might be sustained, but we require other information to let us know how long a beat is, and indeed even what rhythmic unit a 'beat' might be. Additional layers of parametric change—dynamics, performance techniques, timbre, etc.—are superimposed. Once a note has been sounded, our notational conventions generally assume that the job is done. (Cassidy, 2015, p. 2)

Western musical notation is preoccupied with a clock-like precision. Events tick by, each occurring at a set temporal distance from, essentially, all other antecedent and subsequent events. Minor fluctuations as a result of *ritardandi* and *accelerandi* do very little to temper the basic stricture of this system.

Western notation values completion and reproducibility. To that end, it assumes the predetermination of these parameters—that is, the assumption that rhythm or pitch can, in fact, be predetermined. It then houses this assumption in a notation that affects an objective structure: in the case of rhythm, it is attack-driven, duration-specific, and spatially-oriented; in the case of pitch, it is based on socially-constructed demarcations of tempered frequencies. This presumption to objectivity places a limit on the otherwise natural emergence of rhythmical or harmonic variability. A visually-oriented notational system furthermore elides the physical construction of notation in time and space; "representing time on the page—taking a four-dimensional event and reducing it to a two-dimensional surface—will force a certain 'reading' of that space" (Cassidy, 2015, p. 16). Although these assumptions about rhythm have contributed to the development of a very successful and popular musical tradition, the representational preoccupation of Western classical music encourages and often succumbs to a fetishistic obsession with predetermination, enforcing atomistic demarcations between conception and execution, between cognition and action.

The three types of reading contract—anthropological ("document as form"), intellectual ("document as sign"), social ("document as medium")—all apportion agency in slightly different locations. Whether asserting the primacy of a text's inviolable borders, parsing the semantic codes that accrue around it, or embracing a transformative contextuality, the underlying temporal hierarchy of document-interpretation is fundamentally unchallenged. This hierarchy enforces a distinction between an upstream creative process which flows to a downstream literacy (Pedauque, 2003, p. 3).

In music performance, this manufactured distinction between upstream creativity and downstream interpretation belies the physical manner in which sound becomes actual vibration in the world: "An instrument must first be held by a human being before it is that instrument" (McCormack, 2010, p. 5). The same holds true of notation, in that it must first excite physical sound vibrations—in collaboration with a performer, an instrument, a space, etc.—before it is truly that notation. The implicit assumption of much Western music notation is that music and its rhythmic, harmonic, and timbral structures are pre-given.[52] On the contrary, music is, in fact, a physical phenomenon, sound waves excited by and resonating in a medium in real time and space:

> An open E-string bowed on a violin excites at once the string, the body of the violin, the other strings, the body of the violinist, the air around the violin, the material of the room, and the bodies of the listeners. When one wave meets another, they add together, reinforcing each other when they are in phase and canceling each other when they are out of phase. Thus, every sound interacts with all the vibrations already present in the surrounding space; the sound, the total timbre of an instrument is never just that instrument, but that instrument in concert with all the other vibrations in the room, other instruments, the creaking of chairs, even the constant, barely perceptible motion of the air. Measured at some point in space, all of this vibration adds up to a continuous variation in pressure, a wave. Complex, irregular, and erratic, this wave changes constantly and incorporates many frequencies and shifting amplitudes. (Evens, 2005, p. 6-7)

This does not replace the agency of composers and scores in eliciting music from a performer, an instrument, or a space. An anti-representationalist view of music notation does not privilege these excitatory forces at the expense of actors further upstream. On the contrary, "[a]gency is not held, it is not a property of persons or things; rather, agency is an enactment, a matter of possibilities for reconfiguring entanglements" (Barad, 2012, n.p.). As a piece of music emerges in time, it has less to do with the gradual achievement of a predetermined goal than with the progressive displacement of all alternative sounds. Reading is not subordinate to writing; writing and reading—composing and performing—supplement rather than supplant each other.

The traditional parameters of music (pitch, rhythm, duration, dynamic) are emergent properties because they are embodied in the course of their execution. They can be provoked, suggested and guided by notation, but they cannot be determined by it. In most cases of Western classical music, this distinction may be somewhat beside the point. That is primarily because of a protracted period of side-by-side evolution, a symbiotic coalescing of notational and performative priorities tending toward a natural limit of complexity that maximizes certain types of vertical and horizontal rhythmic functions. More interesting is the question that this poses for music notation *in posse*.

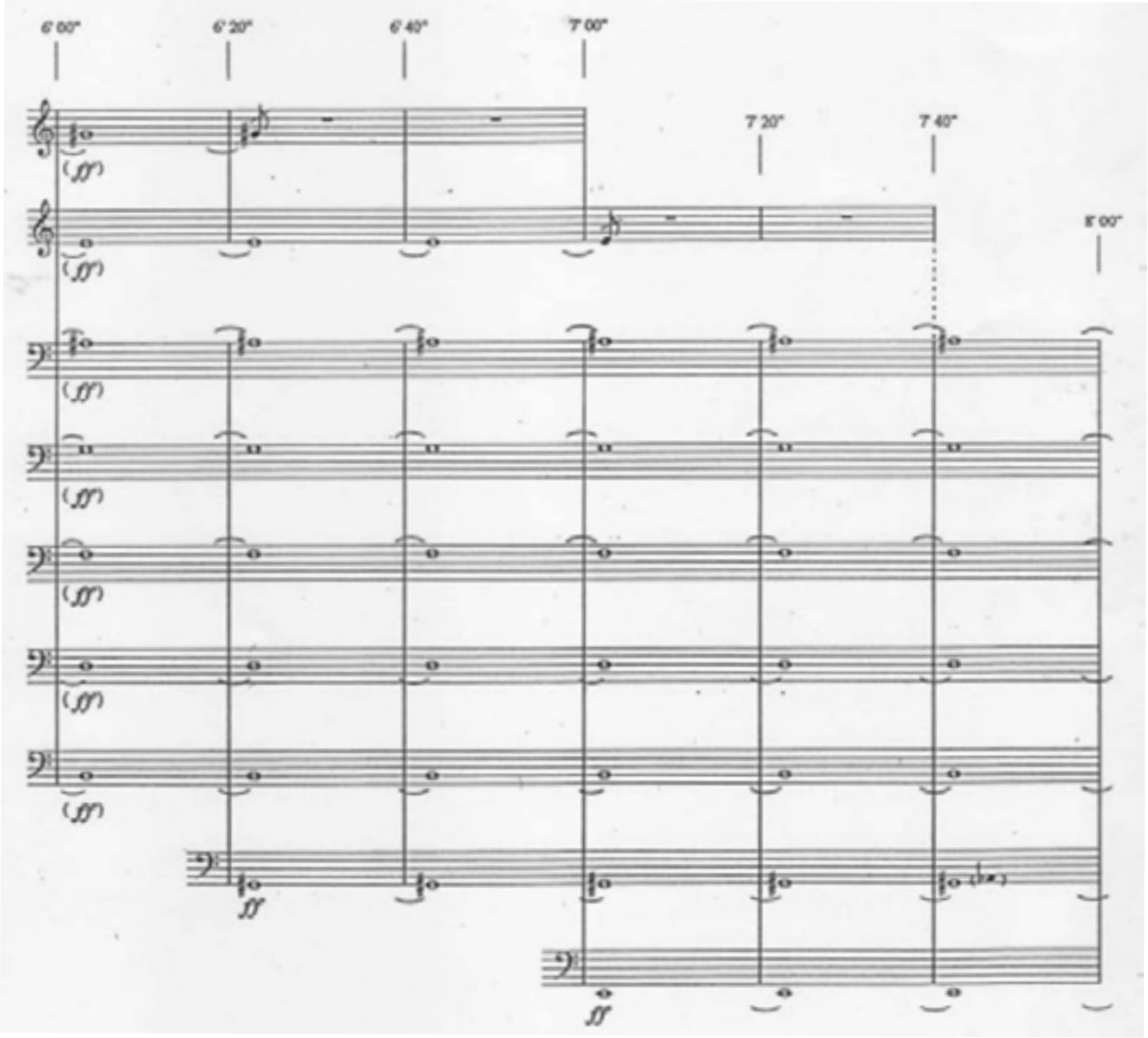
Music notation is inherently representational, even in graphic or text scores that avoid the traditional formats of Western notation. The attempt to codify and transmit information seems to necessitate it,

52 For further discussion of the long-standing discourse around prescriptive and descriptive notation, see also 2.1 *Haecceitas* and Aaron Cassidy's *Because they mark the zone where the force is in the process of striking (Or, Second Study for Figures at the Base of a Crucifixion)*.

but as this discussion of sound and the emergent parameters of music makes clear, this codification is not a necessary precursor to performative action. Many if not most musical parameters can be suggested or prescribed by notation, but as an impulse to interpretation, much as a *forte* indication for dynamic intensity is translated into physical actions such as bow or air speed. The logical question, then, is how much of these seemingly extraneous attendant physical actions can be harnessed by notation? Are the ancillary aspects of sound wave excitation that occur in instrumental musicking only accessible through denotative notational prescription? Or is it possible that the representational media of music notation might create situations in which non-represented (i.e. non-notated) physical actions become necessary and predictable aspects of the total prescriptive act of the notation? How might an embrace of non-representation look in a world of music notation that relies on visual information transmission, and how might these non-represented elements be utilized or even foregrounded in the musical texture? What would it mean to eschew aspects of signification and embrace the emergent properties of pitch, rhythm, timbre? After all, any music notation elides at least as much as it explicitly signifies. The abrogation of (certain elements of) control is one of the principal functions of notation (as in the *forte* marking which leaves specific decisions of bow or air speed to the discretion of the performer). As before, the accrual of fixed decisions in the process of composing and notating is rather more the slow displacement of that which is not signified than the rigid specification of that which is. Being trained to the particular parameters that standard Western notation chooses to prioritize obscures the wealth of potential information omitted by that practice. The asignification of these properties entails the displacement of that agency to something or somewhere else.

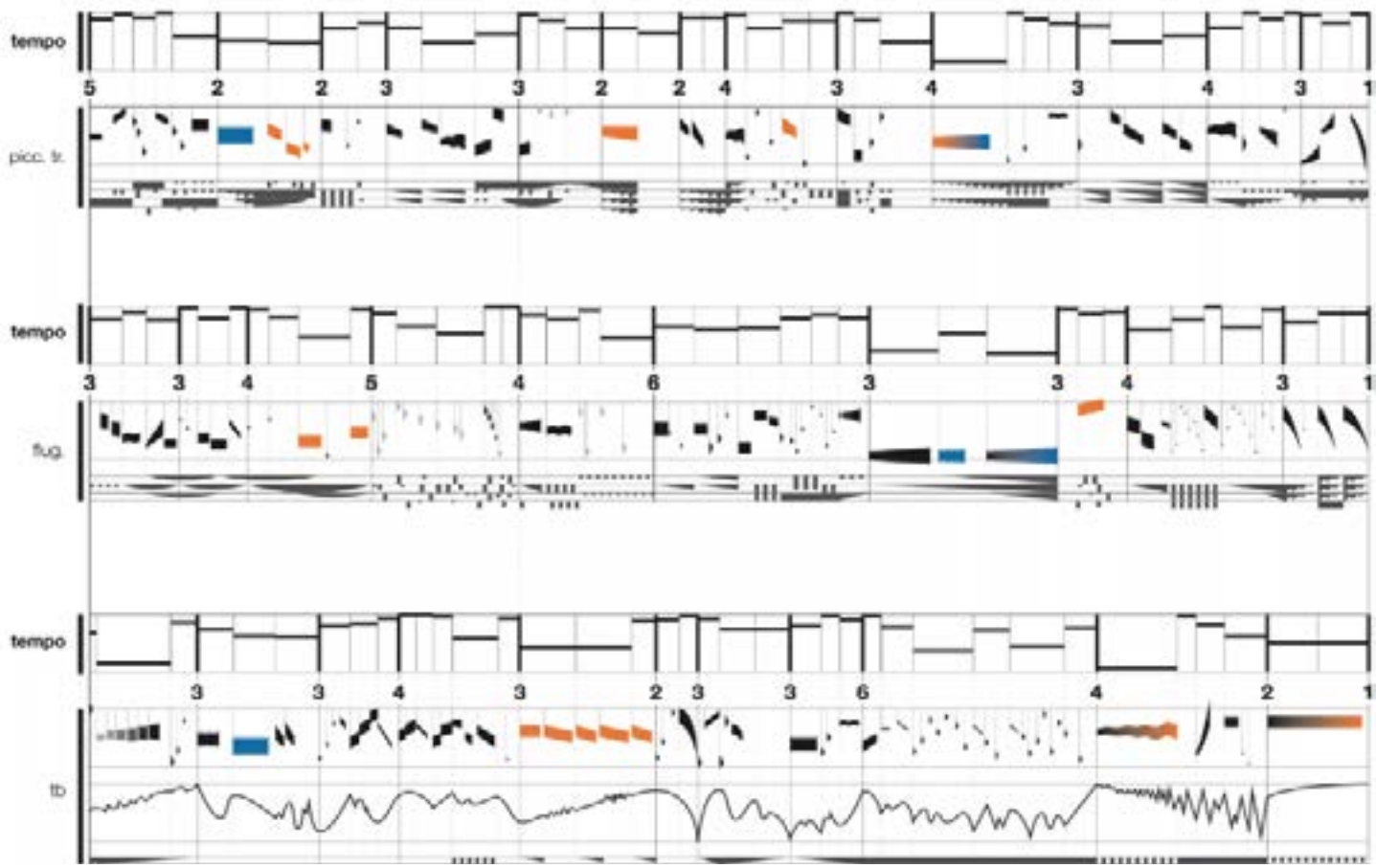
3.4.1 Nonrepresentational Rhythm and Timothy McCormack's *HEAVY MATTER*

The most obvious property of an emergent rhythm is its corporeality. Rhythm is embodied. The execution of rhythm is not computational nor does it consist of the mental manipulation of fixed variables. When asked to imitate such computationalism, the body can do so, but it is not the natural state of rhythm. An example of a more corporeal rhythm can be found in the music of James Tenney. In *Form 1*, Tenney writes for an indeterminate instrumentation distributed throughout a space. The meticulously precise harmonic rhythm, determined by a stopwatch throughout the piece, consist of a slow addition and subtraction of "'available pitches,'" selected and played at the performer's discretion. "Each tone should be preceded and followed by a rest, and sustained for one full bow or breath (on bowed-string and wind instruments), or until the tone has decayed to inaudibility (on piano, harp, guitar, vibraphone, etc.)" (Tenney, 1993, p. 2). Although the macro-rhythm is quite fixed, the micro-rhythms emerge as individual instrumental entrances collide and intersect in time and space, evolving unpredictably in performance. These deceptively simple emergent rhythms take advantage of the inherent corporeal rhythms that emerge from the limits of bow and breath. In so doing, they also reveal the complexity that can reside even in asignified rhythms. There is no compromise between determinacy and indeterminacy. This notation is highly prescriptive, but chooses to prescribe elements that reinforce and exaggerate the natural corporeality of the performers and their instruments at the expense of a pre-given, denotative rhythm.



James Tenney: *Form I* (1993): minutes 6′00″ to 8′00″

Corporeality as an alternative arbiter of rhythm opens many doors. In discussing his notation in *The Wreck of Former Boundaries*, Aaron Cassidy notes that it "seems well suited to strings—particularly as connected to the tablature work I've developed—and also seems to work well with the notation of breath in winds and brass. The 'rhythms' of course don't work in isolation and require some sort of movement notation" (Cassidy, 2015, p. 13). Similarly to Tenney, Cassidy has shifted priorities of denotative time structure to more corporeal elements, in this case strictly prescribed gestural information mediated by gradations of force and resistance.



Aaron Cassidy: *The Wreck of Former Boundaries* (2015-16), excerpt of piccolo trumpet, flugelhorn, and trombone parts

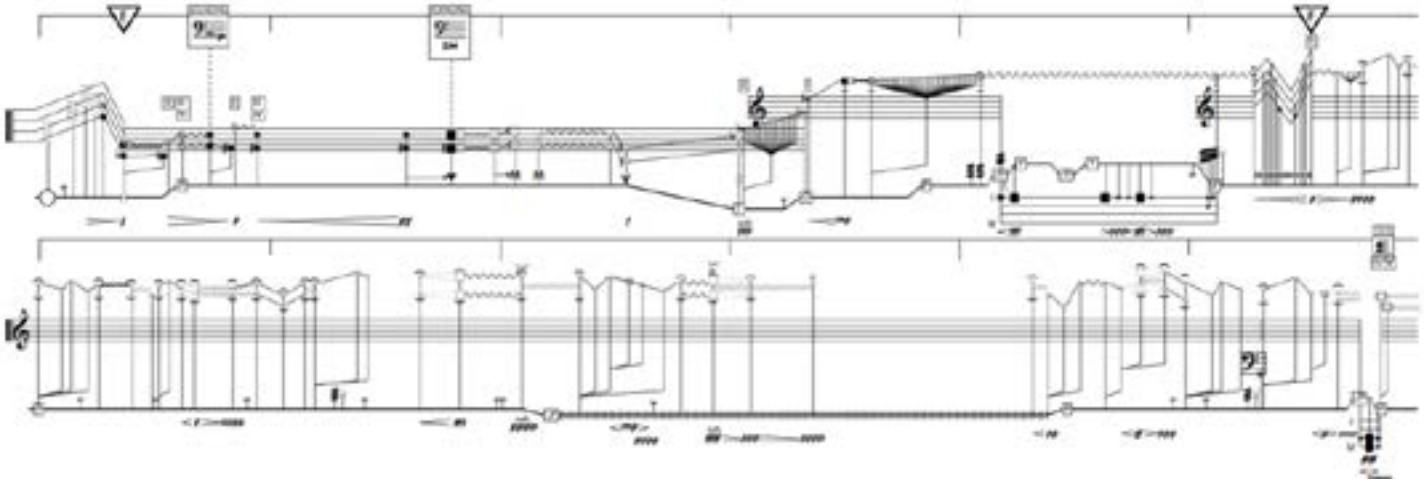
McCormack also relies heavily on the physical embodiment of notated gestures. His radically embodied synthesis of performer and instrument rejects outright any pretension of precisely preconceiving almost any element of a piece of instrumental music. This coming-into-being in the act of musicking implicitly welcomes a rhythm that emerges in space and time, provoked by the stimulus of a notation. But to what extent is the signification of a corporeally-dictated rhythm any less signified than note-headed attacks and durations? Although it shifts the type of information recorded and communicated in the notation, it remains wedded to representationalism. The alteration of the information does not alter the medium of communication; the reading contract has neither disappeared nor transformed in any appreciable manner. A gesturally-gestated rhythm may be less beat-driven,[53] but it is still firmly rooted in predetermination. Tenney's *Forms* indicate a passage through corporeality into truly non-representational rhythm, but corporeality alone cannot break the strictures of signification.

In his trombone solo *HEAVY MATTER* (2012)—part of a *MATTER* series of four solo pieces exploring four different instrumental practices—McCormack develops an instrumental notation that embraces a radical embodied rhythm while avoiding any direct relationship between gesture and duration or pacing. The rhythms are encouraged to emerge as an aspect of the coming-into-being of musicking bodies. All of the *MATTER* scores lack any standard Western notated rhythms, and although they appear to utilize straightforward proportional notation, in which the spatial proximity of actions on the page dictate a strict relationship to their temporal proximity, McCormack rejects this in his stipulation of the piece's "time-space notation":

53 "We often conflate 'rhythm' and 'beat' in Western music" (Cassidy 2015: 7).

> This work utilizes a time-space notation in which events are presented spatially and proportionately in relation to other events, suggesting things like rhythm and duration without prescribing them. Though time is elastic and thus the duration is relatively flexible, the durational/proportionate relationship between events should not vary wildly. (McCormack, 2014-15, p. i)

Here, suggestion supplants prescription. Although a loose proportionality is encouraged (perhaps even demanded), a strict proportionality is rejected. Corporeality drives temporal precision, the latter emerging as a natural, inevitable consequence. Rhythmic prescription is expressly rejected.



Timothy McCormack: *DRIFT MATTER* for solo cello (2013): 3

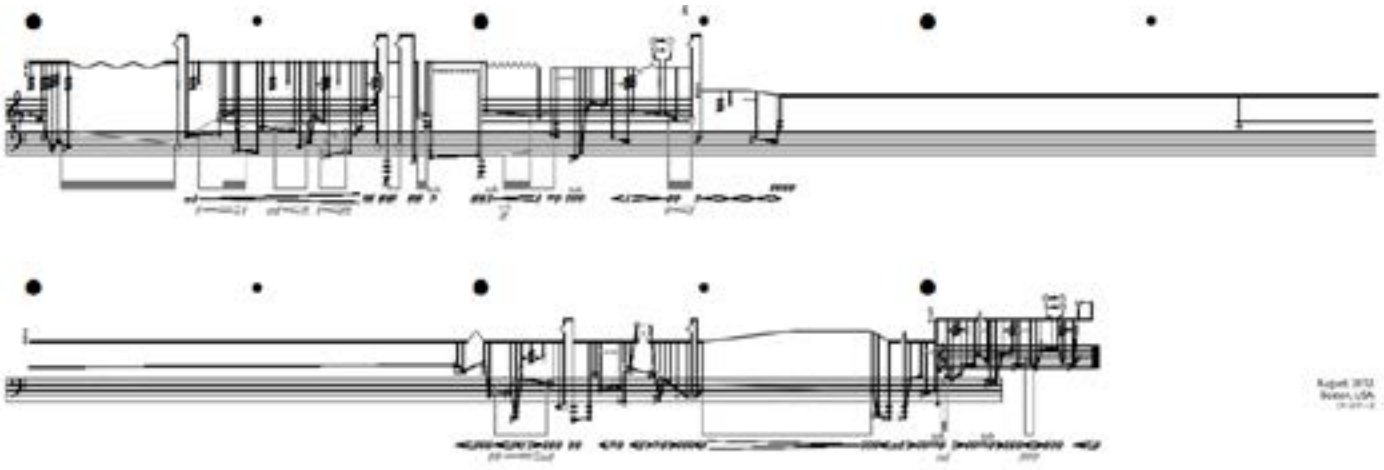
Although technically the second of the *MATTER* solos by some months,[54] *DRIFT MATTER* for solo cello feels in some ways to precede *HEAVY MATTER*, as it is far more continuous with McCormack's previous work for strings than is *HEAVY MATTER* with his previous work for brass. *DRIFT MATTER* expands a palette of action and sound already developed in *The Restoration of Objects*, which

> obsessively focuses on the act of dragging the hair across the strings throughout its entire fifteen-minute duration … In reducing the instruments' mechanism to its most basic form, [it] create[s] an extremely organic, unified and monolithic sound world. This sound world, through its own circulatory proliferation and insistence upon itself, in turn points back towards the nature and circumstances of its own creation. (McCormack, 2010, p. 9)

Though single-minded in its dogged retracing of the bow's trajectory across the instrument, *DRIFT MATTER* has no prescribed up or down bows. The sound world emerges from this radically embodied instrumental practice, but pacing itself finds no anchor in the bow's course (as it did, for example, in Tenney's *Form 1*). In that absence, the "suggesting" of rhythm and duration follows from the more general actions of the piece, the virtuosity of simultaneous and synchronous actions that sprout from this bow motion as it measures its inexorable course. Rhythm emerges from physicality, its limits defined in motion as it evolves, engendered by an intricacy of musical gestures blossoming in real time and space rather than by the rigid, fixed constraint of the physical length of the bow. It is as though the planes of motion of the bow reveal the rhythm already hiding in the cello's "weather-beaten grain … that wood in the work, the tree coming forward in [it], an undocumented record of time" (Barnes, 1937, p. 50). *DRIFT MATTER* reveals an emergent, corporeal rhythm that is asignified and non-representational, yet deeply resonating with the intricacy and virtuosity of other parameters

54 *HEAVY MATTER* was completed in August, 2012, and *DRIFT MATTER* in March, 2013.

in a manner that evaporates in works such as Tenney's, whose rhythms are more closely tethered to the natural durations of the bow or the breath.



Timothy McCormack: *HEAVY MATTER* (2012): 4

HEAVY MATTER reads the trombone and its performer through much the same process, though here, the locus of emergence is breath not bow: air streaming unceasingly through a resonant metal tube for the entire duration of the piece, "constant, heavy, multi-directional and pressurized" (McCormack, 2012, p. i). As in *DRIFT MATTER*, the seemingly natural consequence of the breath as an arbiter of duration and pacing is undermined by McCormack's rejection of phrases explicitly tied to a single breath, opting instead for a texture of constant activity punctuated by noisy inhalations (both notated and not), ingressive phonation (vocalization), and "heavily encouraged" circular breathing. "Inhalations are thus to become a part of the aural fabric of the piece" (McCormack, 2012, p. i)—that is, part of the aural fabric of the piece at the expense of their relationship to the rhythmic fabric.

This provokes a corporeal rhythm emerging through the intersecting idiomaticisms of embouchure, lungs and body superimposed on the various amplifications and resistances of the instrument. "The body produces energy - the instrument absorbs it; the body exerts a force - the instrument provides the resistant space necessary for this force to take form. Just as with the interaction between the directional operations of the bow, the body and the instrument are mutually engaged in the articulation of the other because their relationship is one of mediation, not of hierarchy" (McCormack, 2010, p. 12). Rhythm cannot be strictly proportional here because it is not a purely durational event. It is the diffraction of these bodily and instrumental energies, a stream being bent, which renders the unfolding rhythmic character of the piece simultaneously unpredictable and inevitable. The rhythm emerges as a candle flame, equally as erratic as predictable, capable of flickering in any direction, but nonetheless a fixed phenomenon with a limited scope and an inexorable course, burning down its wick until it gutters out in the consumption of its own exhausted impulse.

Possibility slowly disperses "as some things come to matter and others are excluded, as possibilities are opened up and others are foreclosed" (Barad, 2007, p. 193). Tributaries of metamorphosing sound sliver into space to gradually reveal a retrospective shape, a cutting away of the world until the body of the piece emerges. Form and shape do not preexist *HEAVY MATTER*. In resonance with the conceptual frameworks borrowed from Haraway in chapter 2, McCormack's musical forms and gestures emerge from a processual traversal of the piece's terrain, which "does not map where differences appear, but rather maps where the effects of differences appear" (Haraway, 1992, p. 300). An emergent, embodied rhythm inhabits the micro- and macro-rhythm of the piece in equal parts. To the embodied dynamism of rhythm accrues gradually a relentless formal momentum.

> In their union, both the instrument and the body become dynamic forces, each with properties, laws and functions of their own, and exert their influence over the other in a mutual relationship aimed at the production and manipulation of sound … Sound becomes palpable and tactile, and can be seen in the very effort exerted in its creation, just as that effort is made audible. (McCormack, 2010, p. 9)

Force, as this union of instrument and body in the act of colliding in sound production, is the perceptible manifesting of matter made sound, of flesh made rhythm.

3.4.2 Nonrepresentational Pitch and Joan Arnau Pàmies's *1≈∞ (EoM)*

Joan Arnau Pàmies explores the body in different ways, exposing less flesh and more of the latticework of social contexts that contribute to its production. "Any type of music," he cautions, "like any type of art, is a product of the social relations that evolve from a given set of material conditions" (Pàmies, 2016a, n.p.). This materiality includes not only the performer-instrument interface, but also, in our current situation, "neoliberal capitalism" (Pàmies, 2016a, n.p.). Pàmies sets out to attack "this wall of concrete located in front of us—that is, a standardized and commodified existence—which has robbed us of the possibility of imagining a better future" (Pàmies, 2016b, n.p.).

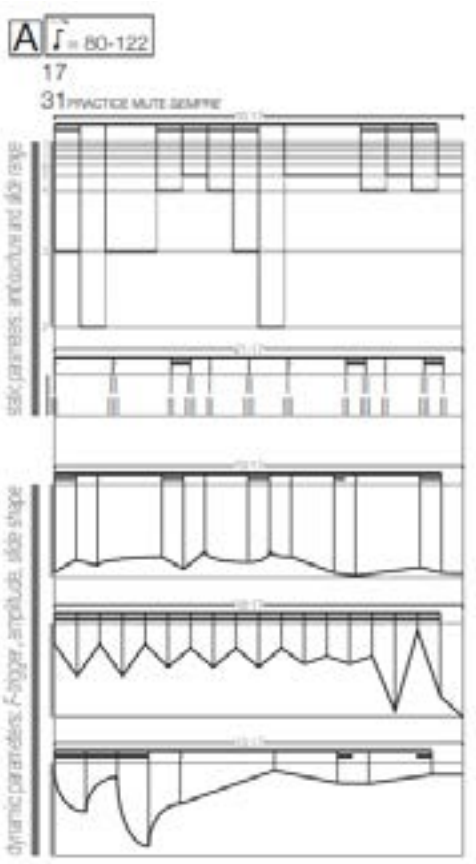
In the introduction to this research, Pàmies's concept of noise-interstate(s) was explored as part of a poietic practice strategy in his *[Vltbn]^4 (o quatre panells per a trombó sol)*.[55] The noise-interstate seeks to take advantage of the naturally-occurring noise in any interaction or communication, allowing it to become a productive force contributing new impetus to the creative process. This is, presumably, one method of embracing the straitjacket of the "given set of material conditions" and attempting to redirect its energy towards fluctuating and unpredictable ends.

The performer's body here becomes a battleground. It is, literally, a landscape upon which the fault lines of traditional practice and the noise-interstate(s) of productive equivocation will collide, superpose, interfere, and diffract. This collision of sedimented and imagined practices must be sparked by the notation. Pàmies can write, as he does in the performance notes for *1≈∞ (EoM)* (2015), that the score "employs a variety of unconventional notational means in the hopes of triggering complex interpretive processes" (Pàmies, 2015, p. 1), but merely articulating that hope does not light the fuse that actually triggers these events.

As he writes about noise-interstate(s), "Deliberate equivocation attempts to reconsider the original notion of certain material and formal constructions in such a way that the process of interpreting the score triggers a procedure of reorganization that is partly unintended during the early stages of the work's formalization" (Pàmies, 2013a, 177). The score itself must disorient and subvert traditional interpretive frameworks to the point that an "unintended" reorientation towards a new and different practice is produced. Implicitly, this new practice would be one built enactively and immanently through the poietic act.

Compared to the structural ambiguities and temporal displacement notation employed in *[Vltbn]^4 (o quatre panells per a trombó sol)*, *1≈∞ (EoM)* goes significantly further in its attempts to trigger this reorganization of organic resources. In this case, there are five staves of parameterized information, but only two of them refer to static information. The other three, the lower staves, correspond to any one of three parameters, but the distribution of that information is "dynamic, in that the performer must choose which notated parameter is applied to each specific technical aspect (e.g., the 19:17 bracketed material on area A could be read as F-trigger, amplitude, or slide shape). The performer must rearrange the dynamic parameters differently for each performance of this piece" (Pàmies, 2015, p. 1).

55 See 1.2 Poiesis as Musical Method.



Joan Arnau Pàmies: *1≈∞ (EoM)* (2015), excerpt of sounding area A

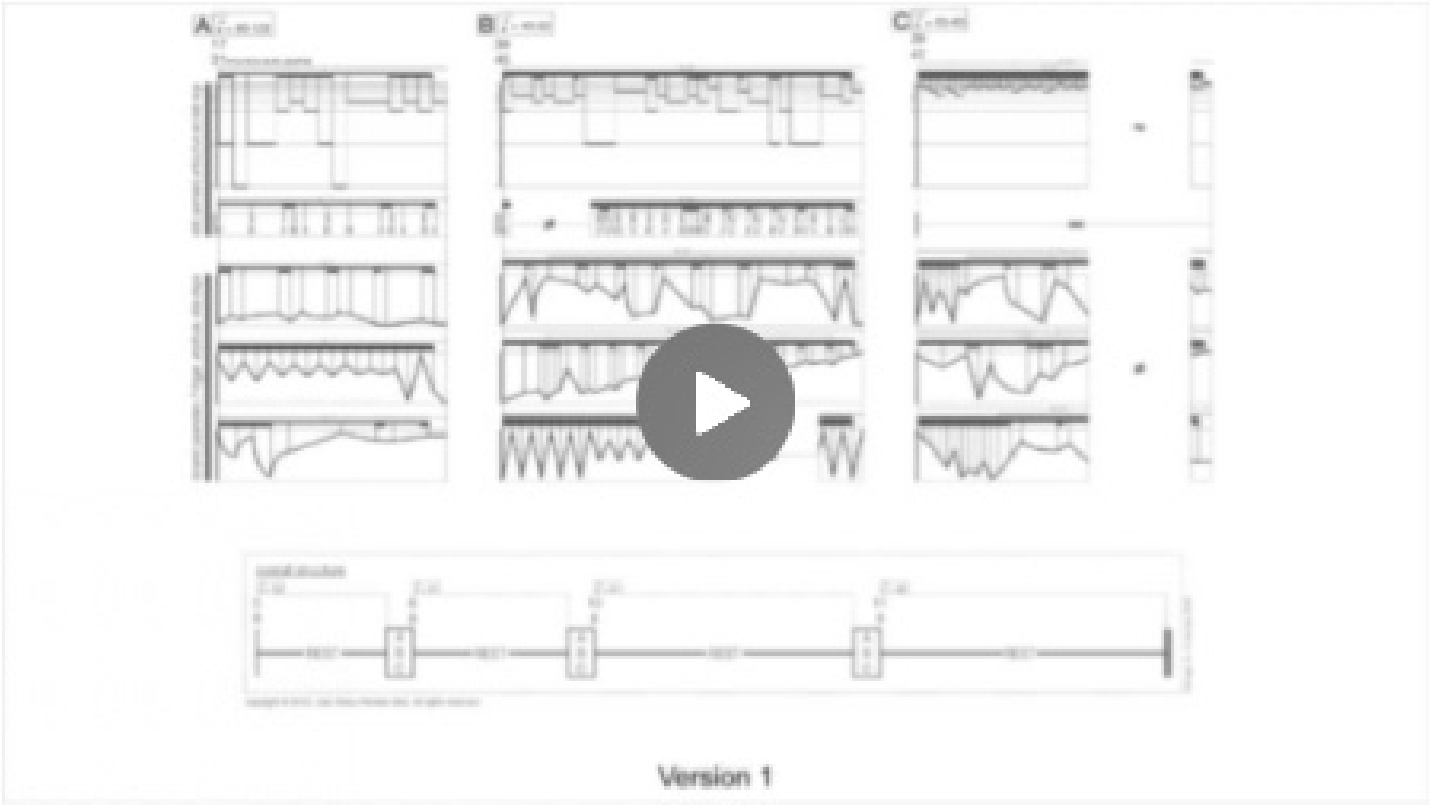
This requires not only a dynamic treatment of parameters in performance, but also a dynamic practice strategy that builds the requisite interpretive tools that enable the constant alternation of parameters. Given that the three sounding areas can also be combined in a myriad of different ways,[56] rote practice of a pre-decided parametric distribution is not only in direct contradiction to the spirit of *1≈∞ (EoM)*'s notation, but is furthermore impractical. Pàmies states an ambition to "create works that do not accept a given tradition as a natural artifact" (Pàmies, 2016b, n.p.); he triggers this deliberate subversion of the traditional composer-notation-performer relation through the rejection of even the illusion of fixed and static information to interpret. The notation necessitates a dynamism of learning predicated on the unmooring of traditional technique and the reembodiment of new patterns of gestures and their stimuli.

This attitude is, at its tamest, a rejection of representationalism as a vessel for traditional forms of content. Everything about the dynamism of the indicated modes of information transmission, learning, and performance trumpets an antirepresentationalism that rejects outright the validity of objective informational containers and traditional parameterized musical notation. This radical departure from traditional notation is perhaps most evident in the transformations to which the pitch material is subjected. Although the slide ranges are static (that is, the regions of the slide in which the variable slide motion will be enacted; represented by roman numerals in the lower of the two "static" staves), the motion articulated by the slide within that region will change with each iteration. This means that the production of fluid microtonal streams, manifesting unexpected *glissandi* with

56 "Three sounding areas (A, B and/or C) must be performed. Any order and/or combination of sounding areas is allowed, except for any reiteration of C (e.g., [in order of appearance] ABC, BCA, BBC, AAC, BAB, BCB, AAA, and similar combinations are allowed. BCC, ACC, CCC are not allowed, for C is repeated at least twice). Each performance of this piece must explore different arrangements of these combinations (that also applies if the piece is performed more than once in the same program)" (Pàmies, 2015, p. 1).

each dynamic interference between partial and slide position, is very similar to the pitch material described in Aaron Cassidy's *Because they mark the zone where the force is in the process of striking*[57] and Richard Barrett's *basalt*.[58] In this case, as well, the tiny, untempered microtonal material is impossible to notate more traditionally.

But *1≈∞ (EoM)* goes even further in this respect. In the cases of Cassidy and Barrett, although they resist traditional harmonic codification and, to some extent, completely identical replication from performance to performance, they are nonetheless fixed relationships that repeat in new situations, even as the manifestation and diffractive qualities of those relationships may shift in time. *1≈∞ (EoM)*, though, rejects that level of fixity completely, situating its material in a truly unpredictable state of flux. A transcription of Cassidy or Barrett's pieces in traditional notation would be a pale imitation of the microtonal diversity they contain; but such a transcription of *1≈∞ (EoM)* would be impossible to even conjecture. This level of dynamism embraces a complete reversal of representational notation, making any semblance of that notation an ancillary byproduct of a noise-interstate that foregrounds the antirepresentational emergence of pitch as a fluid, unpredictable phenomenon. *1≈∞ (EoM)* provokes a holistic, enactive learning process by which the representational fetters of traditional harmonic material is jettisoned, to be replaced by material that resists any formulation within the strictures of a traditional harmonic imagination.



57 See 2.1 *Haecceitas* and Aaron Cassidy's *Because they mark the zone where the force is in the process of striking (Or, Second Study for Figures at the Base of a Crucifixion).*

58 See 3.3 Radical Embodied Cognition, Guides to Discovery, and Richard Barrett's *basalt.*

This antirepresentationalism is a direct evocation of the structural ambiguities with which Pàmies hopes to disrupt the smooth machinery of neoliberal capitalism as it contributes to the constant production of new musics. He situates *1≈∞ (EoM)* as a catalyst within the performer's body, directly contravening the subconscious predilections of traditional technique and triggering the embodied realization of a fresh, poietic act. He writes, "I would like to believe that there is some work to be done in our field, where perhaps we can reclaim creativity and imagination through the difficult—yet hopefully productive—process of constant self-critique, rigorous historical analysis, and the development of a holistic praxis that is skeptical of the thoughtless reiteration of obsolete models" (Pàmies, 2016b, n.p.). In his doctoral dissertation, "Alternative Means of Musical Operation: Repurposing Sonic Creativity Within and Beyond Capital" (2016c), Pàmies goes one step further by concretely suggesting means by which a productive Leftist hegemony ought to be constructed in the new music community;[59] or, as he states his objectives:

> (1) to suggest paths to repurpose mental and behavioral infrastructures so that music can function as both a force of cultural and socioeconomic critique and a token of different material realities, and (2) to incorporate music into a wider leftist hegemonic program determined to put an end to the systemic repression yielded by neoliberal capitalism. (Pàmies, 2016c, p. 103)

As reflected in this binary formulation, Pàmies envisions personal and global movements intertwined in this process, and grounds these operations in a philosophical framework that he derives from the works of Alain Badiou, Herbert Marcuse, and Nick Williams and Alex Srnicek (Pàmies, 2016c, p. 71-95). In (re)purposing these concepts for musical and aesthetic situations, Pàmies relies on a brief schematic of political action on which to base his analogical "transmutation" (Pàmies, 2016c, p. 105): "From politics, New Music borrows a capacity for conflict recognition and resolution. A basic process of political action can be summarized as follows:

> **conflict**—conflict recognition—strategy evaluation—best course of action—action—**resolution**" (Pàmies, 2016c, p. 97; emphasis in original).

This formulation relies on a continuum from conflict to resolution. The schematic itself, in which he aligns the emboldened resolution to its preceding conflict, foregrounds the parallel relationship of the resultant state of resolution (which he takes pain to note may or may not be successful or even fully consummated) to its preceding, conflictual state of being. This dialectical motion, though, which conceives the process within a continuum, attempts to subvert representationalist biases inherent in any attempt to locate centralized, containable knowledge, a symptom of the illusion of objective

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59 Pàmies maintains a clear and rigorous definition of what he terms New Music:

> A simplified definition of New Music may be as follows:
>
> *New Music is an artistic praxis which, by virtue of deliberately employing certain political vectors, aims at generating alternative sonic-aesthetic models to those determined by prevailing material conditions.*
>
> As such, New Music has one ultimate objective:
>
> *New Music offers a glimpse of multiple potential futures; it is a token of different material realities.* (Pàmies, 2016c, p. 96)

For a proper treatment of this definition and its ramifications, one is better left consulting Pàmies's own works (cf. 2016c, p. 47-51). In the present context, I use the term—uncapitalized—in a more general sense.

observability that permeates Western culture,[60] and which, in new music, is arguably a symptom of an invasion by scientism, as Pàmies argues elsewhere in his work.

Pàmies astutely qualifies his entire discussion with an acknowledgment of the allergy many Leftists have to any whiff of hegemony. In due course, I would be remiss not to confess that I suffer from this selfsame allergy: I do not and cannot trust myself to any ideal of hegemony, replete as any such aspiration is with fantasies of categorization and unity (a rather different phenomenon than solidarity, even when only fleeting). I would, of course, also be remiss if I did not acknowledge that Pàmies's much lengthier and more thoughtful explication of his ideals and their potential realization is far more nuanced than it might seem from its cursory treatment here. He takes great pains to augment his thesis with thoughtful acknowledgments of this distrust, and he never fails to account for the anti-hegemonic impulse within various Leftist traditions. Nonetheless, his dialectical imagination of political action is at odds with a tradition of revolutionary thought that attempts to displace the conflict from the resolution by a rupture of emergent action. That is to say, the traditional understanding of direct action stands in contradiction to a dialectical progression from conflict to resolution. This crucial difference—namely, the disruption and abandonment of any illusion of a holistic continuum of political or social progress—merits some small attention.

What distinguishes direct action from other political action is the utter irrelevance of the (often hegemonic) powers-that-be. In Pàmies's formulation, there is still an implicit apostrophe to the previous state of affairs and a general state of discourse. Direct action supersedes this apostrophic action by not dissenting from but rather entirely disregarding the structures that produced the "**conflict**." (This is a rather crude summary, and of course Pàmies also notes this mode of engagement (Pàmies, 2016c, p. 90).) The provocative aspect of direct action is its utter disinterest in resolution; it is the abrogation of engagement with this whole process by simply electing a new tributary of action down which to travel. The dialectical progression sketched by Pàmies is only one form of political momentum; direct action proposes another, rather more attuned to situated and emergent knowledges (especially in the Arendtian sense of poisesis as tool-building rather than tool-wielding).[61] It is, of course, dependent on precisely such localized situatedness and is incapable of emerging in a unified, hegemonic form.

This type of emergent action is often described as horizontal, in that political demands and activities emerge not from a vertical, hierarchical source, nor from a pre-conceived set of ideals or goals. One of the striking aspects of the most famous protest movements of the last decade (e.g. Arab Spring, Occupy Wall Street, *gilets jaunes*) is precisely the way that political demands can be articulated by decentralized, diverse, and emergently evolving mass action. A hegemonic imagination requires some concept of centralization; even if it accounts for a certain amount of variation, compromise, and progressive evolution, even these decentralized elements exist only in the context of some theoretically centralized (and externally observable) momentum. This idea of inertia is very topographical, lodged in a sense of cohesion. Horizontal direct action supplants this mode entirely. Naomi Klein's neologism Blockadia, for example, deliberately and literally supplants this notion of topographical proximity by producing a concept of place in which a vast array of liminal spaces (often indigenous or border-lands) cohere in their confrontation with a set of parallel (and normally hegemonically linked) threats. Her definition of place allows these disparate locations and localized struggles to cohere, but does not allow that coherence to demand centralized or even coordinated action. Rather, it takes power and direction from the situated, emergent political struggles that

60 For a more extensive examination of representationalism and the limits of objective observability with respect to the work of Karen Barad, see 1.2 Agential Realism and Michael Baldwin's *Erasure*.

61 See also the discussion of Anna Löwenhaupt Tsing and disturbance in 2.0 Preliminaries, which is especially pertinent to any discussion of (potential) emergent social transformation.

develop in parallel with each other, entangled but decentralized, necessarily non-hegemonic in spite of their mutual concerns.[62]

This is not the place to pick squabbles over Leftist political tactics, but the issue does become germane as soon as analogies to music commence. Hegemonic strategies preclude localized differences because they assume a position (often, but not always, implicitly objective) from which everything may be observed. This mirrors the obsession with consciousness in cognition. Many conservative approaches to decentralized cognition (e.g. neural networks, connectionism) still depend upon centralized oversight and synthesis. Radical embodied cognition, as examined heretofore,[63] allows for direct perception-action relationships to transpire and accrue, as irrespective of consciousness as direct action is of the state. For notation to embrace non-representationalism, it is not enough for a system to be emergent or radical, but it must also eschew the allure of universalism. A radical hegemony still seeks to array its forces of solidarity in some sort of opposition to a previous hegemony. Direct action as a political force and direct perception-action as a cognitive function both forego disputation in favor of disregard.

As Christian Bök explains of 'pataphysics, Alfred Jarry's science of exception, "Such a supplement is always more substitutive than augmentative, replacing reality instead of accenting reality" (Bök, 1997, p. 4). Non-representational notation cannot merely take a representational container and poke holes in it. The mental crutch of representation must be subtracted, disregarded, and supplanted altogether. Each instance may demand a different form of non-representationalism, as in the differences between the scores of the three composers in this subchapter. This is the horizontal, emergent phenomenon by which the unique, localized situations of each piece provoke varied solutions from even the same composers or performers. Not surprisingly, although McCormack and Pàmies have both written multiple pieces for trombone, in both of their cases, each piece displays radically different notations respective to each situation. The pieces' non-contingencies elicit necessarily independent embodied and emergent learning strategies from both the composer and the performer. Bök describes such varied differences as "declensions of extension:"

> For 'pataphysics, the threat of error finds itself expressed through the three declensions of exception (the anomalos, the syzygia, and the clinamen)--three events that involve a monstrous encounter, be it in the form of an aporia, a chiasm, or a swerve--whatever takes on the character of alterity in the aftermath of some accident. (Bök, 1997, p. 75; emphasis in original)

Jarry's and Bök's anti-reason (or other reason) is not simply a swerve or an aporia, though. The swerve transcends mere direction change, is neither refutation nor rebuttal. The swerve occupies the same space of complete, radically imaginative supplantation as the political and cognitive actions just described.

> "The clinamen involves a brownian kinetics, whose decline defies inertia since such a swerve must imply a change in vector without a change in force. The clinamen represents the minimal obliquity within a laminar trajectory. The curve is a tangent to a descent, but a tangent that defies all calculus since the curve is itself a tangent composed of nothing but tangents ad infinitum: the volute rhythm of a fractal contour" (Bök, 1997, p. 82, emphasis in original).

The swerve, then, is more dimensional than directional. Rather than sliding to a new point on a continuum, it elides that spectrum altogether and slides rather obliquely to some entirely other

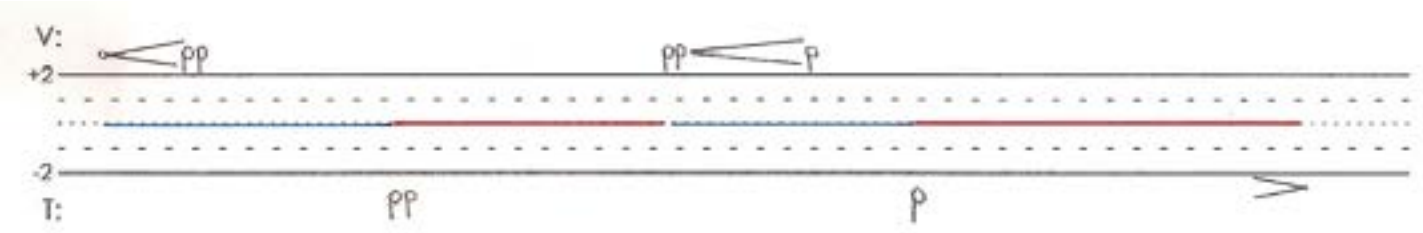
62 Cf. Klein 2014

63 See 3.1 Introduction to Enactive Learning; Embodied Cognition; Enskilment, and 3.3 Radical Embodied Cognition, Guides to Discovery, and Richard Barrett's *basalt*.

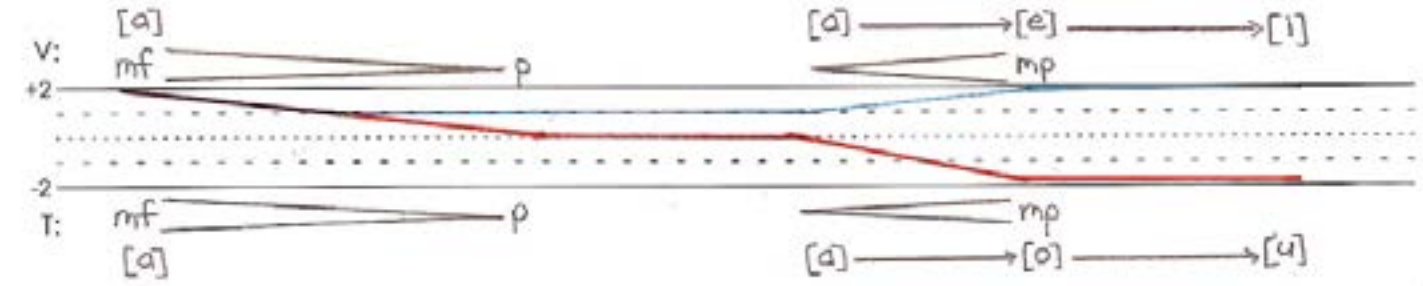
stratum. As Bök, quoting Jarry, notes: "'the function of navigators was to make land'--not to find it'" (Jarry, 1965, p. 199; in Bök, 1997, p. 65). Politically, this relates to the collectivities discussed above in subchapter 3.3, wherein social creativity is distinguished by the emergent capacity to elide easy teleologies, enacting progressive trajectories that evoke rather more Bök's oblique swerves than any easily classifiable hegemonic trajectory. Within music, the task of building poietic learning or notational strategies entails developing tools that enable this non-teleological drift while maintaining the personal (and communal) cohesions that support its emergence without dictating its terms. As one final foray into the idea of nonrepresentational notation, I present Kenn Kumpf's *_they mix above there* as an example of how such obliquities can be sparked by a notation that draws focus in one direction while simultaneously encouraging the development of musical material in the periphery of that zone, accepting and encouraging a dialogue between strictly notated and nonrepresented, emergent musical material.

3.4.3 Nonrepresentational timbre and Kenn Kumpf's *_they mix above there*

Kumpf's beautifully subtle and evocative *_they mix above there* (2008) demonstrates a nonrepresentational notation of one more traditional musical parameter, timbre. Kumpf's notation reduces pitch content to a series of colored lines on a non-standard five-line staff: the five lines in this case represent only a major third spread, and the ample white space between those lines allows for a nuanced and ever-shifting palette of microtones.



Kenn Kumpf: *_they mix above there* (2008), excerpt from opening



Kenn Kumpf: *_they mix above there* (2008), excerpt from closing

The colored lines indicating pitch show both normal played tones (in red) and sung tones (in blue), as well as unisons of the two forms of sound production (in purple). These pitches, alternating and overlaid, are slowly subjected to filtration by both the mouth cavity (shown by IPA syllables below the staff) and the plunger mute (shown by IPA syllables above the staff). Gradually, the rather minimal opening material unfolds into a rich texture of variously combined and superposed filtrations and (multi)phonics.

The notation, then, indicates primarily pitch material, quite precisely despite its idiosyncrasy, with two strata of physical actions layered polyphonically thereupon. At first glance, this pitch material appears to be the primary sonic building blocks of the piece, a solid foundation which the filters can

subsequently ornament. This impression, though is belied by the embodiment of these actions.

In his own dissertation "Pitch Objects and Performative Referentialities" (Kumpf, 2013, p. 1), Kumpf addresses the vagaries of pitch in its various guises and how it can function both compositionally as well as performatively (and to a lesser degree, also perceptually). His own practice as a vocalist informs his engagement with pitch and its endlessly subjective materialization, although he also addresses many aspects of instrumental performance. As the title suggests, he approaches the simple yet slippery concept of pitch by identifying a series of classes of "pitch objects: discrete, monolithic, obfuscatory, gradient, transitory" (Kumpf, 2013, p. 26-40). Any sounding pitch can obtain to any number of pitch objects to varying degrees, and its profile can shift continually and at any time:

> Just as pitch object categories are fuzzy sets, in which each object contains a degree of membership, the change from one object category to another in a passage is not a discrete or immediate process. It is better to imagine the objects as being mapped in a five-dimensional space; transitional passages in a composition, therefore, consist of objects traversing this space, changing their degree of membership to one or more categories as they move. While this remapping of the objects is not necessarily a continuous function, the geometric representation of combinations of pitch objects captures both the vertical, frozen-instant disposition of the notes in a passage, as well as an implicit kind of functionality in the traversal of object-category space. (Kumpf, 2013, p. 40)

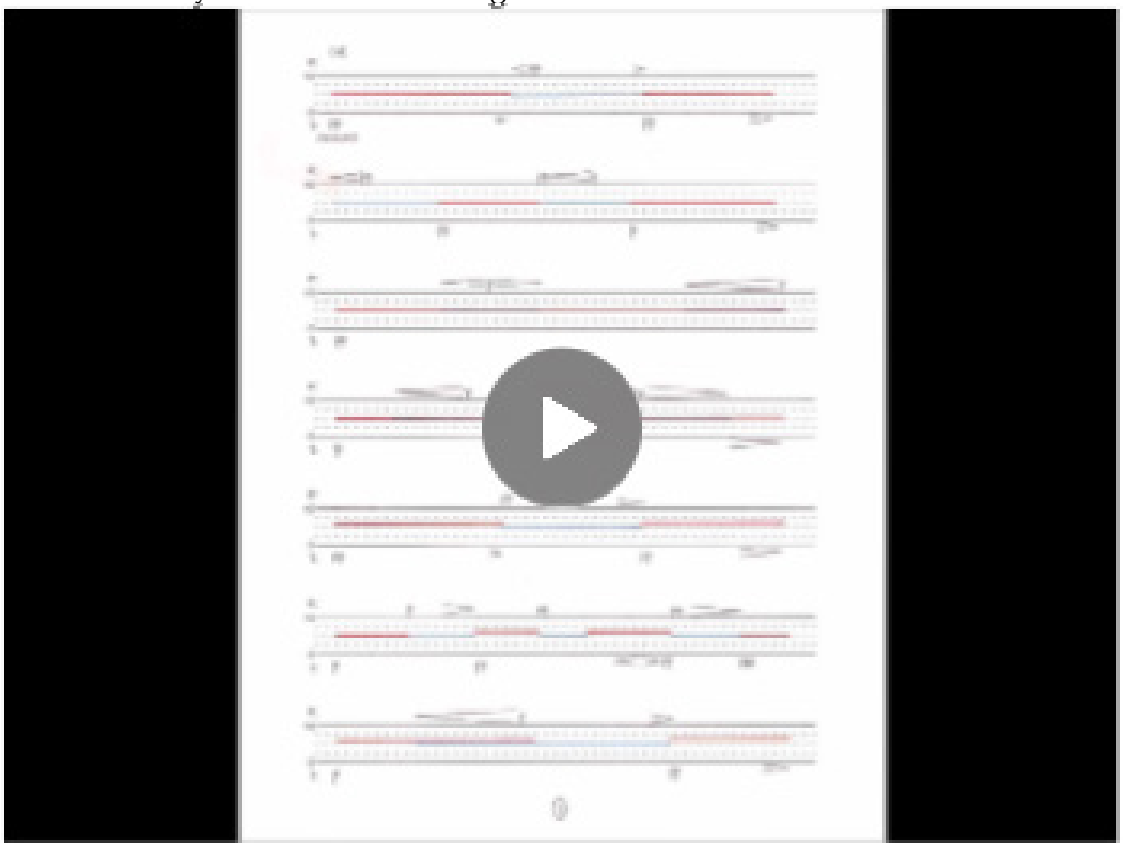
Clearly, although he is using what many may consider the simplest and most fundamental building block of Western music, Kumpf defines pitch as a dynamic and relational phenomenon. He contends that this dynamic notion of pitch alongside the contextual profile derived from its performative referentialities constitute "parallel considerations to traditional harmonic or motivic analysis" (Kumpf, 2013, p. 2). By placing this physical, dimensional quality of pitch alongside and equal to traditional vertical and horizontal music theory analysis, Kumpf makes space for a nuanced understanding of how pitch can function as a more tactile material of music-making. He refers to this himself by describing "pitch as direct sound material—correlating to a perceived fundamental frequency—rather than as a means to an acoustic end that is not necessarily frequency dependent" (Kumpf, 2013, p. 26).

In *_they mix above there*, this tactile treatment of pitch becomes immediately apparent. The near-constant beatings of close multiphonics disorient the pitches from being experienced as frequency-dependent or -discrete events. The perception of these beatings is foregrounded to the point that, after the initial introduction, the unison and solo pitches quickly shift into a world perceivable rather more as tranquil variations on rhythmically fluctuating beatings than as monophonic vestiges of a polyphonic harmonic passage. Kumpf described the piece as "a counterpoint of interferences," rendering starkly tangible the various amplifications, interferences and composites that the superposition of sound waves and "high-pass vs. low-pass filters" construct (private communication with the author, 11 May, 2015).

One can see how, although Kumpf's notation relies superficially on pitch and a polyphonic ornamentation of filters, the performative referentialities that emerge in their embodiment subject these notated elements to a Bökian clinamen or syzyzgia, wherein they are subjected to a declension that shifts their dimensionality away from pitch and filtration onto a completely other, non-representational plane of tactile timbre.

These considerations are far more than theoretical speculations; they inform every part of learning or listening to a piece like *_they mix above there*. The raw materials do not tell the whole story,

and the moment they are prodded, they begin to cast up a dust of other materials, sounds, and superpositions. Learning *_they mix above there* requires a performer to learn to feel and listen to the beatings and filtrations on a fundamental level, as an impulse not as a result. A listener, similarly, must find their way through Kumpf's syszygian sonic dimension—of minimal means but with a richly saturated texture. The timbral hues that emerge form the only signposts, inviting the listener to an entanglement that they did not hear coming.



All three of these pieces embody a tactility that is not ancillary to but deeply entangled with and inevitable in the notation. McCormack's rhythm made fleshy; Pàmies's pitch melted down and poured into new containers; Kumpf's timbral leaves one's ear can turn like the pages of a book: these notations invite a bodily precision in opposition to an intellectual one. These musics capture the essence of this precision, of a radically embodied coming-into-being that expresses the moment in which it occurs, sharpening the point of the situation in its becoming. Karen Barad writes that "matter is not a fixed essence; rather, matter is substance in its intra-active becoming—not a thing but a doing, a congealing of agency" (Barad, 2007, p. 183-4). Their dependence on non-representational elements of notation and embodiment allow bodies to awaken in a performance—composers, performers, and listeners congealing alike—to become "engaged with each other such that they are simultaneously one thing *as well as* separate, autonomous components within that whole" (McCormack, 2010, p. 5). Non-representational notations allow for emergent learning and listening, where situatedness becomes a crucible, distilling and transforming the physical substance of the music. As Chopin says: "[I]t does not state precisely, it is precise."