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Poiesis and the performance practice of physically polyphonic notations

Fairbairn, K.T.

Citation
Fairbairn, K. T. (2020, June 11). *Poiesis and the performance practice of physically polyphonic notations*. Retrieved from https://hdl.handle.net/1887/100478

Version:	Publisher's Version
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Author: Fairbairn, K.T.
Title: Poiesis and the performance practice of physically polyphonic notations
Issue Date: 2020-06-11

Poiesis and the Performance Practice of Physically Polyphonic Notations

Proefschrift

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van Rector Magnificus prof.mr. C.J.J.M. Stolker,
volgens besluit van het College voor Promoties
te verdedigen op donderdag 11 juni 2020
klokke 13.45 uur

door

Kevin Toksöz Fairbairn

geboren te Williamsburg, Virginia,
in 1987

Promotores

Prof.dr. Marcel Cobussen

Prof.dr. Richard Barrett — Koninklijk Conservatorium/Instituut voor Sonologie

Promotiecommissie

- Prof. Mike Svoboda — Musik Akademie Basel
- Prof. dr. Henk Borgdorff
- Dr. Rick Dolphijn — Universiteit Utrecht
- Dr. Agnieszka Wolodzko

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This dissertation is written in partial fulfillment of the requirements for the doctoral degree program docARTES of the Orpheus Institute and Leiden University. The remaining precondition consists of a demonstration of the research and its findings in the form of a lecture-performance.

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Acknowledgments

I would first and foremost like to thank the steady guidance of my supervisors, Prof. dr. Marcel Cobussen and Dr. Richard Barrett, who have shown great patience and provided invaluable guidance and feedback at the most critical junctures. Without their insightful questions and commentary, this project could never have emerged in the condition that it has, for which I am very grateful.

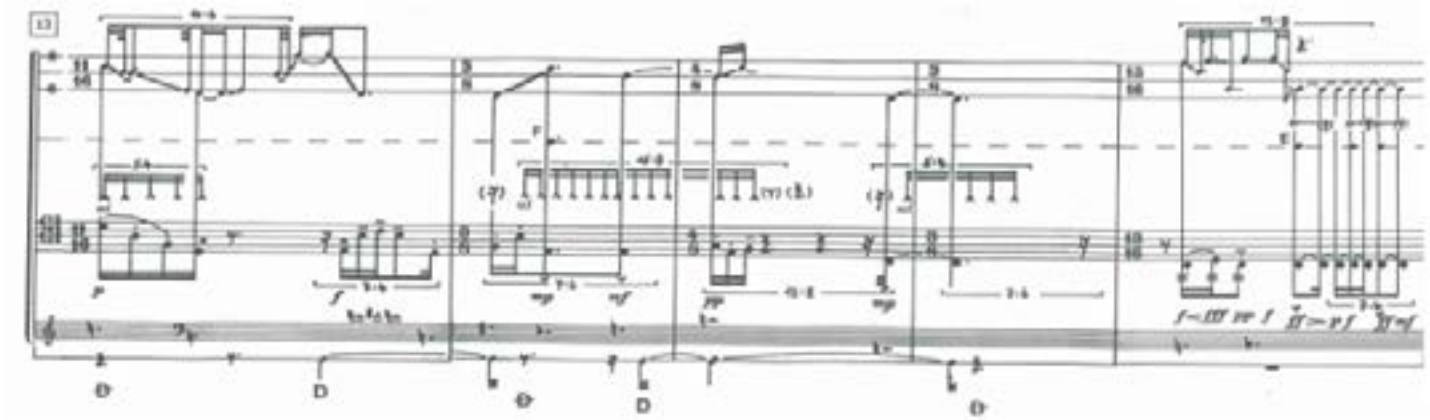
Throughout this research, innumerable other people have contributed both materially and immaterially to its gestation and completion. Special thanks must be given to those who have offered the most tangible (and often time-sensitive) assistance: Coleman Goepfert, João Carlos Pacheco, Jon Fielder, Curtis Rumrill, Leahkim Gannett, Mike Svoboda, Sehyung Kim, Michael Baldwin, Viola Yip, Andreas Eberle, and Stichting de Zaaier, who supported financially the final stages of this research. I would also like to thank those interviewed, whose thoughts and reflections have enriched the following pages: Vinko Globokar, Matt Barbier, Benjamin Marks, William Lang, Stephen Menotti, and Weston Olencki. Even more special thanks must be given to the only person to have read every word at every stage, from well before it was a doctoral project, offering invaluable assistance and feedback along the way: my mother, Brenda.

And lastly I must thank my closest advisor and inspiration, who has driven me to pursue these ideas and ideals both within this project and well beyond in our lives, never allowing me to write or perform without a thorough cross-examination: my wife, Işil Toksöz.

1. Introduction

1.0 Preamble

This thesis investigates the learning process in music as a locus for interaction and entanglement. Musical discourse is susceptible to compartmentalizing stages of agency: the genius composer alone at his desk, the virtuoso performer performing musical acrobatics onstage, the audience enraptured in their plush seats just beyond the fourth wall. Are these activities really so discrete? And if not, then how can one reveal the circulation between these chambers of activity? These questions have concerned me particularly as a performer of complex, avant-garde contemporary music. Many of the scores I perform have extremely complex notations, which serve as a barriers of entry not merely to casual listeners but even to highly trained classical musicians.



Klaus K. Hübler: *Cercar* for solo trombone (1983): mm. 13-17

The staves, from top to bottom, indicate slide position, valve action, diaphragm vibrato, harmonic partial, vocal action, and mute (either with mute (D) or without)

This remove is then exaggerated in performances, as hectic whirlwinds of virtuosity merely reinforce the distance between those initiated and those not. All of this serves, of course, to elevate these compositions and performances, and why should I complain, as a performer who benefits from the awe that these monoliths of complexity inspire? In spite of this, I always felt a great sense of unease in these situations, because the acceptance of these delineated roles of creativity—intellectual composition, virtuosic performance—elides the sometimes more complex intertwinings of these threads of action, creativity, and agency. I wanted to find a way to demystify these pieces and to celebrate, rather, the complexity and ingenuity that emerge in the course of the learning process.

To this end, I have focused this research on the means by which complexity and virtuosity emerge, holistically, through the learning process. Rather than fetishizing the final performance—which may still be a sea of complex polyrhythms overlaid in increasingly uncomfortable patterns on a performer's body—I have attempted to unearth the longer gestations through which an entanglement of creativities coalesce around new musical expression. These intersections of the creative process do not always occur in specific times and places, as will be examined more closely in the course of the study; nonetheless, in examining how the learning process exposes itself to this interplay of agencies, its situatedness in the performer's body becomes a crucible for entanglement. Although complex music can be fetishized as a feat of intellectual athleticism, it is often the result of a much longer incubation within the performer's body, as the intellectual stimuli are dissolved in solution, digested, and only subsequently embodied. My research has attempted to work through both the philosophical and experimental traditions of embodiment and situatedness, to find templates for learning that embrace the acts of doing and making as forms of knowledge production in and of themselves. I examine them not as means to executing knowledge, but as the loci where knowledge

is, in fact, generated. The learning process is not an intellectual, cognitive act that trickles down through the pliable body, but rather a creative process itself in which the body can and often must take the lead. Doing and making become the levers of intellection themselves, to the point where they can not only supplement but even supplant the consciously creative energies of the brain. I have used experimental music notations to foreground questions about how embodied learning can cultivate responsiveness in the face of ever-changing notational stimuli, which is to say, I have attempted to investigate how a single performative body can seamlessly adapt to new notational prompts with equally fresh creative learning strategies. This research project investigates how a performer can build a complex personal performance practice capable of satisfying standards of rigor and replicabaility, while still remaining flexible to the emerging possibilities (and constraints) that new notations invariably engender.

In this context, learning music may be viewed as a form of research-as-making. Throughout the thesis, the concept of emergence plays a key role: how can experimental research in music produce new knowledge without succumbing to teleological notions of performance subsumed to notational intention? In other words, I hope to create a space for engaging with notations that allows for artistic practices to emerge processually, creating an embodied research methodology that remains responsive to the changing notations it encounters. I seek to avoid situations in which expectations about notations and performances can preclude the responsive process of learning music with and within situated temporal and physical constraints. In order to construct this space, I narrow my research down to a specific type of music notations which I herein call "physical polyphony." As a compositional trend, the idea of decoupling discrete physical actions emerged in the late twentieth century and crept into a number of musical aesthetics, from graphic notations to the intricate notational palettes such as those associated with the New Complexity. From a performer's perspective, the fact that these notations represent a relatively circumscribed cross-section of notations which have nevertheless also contaminated a variety of compositional aesthetics made them an ideal laboratory for problematizing the learning process with respect to music. More specifically, as the proliferation of physically polyphonic notations has flourished, the only true criterion which all these notations share is precisely the manner in which they all differ from one another. This intrinsic variability of notational and physical parameters provides me a platform for investigating emergent research methodologies, such that each new piece undertaken can more easily problematize the entire learning process, from initially learning to read the notation to its eventual execution in performance.

In pursuit of new knowledge about embodied—or situated—learning, artistic research in music provides an extremely valuable point of departure. Because physically polyphonic notations cultivate a space for the holistic assimilation of new and variable stimuli, music has the capacity to enact research while embedded in a process of progressive—albeit singular—embodiment. Research in embodiment and learning requires some sort of processual embedding, and while this can in some ways be a hindrance—as such embedding is necessarily linked to personal or anecdotal practice—it can also be an advantage, as it allows processual transformations to be reified directly in the act of research. As previously stated, physically polyphonic notations provide a unique combination of notational stimuli that recur in everchanging, ceaseless transformation. This allows a personal research methodology to expose itself to a progressive series of notations and to experiment with learning strategies that optimize adaptability within a framework of replicability. In searching for models for this type of research, I found myself returning repeatedly to the fields of embodied cognition and anthropology. The latter, in particular, has always been forced to accommodate forms of research-in-practice, in this case because of its reliance on field research (although the conflict between theory- and field-based progression has been present as long as the discipline itself). Perhaps for this reason, it has also proven capable of producing reliable templates for embodied and

embedded knowledge production, such as the conceptual frameworks of way-faring and storytelling.

Tim Ingold's conception of way-faring, examined more closely in chapter 2, explores a notion of perpetual wandering in which maps emerge from the journey and are useful only until the next map and the next departure present themselves. Anna Löwenhaupt Tsing, whose work is also addressed in more detail in chapter 2, houses a similar idea within the ecological concept of disturbance. For Tsing, disturbance is a state of being, something that "is always in the middle of things: the term does not refer us to a harmonious state before disturbance. Disturbances follow other disturbances" (Tsing, 2015, p. 126). In charting a trajectory through the mutable landscape of disturbances, she chooses to house her research methodology within the framework of storytelling, in which development is necessarily processual. Unlike an academic study of literature, in which a concept and its discussion can exist external to the story, open to examination at any remove or duration, the act of storytelling demands a certain pacing and progression, a containment within the unfolding. Ingold's way-faring indicates a similar path, celebrating the situated vantage points that emerge through the research trajectory. He deems it not only acceptable but moreover advantageous that research require situatedness and welcomes shifting frames of reference. Another thinker who hovers over these pages, Donna Haraway, enthusiastically welcomes the partialities that emerge from such situatedness: "[W]e 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). For Haraway, Ingold, and Tsing, partialities and disturbances make possible the generation of uniquely productive knowledge-producing activities. My research has sought to chart a similar way-faring journey through the realm of physical polyphony, in the hope that the maps that it unfolds might prepare the embarkation for some other journey with other vantage points.

Way-faring and storytelling become valuable tools for harnessing artistic practice as a form of research-in-practice. They become a means to harness anecdotal experience as a rigorous methodological framework: in this case, (personal, situated) learning is a methodology: a practice of epigenetic personal transformation through entanglement with other agencies (e.g. composer, notation). Embodiment and situated learning emerge as a practice-based medium for establishing responsive performance practices. This, of course, opens up the complicated question of how to judge what, exactly, it means to be responsive. Once again, I will turn here to the field of anthropology for guidance, mining the resources available within that discipline for models of value systems that embrace consistency alongside constant variation (which discussion occurs chiefly in chapter 1.1). The field of embodied cognition (treated in depth in chapter 3) provides a further useful model, though. In particular, the developments within the field of artificial intelligence over the last several decades have provided invaluable evidence for embodied research-as-practice. In the course of developing very constrained artificial intelligences, and in expanding those experiments over decades, this discipline has provided evidence within drastically simplified situations (i.e. reduced variables) for how intelligence and knowledge are produced emergently and situatedly. In the long progression from computationalism (the idea of intelligence as a computer) to radical embodied cognition (distinguished by situated, emergent enskilment), much evidence has emerged to support the idea that Haraway's situated partialities can underpin concrete, rigorous, and replicable learning strategies that simultaneously embrace embodiment, emergence, and response-ability.

With respect to music, I extrapolate two primary methods from the experimental traditions of radical embodied cognition. First, from the fields of artistic intelligence, I reference Pfeifer and Bongard's design principles for emergence (Pfeifer and Bongard, 2007, p. 87). These principles guide the construction of learning strategies for physically polyphonic notations that mirror those used in designing artificial intelligences, which serve chiefly to facilitate the emergence of efficient, adaptable learning strategies in robots. This integration of adaptation as a structural design element stands opposed to

a computational strategy that seeks to use pre-determined templates of performance practice to assimilate new stimuli into a pre-existing pattern of behavior. In order to maintain some level of rigor, I introduce also the tenets of a simple task analysis, as proposed by Wilson and Golonka (Wilson and Golonka, 2013, p. 2-3), which propose specific questions to reflect on this adaptive enskilment process, thereby providing a consistent means to assess the efficacy of the embodied learning strategies.

I map these emergent strategies onto various pieces of music, thereby highlighting aspects of musical performance that can be optimized that may otherwise be easily elided through more traditional, classical music learning models. Similarly, I address emergence as a valuable analytical tool, proposing it as a medium for theorizing the role of non-representational elements in music notation, which elements can similarly be overlooked or ignored in more traditional (harmonic- and rhythmic-based) musicology. I do not hope to challenge or supplant these other modes of learning, thinking, and analyzing, but nonetheless harbor hope that by elucidating the role of emergence and embodiment in learning and performing music, this thesis can enrich the already fertile terrain of musical interpretation. To add balance to these reflections and their relationship to more traditional modes of thinking, I provide a short appendix which examines other performers' journeys with some of the same pieces of music. It demonstrates that, far from existing in binary opposition to one another, traditional classical and emergent modes of learning entangle with and contaminate one another as each performer charts their own solutions to these musical problems. In the course of this research, I mine insights from these varied disciplines in order to develop targeted learning strategies within the context of physically polyphonic notations. It is to be hoped, of course, that these strategies can also migrate back into the disciplines from whence they came, that the contamination does not come to rest in physically polyphonic notations but rather runs back into other research practices, as well. Just as the targeted, bounded research done by Pfeifer and Bongard in robotics helps me to extrapolate the general principles of emergence and embodiment to the problems of learning music, I hope that by similarly focussing on applications of emergence and research-in-practice, my development of learning strategies for music can in turn influence also other researchers, be they roboticists, anthropologists, or others besides. By focussing on research-in-practice, I aim not only to aid other music performers engaging with physically polyphonic notations, but also to create frameworks for the practical application of embodiment that may also prove useful for interdisciplinary borrowing.

By focusing on the development of these research-in-practice strategies, I continually circle Hannah Arendt's conception of poiesis. While navigating these various transdisciplinary fields to support the development of effective artistic practices, Arendt's understanding of poiesis provides an invaluable model for a marriage of creativity and craftsmanship. For Arendt, poiesis demarcates the creative act within what she calls work, one leg of a triumvirate also including labor and action, all of which together describe the metabolistic survival and interaction of human society. As the creative expression of work, poiesis exists outside of strictly temporal, goal-oriented situations, and indicates instead the creative process of tool-building. The resultant tool may then be used to effect other learning and creative enskilments. This idea of a creative process geared towards the development of tools rather than objects proves extremely fertile as a support to artistic research-in-practice. It enables these reflections on enskilments to coalesce around concrete learning strategies that remain adaptable to the mutable mental and physical demands presented by each new physically polyphonic notation. It also encourages the metabolism of interdisciplinary research by which the specific tools developed in these pages may resonate further into other studies of music or other fields entirely. Those strategies, though, require a certain amount of way-faring, a certain amount of unfolding within these musical-notational topographies. This preamble serves as a short preliminary ambulation, a preface to the subsequent circumnavigations, contaminations, and disturbances that will allow a poietic performance practice to emerge. By the end, this thesis should indicate pathways by which new vantage points and performance practices can continue to develop, well beyond the few propositions contained in these pages, but before that, one must begin from the beginning, with an exploration of poiesis and its relationship to the creative process.

1.1 Poiesis: *Vita Activa* and Theories of Value

Poiesis, though as a word almost impossible to translate, has proven exceptionally fertile for transplantation to many different disciplines. In Greek, it sketches the outlines of an idiosyncratic concept of craftsmanship—a craftsmanship engaged in production as a literally creative/creating act, neither necessarily material nor immaterial. In addition to tasks considered craftsmanlike today, Greeks also used poiesis to describe the arts of both poetry and legislation, thereby underscoring the deliberative technical and aesthetic aspects of these creative acts, each both fabrication and handicraft. A combination of formal rigor and attention to social context constrains (or seems to constrain) these arts, but is nevertheless accompanied by a necessity to reimagine those constraints in order to stimulate the production of new ideas (as in poetry), civic functions (as in legislation), and relationships (as in both, of course). Poiesis construes the act of creativity as an open-ended utility. This utility is not about the simple conversion of material into new objects, but denotes rather a type of creating act both aesthetic and mundane, producing new objects, relations, or ideas that would in turn produce other things themselves. Giorgio Agamben elucidates the sense of creativity and production that the concept of poiesis evoked:

> The Greeks, to whom we owe all the categories through which we judge ourselves and the reality around us, made a clear distinction between poiesis (poiein, "to pro-duce" in the sense of bringing into being) and praxis (prattein, "to do" in the sense of acting). As we shall see, central to praxis was the idea of the will that finds its immediate expression in an act, while, by contrast, central to poiesis was the experience of pro-duction into presence, the fact that something passed from nonbeing to being, from concealment into the full light of the work. The essential character of poiesis was not its aspect as a practical and voluntary process but its being a mode of truth understood as unveiling, ἀ-λήθεια. (Agamben, 1994, p. 42)

Unveiling is itself a useful term, because although poiesis entails production, the unveiling process differs from the immediacy of action that Agamben ascribes to praxis. Unveiling is focused—teleological in a localized context—and yet opens outwards with an entropic, irreversible directionality. This directionality has an arc of unfolding; it requires some duration to incubate. This period of creative metabolizing effects the ultimately ateleological nature of poietic unveiling, through which it encourages ever new branchings of potential. Poietic creativity produces a tool, often with a predetermined purpose, but the tool-building process itself can also discover or create alternative uses. Poiesis emerges from this confluence of localized specificity and terminal indeterminacy, open-ended, but not unending. It is a process that can produce relations and alter the world around it, and yet still differs from both mundane acts of production and grand visions of dynamic, ceaseless transformation in the world. As such, the concept of poiesis helps to bridge a very simple but influential division between the study of objects and their set identities on the one hand, and the study of their relations in constant flux on the other. These two poles of understanding, themselves descended from the Greek tradition (Parmenidean and Heraclitean, respectively), have been at odds for much if not all of the history of Western thought. In diffracting these two modes of understanding through each other and pushing beyond this falsely binary impasse, Hannah Arendt developed her own distinct and unique theory of poiesis. In the present work, I will explore her interpretation of the concept and then present it as a methodological framework for learning physically polyphonic musical notations.

In *The Human Condition* (1958), Arendt outlines what she calls the *Vita Activa* (the active life), in which she centers her analysis of human society through a lens of activity and social relations. In contrast to much of Western philosophy, in which the human condition was examined through a lens of inner reflection, Arendt focuses rather on how human activity within the pluralistic domain of

social interaction comes to define the human condition. She identifies this active life (i.e. life within pluralism and social interaction) as the primary driver of creativity, among other things, and divides it into three key components of human character: labor (*animal laborans*), work (*homo faber*), and action (*zoon politikon*). She characterizes the differentiation of these three modalities of being so:

> Labor is the activity which corresponds to the biological process of the human body, whose spontaneous growth, metabolism, and eventual decay are bound to the vital necessities produced and fed into the life process by labor. The human condition of labor is life itself … Work provides an "artificial" world of things, distinctly different from all natural surroundings. Within its borders each individual life is housed, while this world itself is meant to outlast and transcend them all … Action, the only activity that goes on directly between men without the intermediary of things or matter, corresponds to the human condition of plurality, to the fact that men, not Man, live on the earth and inhabit the world … this plurality is specifically *the* condition … of all political life. (Arendt, 1958, p. 7)

Labor is organic, cyclic, unending; Arendt references Marx's description of labor as metabolistic. Work, by contrast, is focused on producing things ostensibly outside of time, which is to say, outside of the temporal cycle of labor. Work, for Arendt, produces things that survive beyond their use in labor and contribute to further creativity within and through those cycles. Action, in contrast to work and labor, is engagement in society. Action is centered on humans as political beings, where plurality and interaction are inevitable and indispensable. Action emerges from social relations and what it produces, creatively, are further refined social relations. Labor and work produce the context in which action can emerge. Each of these three elements correspond to a different level of human creativity, from labor as the most fundamental, metabolistic creativity that produces for immediate consumption in the service of basic needs, to action as the social realm where actions are produced in dynamic relation to others and move outward in ever-growing, concentric ripples of agency that belie easy reduction. Work, situated between these ends of the spectrum, is used to outline a totally different form of creativity, a poiesis, in which tools are built which will enable the further creative processes of both labor (metabolistic production of the means to living) and action (the dynamic production of social relations). For Arendt, poiesis is situated outside the cycles of both labor (production and consumption) and action (social interaction). Labor is the continuous (re)producing of material or immaterial products that provide the basis for continuous interaction in the social realm of the *Vita Activa*. Poietic creativity, in contrast, is situated distinctly outside the social and political arena of the *zoon politikon*, as its products—the tools themselves—are still contained in some definable way, outside the currents of history that swirl in the purely social realm. The tools, as they are used, open outwards into the world (and in so doing are often repurposed beyond their original design), but the creative process of tool-building itself occurs in an isolated space outside the metabolistic cycles of labor and action. For Arendt, this concept of the atemporality of tools is a crucial demarcator of poiesis; these tools will be used later to effect new forms of creativity. As a consequence of that, she envisions the creative act of tool-building as a radically different form of creativity than those involved in labor and action.

Each of these categories has a parallel in music and performance practice. When preparing a piece of music, any piece, there are discrete procedures involved that fit into all of these categories: the laborious, time-consuming tasks drilling isolated passages; the work of crafting a performance technique that enables this labor of learning pieces; and the public act of performing in society, exposing the fruits of creative labor and work to the public gaze. These elements—the metabolistic cycles of practicing that maintain musical practice, the tool-building phases that hone technical mastery, and the performances that release the creative act to social absorption—define the basic categories of performance practice. As a musician engaged in building a practice and learning

individual pieces of music, looking closely at these three Arendtian categories can reveal some of the ways in which conventional performance practice sometimes confuses these three discrete modalities in the construction of learning strategies.

In addressing specifically the learning process of music, it is often ignored or elided that there is in fact a huge and appreciable difference between the actual execution of difficult pieces in performance and the rather different process of learning them (in other words, the instantiation versus the gestation). If this distinction is properly parsed, though, we can identify two distinct types of pieces in addition to those that are difficult (or easy) both to learn and to execute: 1) pieces that are easy to learn but difficult to execute; and 2) those that are difficult to learn but subsequently easier to execute. The mere execution of difficult music (the instantiation of virtuosity) is not very interesting; how they are learned and incorporated into practice, though, triggers a fascinating set of questions about the performer's engagement with composers, notations, and most notably themselves (the gestative process of learning new skills). This study focuses on the difficulties present in a particular notational trend that arose in avant-garde classical music in the late twentieth century, physically polyphonic notations. These notations typically decouple different physical actions within a single performer's body, notating them as separate strands of polyphonically distinct voices which will then be incorporated into the performer's body in the act of learning and performing. As will be seen, these pieces actually come in a huge variety of styles and no two notations are the same (itself perhaps a more interesting departure from the traditions of classical notation than the decoupling of physical gestures itself). What unifies them more than a particular notational appearance is, in fact, the difficulties they present within the learning process. Engaging Arendt's modalities of creativity enables an elucidation of the learning process whereby the variability and adaptability that pieces such as these necessitate can be situated within the organic needs and potentialities of the performer's body. Poiesis, the unique creative process of *homo faber*, constructs the tools that enable creativity and labor, and so provides a useful organizing principle for a rigorously variable methodology of learning, as will be seen in the ensuing discussions of physically polyphonic repertoire for the trombone.[1]

The poietic act within Arendt's *Vita Activa* helps to propose a reimagination of performance practice. As she notes very clearly, the role of work is to produce what she refers to as tools. These tools are the "instruments which can ease the effort of labor considerably" (Arendt, 1958, p. 121). A tool in this case can be almost anything—remember, for example, the variety of acts considered poietic (e.g. poetry, legislation), all of which use a variety of physical and intellectual tools to produce new poems, laws, etc. In music, the development of tools can refer to embodied physical skills as much as to theoretical and mental constructs that enable one to approach a piece or a passage within a piece. And, just as with creative acts like poetry or legislation, the raw materials that enable the construction of these analytical or theoretical tools can be mined from the realm of action: that is, from the realm of plurality, where people meet and their differences and values encounter each other. This germination within plurality enables the effective construction of new tools and new creativities. The poietic act is a bridge between the realm of plurality where we encounter radically different pieces and demands, and the realm of labor where we internalize and effect the execution of one of these pieces in isolation. Arendt writes that, "[d]uring the work process, everything is judged in terms of suitability and usefulness for the desired end, and for nothing else" (Arendt, 1958, p. 153). This implies that the

1 The trombone itself is arbitrary. For the purposes of this study, I have limited my research to pieces that I have both learned and performed personally; as a trombonist, I have therefore been limited to pieces for trombone (with one brief exception in the conclusion). The products of this research on the learning process of physcially polyphonic notations are intended to extrapolate more generally beyond the purview of the trombone alone, and concern solely the activity of any instrumentalist facing the challenges of reading and learning these notations, rather than the specific performance practice of the trombone.

poietic act takes place within a specific context; work, unlike action, is localized. The production of a tool implies a goal for its initial use, the "desired end," by which the craftsman manipulates material to produce a tool that can effect that end. As with most tools in the hands of craftsmen, though, whether potters or poets, the localized goals that provoke the creation of a new tool are not the only situations in which that tool can come to bear.

This paradox sums up what can be so difficult about tool-building as it applies to the musical tasks of practice-building. Performers are driven to produce tools and practices that apply to a variety of contexts, and yet, each context will also demand new tools or modifications to existing ones. If, as Arendt writes, "the actual work of fabrication is performed under the guidance of a model in accordance with which the object is constructed" (Arendt, 1958, p. 140), then the model in question will change with every new piece of music, each of which will in turn provide a new model, and therefore a new impetus to the tool-builder, the practitioner. The correspondence between tools that maintain their use in new contexts and the necessity for new or varied tools provides the essential challenge in approaching experimental repertoire of any kind. Here, again, Arendt's spectrum of labor-work-action proves useful. Although the localized work of tool-building is task-specific, we must recall her observation that this work mines the "desired ends" of these tasks from the realm of action and the pluralistic motives and needs of society. In music, these pluralistic influences come from both the composer and the public, from the history of the instrument as well as its inherent potential outside of that tradition. All of these elements come to bear forcefully upon the musician engaged as *homo faber*, working dynamically to hone tools that enable the blossoming of creativity within the learning process.

Arendt points out, quite rightly, that these acts, and the intersections of action, work, and labor, are very much about the creation of values. After all, the act of tool-making is, as has been just examined, inherently teleological in the design and construction of specific tools, even as those tools themselves may inevitably outlive their initial teleologies. Poiesis is therefore also imbued with fundamental biases towards some system of values. That is to say, tools are imbued with fundamental purposes, however radically their eventual use may migrate from that initial conception. If these poietic acts are indeed intrinsically connected to the domains of labor and action, drawing motives from and then enabling cycles of creativity and action in both domains, then the values that determine the goals of the tool-building process become immensely critical. In other words, the system of values that determines the purpose(s) with which a tool is imbued matter. Arendt writes that, "[v]alues, in other words, in distinction from things or deeds or ideas, are never the products of a specific human activity, but come into being whenever any such products are drawn into the ever-changing relativity of exchange between members of society" (Arendt, 1958, p. 164). This relation to the scalable demands of metabolistic labor and social activity means that the poietic act, as it relates to the teleological design of enabling tools, is intensely susceptible to whatever value system guides that teleology. How those values are decided cannot be casual or lackadaisical. Too often, the use of tools (i.e. learning strategies, technical practices, etc.) create biases of values in the learning process, guiding a performer down one interpretive path or another based not on the idiosyncrasies of a particular piece or its notation, but on the idiosyncrasies of the pre-existing practice that may best be suited to one or another "desired end." To quote a common English adage, if all you have is a hammer, everything looks like a nail. Choosing (or using) the tools of performance practice in learning new music is no different.

Arendt diagnoses this confusion of ends as a "perplexity, inherent in all utilitarianism," which results from "an innate incapacity to understand the distinction between utility and meaningfulness, which we express linguistically by distinguishing between 'in order to' and 'for the sake of'" (Arendt, 1958, p. 154). Delineating the roles of creativity in Arendt's modalities reveals how these values come to be

reified in performance practice itself, wherein old biases of traditional techniques guide performers to interpret a new notation merely "in order to" achieve some resultant sound (i.e. the resultant sound is consequent to and hierarchically downstream from what the technique determines as idiomatic). Recasting that process "for the sake of" the notation and the resultant sound entails an entirely different approach to establishing values—the right and wrong, correct or incorrect, accurate or inaccurate of a musical interpretation. A poietic approach proposes establishing values "for the sake of," an alternative system in which those values are crafted and honed with respect to individual pieces, case by case and attuned to specific situational demands. The interpretive tools—everything from reading the notation to embodying the prescribed actions through instrumental practice—do not need to be invented completely anew over and over, but can be repeatedly reopened to the creative act of poiesis, the craftsmanlike commitment to building (new) tools, primed to optimize the creative process in each new task.[2]

Arendt's action-based philosophy is still rooted in political philosophy, and thereby concerns itself chiefly with closed systems (ancient Greece or Rome, modern nation-states or labor markets—that is, closed political and social systems). If we take seriously her statements that values emerge from the pluralism of the social and political domain, that is, the field of action, then such closed systems cannot suffice to understand how value can be mined therefrom. She writes herself that "action, moreover, no matter what its specific content, always establishes relationships and therefore has an inherent tendency to force open all limitations and cut across all boundaries" (Arendt, 1958, p. 190). Anthropologist David Graeber has explored precisely this question: "What if one did try to create a theory of value starting from the assumption that what is ultimately being evaluated are not things, but actions?" (Graeber, 2000, p. 49). Like Arendt, he sees social values as emerging from the relations that "cut across all boundaries," rendering the creation of value systems relevant and supplying the dynamic contexts in which those values emerge and fluctuate (as they inevitably do). "Value … can best be seen in this light as the way in which actions become meaningful to the actor by being incorporated in some larger, social totality—even if in many cases the totality in question exists primarily in the actor's imagination" (Graeber, 2000, p. xii).

The field of anthropology offers us open systems that explore the ramifications of both intra- and inter-cultural values. Graeber's work on a theory of values for anthropology takes action and interaction as the essential locus of value creation, as opposed to more object-oriented approaches favored by his anthropological predecessors, themselves based on either sociological, economic, or structuralist premises.

> There are, one might say, three large streams of thought that converge in the present term [value]. These are:
>
> 1. 'values' in the sociological sense: conceptions of what is ultimately good, proper or desirable in human life
> 2. 'value' in the economic sense: the degree to which objects are desired, particularly, as measured by how much others are willing to give up to get them
> 3. 'value' in the linguistic sense, which goes back to the structural linguistics of Ferdinand de Saussure (1966), and might be most simply glossed as 'meaningful difference'
>
> When anthropologists nowadays speak of 'value'—particularly, when they refer to 'value' in the singular when one writing twenty years ago would have spoken of 'values' in the plural—they are at the very least implying that the fact that all these things should be called

2 Although this thesis deals primarily with instances of physical polyphony, the final chapter explores several cases that extrapolate these processes to other notational strategies.

> by the same word is no coincidence. That ultimately, these are all refractions of the same thing. (Graeber, 2000, p. 1-2)

But Graeber moves in a much different direction, influenced by a handful of anthropological predecessors including Marilyn Strathern, Nancy Munn, and Terence Turner. He eschews an objective (or objectifying) approach, in which an object is a vessel that inherently contains some (fixed) specific value. This staticism afflicts all three of the examples listed above. For Graeber, "[v]alue, then, is realized mainly in the public, communal sphere, in the forms of concrete circulating media" (Graeber, 2000, p. 74). As does Arendt, he sees the roles that these items take on in the dynamic, pluralistic flux of society as the true containers of value, which is to say that value is stored not in the objects themselves but in the interstitial relations they share with others. And, again similarly to Arendt, he notes that this does not divorce value from the object itself, but actually entangles the object even more intimately with the material world that surrounds it, its valence thus emerging from a radiating network of other intertwined objects, media, and agencies. "This is the sort of materialism … that sees society as arising from creative action, but creative action as something that can never be separated from its concrete, material medium" (Graeber, 2000, p. 54). Value is generated, created by use, and imbued with meaning through that utility. Graeber sketches the same sort of paradox as Arendt's poiesis, in which the task-oriented construction of tools is subsumed into an unpredictable web of relations and engenders creativity and production both of and within that web of relations.

The interesting point for Graeber, though, is also how unconsciously this whole value-creating and -storing process emerges, which contributes to the very human tendency to presume that one's values are either objective or universal. He describes the way that social structures produce value through enacted and reenacted actions.

> 'Social structures'—like any other sort of structure—are really just patterns of action. But they are very complicated patterns: they not only coordinate all sorts of intentional human action, they are also the means through which actors are continually redefining and even remaking themselves at the same time as they are reproducing (and also inevitably, changing) the larger context through which all this takes place. (Graeber, 2000, p. 59)

This is rarely a conscious process, though. Graeber cites Jean Piaget, who also studied the development of knowledge and social structures using a framework of action rather than contemplation. Piaget relied heavily on Kurt Gödel, whose incompleteness theorems state that "in any consistent formal system *F* within which a certain amount of arithmetic can be carried out, there are statements of the language of *F* which can neither be proved nor disproved in *F* … such a formal system cannot prove that the system itself is consistent (assuming it is indeed consistent)" (Raatikainen, 2015, n.p.). Graeber uses Gödel's work on mathematical systems to help demonstrate that in order to have a theoretical understanding of one's actions and this construction of social space, a critical distance is necessary, just as in mathematics a higher order of complexity is necessary to prove any theorem. Such a vantage point from a higher order of complexity is rarely present in the quotidian web of social relations and actions that create values, though; "individual actors tend to be aware of only … the specific thing they are making or doing, the specific end they have in mind" (Graeber, 2000, p. 59). Rather than engaging a particular goal or value and consciously crafting their actions in the world around that, the opposite tends often to be the case. The systems of values and larger order structures that come to organize and make sense of these smaller actions are in fact creative products thereof. They are themselves rather more dynamic than static, typifying the emergent intertwining of creativity and utility that Agamben ascribes to poiesis. "The crucial point is that what we call structure is not something that exists prior to action. Ultimately, 'structure' is identical with the process of its own construction. Complex abstract systems are simply the way

actors come to understand the logic of their own interactions with the world" (Graeber, 2000, p. 61).

Piaget's work, though much of it is now debunked or fallen out of favor, provides a key to unlocking how this comes to be important for the interpretation of musical notations. In studying children, he examined how the solipsistic imaginations of objective values are gradually overcome. For Piaget, this occurs as children gradually outgrow their early egocentrism, recognizing slowly that other perspectives exist and must be accounted for. In Piaget's study of children, this informs many very basic interactions in the social sphere, from learning sharing or even dissembling. In anthropology, as well, the necessity of accounting for these cross-cultural perspectives is an obvious factor (though has still been too easily ignored on occasion). In music, however, this egocentrism is much less acknowledged, in part because it can occur more unconsciously and has been little discussed. The fact that it can elude consciousness or discussion, though, is itself a product of how easy it is in most situations to rely on pre-existing and pre-constructed practices (and thereby value systems) that have proven useful in the past. It is much easier to ignore the suggestion that different actions necessarily construct different values, and equally easy to overlook the fundamental idea that neither one technique nor another is inherently more true or correct than the other.

After all, value is a loaded word: good versus bad, right versus wrong, valid versus invalid—all these concepts come into play when we interpret music, whether we like it or not. I propose engaging with physically polyphonic pieces analogously to the pluralistic conceptions of Arendt and Graeber, recognizing that "value is not *created* in that public recognition. Rather, what is being recognized is something that was, in a sense, already there" (Graeber, 2000, p. 77). If these structures are consubstantial with the actions that create them, then we have the opportunity to embrace our own agency in choosing which actions we take to provoke the emergence of the values that pertain in each situation. We have to meet these pieces in a field of plurality, recognizing what is very obvious anthropologically, namely, that every place (or piece) can have a separate system of values, of right and wrong, good and bad, and that that is not only appropriate but necessary, if not inevitable. "Development, in turn, becomes a matter of internalizing the fact that other [subjective perspectives on the world] are possible; or, to put it a bit more technically, creating structures which are really the coordination of different possible perspectives" (Graeber, 2000, p. 63). From a critical distance that acknowledges these variable perspectives, we may engage with a piece from our own role as an implicated observer, and then come to terms with the particular, localized set of values that is demanded or offered by the situation, which includes the demands of instrumentations, notations, composers and audiences, etc. All of these elements can and will be constructed anew in each situation (as the following chapters will explore), even if ultimately some previous values or interpretive decisions still pertain. How this poietic construction of values unfolds in practice should become apparent as the study progresses.

Poiesis provides a methodology for embodying particular actions that contribute to the creative process of value creation in the pluralistic domain of music. Embracing theoretical constructs that allow us to approach a piece on its own terms—and not on our own or other preconceived terms—allows us to overcome the childish egocentrism of the performer embedded in a static practice. It allows us to embrace the itinerant and exploratory role that we have as performers. The piece is not a visitor to us, forced to integrate into our own values. We are all plural to each other, and we must approach the piece responsive to how our interactions with it will uncover a set of values that is uniquely tailored to the specific situation. We must develop cooperatively with a notation, crafting tools that enable the performer and the notation to both most efficiently embody their creativity in each local task. *This* is the poietic act: constructing tools and methodologies to engage responsively with each individual piece's physical and mental demands. If a structuralist system of values seeks meaningful difference, than a poietic system of values seeks instead *meaningful interaction*.

1.2 Poiesis as Musical Method

I. Vinko Globokar: *Echanges* (1973)

But what does this look like in practice? A poietic approach eschews the impulse to approach scores looking for footholds that conform to our preexisting values of execution. Rather, we must experiment with a piece physically and mentally to find the points where meaningful interactions appear, where different parameters rub against each other and interfere or cooperate most dramatically. These moments of meaningful interaction help us to empirically determine a productive theory of values for an individual piece, but how it does so may always vary.

Vinko Globokar's solo *Echanges* (1973) poses a few serious problems for the performer (in this case, any player of a brass instrument). The score is comprised of a collection of successive boxes, each indicating four parameters: mouthpiece, articulation, dynamic, and mute, each of which in turn has four variations.

Vinko Globokar: *Echanges* (1973), excerpt
The indications to the left explain the four parameters and their respective four variations. Each box within the score on the right contains one marking for each parameter.

The four physical parameters are meant to be in constant flux, overlapping within a constant stream of activity and sound. When playing the score verbatim, though, box by box in the order prescribed, it simply doesn't work. The changes from box to box are too synchronous, such that pauses would be inevitable in any literal reading of the text, in direct contradiction to Globokar's indicated priority of unceasing sound, activity, and especially energy. When making so many simultaneous changes (of mute, articulation, mouthpiece, etc.), the sound is inevitably broken, inconsistent, fragmented. In order to overcome this and to maximize the energetic qualities of the piece, Globokar instructs that the performer "should develop a version derived from the prescribed material" of the score (Globokar, 1973, p. ii).[3] Globokar's own performances bear this out; they are typified by a constant stream of evolving, metamorphosing sound as he charts his own course through the notated boxes.

3 "Ausgehend von dem vorgeschriebenen Material soll der Blechbläser eine Version ausarbeiten, in welcher durch den Wechsel der Mundstücke oder der Dämpfer keine Pause entsteht" (Globokar, 1973, p. ii; trans. mine).

Perhaps for this reason, it is almost never played. It is impossible to read through it strictly and denotatively, and yet, at the same time, improvising is also completely out of the question, given the clearly circumscribed gestural and sonic vocabulary of the piece. To prepare *Echanges*, I had to develop a different way to approach the piece, because after attempting a typical reading of the score, or even just a rearrangement of the score—as the performance notes at first seem to suggest—clearly did not suffice. In some ways, that is part of the ingenuity of Globokar's system here, in that it does not allow the performer any option to work traditionally, precluding the escape hatch of habitual practice. They will at some point run into these paradoxes and contradictions and be forced to work their way out of it (or perhaps, into it).

I spent many hours working on the types of actions and gestures in the boxes, working with the instrument and with the mouthpieces and mutes required, reading Globokar's essays on his own works, and listening to his own recordings while carefully marking his own trajectory through the jungle of parameters. Practicing various boxes alone gave me an understanding of the piece's logic and vocabulary, sensing physically and slowly more intuitively the patterns of action that construct the operational system of values for this piece. By being responsive to the demands of the augmented instrument and to Globokar's more general aesthetic identity, I was able to internalize the priorities that emerge from the parameters as they interact, interfere with, and amplify each other. By building a set of tools for engaging with the technical elements of the different mouthpieces and the embodied logic of constantly swapping mouthpieces and mutes (which demands a unique sitting posture since both arms are often away from the instrument), I was able to construct a value system for the piece that was not an intellectual reaction to the score, but an embodied construction assembled alongside and diffracted through the score.

Three examples show this transition: 1) a literal reading of the score (with all changes occurring from box to box simultaneously); 2) a version with transitions between boxes merely obscured and elided; and finally, 3) an expression of the precise language of the piece delivered more intuitively than recitatorily. When Globokar requests that the performer "develop a version derived from the prescribed material," he is in fact implying this higher-level abduction from the notation, in which the vocabulary of the circumscribed language is internalized to the point where replication is replaced by recursivity.

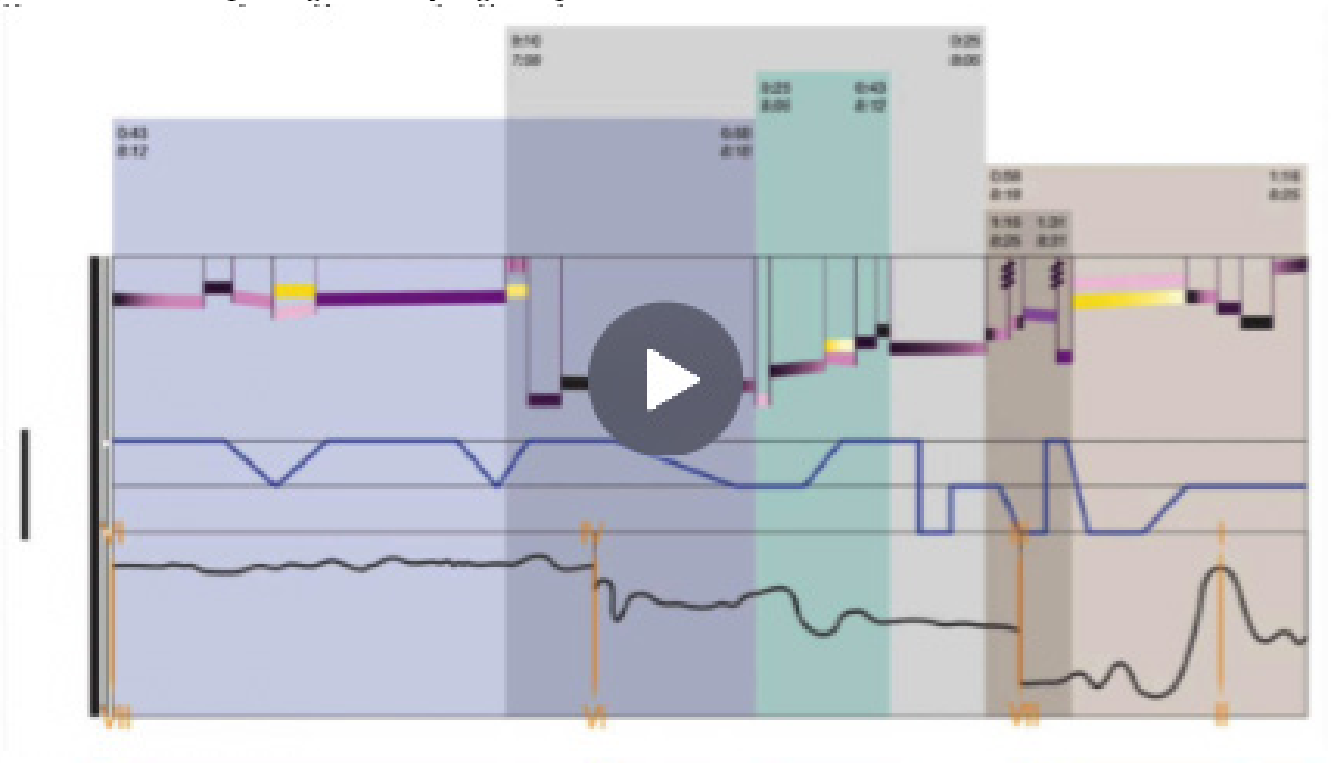
The poietic process entailed disorienting myself from my own personal practices and biases and listening responsively to the score as a living rather than static document. In this case, for this one piece, I arrived at a theoretical approach that allowed me to perform it in a convincingly idiomatic but still very precise language. This poietic methodology deprivileges authorial intent as an *objective* indicator of what constitutes a right or wrong interpretation, but it does nevertheless allow for an interplay between the composer's interventions or statements and the performer's trajectory in learning and performing the piece. In my case, at the same time as I learned *Echanges*, I also learned *Res/As/Ex/Ins-pirer*, another solo piece of Globokar's for brass instrument from the same cycle, *Laboratorium*. Unlike with *Echanges*, I did find myself capable of performing *Res/As/Ex/Ins-pirer* verbatim, performing every box as written and in the order they appeared on the page. Interestingly, Globokar's responses to hearing these pieces revealed his commitment to the preferences of abduction over reiteration stated in the scores. Although I was able to play the material of *Res/As/Ex/Ins-pirer* very precisely, and although it was technically completely accurate, it was lacking something more important for Vinko, something that he expected to emerge intuitively through the energy of the piece. The values with which I had ended up approaching the piece failed, despite all of the preparation I had done, dutifully faithful to the denotative prompts of the score and very precise in seemingly objective ways. In contrast to that, Globokar was completely satisfied and practically elated with my performance of *Echanges*, which emerged from a more complex study of the vocabulary of the score, enunciated by my own performative energy. Globokar's overwhelming affirmation of this abductive learning strategy is, of course, reflected in his performance notes; and yet, like many conservatory trained musicians, I found myself hesitant to embrace it fully. I desired to play the exact notes on the page, and so to elide my own agency in reifying the performative energy of the piece. After working with Globokar, I found myself moving very radically in the opposite direction: I not only embraced fully my poietic contribution to *Echanges* and relearned *Res/As/Ex/Ins-pirer* in the same mode, I also began to actively adapt this learning strategy to other pieces, as well. The experience was, for me, a lesson in exactly how important this sort of responsiveness is in approaching a piece—it is absolutely critical to be able to construct a compatible system of values by which to be precise, because not all forms of precision are the same. There are too many different ways to be accurate. Adaptability, in this respect, becomes an invaluable part of the performer's arsenal.

As a performer and composer both, Globokar exemplifies this approach. *Echanges* is, once again, a useful example, as the composer was also the first performer of the work before going on to play it nearly 300 times in 30 years. Globokar insists that as a composer, he gives himself up completely to his fantasy, writing whatever he imagines irrespective of its technical difficulty or realizability. Only afterwards, once the piece is complete, does he pick up the instrument and begin to look for solutions to the problems of his own notation (conversation with the author, 19 October 2018). This division of labor is very telling. Although *Echanges* was written in the early years of Globokar's role at IRCAM as its first head of instrumental and vocal research, he insists that it was not written as a means of research, and that specific experimentation with the technical effects of the piece (notably, the use of different mouthpieces or, in *Res/As/Ex/Ins-pirer*, ingressive playing) was not a part of his compositional method. In *Echanges*, he notes only an obsession with the idea of parameters, which was in those years very much a part of the *Zeitgeist*, and referred all discussion of the gestational process not to compositional or even individual work, but to his collaborations with colleagues at the time, both improvisational and in notated music. As such, the almost romantic fantasy of composition Globokar describes emerges as a borderland isolated between the two bodies of more situated knowledge: the first built in collaboration with his colleagues while experimenting in the field; and the second built through his retrospective engagement with the score as he searches for performative solutions to his own fanciful score in personal, embodied practice (conversation with the author, 16 June 2019). This predilection for finding both questions and solutions not through intellection

but through embodied practice is one example of a poietic approach, capable of building creative learning strategies responsive to localized, situated performance problems. Globokar embraces the fact that actions construct systems and their values emergently, and therefore eschews the impulse to over-dramatize the intellectual components of the score-reading process in a piece like *Echanges*. Rather, he designs a notational system that closes off the possibility of a normal, classical approach, and implicitly welcomes the performer to construct an interpretive system actively, by embodying the demands of the piece in real time and allowing the poietic construction of a methodology to emerge organically from that engagement. In doing so, the performer constructs a unique conception of accuracy rooted more in the energy and dynamism of the piece's 'changes' than in the denotative replication of particular boxes of material. This approach can only be arrived at through active interaction with the piece and a poietic approach that welcomes the entanglement of score and performer and their collaborative construction of tools to develop unique creative expressions.

II. Joan Arnau Pàmies: *[Vltbn]^4 (o quatre panells per a trombó sol) (2013)*

Joan Arnau Pàmies's work poses many very interesting and completely different problems for a potential interpreter. His first trombone solo, *[Vltbn]^4 (o quatre panells per a trombó sol)* (Pàmies, 2013b), uses a parametric approach that splits up pitch (upper staff, with vocal material in yellow), valve (middle staff) and slide position (both shape of motion and varying regions of the slide given by boundary positions in roman numerals). Furthermore, he notates what he calls "*temporal displacement notation*," (Pàmies, 2013a, p. 179), in which time stamps are given for the performance of fragments from the passage in varying temporal durations.



Joan Arnau Pàmies: *[Vltbn]^4 (o quatre panells per a trombó sol) (2013)*, panel I
The piece begins at zero minutes and ten seconds (ten seconds after beginning the stopwatch), and each box is marked with the time stamps at which that passage will begin and end in the upper left and right hand corners, respectively. As the notation is performed twice through in different instrumental configurations, the lower time stamps in italics refer to the second passage through the four panels.

For a performer intent on breaking into this score, one of the first and most interesting aspects is the pitch notation. No pitches are given, nor is the range even precisely specified, only that the "vertical position of the violet lines indicates (higher/lower) approximate register only in relation to the harmonic series. Specific partials are not indicated" (Pàmies, 2013b, p. 5). This leaves quite a lot up to the performer. To give an idea of how much is left to the performer, here are two versions with markings to show potential pitch organization: on the left, treble and bass clef staffs have been superposed on the score to show where pitches might lie given an even distribution visually; on the right, the partials are indicated, meaning that as the distance between the partials increases in the upper register, the rate of change in pitch decreases.

Excerpt from the author's score showing two versions of interpreting pitch: on the left, a more or less even pitch gradation show by a grand staff from four ledger lines below the bass clef to the top of the treble clef (an average proficient range for a professional trombonist); on the right, a similar range notated with each harmonic partial separate (as comparison to the left, the four Bb's from below the bass clef staff to the middle of the treble clef staff can be seen as partials 1, 2, 4, and 8)

Both readings are equally valid, and can even both be considered conventional as they respectively adhere to different aspects of traditional trombone performance practice. And yet, the first notated pitch line in the green box would be around a D below the bass clef in version 1, but around a G at the top of the bass clef in version 2—more than an octave difference! Perhaps even more troublingly, unlike in some other pieces where the relative pitch information is given by very thin, comparatively precise lines, the pitch here is notated in large bands. Essentially, any line could be interpreted anywhere within a range of a third to even a fifth. How does one do this 'precisely' when such a broad range of possibilities all seem equally valid?

A poietic approach would look at these parameters and question whether the specific pitch is the most important criterion. Perhaps, given the biases of traditional performance practice, these concerns about the specific pitch are a distraction from rather than a support for a responsive (response-able) learning strategy. In preparing this piece myself, I resolved this impasse by seeking more recordings of Pàmies's work and reading his published writings. In doing so, I found that these interpretive problems were not a byproduct but a central component of his work. In his 2013 essay *Noise-interstate(s): towards a subtextual formalization* (2013a), Pàmies outlines a compositional approach that embraces the constructive aspects of noise in information theory.

In information theory, noise was always acknowledged as a natural component of any communications system, but was originally only formulated as an element subtracting from and obscuring semantic content, called equivocation.[4] Only later, through the work of Henri Atlan,[5] did this equivocation come to be seen as a potentially productive phenomenon, a surplus not only of information but also of potential. Atlan, a biophysicist, identified situations in which "it is possible to imagine a viewpoint in which the equivocation is constructive rather than intrusive, for example when it causes a system to re-organize itself at a higher level of complexity" (Hayles, 1988, p. 3-4, quoted in Pàmies, 2013a, 175-6). Following the previous discussions of Arendt and Graeber, this formulation immediately invites associations with the poietic provocation to creativity in

4 cf. Shannon, Claude E. (1948). A Mathematical Theory of Communication. *Bell System Technical Journal*, 27(3,4).

5 cf. Atlan, Henri. (1974). On a Formal Definition of Organization. *Journal of Theoretical Biology*, 45, 295–304.

unpredictable situations and the construction of values through enactive structural processes. This use of equivocation and noise as constructive, integral components of the compositional process is the hallmark of Pàmies's noise-interstate:

> The noise-interstate is a psychological state that exists within the performer's psyche during the interpretive process of my work. Its primary goal is to contribute to the elaboration of multiple potential sonic outcomes whose particularities share certain essential characteristics among themselves and in relation to the original musical score. While the identity of the resulting music stays intact, the noise-interstate diversifies the potential interpretations of the work, thus presenting a greater degree of sonic variation across a number of performances … What I propose is an approach to notation that allows the noise-interstate to intervene. (Pàmies, 2013a, p. 177)

Pàmies is adamant throughout that the interventions of the noise-interstate can be reserved for particular qualitative elements, and do not justify liberties taken by the performer with respect to information recorded more efficiently. In his own words:

> The type of reorganization that takes place during performance is not left completely to the performer's discretion but instead assists in the redistribution of potential sonic relationships in such a way that the piece is dimensionalized but its integrity remains intact. The performer is thus capable of creating degrees of variance, which may suggest unaccountable formal paths that transcend both the peculiarities and the original implications of the compositional process of the piece. (Pàmies, 2013a, p. 177)

This approach, though it seems to reflect a certain conservatism with respect to the division of labor between composer and performer, resonates strongly with the task-oriented nature of Arendt's poietic act. Rather than reinventing whole swathes of behavior, the craftsman designing interpretive tools within Pàmies's noise-interstate must be responsive to the qualities and quantities of equivocation present, and must then tailor the resultant learning strategies to the types of potential afforded by the physical and mental demands of the piece.

In learning *[Vltbn]^4 (o quatre panells per a trombó sol)*, I took the ambiguities in the pitch material as opportunities. As with Globokar's piece, I allowed physical experimentation with the piece to guide me, rather than beginning from a point of externalized intellection. Pàmies writes in the performance notes to the piece, "**The use of a stopwatch is required during rehearsal as well as in performance**" (Pàmies, 2013b, p. 2, emphasis in original). Although this may seem to be an excessive micro-managing of the learning process, it is really an attempt to gently guide the performer towards this type of emergent learning strategy, wherein the logic of the piece is felt in the real-time embodied demands of the shifting tempi and the resultant transformations in the physical logic of the gestures. Actually practicing that way, with a stopwatch on from the very beginning, forces the performer to immediately reckon with the composed equivocation.[6] The performer then builds the tools for effecting this creative process, solving the riddles of deliberate equivocation, allowing the actions themselves to develop the structures that will govern their interpretation.

Practically, this means that the piece takes on a much noisier character. In a piece of more traditional music, in which the precision of pitch is typically very high in the hierarchy of interpretational importance, I always prioritize the cleanliness of that parameter. In *[Vltbn]^4 (o quatre panells per a*

6 Pàmies also writes: "Therefore, it is strictly discouraged that the performer facilitates this notation into a more conventional practice (i.e., standard notation), for that would miss the potential multiplicity of sonic outcomes when performing from the original score" (2013a, p. 2).

trombó sol), though, that parameter takes on a much different character. When allowing the execution of the pitch bands to occur simultaneously and with equal attention to the slide and valve motions (all within the fluctuating flow of the temporal displacement notation), the lips inevitably find spaces between partials, voicing noiser multiphonic textures in place of cleanly articulated pitches. This is accentuated by the motion that is present in almost every pitch band: each band, particularly those of long duration, contains some small motion and is almost never static, but that motion is typically carried over the entire duration. These long, slow motions in the lips, attempting to incorporate very small pitch gradations over a period of time, interfere with the slide positions. Even when a pitch is articulated cleanly and the lips find a stable partial upon which to land, the sudden changes in slide position or the slow motion of the lips up or down inevitably move away from that cleanliness and find other, more liminal, noisy textures. This effect is only accentuated by the extreme dynamic demands and the layered vocal material that further distorts the sonic texture. The time spent practicing within these peripheries of technique, for example on the borders of harmonic partials or dynamic stability, make possible the further abductive leap that Pàmies desires, namely, that this will engender not only a noisier texture, but also inculcate a willingness to mine these liminalities for "the elaboration of multiple potential sonic outcomes" (Pàmies, 2013a, p. 177).

As a performer, one must take a great leap of faith to embrace an approach like this. Everything in my conservatory training prepared me to prioritize certain parameters, especially pitch, and the impulse to do so can override specific notational directions to the contrary in even the most intrepid experimental performer. In the case of *[Vltbn]^4 (o quatre panells per a trombó sol)*, Pàmies has designed the score and requested specific practice strategies that guide the performer into allowing certain physical interactions with the notation to explore sonic textures outside the realm of traditional performance practice. Trusting this process is perhaps the most difficult part for a performer, for it means overriding many deeply ingrained impulses. In doing so, though, a whole new method of interacting with the instrument is opened up, developing new skills tailored to the unique demands of the piece and demonstrating a virtuosity that emerges from the task-specific questions posed by the notation. One of the hardest biases to overcome is the idea that, by performing these noisy textures, one will sound 'out of control,' like a trombonist deliberately failing. In my personal experience performing this piece, though, that has been anything but the case. Once the trust in this learning strategy bears fruit, the resultant sound, for all of its noisy texture and less-than-classical pitch accuracy, retains a great degree of control and intentionality, which audiences seem to intuitively grasp.

Learning to be responsive to—and to collaborate in developing—a system of values that prioritizes deliberate equivocation and noise-interstates over clearly articulated classical control is a skill in itself. The chapters that follow will continue to explore how this skill can be nurtured, so that a virtuosity of execution can be accompanied by an equal virtuosity of learning, but these first two examples help to outline the strategies by which a performer can begin to build responsivity to the task-specific demands of individual notations. Poiesis describes the methodology by which this can be achieved. It is a form of handicraft, in which the craftsman's responsiveness to the material she is working with may and must vary from piece to piece. It is the craftsman's responsiveness to the milieu in which she works: the plurality of society and the dynamic, constantly reenacted set of values at play in any situation. Poiesis demands a commitment to creating tools to facilitate the physical and mental creativity required in order to meet each piece on its own terms, as a unique individual and agent in the search for meaningful interaction.

1.3 Physically Polyphonic Notations

I will be using the term physically polyphonic notation to indicate several varied but related trends within music composition that arose in the second half of the twentieth century and expanded radically at the beginning of the twenty-first. In its simplest form, physically polyphonic notations can be described as notations that isolate distinct physical actions and gestures and notate them separately and asynchronously from one another. This can occur in many ways, but the most prevalent notational format for recording these sorts of decoupled actions is a tablature.[7] The idea of using a tablature to decouple and dissociate strands of activity considered unified and holistic in traditional performance practice can be traced back to compositional developments from the twentieth century, especially but not only total or integral serialism. Earlier experiments with the parameterization of individual musical elements certainly existed, perhaps most famously in the Second Viennese School's serialization of pitch class. Other experiments existed as well, from isomorphic parameterizations of tempo in the *Ars Nova* even up to Stravinsky's method of stratifying temporal relationships (though this was first discussed analytically in the 1950's, cf. Cone, 1962). With respect to the parameterization—whether serial or not—of multiple musical elements simultaneously, and specifically the polyphonization of explicit physicality rather than of musical semantic items, the story begins more recently.

In *Mode de valeurs et d'intensité* (1949), Olivier Messiaen composed a short study parameterizing not only pitch (which had already been extensively parameterized, most famously by the serialization of Arnold Schoenberg and the Second Viennese School) but also durations, attacks, and dynamics. Although he himself would already leave this idea behind in the ensuing years, his role leading the early Darmstädter Ferienkurse für Neue Musik exposed a younger generation to these ideas, and they in turn became a central component of the aesthetic that emerged from that milieu in the following decades, notably in the work of composers such as Pierre Boulez, Karlheinz Stockhausen, and Luigi Nono. Boulez's own massive work from 1951, *Structures Ia*, exemplified this approach, far surpassing previous parameterizations (such as Messiaen's in *Mode de valeurs et d'intensité*) and encompassing a much more ambitious treatment of the four parameters of pitch, duration, articulation, and dynamics.

These early investigations were particularly augmented by the advent of electronic music. In the early studio for electroacoustic composition in Cologne, Karlheinz Stockhausen was particularly outspoken about the potential offered by delimiting different musical parameters and composing them separately. He described his understanding of these parameters in his highly influential essay "…HOW TIME PASSES…" (1959), detailing the ultimate consubstantiality of rhythm and pitch: a rhythm sped up transitions into a low pitch, and then, sped up further, into any other higher pitch within the realm of audibility; furthermore, changes in internal rhythm contribute to timbral variety. Stockhausen later summed up this development very tellingly, noting that "once such a continuum becomes available, you can control it, you can compose it, you can organize it" (Stockhausen, 1971, p. 93).

In the same period, indeterminacy proposed another means of decoupling parameters of musical expression, such as in John Cage's *Variations*. In *Variations I*, a map of dots with a transparency containing five lines overlaid force the performer to interpret five different parameters (relative pitch, duration, amplitude, order, and noisiness) by measuring or interpreting the distances from points to lines (which vary depending on the pages of the score that are used, hence the title).

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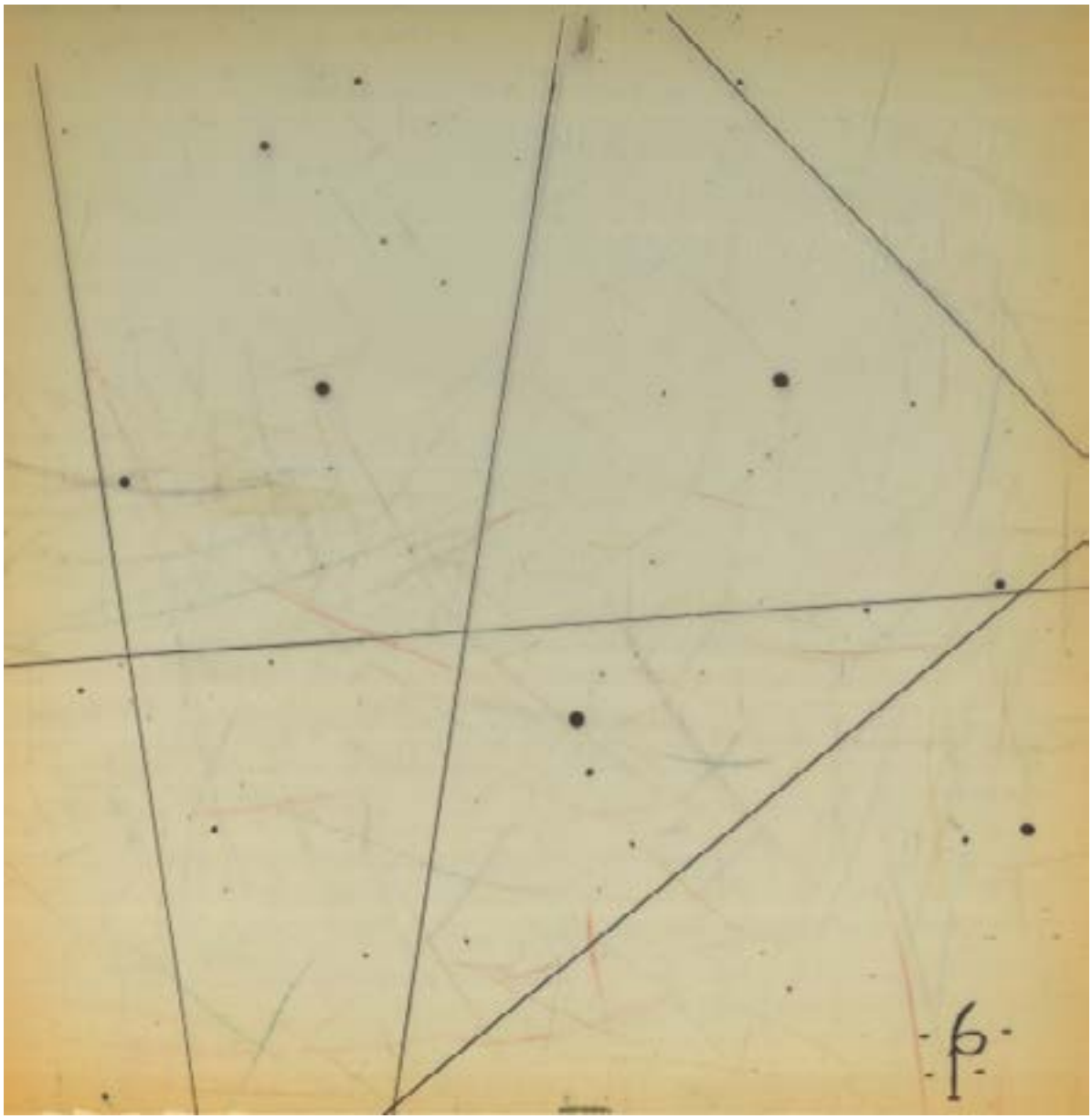
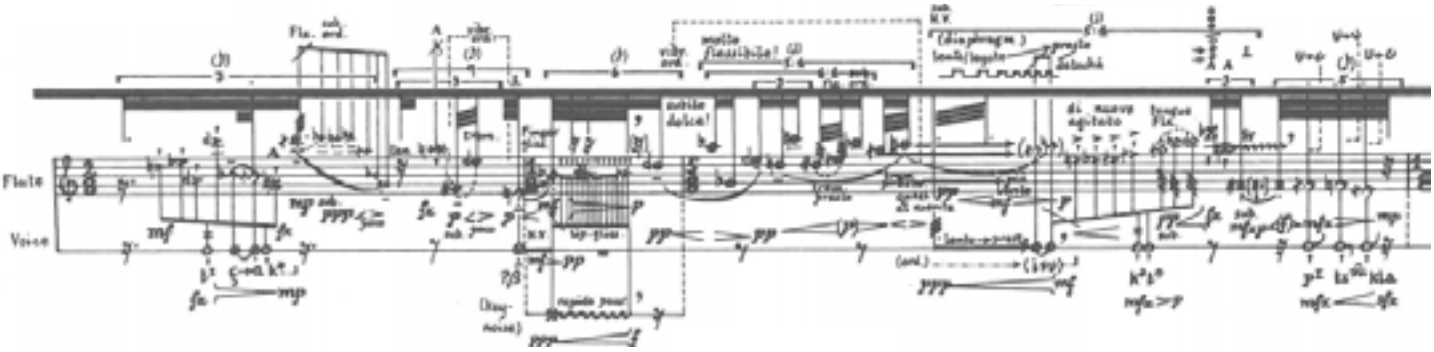
7 Tablature notations specifically will be explored more fully in 3.2 Tablature, Shared Performance and Klaus K. Hübler's *Cercar*.

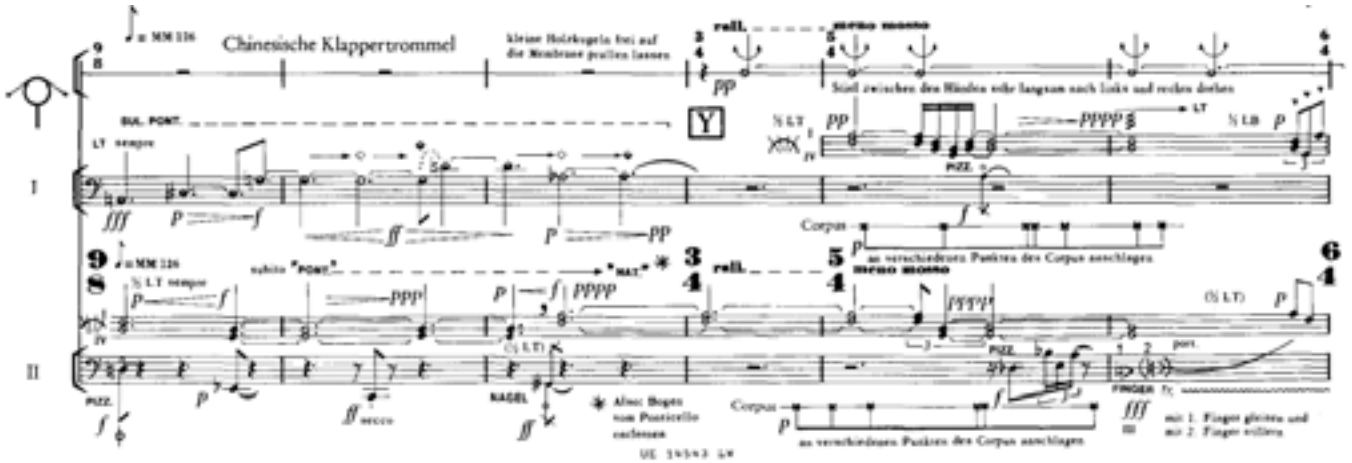


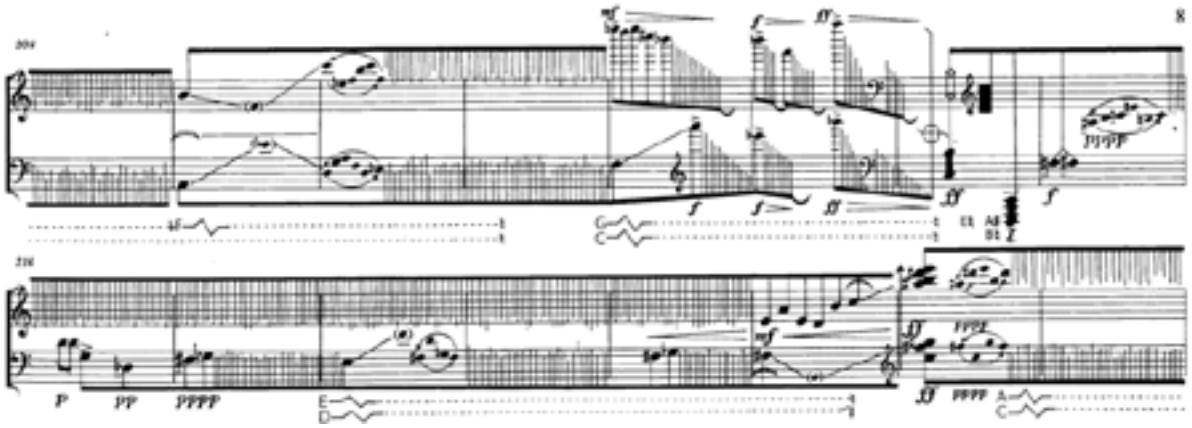
John Cage: *Variations I* (1958), transparencies 1 and 6, overlaid
The performance instructions indicate that each dot is to be interpreted with respect to its distance from each of the five lines, which respectively indicate "lowest frequency, simplest overtone structure, greatest amplitude, least duration, and earliest occurence" (Cage, 1958, p. 1)

Whether as a result of intellection such as Stockhausen's or Cagean straitjackets of indeterminate prescription, the temptation to control seems to permeate much of the early experimentation in parameterized physical actions. In fact, the dissociation of elements along these continuums was itself a deconstruction of technique. As these trends evolved beyond their serialized instantiations, they became characterized by exertions of control that threatened to perforate the physical possibilities of a single performer's body, as in the works of Brian Ferneyhough, where multi-stave notation is used to facilitate the prescription of detailed directions for not only played notes, but also mouth-shape and vocal activity.



Brian Ferneyhough: *Unity Capsule* for solo flute (1975), p. 2
In addition to the many indications vying for the performer's attention in the primary staff, there are additional layers of vocal and key noises beneath; note the stems that run from the beams down through all three staves, indicating a synchronous if complicated superposition of actions

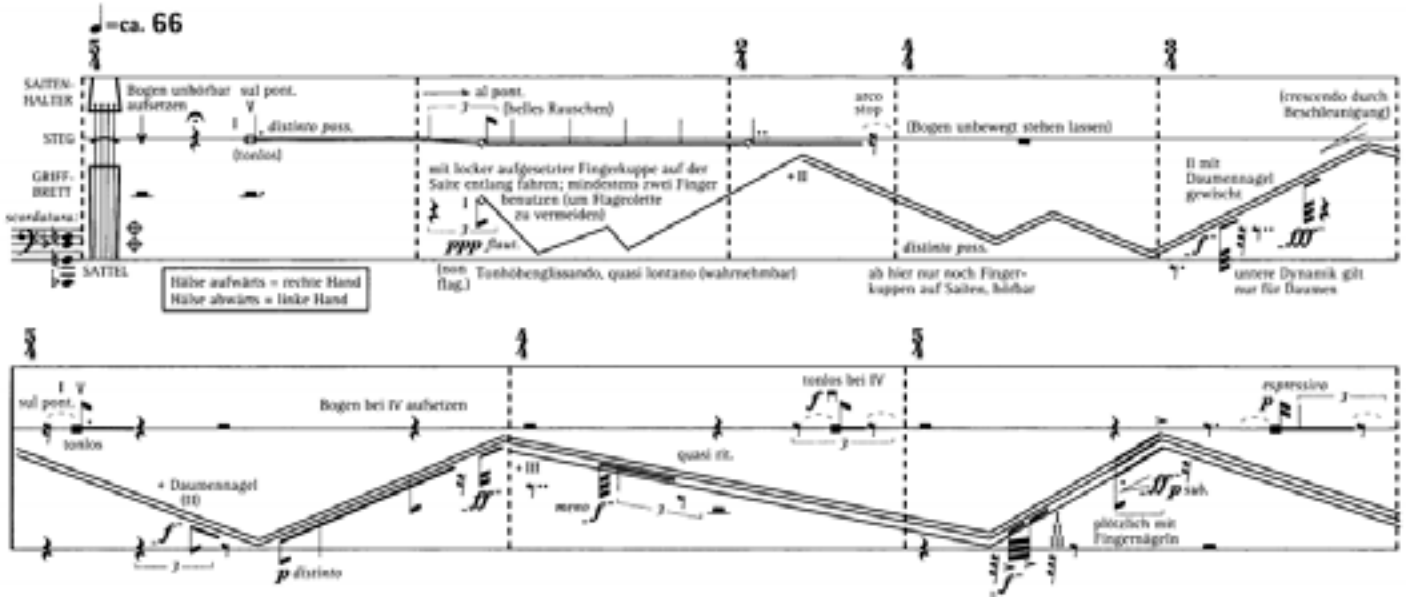
Although connected to elements of increasing control, early experiments with tablature notations in Western experimental classical music are characterized more by a parameterization of physicality than of musical elements. The earliest examples date to Mauricio Kagel's reconstruction of the cello as a theatrical competitor in *Match* (1966) and some of Luciano Berio's experiments with instrumental technique in early *Sequenzas* for harp (1962) and trombone (1966).

Mauricio Kagel: *Match* for two cellists and percussion (1966), p. 18
Most notable are the indications for the cellists (I and II) to strike the body (corpus) of the instrument, notated asynchronously but graphically



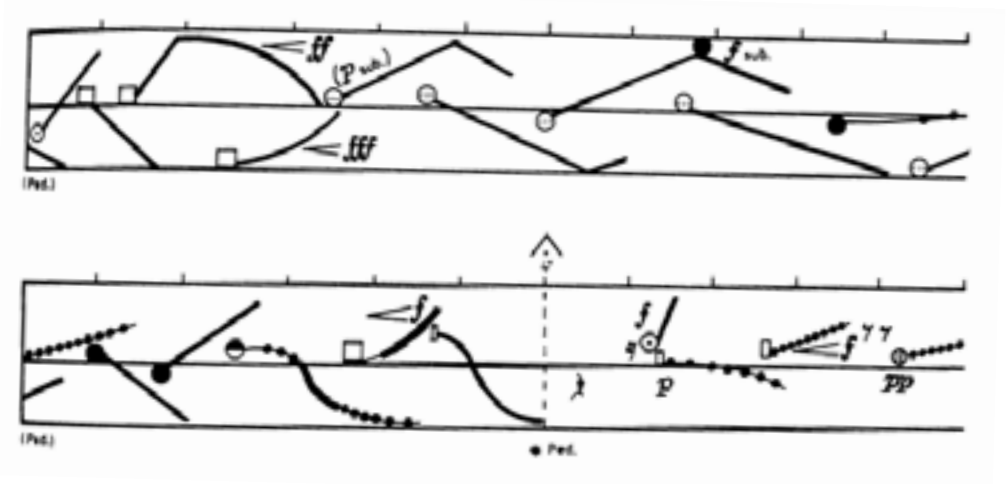
Luciano Berio: *Sequenza II* for harp (1962), p. 8
The pedal notation indicates foot motion that is continuous and dissociated from both the notated parts in the hands and, occasionally, from one another; these motions begin synchronously with other musical actions but continue independently

These examples evolve from a disassembly of the instrument, and yet notably, maintain a high degree of synchronicity between the multiple strands of activity. As with the multi-staff notation above, these tablature notations seem to embrace parameterization for primarily organizational purposes, facilitating the accurate transmission of superposed but synchronous actions. In the case of Kagel, for example, this tablaturization follows similar, highly physicalized notations in other works (e.g. *Music for Renaissance Instruments* of the same year, 1966) and seems to extrapolate from those notations of gesture a further choreography of indeterminately asynchronous actions (as in the example from *Match*, above). Moments of asynchrony, as in the imprecise pedal notations in Berio or the gradations of change implied by oral actions in Ferneyhough, are ancillary rather than primary material.

At this point, these two strands of parameterization (of musical elements and of tablaturized physicality) were connected mainly by their exertions of increasing control over the agency of the performer. It is when these notations began to break into asynchrony that they emerged as true compositional trends. Although the tablatures of Berio maintain rather strict homophonic rhythmic relationships, shortly after this period, the tablature notations in Helmut Lachenmann's works of the late 1960's would initiate a disassembly of idiomatic actions into occasionally asynchronous and decoupled layers of activity.



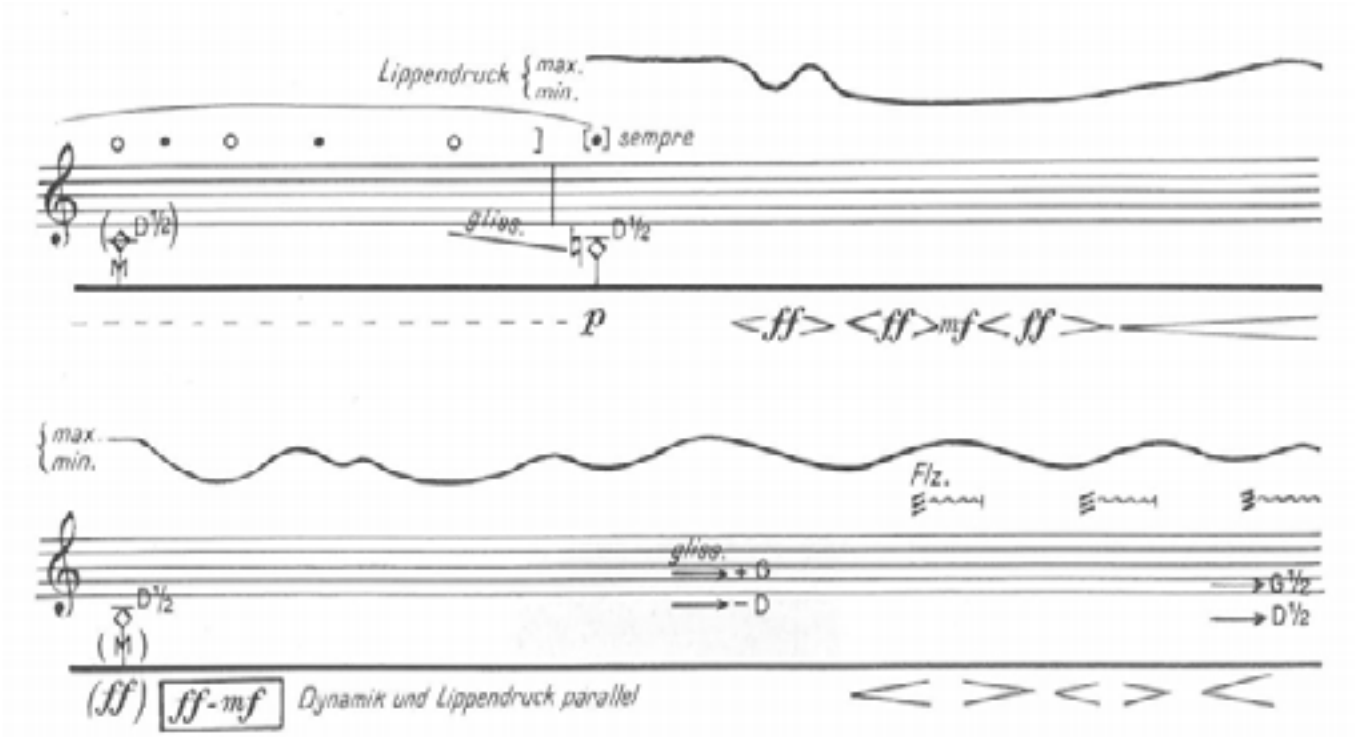
Helmut Lachenmann: *Pression* for solo cello (1969), p. 1



Helmut Lachenmann: *Guero* for solo piano (1970), p. 4
Both of these scores show multiple actions overlaid, e.g. the isolated actions in *Pression* that are notated above and below the more continuous lines indicating bow motion, and the polyphonic hand motions that are superposed on one another in *Guero*

Lachenmann termed his compositional style *instrumental musique concrete*, a direct homage to the electroacoustic *musique concrète* of Pierre Schaeffer, in whose studio Stockhausen studied and experimented with the electronic manipulation of parameters that would prompt his later pronouncements on the potential of parameterization (Tutschku, 1999, p. 30). Lachenmann's use of the term also indicated a commitment to exploring the idiomatic capacities of the performer-instrument interface that then reveals the fault lines between physical body parts that he exploited in these heavily graphic notations.

Similar patterns would emerge in other notations, such as Heinz Holliger's notation in *Studie über Mehrklänge* (1976), which, though reminiscent of Berio's notations, breaks into asynchronous, polyphonic layers of activity reminiscent of Lachenmann's *instrumental musique concrete*.



Heinz Holliger: *Studie über Mehrklänge* for solo oboe (1976): p. 1
Note the tablature notation of lip pressure that enters above the primary staff, decoupled here from dynamic action and flutter tongue articulation

One overwhelming trend should by now be clear: despite the complex web of associations and mutual influences that are clearly present, no two notations are the same, even from the same composer. Somehow, the exploration of physical polyphony as an organizational principle for notation has proven resistant to systemization, even within single composers' works. Although certainly minor, superficial similarities can be noted and accounted for, the clear diversity of directions that these notations mine seems to be an inherent trait of this notation, one which continues to be evident in works up to the present day. It is this fact, in stark contrast to previous parameterizations such as integral serialism, that sets apart physically polyphonic notations as a subset of repertoire demanding attention: more than perhaps any other trend in notation, it is the variability of notations rather than their similarities that proves to be the defining feature of the set.

This remains true even as these trends diversified. The repertoire most heavily associated with physical parameterization comes from the 1980's and a second heyday of the Darmstädter Ferienkurse, the latter often linked to the influence of Brian Ferneyhough (Hockley, 2018, p. 2). In this decade, a number of young composers began experimenting with increasing and increasingly

diverse systematizations of complexity, a trend coined by Richard Toop in his famous essay on "Four Facets of the New Complexity" (1988). Although not one of the young composers addressed in Toop's essay, Klaus K. Hübler's radical experiments with physical polyphony would come to be hugely influential on the ensuing development of trends associated with New Complexity.[8] In fact, it is largely due to this influence that physical polyphony is seen today as overwhelmingly associated with this period and style of composition, despite its much longer lineage, as detailed above. Since Hübler, an increasing number of composers have begun to make use of similar notations, from Richard Barrett and Claus Steffen-Mahnkopf, to Aaron Cassidy and Wieland Hoban, to a younger generation including Joan Arnau Pàmies, Sehyung Kim, Andrew Greenwald, et al. The proliferation of composers experimenting in this tradition has only increased its diversity.

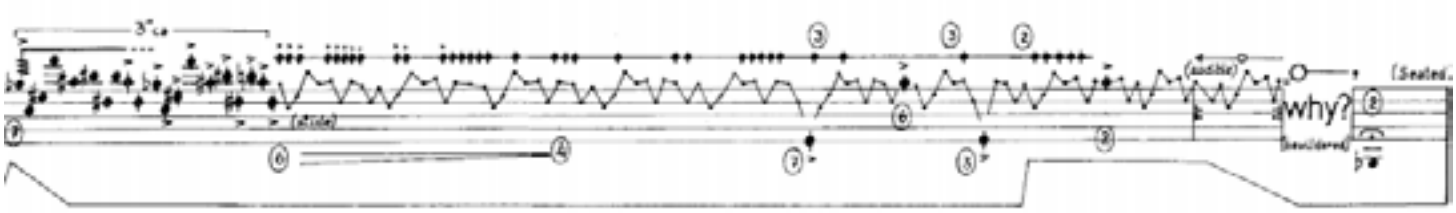
As has been noted, originally, there were two more or less distinct trends—serialized or serial-influenced parameterization and tablaturization—that merged increasingly despite the proliferation of diversity within notations demonstrating aspects of physical polyphony. Given the variety afforded by such notations, I propose two distinct criteria in the course of this research by which repertoire can be identified and organized. The first, noted already, is the identification of *variability* as a defining feature. The second is *asynchrony*. As has been seen, certain obvious early experiments with these notations are not strictly polyphonic in their treatment of physicality, and even later, there remain tablature notations that are both asynchronous (decoupled) and synchronous (coupled). What these two elements (variability and asynchrony) demarcate is not an aesthetic boundary but a barrier to entry in the learning process.

This dissertation is concerned with performance practice and the learning process of physically polyphonic works. As such, it focuses on the experience of the performer, not on an analysis of compositional methods. This repertoire presents itself as a uniquely unified group despite its aesthetic and technical variety because of its unique demands in the learning process. Ever since I first began playing this repertoire, I have been continually struck by the wall that these notations present to even many very adventurous new music specialists. I invariably receive admiring respect for my ambition and fortitude in tackling these pieces from players who, as I well know, perform other pieces that are in fact more virtuosic and challenging from a purely technical, instrumental standpoint. I always wondered, what is it that is so intimidating to them? And why does my willingness to embark on these pieces instill in them such respect, or even envy? After many years of reflection, and after noting carefully which pieces seem to provoke these responses, it has become quite clear to me that the technical difficulty of a piece has little or nothing to do with the barrier of entry that it presents to the performer. Rather, the disorientation from traditional technique required to reimagine instrumental practice when approaching these experimental notations seems to be the primary—if not only—defining feature demarcating the limits of the repertoire that resides behind this barrier of entry. These disorientations are necessitated not only by the truly polyphonic treatment of physicality, but also by the fact that each new piece presents a different version of that polyphony, demanding thereby different dis- and re-assemblies of instrumental practice. It is for this reason that, in organizing the purview of this research, I deliberately omitted some pieces that display obvious tablaturized and physicalized notations, while including others that might seem out of place in respect only to the consistency of aesthetic or compositional trends. This will become clear in a short review of the specific trombone literature.

The first piece to use overt tablature notation for the trombone is the aforementioned *Sequenza V* (1966) of Berio. In the piece, Berio notates the plunger mute on a separate staff, where it moves from open to close synchronously with the played actions on the normal staff, occasionally rattling

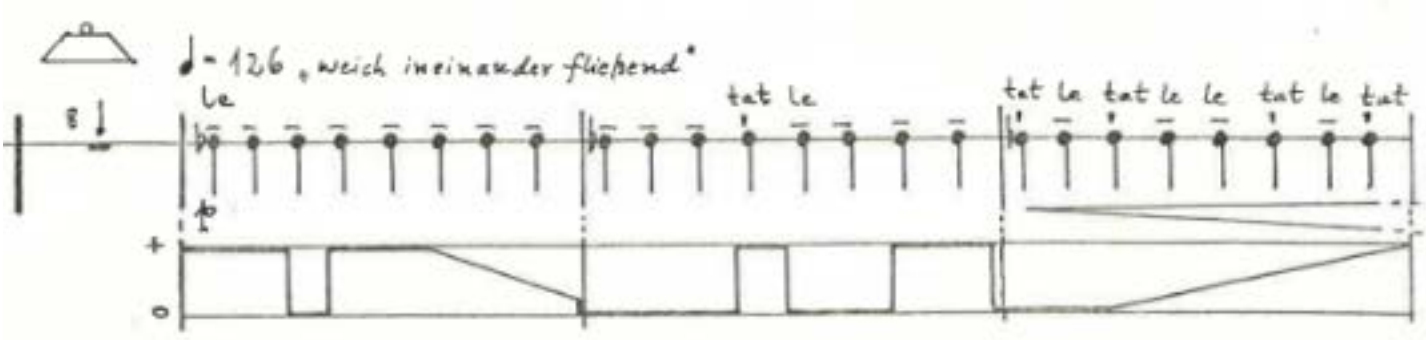
8 For a more in-depth discussion of Hübler's music and the development of his notation in this period, please see section 3.2 Tablature, Shared Performance, and Klaus K. Hübler's *Cercar*.

in the bell during sustained notes (both played and sung). Although the mute action remains strictly homophonic, there is also one interesting outburst of physical polyphony at the end of the introduction (part A), where the slide and articulation become decoupled graphically, to which notation many different players have found varying solutions. This vagueness of intention perhaps limited the influence of the passage as an example of physical polyphony. The mute writing, though, influenced many composers, such as Nikolaus A. Huber, whose *Presente* makes use of the same homophonic decoupling.



Luciano Berio: *Sequenza V* for solo trombone (1966): p. 1, part A
As the notated pitches disappear, the remaining graphic notation indicates a decoupling of slide and articulation.

Luciano Berio: *Sequenza V* for solo trombone (1966): p. 1, part B
Note the line below the staff, which notates left hand mute action (plunger mute) separately from but synchronously with actions in the primary staff

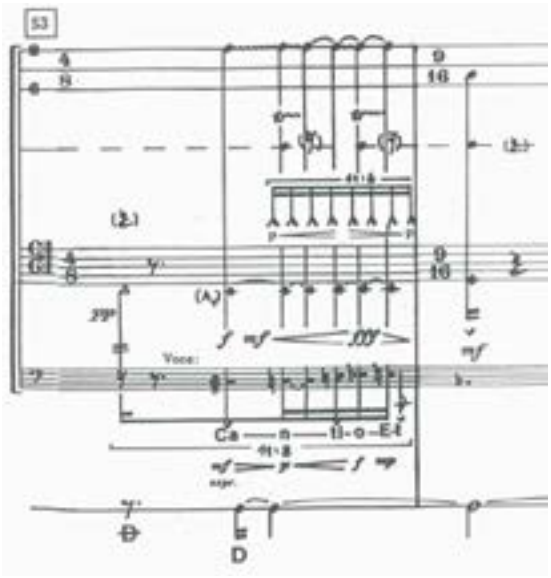


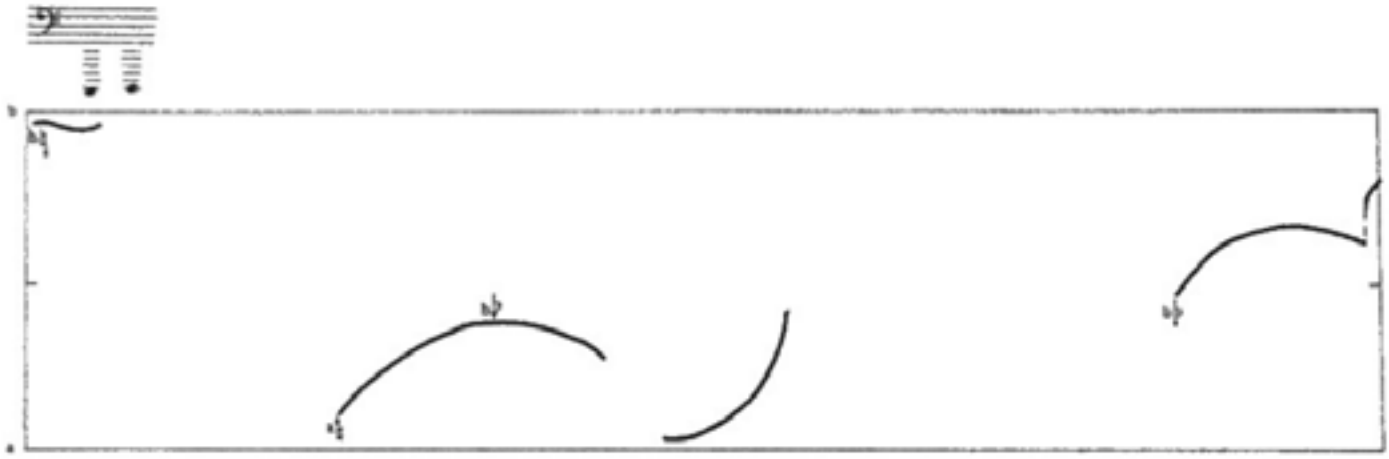
Nikolaus A. Huber: *Presente* (1979): p. 4, system 1

Berio's notation is a huge departure from previous trombone pieces, but its intense demands are rather more physical than notational. *Echanges*, Globokar's solo from 1973, is the opposite; although the techniques required to perform the notated gestures on the variety of mouthpieces and mutes are not terribly demanding, the disorientation of traditional performance practice is. Globokar wrote the piece while preoccupied with issues of musical parameters,[9] and the piece demands a constant, dynamic interchange of four different parameters simultaneously and, effectively, asynchronously (as detailed above, cf. section 1.2).

Globokar's notation, although not tablaturized in any specific way, makes use of superposed parametric changes to demand a physically polyphonic learning and performance strategy of

9 Interestingly, as with many of Globokar's works, in spite of the prevalence of noisy and unpredictable techniques and timbres, he retains a strict serial organization to pitch content, in this case deriving all normally pitched material from one of his favorite all-interval tone rows.

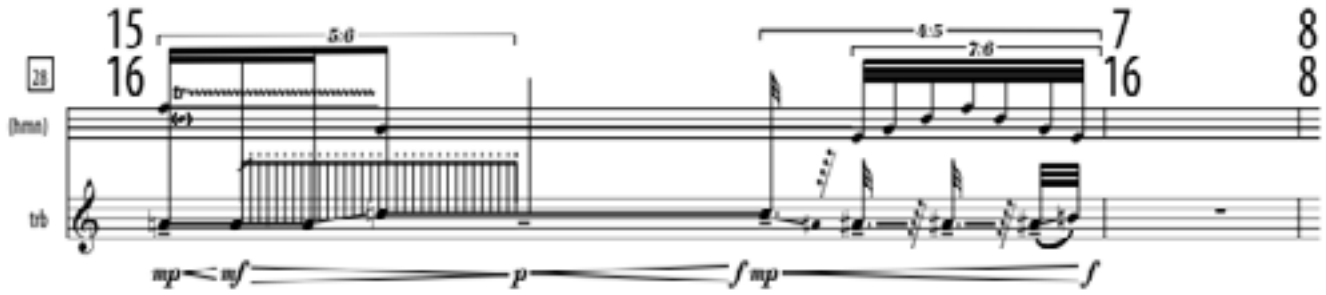
the performer, unlike the complicated but ultimately still rather traditional demands of the Berio *Sequenza*. The drastically, incomparably richer performance history of *Sequenza V*, while perhaps due not only to this reason, underscores dramatically the barrier of entry that physically polyphonic works pose in contrast to tablaturized works that maintain a strong connection to traditional performance practice and coupled notations. A similar split occurs with the two famous tablaturized notations for trombone solo from the early 1980's, Klaus K. Hübler's *Cercar* (1983) and John Cage's *Ryoanji* (1985).

Klaus K. Hübler: *Cercar* for solo trombone (1983): p. 7
The staves, from top to bottom, indicate slide position, valve action, diaphragm vibrato, harmonic partial, vocal action, and mute (either with mute (D) or without)



John Cage: *Ryoanji* for solo trombone with obligato percussion (1985): p. 6
The lines in the box indicate played notes (all *glissandi*) within the specified range

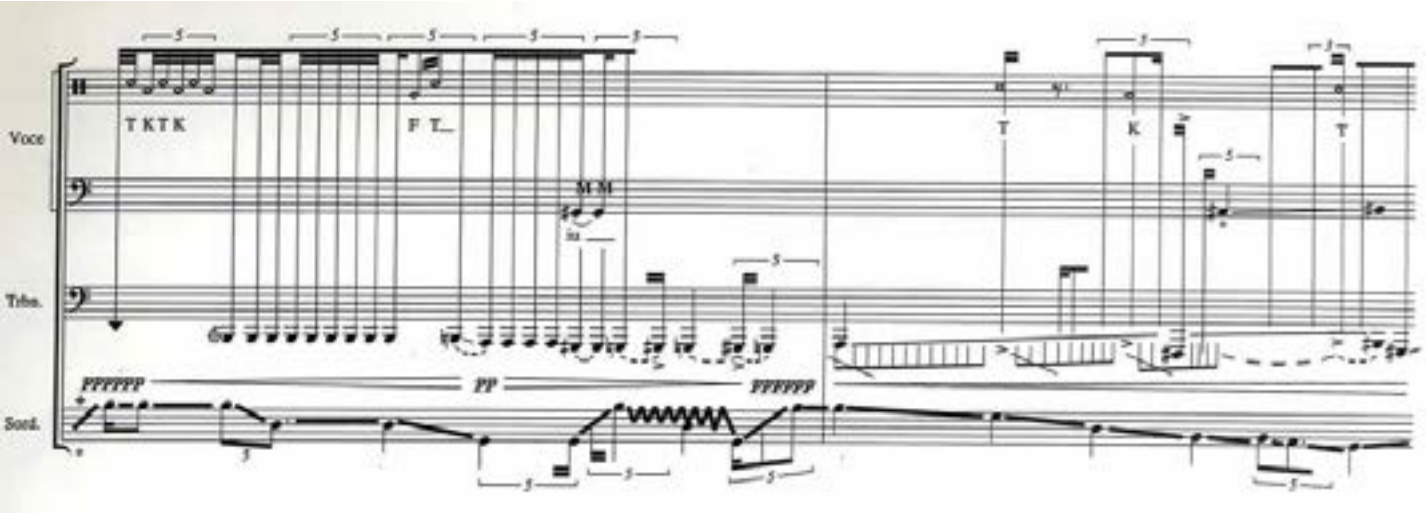
Cage's notation is a fairly rudimentary tablature expressing one-dimensional slide motion across time (with pitch references written in), and as with the Berio, its difficulties are primarily technical (in this case, the extreme low register). Hübler's solo, though, contains an extremely thorough decoupled tablature notation, containing a complex tapestry of polyphonic physical activity, as will be discussed at length in section 3.2. Cage's piece, though not as popular as Berio's *Sequenza*, also enjoys a much richer performance history than Hübler's piece, which stands in the repertoire as a monolith of complexity and notational difficulty.

Following Hübler's tablature, which parameterizes virtually every possible element of trombone technique, a number of other composers began to slowly incorporate physical polyphony into their writing for the trombone, mirroring his influence and the general trends in the broader repertoire. Richard Barrett explores decoupled trombone notations in several works, including both of his earlier works for trombone, *EARTH* (1987-88) and *basalt* (1990-91),[10] as well as more recently in *membrane* (2017-19).



Richard Barrett: *membrane, IV. song* (2017-19): mm. 28-29
In this movement, the upper staff indicates gradations of opening and closing the harmon (i.e., wawa) mute

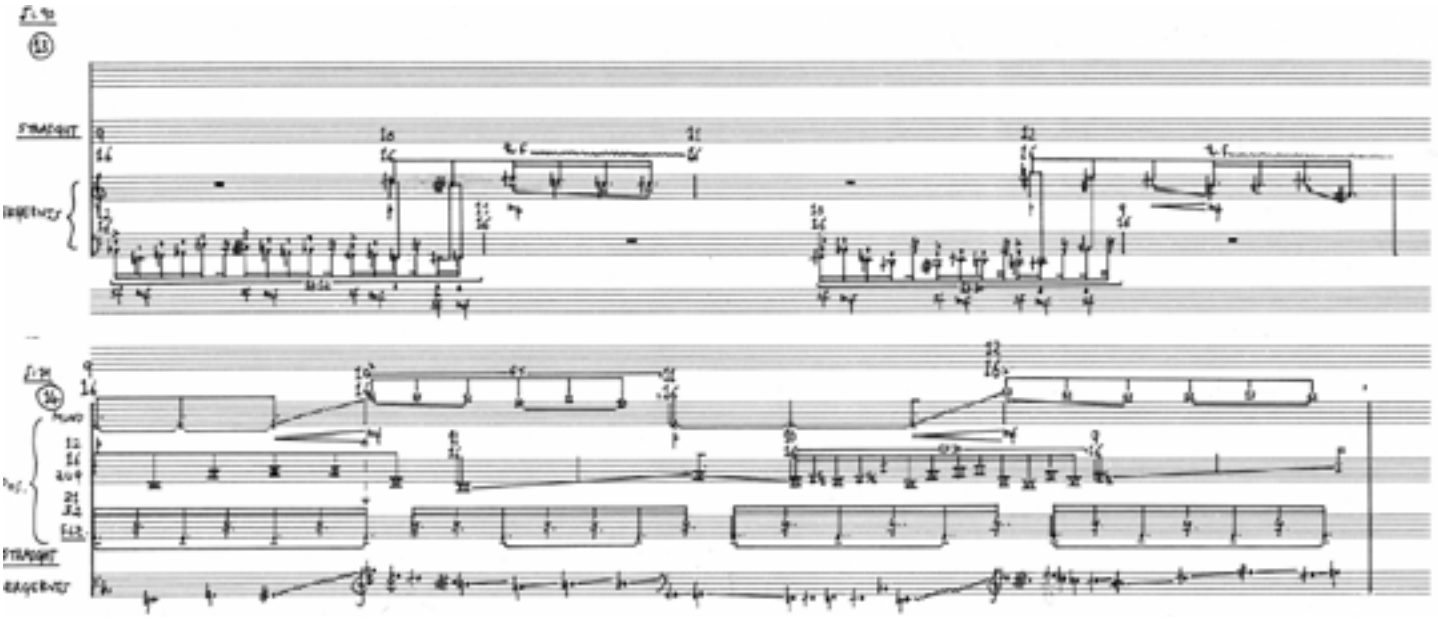
Luca Francesconi also experimented with physically polyphonic notations for trombone in both *Respiro* (1987) and *Animus* (1995), the latter a reworked version of the former with live electronics. Francesconi maintains a fairly traditional notation with voice and mute notated on separate staves, but occasionally these multiple voices do diverge into polyphony.



Luca Francesconi: *Animus* (1995): p. 3
The three staves indicate voice (both percussive, above, and pitched, below), normal played notes, and mute actions

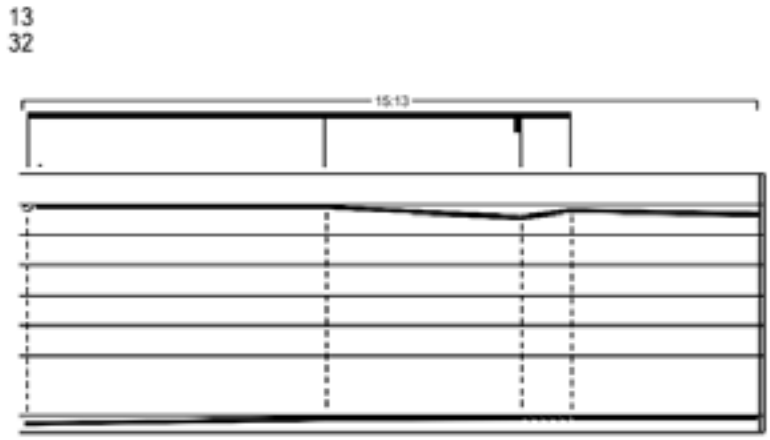
Wieland Hoban, who has written extensively on both physically polyphonic notations and the music of Klaus K. Hübler, has also developed his own language of parameterization, such as in his trombone solo *Zerscherbter Wahn* (2002), in which the notation morphs from periods of traditional polyphony (realized within the single trombonist) and physical polyphony as it has been defined here.

10 For a more thorough discussion of the latter, see 3.3 Radical Embodied Cognition, Guides to Discovery, and Richard Barrett's *basalt*.



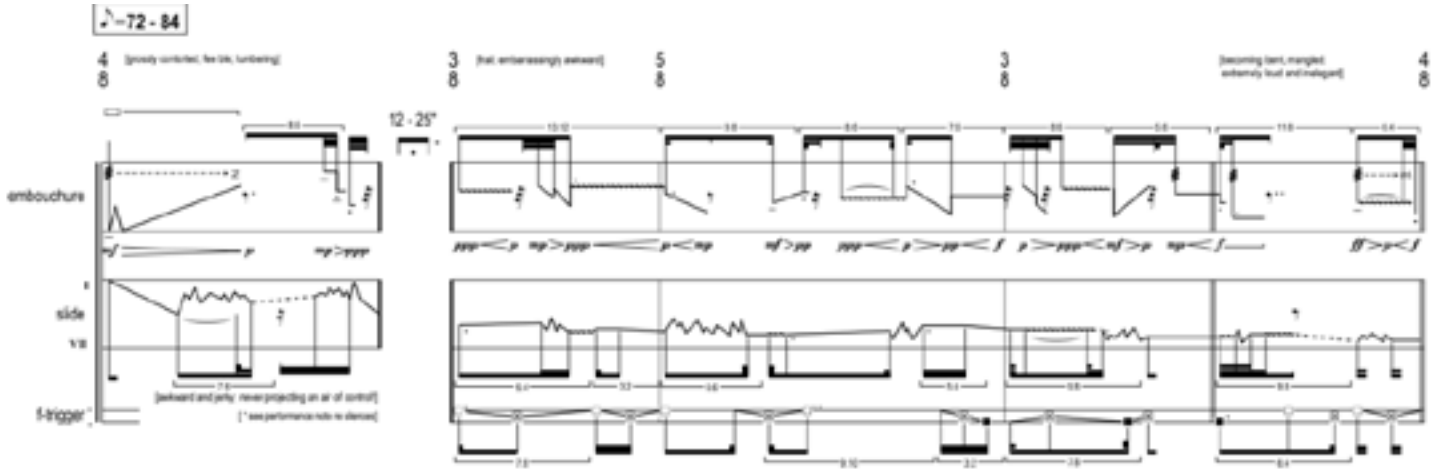
Wieland Hoban: *Zerscherbter Wahn* (2002): systems 13 and 14
System 13 shows two polyphonic lines, performed simultaneously by the trombonist, "akin to a split personality" (Hoban, 2002, p. 2)
System 14 shows a physically polyphonic passage in which the embouchure (harmonic partial) and slide position are notated above (Mund and Zug) and the resultant pitches below (Ergebnis). The resultant pitches serve primarily as an aid to the performer, as there are clearly more microtonal variations from the polyphonic superposition of embouchure and slide position than can be notated clearly below.

This trend seems to explode (comparatively) in the 21st century, with several composers who acknowledge the influence of Hübler writing multiple works for trombone solo. Aaron Cassidy, well known for his works of physical polyphony and complex tablature notations, first wrote for trombone solo in 2006 with *songs only as sad as their listener*. This work, although it features a tablature notation and all of the trappings of physical polyphony, does not in fact contain any moments of asynchrony or decoupled activity. Despite the complicated rhythms underpinning the slow, gradual changes in slide and valve motion, they remain coupled throughout.



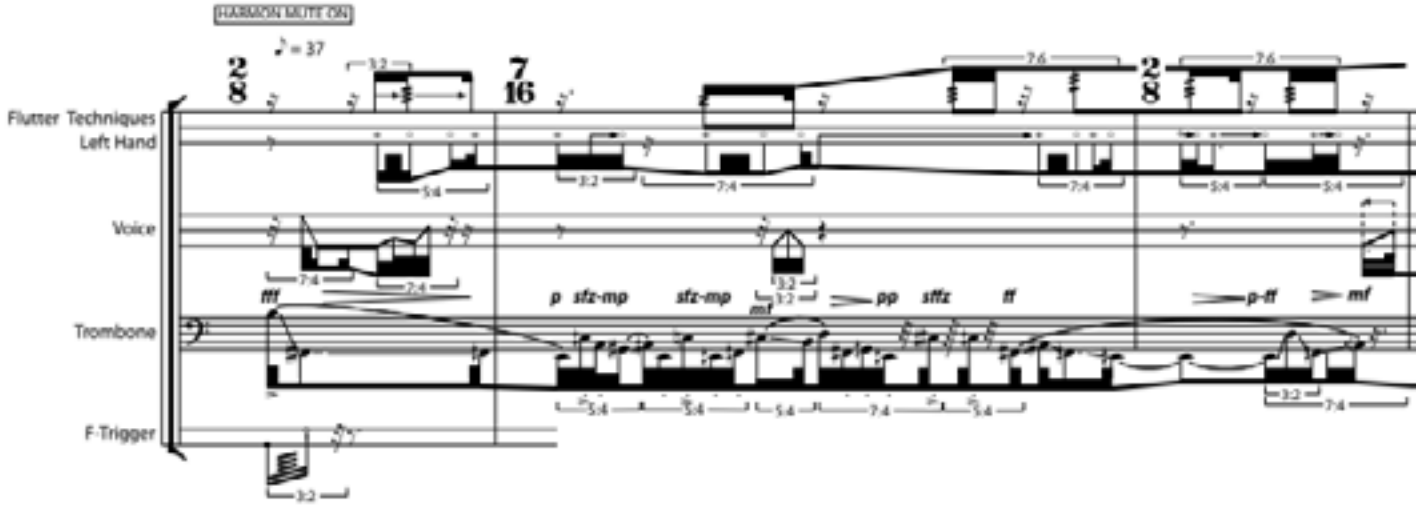
Aaron Cassidy: *songs only as sad as their listener* for solo trombone (2006): m. 8
The upper line denotes rhythm and the two lines (connected by dotted lines aligned to the rhythmic beams) indicate slide motion (on a single partial) and valve action

His second trombone solo, *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)* (2008),[11] features a much more radical physically polyphonic notation, exploring the limits of interference in three parameters: slide, embouchure, and valve.



Aaron Cassidy: *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)* for solo trombone (2008): opening
The three staves indicated embouchure (harmonic range), slide position, and valve action

Timothy McCormack[12] and Joan Arnau Pàmies[13] have also written two trombone solos.[14] McCormack's two works, *Here is a sequence of sounds, each having a sound and a meaning* (2009) and *HEAVY MATTER* (2012), explore totally different methods of dissecting and reassembling trombone technique, as evidenced by their dissimilar notations (the former, heavily tablaturized; the latter, streamlined but with clear superpositions of polyphonic activity).



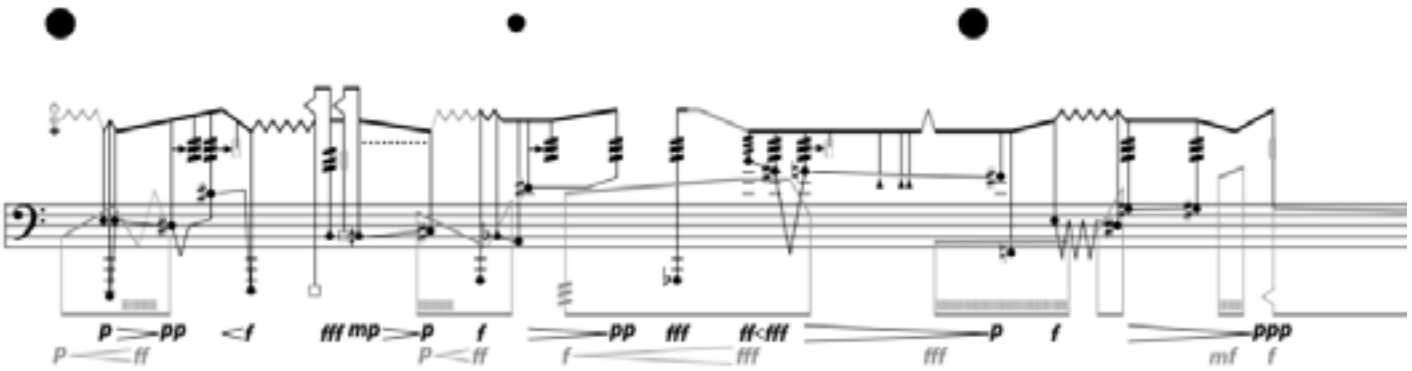
Timothy McCormack: *"Here is a sequence of signs, each having a sign and a meaning,"* for solo trombone (2008): opening
The staves indicate flutter tongue action, left-hand mute action (wawa mute), vocal action, played pitch, and valve action

11 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)*

12 See 3.4.1 Non-representational rhythm and Timothy McCormack's *HEAVY MATTER*

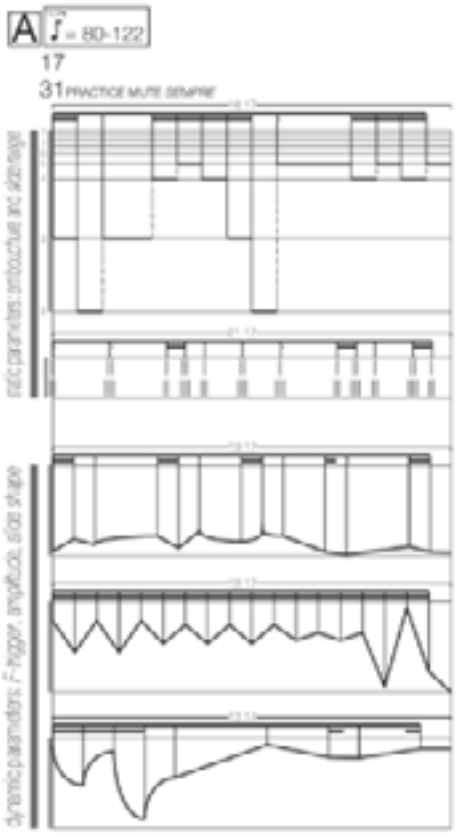
13 See 1.2 Poiesis as Musical Method and 3.4.2 Non-representational pitch and Joan Arnau Pàmies's *1≠∞ (EoM)*

14 In McCormack's case, that is more accurately phrased as two *extant* trombone solos, as his first exploration of the instrument and its potential for physical polyphony, *Map* (2009), has been rescinded.



Timothy McCormack: *HEAVY MATTER* for solo trombone (2012): opening
The overlaid lines indicate time (black dotes), played pitch (stems up and dark dynamics), vocal action (stems down and gray dynamics), left-hand mute action (within top beam), and articulation (beneath mute notation)

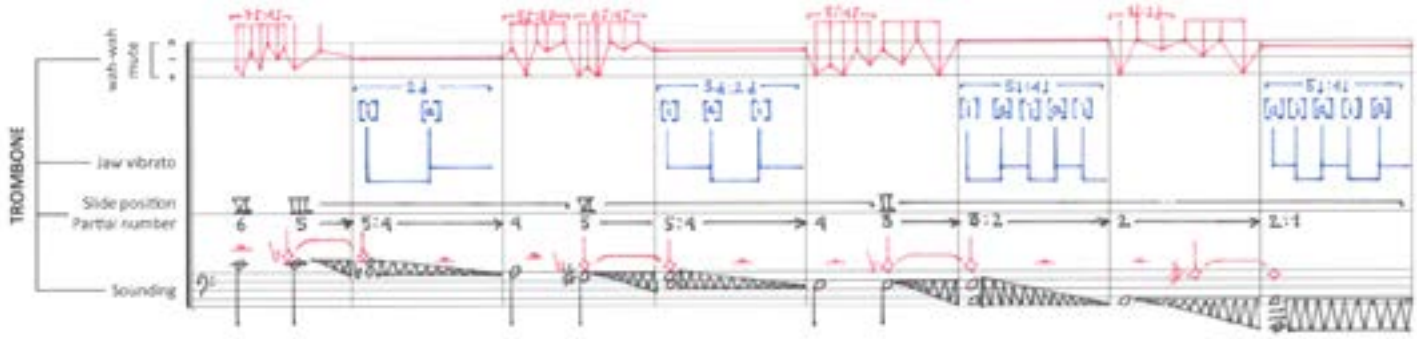
Pàmies's two solos also demonstrate two drastically different takes on the potential of the trombone's idiomatic qualities. The first, *[Vltbn]^4 (o quatre panells per a trombó sol)* (2013), has been examined above (cf. section 1.1). The latter, *1≈∞ (EoM)* (2015), takes an even more radical approach to shifting, unstable superpositions of parameters (cf. section 3.4), layering multiple, variable lines that change from iteration to iteration, even within a single performance.



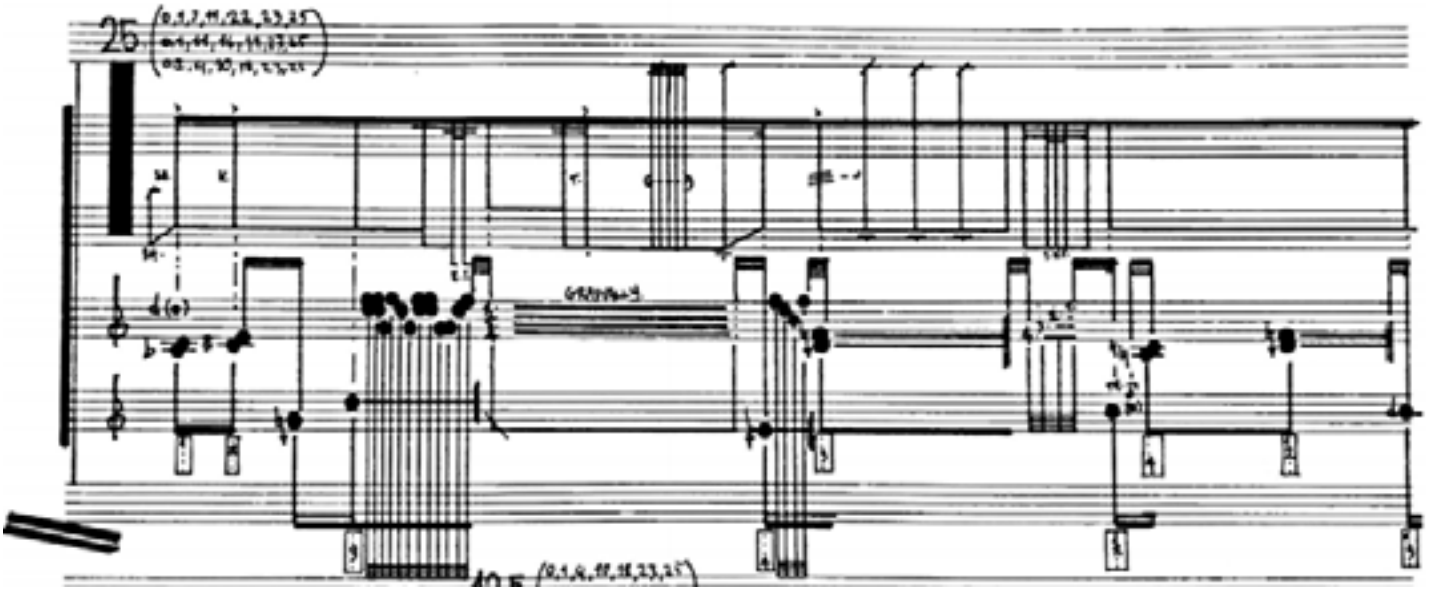
Joan Arnau Pàmies: *1≈∞ (EoM)* for solo trombone (2015): section A[15]
The top two staves indicate harmonic partial and region of slide movement; the bottom three staves represent (variably and interchangeably) dynamic, valve action, and slide motion within the specified region

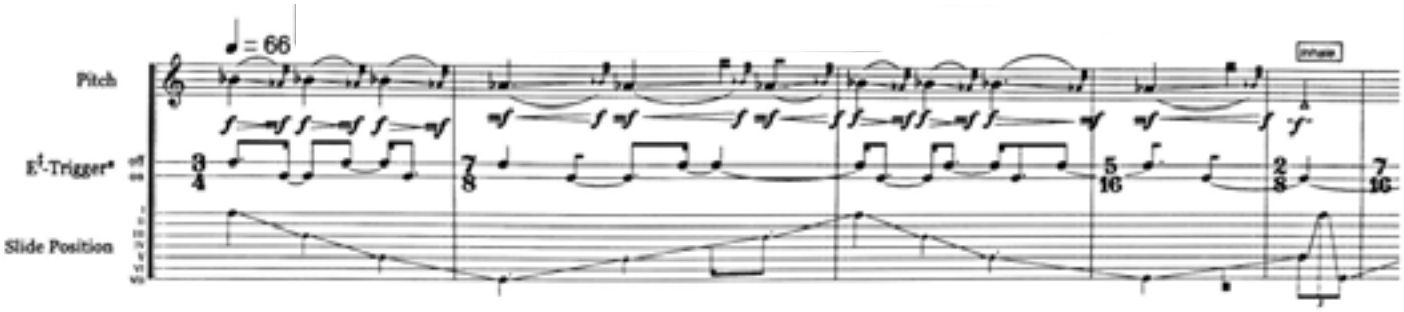
15 See 3.4.2 Non-representational pitch and Joan Arnau Pàmies's *1≠∞ (EoM)*.

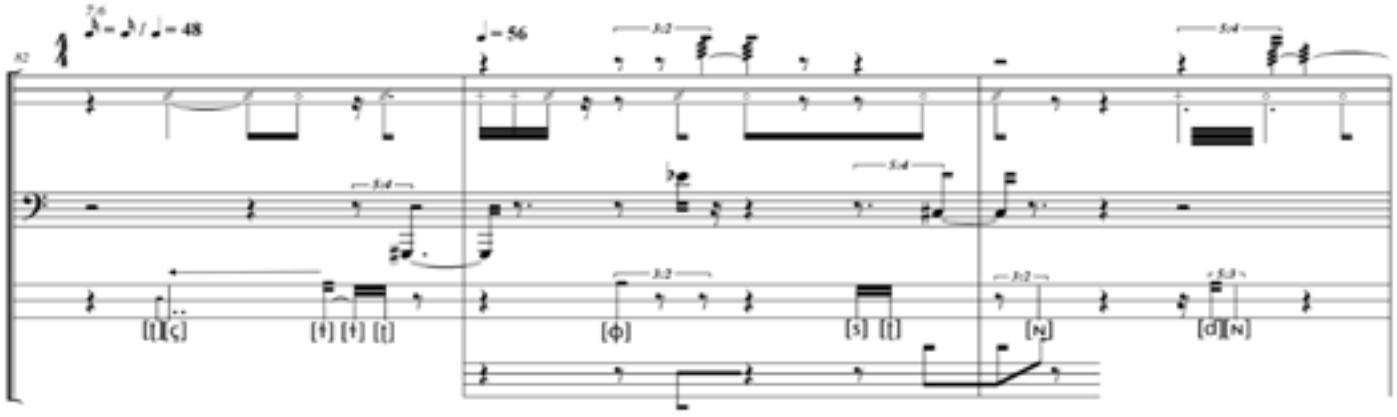
Other composers in this time period have written similarly heavily tablaturized, physically polyphonic notations, such as those of Michael Baldwin,[16] Sehyung Kim,[17] Andrew Greenwald, Yoshiaki Onishi, and Paul Hübner (himself a major proponent of such repertoire on the trumpet).

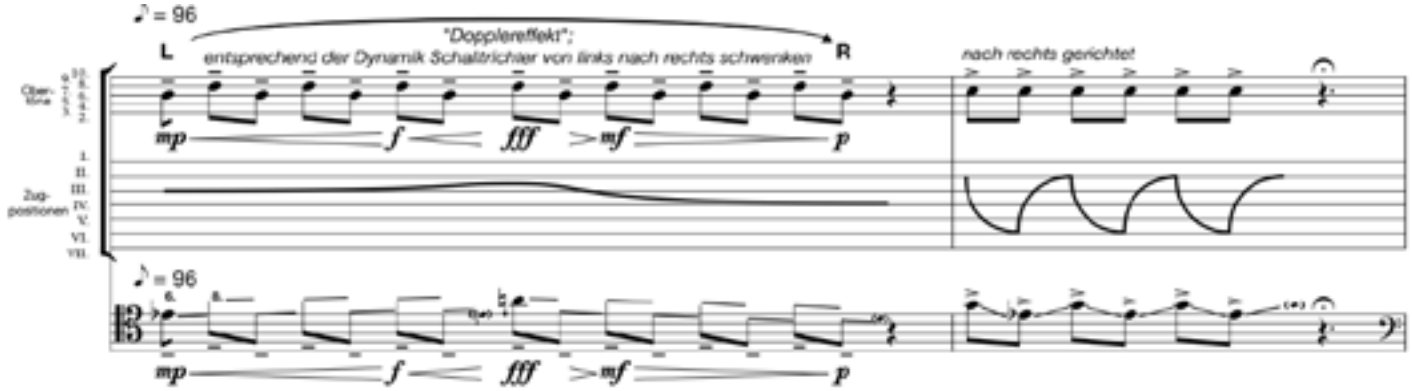


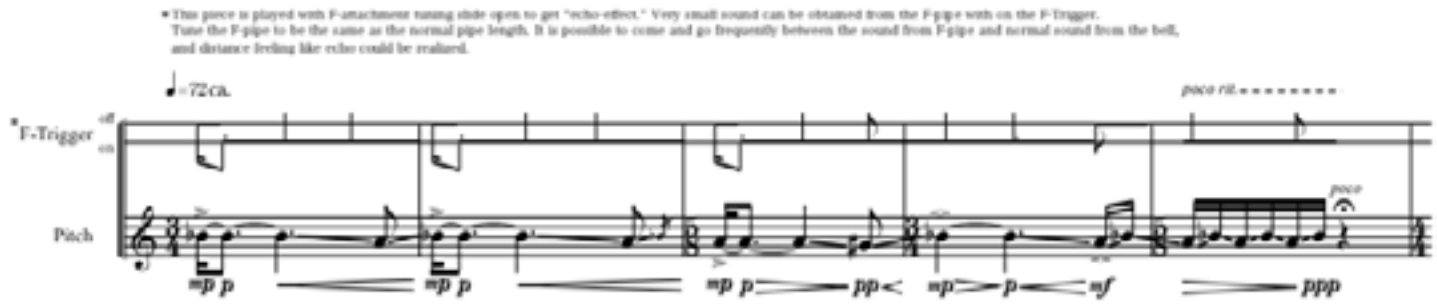
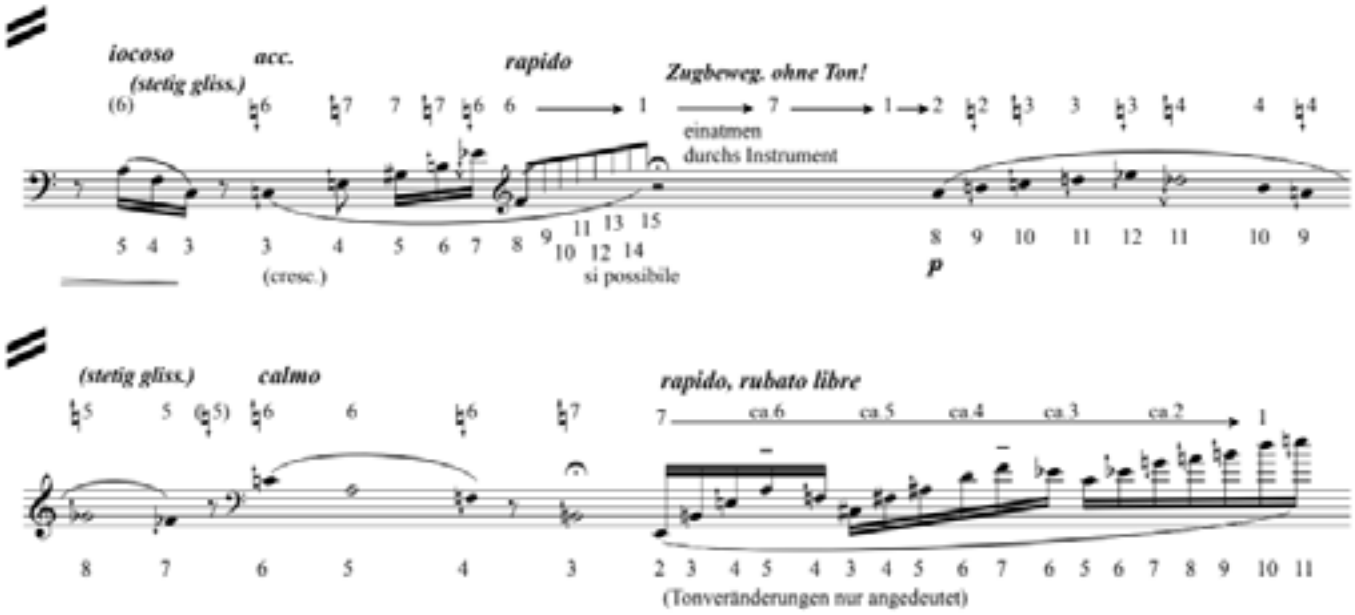
Sehyung Kim: *IL* for solo trombone (2014/2015): p. 4
The multiple staves notate left-hand mute action (wawa mute), jaw vibrato, slide position, harmonic partial, and sounding pitch (with vocal actions in red)

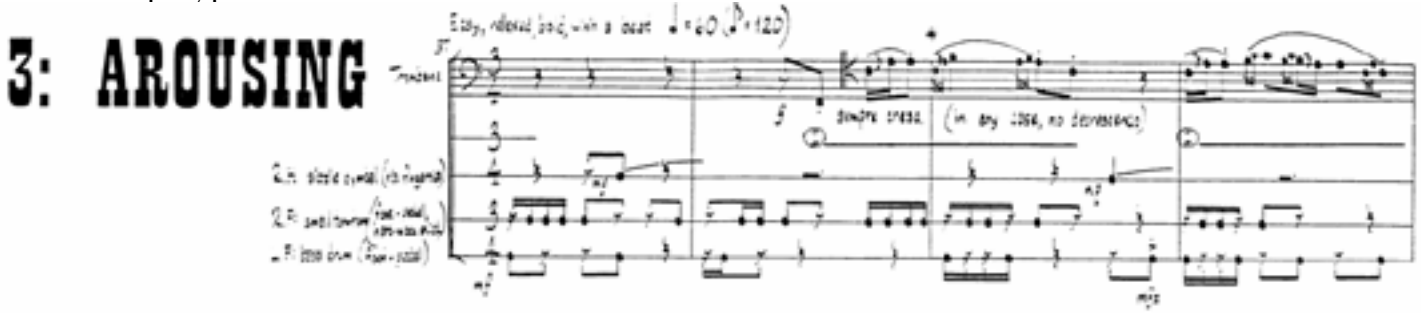


Andrew Greenwald: *A Thing is a Hole in a Thing it is Not (vi)* for solo euphonium (2015): p. 2
The multiple staves indicated valve action (for the four valves of the euphonium) and pitch material, including lip multiphonics

Yoshiaki Onishi: *Spargens* (2012): opening
As indicated in the score, the three systems indicate pitch material, valve activation (which disrupts pitch material), and slide position

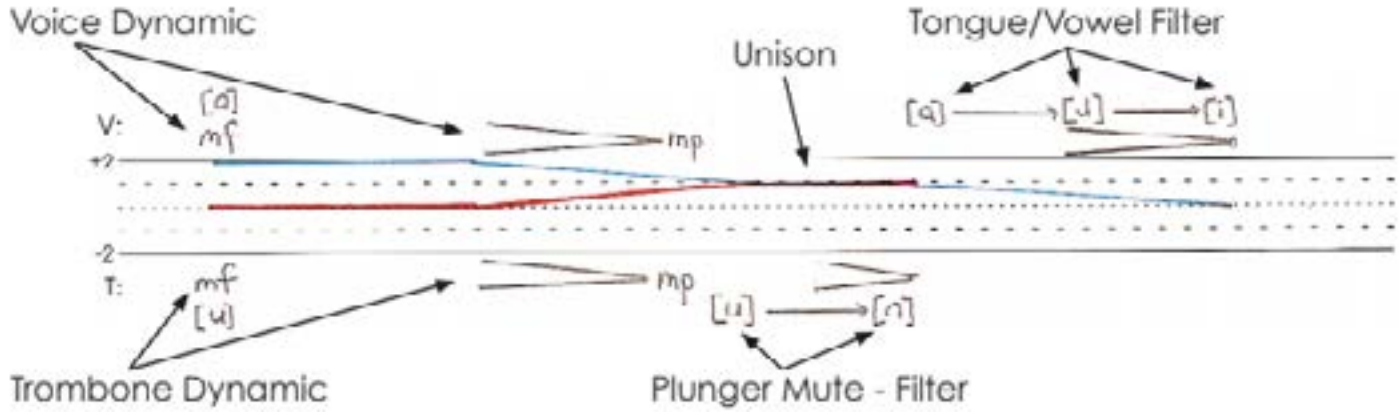
16 see 2.2 Agential Realism and Michael Baldwin's *Erasure.*
17 see 2.3 Autopoiesis and Sehjung Kim's *Sijo_241015.*

Paul Hübner: *diktatorinnengattinen* (2015): mm. 82-84
The four systems show, respectively: flutter tongue and left hand action, pitch material, voice, and embouchure / multiphonics (lip)

In and among these pieces, though, are also a handful of heavily tablaturized notations that do not, in fact, contain any physical polyphony. The consistently coupled activity in pieces like Robin Hoffman's *Straßenmusik* (2015), makes use of decoupled staves as more of a compositional tool than a reimagination of technique, as evidenced by the lower staff which gives a transcription of the action notation in traditional form.

Robin Hoffmann: *Straßenmusik* (2015): mm. 1-2
The top system indicates partial and the middle system indicates slide position; the bottom system the notates a transcription of the resultant pitch material as derived from the upper two systems.

Yu Kuwabara's *Rattling Darkness* (2017) and Manfred Stahnke's *Tom's Twin* (2006/2012) also incorporate elements of tablaturization, but in both cases use it as a tool to access idiomatic qualities of the trombone's physicality without mining any broader potential of physical polyphony. In Yu's case, the tablaturization allows for greater inflections of half-valve technique, whereas Stahnke isolates the microtonal inflections made available by the trombone slide and the natural overtone series.

Yu Kuwabara: *Rattling Darkness* (2017): opening
As indicated, the pitch material is affected by the valve motion notated in the upper staff, wherein an echo effect is produced by the sound coming out of the removed F-valve slide

Manfred Stahnke: *Tom's Twin* (2006/2012)
The numbers above the staff indicate slide position (with microtonal inflections given by accidentals and markings to glissando more or less smoothly) and the numbers below the staff indicate harmonic partial.

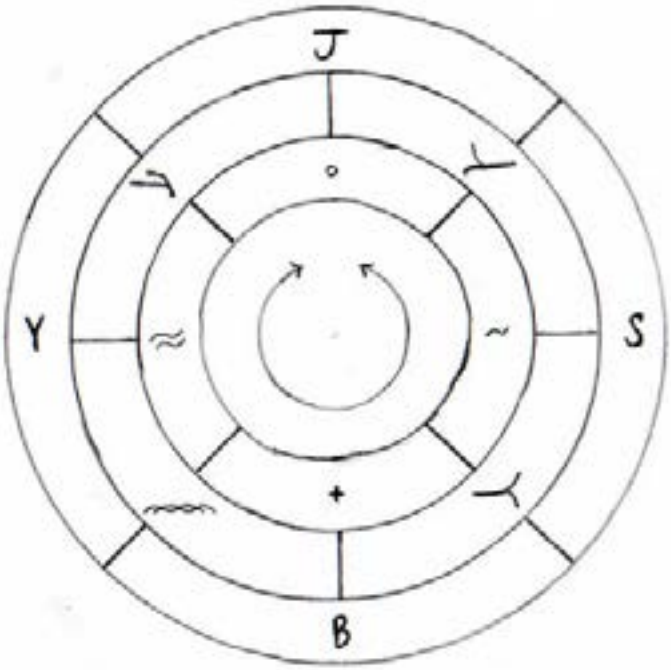
Perhaps the ultimate extreme of synchronous tablaturization is Ben Johnston's solo *One Man* (1988), in which the trombonist also plays a series of percussion instruments, producing a one-man-band effect both musically and theatrically. Although the level of coordination can be quite intense at times, and the technical demands of also learning non-trombonistic instruments provides a unique and intimidating challenge, with respect to the physical gestures required, they remain homophonic rather than polyphonic.

Ben Johnston: *One Man* (1988): opening, mvt. 3
The right hand, right foot, and left foot are indicated to play sizzle cymbal, small tamtam, and bass drum (respectively), accompanying the trombone material notated in the upper staff. Each movement uses a different set of percussion instruments notated in similar fashion.

In contrast to these pieces which demonstrate complex treatments of the trombone and its physicality without engaging elements of physical polyphony, there are also works from this century by composers who have eschewed complexity and tablaturization, but have still taken advantage of physical polyphony to problematize and explore alternative characters of the trombone. Kenn Kumpf's *_they mix above there* (2008)[18] employs an extremely minimalist texture which ultimately exposes an arresting sonic vocabulary unique to the piece, made possible by the permutations of physical polyphony inherent in his notational approach.



Kenn Kumpf: *_they mix above there* (2008): excerpt from performance instructions (Kumpf, 2008, p. 2)
As indicated, the single staff incorporates dissynchonous actions including played and sung material (red and blue lines), alongside plunger mute and oral cavity actions that manipulate that material (indicated below and above the staff, respectively)

My own compositional work (primarily under the name Juna Toksöz Winston) has also taken advantage of physical polyphony to explore less complex but equally experimental corners of the idiomatic possibilities of the instrument, as in *the old connubial men of the sea* (2015) and *ay neden şeftali gibi kokuyor?* (2016).



Juna Toksöz Winston: *the old connubial men of the sea* (2015): excerpt
Each concentric circle indicates four types of material for one performative parameter; at any point in time, four actions are notated, each parameter changing to another action within its circle irrespective of changes within other circles

18 See 3.4.3 Non-representational timbre and Kenn Kumpf's *_they mix above there.*

Juna Toksöz Winston: *ay neden şeftali gibi kokuyor?* (2016): excerpt
Four lines are overlaid indeterminately; four parameters of action within the oral cavity are then determined by the respective distances of the four lines from each other, changing as the lines converge or diverge within the performer-determined direction of reading

This brief exploration of the physically polyphonic and otherwise tablaturized notations for solo trombone is not intended to pedantically draw a line between strict physical polyphony and works that only toe the line. Rather, the discussion of which works truly cross that line is intended to underscore the relevance these scores carry for a performative and learning-based discussion. As previously stated, from this perspective, the aesthetic priorities or similarities in these notations are irrelevant from a performer's standpoint. On the contrary, the barriers to entry that physical polyphony can pose in works as diverse as Globokar's *Echanges*, Klaus K. Hübler's *Cercar*, and Kenn Kumpf's *_they mix above there* demonstrate how relevant this categorization is from the perspective of the learning process. The combination of challenges posed by truly *asynchronous* physical polyphony alongside the extreme *variability* of notations from composer to composer and piece to piece distinguish this repertoire with respect to the concerns of learning. To overcome these challenges, new learning strategies are required, and developing these strategies demands tool-building in a poietic sense. Such tools need to be created in order to entrain adaptable methodologies for building new performance practices both accurately and efficiently.

These pieces all pose unique but related challenges to the performer tasked with reassembling their bodies and techniques, since all of these pieces must, eventually, be embodied holistically by a single performer. Interestingly, although the early proponents of serialization and parameterization are often viewed as prioritizing a computational, rigorously stratified approach to these elements, they were not unaware of the eventual holism that these methods entail. Stockhausen himself, at the end of an essay detailing the potential of parameterization in electronic music, writes: "There is a very subtle relationship nowadays between form and material. I would even go so far as to say that form and material have to be be considered as one and the same … a given material determines its own best form according to its inner nature. The old dialectic based on the antinomy—or dichotomy—of form and matter has really vanished" (Stockhausen, 1971, p. 111). In addressing the almost spiritual holism of these elements he had directly previously elucidated as separately articulable parameters (as with the holism of rhythm and pitch), Stockhausen explicitly acknowledges the role of parameterization as a compositional tool that must eventually be subsumed into a more holistic framework in its ultimate expression.

Despite polyphonic asynchrony, the unifying performative demands of these pieces are the learning strategies necessary to accomplish this eventual *re*assembly of instrumental practice within a single, performing body. The following chapters will explore the physically polyphonic repertoire of the trombone specifically as a laboratory for problematizing this poietic approach to the learning process.

In order to reflect the focus of my present research on the learning process relevant to these unique notations, the following chapters will not be analyses focused on the compositions themselves, but will examine the works in question as they pertain specifically to the situated challenges of learning, enskilment, and practice-building.

In the spirit of Globokar and Pàmies, who designed notations requesting an embodied and enactive approach to discovering the poietic tool-building process, the subchapters in part 2 will explore not the physical anatomy of these tasks' execution, but will instead offer a series of theoretical templates that have proven useful in my own artistic practice. These approaches are not prescriptive of successful learning strategies, but taken together, suggest the outlines of a methodology that embraces the entanglement of conflicting strands of physically polyphonic actions as a means to rediscovering the unity of the body with the instrument and its environment, undergirding learning strategies that help the performer to holistically learn and execute notations that seem, at first glance, to demand the opposite. The first theoretical template (2.1) traces the notion of *haecceitas* from its coinage by John Duns Scotus in the scholastic era to its appropriation by Gilles Deleuze and Félix Guattari in the 20th century, using it as a diffraction grating for learning the superposed technical demands of Aaron Cassidy's *Because they mark the zone where the force is in the process of striking*. The second theoretical template (2.2) mines Karen Barad's agential realism for learning strategies that help the performer to access Michael Baldwin's *Erasure* (2011); Barad's scientific realism will be used to highlight the non-metaphorical implications for the holistic embodiment of these notations. The third theoretical template (2.3) traces the process of learning Sehyung Kim's *Sijo_241015* (2015) alongside Humberto Maturana's and Francisco J. Varela's concept of autopoiesis, which explicates the organic processes by which complex, interdependent unities can be formed, revealing the nature of the learning process as a form of growth and symbiosis.

Part 3 takes a closer look at the real-world implications for the holistic execution of decoupled actions. By exploring the history of embodied cognition and enactive learning (3.1), the experiences of learning Klaus K. Hübler's *Cercar* and Richard Barrett's *basalt* will be examined through the lenses of shared performance (3.2) and radical embodied cognition (3.3). In contrast to chapter 2, which addresses the theoretical side of constructing learning strategies, these subchapters will incorporate focussed discussion of specific practice strategies alongside musical examples. Together, these two studies will help to explain the cognitive and physical tasks that cohere in the learning of these dissociated practices, thereby also examining the nature of emergent enskilment and the role of situated knowledges in crafting the variable identities necessary to adapt to different pieces and situations fluidly and efficiently. This discussion will inevitably point towards the political implications that radical embodied cognition and variable, situated learning strategies pose to the traditional performance practice of the Western classical conservatory tradition. The final subchapter (3.4) will examine the role that the anti-representational strategies central to many of these theories play in the notational process itself, contained in a brief diversion from performance practice into a closer examination of notations by Timothy McCormack, Joan Arnau Pàmies, and Kenn Kumpf.

The conclusion will return to Hannah Arendt's poiesis as a unifying concept for these disparate learning strategies. In so doing, her own extrapolation from poiesis to the broader domains of political action and social interaction will be used to contextualize these learning strategies in a broader musical environment.

2. Poiesis in Practice

2.0 Preliminaries

> It matters which thoughts think thoughts. We must think!
> (Haraway 2016: 57)

The following chapter comprises three subchapters (2.1-3) devoted to borrowed ideas and cross-pollinations; they seek immersion in other disciplines, encouraging their concepts to diffract through the practice of learning music. First, though, it is perhaps useful to begin with a glance askance at a musical concept that has itself migrated elsewhere, in the hopes that as it circles back to its home discipline, it can bring with it all of the messy cross-pollinations and contaminations that have, through these peregrinations, woven themselves into its own conceptual fabric.

In attempting to describe a vision of ecological entanglement, Anna Löwenhaupt Tsing borrows the musical term "polyphony" to help elucidate the vast, interconnected, multi-scalar relationalities of ecological co-existence. In moving beyond the bounded concepts of "community," she describes a "polyphonic assemblage" rooted in the "patterns of unintentional coordination" that emerge from "the interplay of temporal rhythms and scales in the divergent lifeways that gather" (Tsing, 2015, p. 28). Tsing is fascinated by the simultaneous dis- and inter-connectedness of Renaissance polyphony, the consubstantiality of "separate, simultaneous melodies" and "the moments of harmony and dissonance they [create] together" (Tsing, 2015, p. 28) For Tsing, this vision of polyphonic assemblages offers a conceptual framework outside of teleologies; that is to say, she draws inspiration from polyphony that revels in the rub and the abrasion of voices' superposition, in contrast to what she describes as progress-driven music in which "unity was the goal … a unified coordination of time … music with a single perspective" (Tsing, 2015, p. 28). Her ruminations on ecological co-existence embrace the idea of polyphony as an entanglement of consonance and dissonance, neither taking precedence in resolution but intertwined and interdependent, journeying and well-travelled.

Tsing characterizes this as a "curiosity [that] follows such multiple temporalities, revitalizing description and imagination. This is not a simple empiricism, in which the world invents its own categories. Instead, agnostic about where we are going, we might look for what has been ignored because it never fit the time line of progress" (Tsing, 2015, p. 26). For Tsing, polyphony comes to represent a vision of multi-scalar coexistence that is not predicated on narratives of directional progress nor wedded to teleological points of arrival (historical, ecological, cultural). As with polyphony, where consonance and dissonance rub shoulders symbiotically, Tsing does not take this as an impetus to counter the myth of order with the myth of unbridled chaos. Rather, rejecting teleologies means accepting the consonances as much as and in order with the dissonances, refusing the siren call of resolution, as occurs also in ecological systems, where this ebb and flow emerges from the concept of "disturbance":

> Humanists, not used to thinking with disturbance, connect the term with damage. But disturbance as used by ecologists, is not always bad—and not always human. Human disturbance is not unique in its ability to stir up ecological relations. Furthermore, as a beginning, disturbance is always in the middle of things: the term does not refer us to a harmonious state before disturbance. Disturbances follow other disturbances. (Tsing, 2015, p. 126)

In the following subchapters, physically polyphonic notations provide exactly this disturbance. As a set of repertoire whose primary distinguishing quality is their variation, these pieces make visible the mutable nature of learning music, where new learning and technical strategies are embedded in a field of disturbances following disturbances. Through the next three subchapters, the nature of

these disturbances will be examined more closely through the aid of a variety of theoretical gratings. Throughout, these notions of superposition and symbiosis will recur, supporting a commitment to a musical methodology rooted in the relationality of polyphonic agencies. Haraway, channeling Marilyn Strathern, describes this commitment to following the grains of relations as "accepting the risk of relentless contingency, of putting relations at risk with other relations, from unexpected worlds" (Haraway, 2016, p. 34).

In attempting to verbalize this commitment to relationality, Haraway settles on the term sympoiesis, itself derived from poiesis by way of autopoiesis.[19] "*Sympoiesis* is a word proper to complex, dynamic, responsive, situated, historical systems. It is a word for worlding-with" (Haraway, 2016, p. 58). In the following subchapters, many different layers and scales of agencies are mined through their potential to world-with: the concepts themselves as they migrate from discipline to discipline, diffracting (cf. Haraway 1992b) and seeking "generative friction" (Haraway, 2016, p. 61); the interwoven agencies of composers, performers, and audiences—the music-writers and music-learners and music-listeners; and of course the complex ecosystem of the single performer's body, tasked with embodying the polyphonic consonances and dissonances of gesture that emerge in the notations under consideration.

Sympoiesis inhabits the lineage of poiesis as an act of creation and tool-building in an Arendtian sense, but imbues it additionally with the myriad of other poietic agencies that abound, intersect, coexist. In pursuing a poietic methodology for learning music, the embrace of these varieties of terms and concepts is intended to aid in a process of "material-semantic composting" (Haraway, 2016, p. 31). The diffraction of these terms and concepts through one another endeavors to cultivate a situation in which new disturbances can provoke new virtuosities of learning music. The particular concepts, pieces, and methodologies described hereafter are not prescriptive, but are stories that hopefully make possible a space in which new relations between notations and performers as well as between discrete actions within the performer's body can emerge. Physically polyphonic notations make this possible in part because they necessitate an initial disorientation from traditional interpretive strategies, a disturbance that allows us, as performers, to reevaluate which orientations and scales and relationalities we choose to embrace. I have chosen to house this commitment to ateleological relationality in the guise of poiesis. As Haraway writes, "Other words for this might be materialism, evolution, ecology, sympoiesis, history, situated knowledges, cosmological performance, science art worldings, or animism, complete with all the contaminations and infections conjured by each of these terms" (Haraway, 2016, p. 97).

Haraway combines the methodologies of these commingled concepts under the term speculative fabulation (one of many SF's that she continually circles back to—"science fiction, speculative fabulation, string figures, speculative feminism, science fact, so far" (Haraway, 2016, p. 2)). She uses fabulation as a form of storytelling, a weaving of superposed and consubstantial realities. Stories and storytelling recur as alternative methodologies, markedly in the work of Haraway and Tsing, but well beyond their purview as well, and as early as the work of Arendt, who introduced stories as a way of imagining the processual creativity of poiesis and human interactions. Stories are not facts, and they resist being recorded as data, and yet they contain information. They are the ripples that radiate from disturbances, traversing one even as the next is already superposed thereupon. They communicate and indicate, but also remain constantly vulnerable to the interpolation of fresh interjections and interpretations as their context shifts. They are not data points but trajectories, unravelings. Arendt considers stories the tools of action and speech (and therefore as an offshoot of poiesis):

> It is because of this already existing web of human relationships, with its innumerable, conflicting wills and intentions, that action almost never achieves its purpose; but it is also

19 For a closer discussion of autopoiesis, see 2.3 Autopoiesis and Sehyung Kim's *Sijo_241015*.

> because of this medium, in which action alone is real, that it 'produces' stories with or without intention as naturally as fabrication produces tangible things … They themselves, in their living reality, are of an altogether different nature than these reifications … [T]he stories, the results of action and speech, reveal an agent, but this agent is not an author or producer. Somebody began it and is its subject in the twofold sense of the word, namely, its actor and sufferer, but nobody is its author. (Arendt, 1958, p. 184)

As bodies of knowledge that embody the interstices of fluid relations, capable of drifting through temporal and spatial constraints with ease, stories form essential tools for developing the kind of methodologies that can accommodate and assimilate these insterstitial forms of knowledge and expression. Tsing writes, over half a century later:

> To listen to and tell a rush of stories is a method. And why not make the strong claim and call it a science, an addition to knowledge? Its research object is contaminated diversity; its unit of analysis is the indeterminate encounter. To learn anything we must revitalize arts of noticing and include ethnography and natural history. But we have a problem with scale. A rush of stories cannot be neatly summed up. Its scales do not nest neatly; they draw attention to interrupting geographies and tempos. These interruptions elicit more stories. This is the rush of stories' power as a science. (Tsing, 2015, p. 38)

Storytelling's power as a form of science and a research methodology is, as previously remarked, not new to Haraway and Tsing. Anthropologist Tim Ingold remarks on both the allure as well as the possible misuse of storytelling as a methodology in its application over time:

> Now of course, anthropologists have long recognised the educative functions of storytelling the world over. But they have been wrong to treat stories as vehicles for the intergenerational transmission of encoded messages which, once deciphered, would reveal an all-embracing system of mental representations. For stories do not, as a rule, come with their meanings already attached, nor do they mean the same for different people. What they mean is something that listeners have to discover for themselves, by placing them in the context of their own life histories. (Ingold, 2011, p. 4)

Ingold goes on to describe this form of storytelling as a type of emergent learning, or in his own terms, as guided rediscovery or even way-faring.[20] It is precisely this aspect of storytelling, though, which has made the concept a useful tool for Arendt, Haraway, and Tsing, among others; because it embraces forms of knowledge-making that unfurl dynamically (rather than being contained in a static informational vessel), storytelling makes disturbances and polyphonies necessary components of knowledge-making, rather than exceptions or interruptions. Marcel Cobussen describes how way-faring storytelling contributes to pluralistic knowledges:

> Therefore, it would be difficult to maintain that the quality of a theory depends on its ability to better (re)present reality than other theories. Instead, my claim is that the value of a theory depends on its capacity to convince. Theorizing is in fact telling a story, and its *auctor intellectualis* may hope that it offers some new insights, some new ways of experiencing the world. (Cobussen, 2017, p. 81)

20 For further discussion of Ingold and guided rediscovery, see 3.1 Introduction to Embodied Cognition; Enactive Learning; Enskilment.

A refusal to be reactive to other theories does not in itself negate them. A way-faring attitude of storytelling opens a space in which the importance or dispensability of other theories can evolve and develop over the course of a research story-journey; the "capacity to convince" includes as much this dialogue with other knowledge-producing activities as it does with a direct author-reader relationship. According to Jerome Bruner, "[I]t is not textual or referential ambiguity that compels interpretive activity in narrative comprehension, but narrative itself" (Bruner, 1991, p. 9). This is to say that the plurality of knowledge-making that storytelling offers as a methodology is not a result of the ambiguity of its subject, but rather of the distinctive way-faring, cross-contaminating qualities that it activates. As Ingold notes, "it may not be until long after a story is told that its meaning is revealed, when you find yourself retracing the very same path that the story relates. Then, and only then, does the story offer guidance on how to proceed" (Ingold, 2011, p. 4). A story can offer a new way of experiencing the world, but as with any experience, it must be lived in real space and time if it is to disclose any of its secrets. Stories offer a framework of viewing the learning and practice-building of various disciplines in this unfolding, emergent, experiential process. Bruner connects this idea of narrative as methodology to Roland Barthes' distinction between readerly (*lisible*) and writerly (*scriptible*) texts, and certainly Barthes' concept of writerly texts melds well with the notion of narrative as guided rediscovery: "The writerly text is a perpetual present, upon which no consequent language (which would inevitably make it past) can be superimposed; the writerly text is ourselves writing, before the infinite play of the world (the world as function) is traversed, intersected, stopped, plasticized by some singular system (Ideology, Genus, Criticism) which reduces the plurality of entrances, the opening of networks, the infinity of languages" (Barthes, 1973/2002, p. 5).

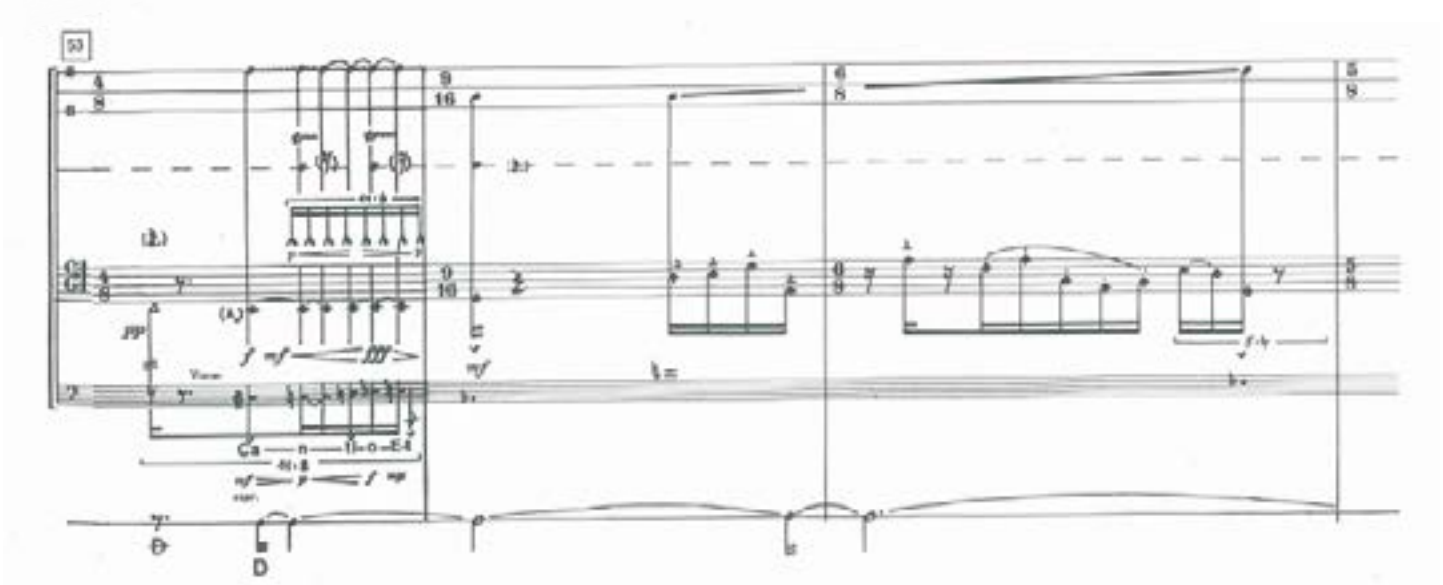
Stories offer a way to live the world emergently, traversing a topography, a "process … akin to that of following trails through a landscape: each story will take you so far, until you come across another that will take you further" (Ingold, 2011, p. 4). Barthes follows the topographical contours of narrative to an infinity of languages, Ingold to a (re)discovery of enactive enskilment, Arendt to tool-making as creativity, and Haraway to speculative fabulation as world-making. All of these approaches mine stories for their polyphonic cross-pollination, for their sympoiesis. It is precisely these cross-contaminations that I seek; they drive us and guide us not forwards, but merely elsewhere, and it is those elsewheres that allow new forms of musical expression to germinate. Following Tsing, we hope to be "contaminated by our encounters; they change who we are as we make way for others. As contamination changes world-making projects, mutual worlds—and new directions—may emerge" (Tsing 2015: 31). The following essays are not stories, per se, but do invoke the spirit of wayfaring and contamination. They allow non-musical theoretical gratings to diffract through specific pieces of physically polyphonic music, each proposing a certain pathway through the particular contours of each piece and its learning process. They are only propositions, the momentary pathways available to myself in the learning process, with the theoretical models that served as constellations to help me navigate these particular topographies. They are singular stories intimating the outline of how some other story might later emerge. To another performer in another situation, some other confluence of concepts, learning methods, and performance practices may take the place of those proposed in the following pages. As discrete theoretical gratings, the way in which these essays inform the development of physically polyphonic performance practice may or may not bleed into one another; they are neither continuous nor sequential, but do hopefully amplify and resonate with one another. Or at the very least, contaminate one another, as part of an evolving process of poietic learning and tool-building.

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)*

How might a performer steeped in the classical music tradition learn and perform a work like Aaron Cassidy's *Because they mark the zone where the force is in the process of striking*? The notation itself is immediately jarring: the rhythmic material looks familiar, albeit complex, but all note heads have evaporated leaving only lines traced along the empty staves. As if this were not disorienting enough, the performance instruction makes it explicit: "never projecting an air of control" (Cassidy, 2006, p. 1). A notation like this resists casual acquaintance. It demands a certain level of classical music acumen (with respect particularly to the rhythm) while simultaneously distancing itself from that tradition by replacing conventional noteheads with tablaturized instructions for the performer's body. Cassidy has notated three different layers of the physical action of playing the trombone, each on separate staves. The top staff indicates slide motion, notated with the slide all the way in at the top, and all the way out at the bottom. The middle system indicates lip tension from loose to tight, which consequently prescribes the relative placement within the harmonic series with a range from partial 2 to as high as possible. The third and lowest staff, which appears intermittently, indicates valve activation, with three positions indicated: undepressed, half-depressed, and completely depressed.

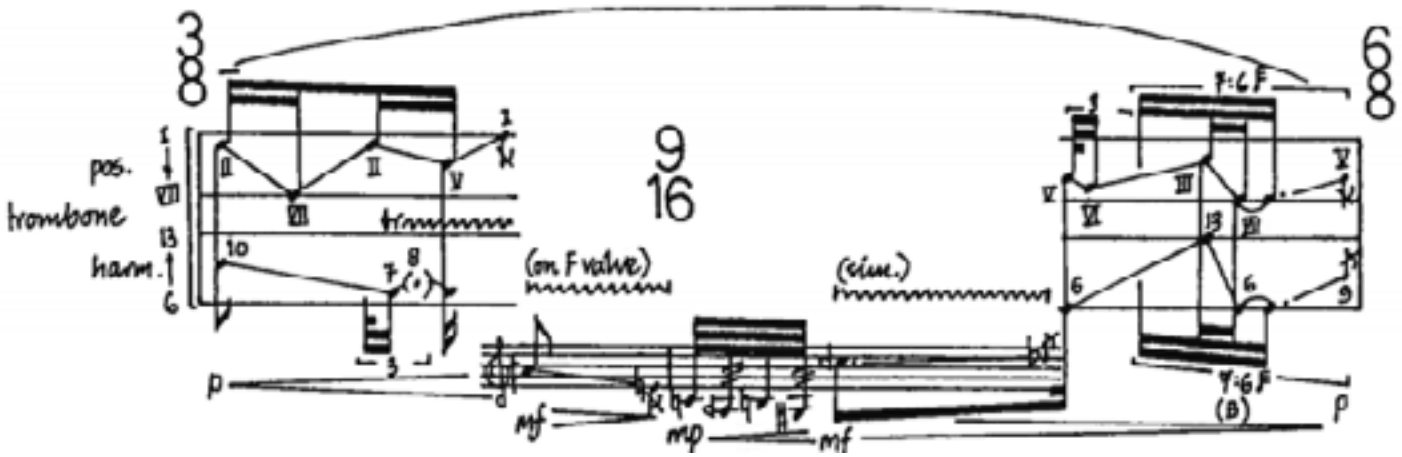
Any notational decision presents an opportunity to a performer. Whether it be traditional or experimental notation, each notational moment provides a means for the performer to parse a composer's interests, priorities, and preoccupations. What they choose to indicate, and equally what they choose not to indicate, become critical clues to the performer, not merely to satisfy the composer's wishes per se, but to understand the gestation of the notation so as to better nurture the practical techniques that can bring it to sound in the real world. In traditional classical music, this is equally true, even if the homogeny of notational strategies can at times obscure the critical differences between what a composer chooses to notate and not to notate. A composer who has a separate dynamic and articulation marking on each note has shown how much these details have preoccupied her, while a composer who has very little articulation markings but many fingerings has revealed another discrete preoccupation. Noticing which elements she chooses to foreground or

background is one of the first and most critical elements to consider when embarking upon a learning and interpretive journey. In notations such as Cassidy's, this is even more so the case. Because physically polyphonic notations vary so much from composer to composer and score to score, a huge volume of information is intimated by the choices the composer has made in each unique piece. By taking special care to notice which specific elements are chosen as parameters, the ways in which they are manipulated, and especially which are omitted, the performer can already begin to construct a new set of practice tools before even picking up the instrument. Cassidy's score provides a fantastic example of just such a set of both accentuated and omitted parameters, but to better appreciate this, I will first introduce three other notations that predate it: Klaus K. Hübler's *Cercar*, Richard Barrett's *EARTH*, and Aaron Cassidy's first trombone solo, *songs only as sad as their listener.*



Klaus K. Hübler: *Cercar* (1983): mm. 53-55

When compared to Hübler, it is interesting to see how much has been left out by Cassidy in *Because they mark the zone*: in *Cercar*, Hübler notates as many layers as possible and they are treated very equally as polyphonic voices.[21] Cassidy, though, has left out many of these layers (including mute, diaphragm accents, voice, and mouth shape) and has furthermore reduced the specificity in both the harmonic series and slide content, which are both relativized.



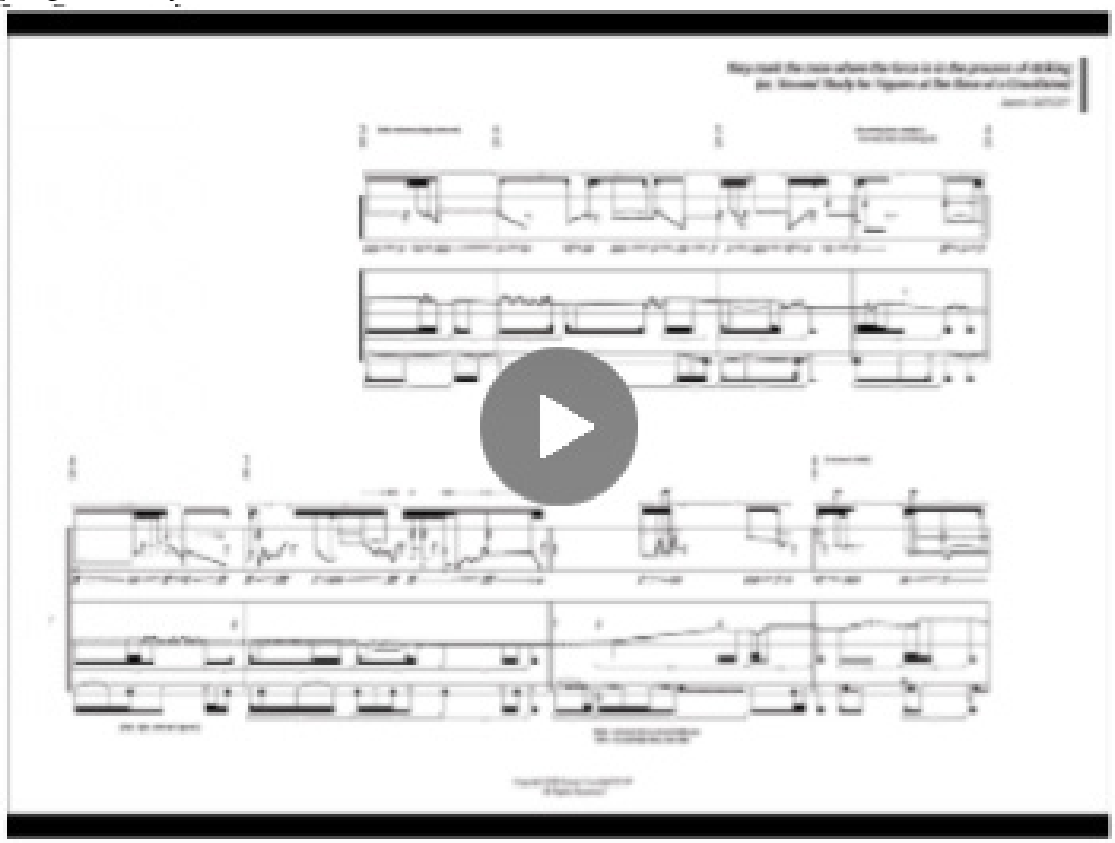
Richard Barrett: *EARTH* (1988): mm. 248-50

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

Unlike Hübler, Richard Barrett's notation treats almost exactly the same parameters as Cassidy's *Because they mark the zone*. However, in Cassidy's score, there is quite a bit *more* specificity and complexity of rhythm and the different strata of material are far more decoupled. This is in strong contrast to the decoupled passages in *EARTH*, in which the rhythms are more straightforward and the destinations of slide position and harmonic motion are largely homorhythmic.

Aaron Cassidy: *songs only as sad as their listener* (2006): m. 5

Cassidy's earlier trombone solo, *songs only as sad as their listener*, sets fewer and less complex parameters within a simultaneously more complex rhythmic framework. The rhythm is the only instance, though, in which *songs only as sad as their listener* is more complex, for despite the somewhat less extreme nested tuplets in *Because they mark the zone*, the overall density of activity in the latter is drastically more frenetic. Within these short examples of early decoupled notations for trombone—all precursors to *Because they mark the zone*—it becomes more clear precisely which parameters are foregrounded in *Because they mark the zone*, as well as which elements are backgrounded or omitted entirely. One can see how, for Cassidy, rhythmic specificity emerges as a more critical musical element than absolute pitch. One can also begin to see how the different physical actions are increasingly interwoven even as they are increasingly decoupled. Cassidy utilizes these foregrounded musical elements in his notation to explore the physicality of the instrumentalist as their primary physical actions are progressively stratified.



Cassidy writes that the physicality inherent in his tablature notations "are not means towards an aural result but instead are already musical materials in their own right" and refers to this concomitance of sound and gesture as part of the piece's "ontological identity—its haecceity, in Deleuzian terms" (Cassidy, 2008b, p. 22). Although Gilles Deleuze and Félix Guattari do introduce and make extensive use of the term "haecceity" in *A Thousand Plateaus*, its original provenance lies in the work of the 13th-century Scholastic philosopher John Duns Scotus.[22] *Haecceitas*, or the *individua differentia*, is one of Duns Scotus's primary contributions to scholastic philosophy, along with the real distinction (sometimes also called the formal distinction). Haecceity refers to the thisness of a thing or person, as opposed to its quiddity, or whatness. This is to say that in a traditional scholastic view of ontology, there are many different (one might almost say parameterized) properties that constitute a being: the form, the matter, etc. In the commingling of these elements emerges the essence of each entity. Scotus's haecceity, the individual difference, is a means to isolate the mystery of the individual within the ontological framework—in other words, what is it that makes Socrates Socrates, beyond being merely a man? Why exactly is he Socrates and not Plato? This problem was a major preoccupation for Scholastic philosophers, and for Scotus, it was intimately tied to the concept of indivisibility. According to Scotus, the humanness of Socrates is part of a common nature, what Scotus calls a non-numerical unity, which is to say that humanness is divisible, or rather, expressible in many different entities: Socrates, Plato, and so forth. The individual difference is tied to the indivisibility and individuality of Socrates. Like any property, a haecceity is an entity itself, and yet it is fundamentally indivisible, and so not separable from the larger particular itself. This, in turn, relies on Scotus's formal distinction. For my purposes, I can say that the formal distinction refers to a property or element that is both distinct in itself and yet necessary and requisite to the whole; it is conceptually discrete but cannot exist outside of its context. It is therefore inseparable at the same time that it is *formally* distinct. A haecceity is precisely such an entity, in that it is a property of while inseparable from the whole. The distinct individuality and indivisibility of this whole—the entity's thisness—resides in a haecceity. Implicit in any discussion of a haecceity is the idea that certain aspects of an entity are inextricable even if they are distinct, and that it is the relations between components (and not the components themselves, accounted individually) that comprise the identity of an entity.

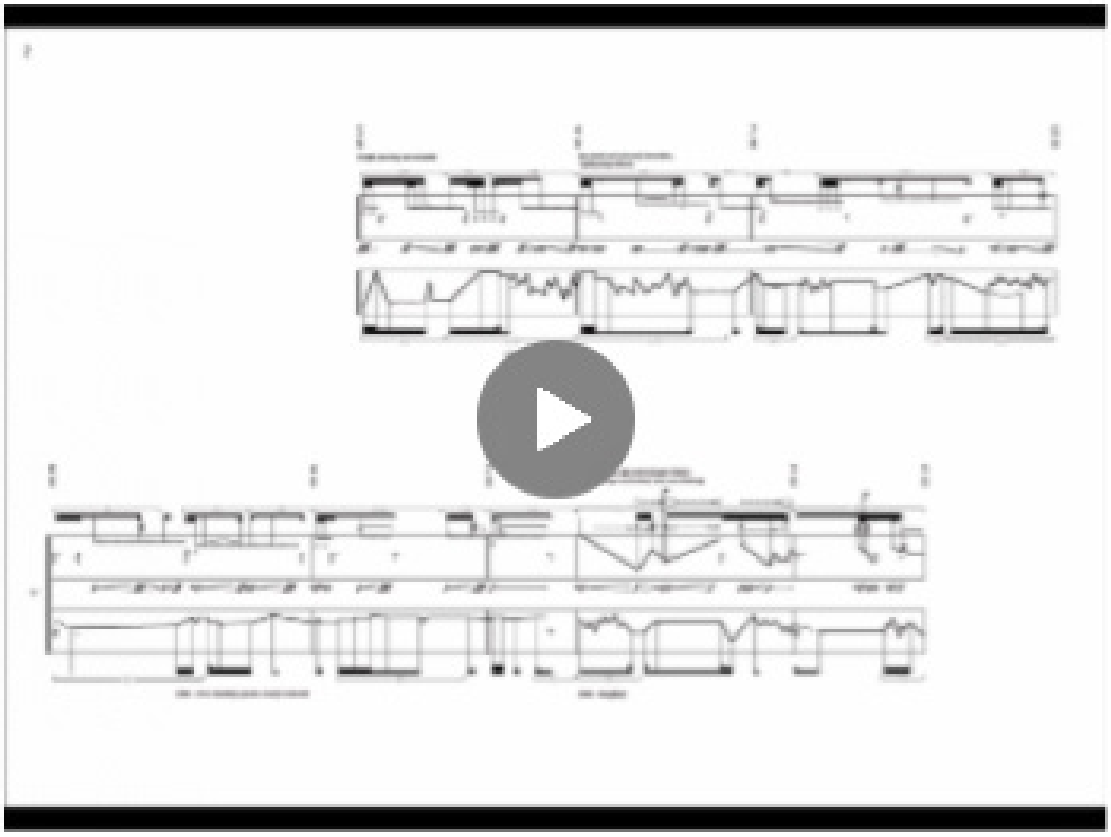
The notions of *haecceitas* and the real distinction were highly relevant to one of the most critical and controversial questions facing Scotus and his contemporaries: the Holy Trinity.[23] For many centuries, theologians and philosophers had tackled the problem of parsing the respective unity or discreteness of the three members of the Holy Trinity, leaving a long and troubled history as the problem remained stubbornly unresolved up until the time of the Scholastics. How can three different things coexist in separate forms and yet be one and the same? In his own attempts to successfully resolve this complicated issue of discrete but consubstantial entities, Scotus posits the divine essence as an immanent universal. In elucidating this idea, Scotus posited that the divine persons are expressions of this immanent universal, which (unlike some other universals) is expressible in its purest form in multiple instances. For Scotus, then, "the divine essence is communicable … however, the divine essence is indivisible. The divine persons, although they are exemplifications of divine nature, are not substances or individuals, since they are incommunicable. The only indivisible thing in God is the divine essence" (Cross, 2003, p. 188). These distinctions between divisibility and communicability cut to the heart of the formal distinction, revealing the thread of haecceity by which internal relations come to constitute identity and quiddity, leading also to communicability. The divine essence (the

22 "Cf. *Met.* VII q. 13 n. 61 (*Questions on Metaphysics*, II.208-209) and 176 (II.240-41)" (Ingham and Dreyer, 2004, p. 113).

23 In fact, the question of the Holy Trinity was the only instance in which William of Ockham fully accepted Scotus's formal distinction (Ingham and Dreyer, 2004, p. 34).

superposition of formally distinct entities in relation to one another) is communicable despite the more molecular entities' incommunicability. In orthodox Scholastic interpretation, the divine essence is not technically identical to a haecceity, since God is different from individuals such as Socrates and cannot be analyzed by the same philosophical principles. Nevertheless, the divine essence in this explication of the Holy Trinity operates very much like a haecceity, since Scotus identifies the divine essence (an individuating quality and identity) as the actual criterion of indivisibility. The most visible exemplifications of this divine essence, the three forms of the Catholic god, are not in themselves individuals; they are instantiations of the immanent universal linked by a shared identity inseparable from but formally distinct from their discrete identities—in other words, essentially a *haecceitas*. They are formally distinct but for all practical purposes indivisible—expressible only in the whole.

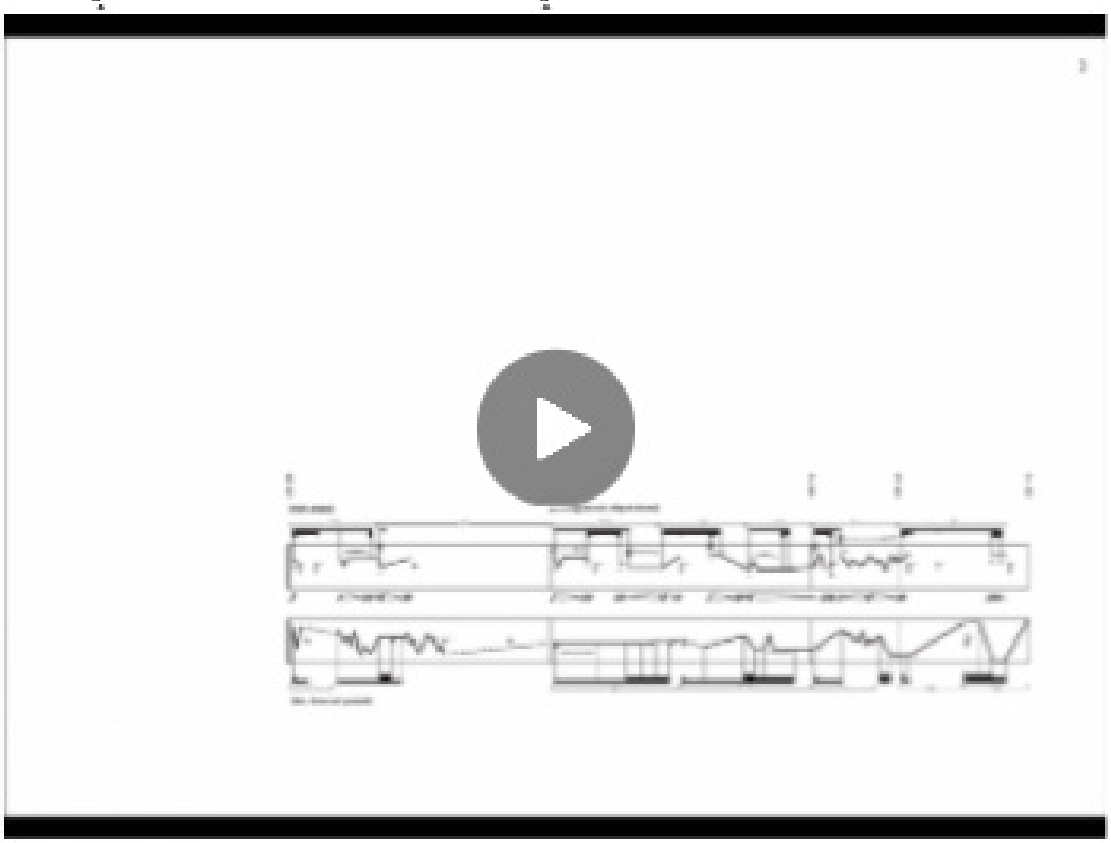
Applying this formal distinction to *Because they mark the zone*, we can see a similar relationship between the three layers of physical actions and the underlying individuality of the score and its resultant performances. The three physical actions are formally distinct in Scotus's sense, since they can be intellectually regarded separately. As discrete actions, they are visibly distinct in the notation; they are not, though, individually communicable. The thisness of the score and its resultant performances reside within the *interaction* of these three decoupled physical actions, which are inseparable as they are entangled in the single body of the holistic performer. They are conceptually independent and yet physically co-dependent, utterly contingent upon one another, each line both hindering and helping the other polyphonic actions. The valve action would simply not respond the same way, let alone sound the same way, without its interaction with the other two physical strands of material, which are likewise as affected themselves. Listen once more for this co-dependence within the independence of movement, for the haecceity that emerges from the performance of these actions.



Haecceity is an access point, a way for the performer to understand the piece as something beyond a prescribed set of gestures. Each piece is, instead, a unique performative and physical system with a sense and identity all its own. Deleuze and Guattari write that, "it is a matter of surrendering to the wood, then following where it leads by connecting operations to a materiality, instead of imposing a form on matter" (Deleuze and Guattari, 1987, p. 408). As with a woodworker following the grain of the wood, allowing the wood's inherent form to aid and reinforce his craft, a performer's analysis of this piece must surrender to the physicality of the notation, learning more than just the *specific* motions of the piece (e.g., a rote-reflexive execution of one 13:12 rhythm), but also the *types* of motion within the piece (e.g. patterns of unaligned articulations and slide movement shapes). As with woodworking, these are always questions of actions in motion; cutting a piece of wood with the grain uses the wood's form to encourage a dynamic creative process, not a static object. Similarly, this performative analysis, rooted in the idea of poiesis as building tools for (a) practice, is concerned first and foremost with the *types* of interactions that occur at the intersection of the decoupled gestures. It seeks to find patterns and shapes within the body that enable polyphonic gestures to abut and superpose upon one another; it develops a practical feeling for these polyrhythms, subsequently allowing the germination of this physical/gestural vocabulary to inform the execution of specific polyrhythms that emerge in the piece as a consequence of the learning process.

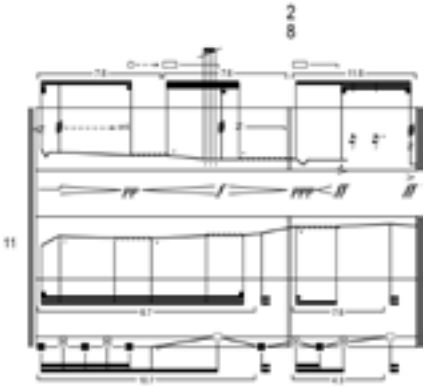
This careful fertilization of a performative practice that allows systems of movement to inform more targeted musical learning is what it means to follow the operations where they lead to a materiality—as Deleuze and Guattari envisioned following the grain of wood—and in Scholastic terms, this materiality is the individual essence, a *haecceitas*. As in Scotus's view of the trinity, where the indivisibility was located in the divine essence and not in its exemplifications, the materiality is located in the haecceity and not in the distinct lines of motion that are constellated around it. It is these actions that we follow; these actions are the connective tissue that reveal to us the form in its materiality. In this sense, materiality is a performativity, something deeply rooted in the actual manipulation of the instrument in real time. It is a physicalization and temporalization that is indivisible within the act of realizing and performing it. This performance reifies the haecceity that is the individuating quality of the piece and its interwoven polyphonic physicalities.

A piece like *Because they mark the zone* does not exist on paper or theoretically: it exists only in the actual collision of physically dyssynchronous actions in real bodies and in real time. The consolidation of these elements is not merely a composite, it is a fundamentally idiomatic reading of the score. Such consolidation is the distinct identity and thisness of the piece. The different strands of decoupled physical material do not exist in a bubble, isolated from one another and reassembled in some way *ex post facto*. They exist alongside each other and in the same body, and thus are consequently inextricable and co-dependent. For example, the slide arm responds to the rest of the body, and to the fluctuations in air resistance, amplitude, and tension that change in relation to the other parameters. Cassidy refers to such collisions of physical actions as "polyphonic byproducts" (Cassidy, 2002, p. 151). The polyphonic byproducts are, in essence, the haecceity. They are the element that is inseparable from the piece, indivisible from the interweaving of the decoupled physical actions. Were the slide, valve, or lip motion to be isolated and performed solo, the extracted material would not be identical to the same action executed in the context of the piece—all of the resistances, interferences, and amplifications that result from the inter-relationality of these polyphonic gestures are indivisible from each individual strand of action. Were other parameters, say voice, to be layered on top of what we see here, the result would again be altered, irrespective of the precision of each independent parameter. The haecceity of the piece emerges from the entanglement of these particular actions. Finding the particular and distinctly individual dialogue of the physical actions in this piece is the performer's practical challenge, wherein they cultivate the haecceity of the piece in order to subsequently reap its emergent materiality.

In addition to the slide, lip, and valve actions that constitute the bulk of the notation of *Because they mark the zone*, there are actually several further parameters notated, as well. They lurk slightly on the periphery because they are more obvious: namely, the dynamics and character indications, many of which are extremely descriptive. From the performer's perspective, after struggling with such precise and occasionally overwhelming control over so much of the physical performance of the instrument, how is there room then for interpretation? After relinquishing control over so many fundamental aspects of technique, how can they effect the difference between 'frail, embarrassingly awkward' and 'mangled, inelegant'; between 'increasingly focused, collapsed' and 'flabby'? (Cassidy, 2008a, p. 1) By focusing on the interaction of these physical components as a path towards the haecceity, the detailed notation is not an obstacle to interpretation, but rather a means to access the language of the piece that, in fact, allows for interpretation to emerge. Pursuing idiomaticism leads the performer to surrender to the motion within the piece, and to develop an intuitive sense for the types of motion and physicality it requires. The composer's control over such fine nuances of physical technique do not preclude character and interpretation, but rather necessitate it: the physicalization of the piece demands the interpretative collaboration of a live performer.

Orienting a learning method towards this concept of haecceity leads inevitably to redefining how one judges success or failure in interpretation. A performer naturally desires some barometer by which to track their progress, but with a learning method so dependent on polyphonic byproducts, which emerge from extra-notation collisions of physicality, how can we judge our progress? What is precision in this case? What is an idiomatic or successful performance?

To be able to play this piece precisely, or to even feel comfortable striving towards precision, requires intuiting or learning its haecceity: to come to terms with the individuality and thisness of the notation; to access the strata of physicalized actions and how they create a unique set of interactions; to embrace and embody the interdependency of all the interwoven physicalities of each piece. Cassidy's notation subtly moves beyond simple questions of pitch and rhythm, and precision begins to reside less in the destination points of an action than in the inter-relationalities it builds as action coincide. For example, the speed and shape of the slide arm in relation to the valve depression and

the lip tension demands a type of precision that is not so intimately connected to the question: was the resultant pitch on the downbeat of measure 11 exactly middle C? This can be counter-intuitive to a classically-trained performer (it certainly was to me, at first!), but ultimately, engaging with this idea of haecceity—the unique physical vocabulary of each piece—leads to an idiomatic rendering of a piece, as opposed to a purely denotative execution of gestures.



Aaron Cassidy: *Because they mark the zone where the force is in the process of striking*, m. 11

So what does that mean in reality? In this example, rather than aiming for middle C in measure 11, I am actually focusing instead on creating appropriate relations of velocity and directionality between the different physical strata. I am interpreting the notation as sets of relationships, not isolated points of arrival. Deleuze and Guattari describe this as relying "not on points or objects but rather on haecceities, on sets of relations" (Deleuze and Guattari, 1987, 382). The relations determine the motion, and the resultant pitches are exactly that: resultant. I could mark various reference points and strive to hit middle C as I approach measure 11, much like a telephone pole supporting a wire stretched across it. However, this kind of interpretation misses the piece's underlying haecceity, which rests in the relationships between the actions. It emerges from the way that they intersect with each other and thereby creates both the performative physical vocabulary but also the resultant sonic vocabulary of the piece. Deleuze and Guattari discuss haecceities as topologies, in opposition to geometries and geometrical rules: this is the difference between a pure circle, which is a geometrical rule, and round objects in the world, each of which is circular in its own individual and irreproducible way. A geometrical precision requires the plotting of individual points and the subsequent explication of their relationship functionally, graphically. The haecceity requires a topographical precision, which has less to do with the reproducible placement of a particular point, and more to do with the precision of its placement within a plane of motion, within a shape. This fundamental shift in what constitutes precision is essential to interpreting precision within the context of a piece that relies so heavily on a polyphony of physical motions. It is a precision that not only coheres within constant motion, but actually requires it. Deleuze and Guattari write, "it is not … a question of extracting constants from variables but of placing the variables themselves in a state of continuous variation"(Deleuze and Guattari, 1987, p. 369). Returning to my very first observation at the beginning of this section, a composer's notation is a hugely important window into a piece's haecceity. In this case, if the pitch is as relativized and the slide motion as intricately notated as they are in this case, it should be obvious that these elements of movement, momentum and interactivity are critical to the piece in a way that isolated pitches are not. The interrelationships of these continually shifting variables are the most fundamental and basic structure of *Because they mark the zone*. The continuity of motion and the polyphony of physicality are foregrounded, while the destination points of specific harmonic gestures are resultant. An idiomatic interpretation of the piece has to integrate this into both the learning method and the fundamental instrumental practice that the performer develops. One has to explore these motions until they become a self-sufficient vocabulary,

which can be achieved by following the lines of motion and learning broader vocabularies and inter-relationalities from them. Practicing this means not just capturing a specific moment, but learning how to create and interact with a type of moment. One follows between the lines in search of this performative materiality. Being precise means exactly this. It is the discovery of a haecceity.

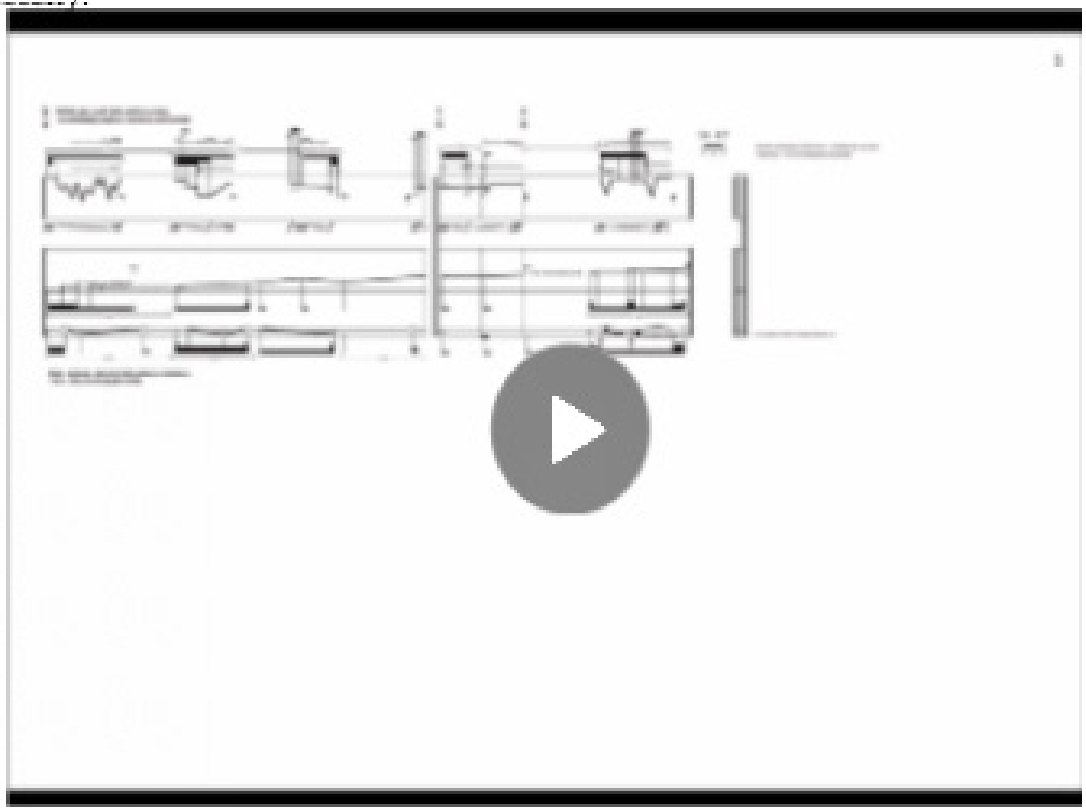
Of course, haecceities do not apply only to interpretation and notation. I have used the concept here as a means to develop specific learning strategies and interpretive priorities in physically polyphonic scores, but the concept itself is much richer than that. It can elucidate any manner of polyphonic assemblage, involving potentially not only a performer or a notation, but also locations, audiences, or even social contexts. In the case of Cassidy's score, these ideas can also help to examine some of the potential difficulties in presenting such pieces in performance. Its flurry of virtuosity can seem to prioritize the communication of effort over accuracy, especially to those performers or audience members who bridle at the fact that not all complex rhythms are immediately audible as such. In *Because they mark the zone*, the intermittent and prolonged freezes also add a layer of theatricality, further obscuring the purely harmonic and rhythmic complexity of the work for audiences. A performer may be confused by the seeming incompatibility of gestural theater and textual precision, especially when it comes to public performance situations. In the general discourse, too, it is unfortunately all too easy for discussions of interpretation and reception to center around the opposition of these elements: impossibility subverting notatational detail; theatricality undermining virtuosity; effort overriding control. Musicological analysis can at times be susceptible to exaggerating these fault lines, although in recent decades this has been increasingly accompanied by attempts to open up analytical tools to accommodate these disparate elements. Among other potential applications of haecceitas is its utility as a tool for assimilating these superposed elements rather than placing them in interference to one another. Effort and control are not contradictions, nor does theatricality preclude the foregrounding of rhythm or harmony. A performer unsure of how to embrace the seemingly conflicting logics of these coexisting musical elements can use these same learning strategies to guide broader interpretive questions, finding ways to present a piece like Cassidy's that seeks to enfold these rich contaminating musical possibilities into one another. Haecceitas provides tools to discuss these polyphonic interpretations analytically, as well as to open up the possibility to view the piece in even larger contexts beyond the concert stage. These sorts of scaled-up perspectives will be examined more closely through other concepts later in the chapter.

The questions of precision posed by physically polyphonic scores and their relationship to musicological analysis also open an old debate about prescriptive and descriptive notation, and how accuracy can be defined in each case.[24] I am proposing that there is a way to foreground the relations of prescriptive actions as a meaningful interpretation of accuracy. Although much historical music notation is in fact a hybrid of prescriptive and descriptive notation, most traditional notation tends to fall into the latter category, since it indicates intended harmonies and rhythms (hence, descriptive) more often than specific physical descriptions of how they should be articulated (prescriptive). As such, purely prescriptive notations such as Cassidy's appear as relative late-comers to the field (although, of course, early tablature notations would belie this oversimplification). In this context, a return to Scotus's philosophy can provide an alternative view of the relationship between prescription and description, and the role of choice in embarking upon action versus envisioning intent. He makes a distinction between two types of choice: "A choice$_1$ is any act of the will that follows the intellect's act of full apprehension, i.e. an act of the will that is carried out neither in a state of ignorance nor in a state of emotional perturbation. A choice$_2$ is a choice to *do* something, or, as Scotus says, an *efficacious* choice" (Pini, 2013, p. 75, emphasis in original). Scotus refers to the first class

24 Charles Seeger (1958) first introduced the words prescriptive and descriptive, and the opposition or balance between these two ideals of prescriptive or resultant notation have been a recurring theme in musicological discourse ever since.

of choice as a wish, which is analogous to a descriptive notation, marking an intended or wished-for result. The latter class of choice, efficacious choice, is instead a mere embarking-upon-an-action, prescriptive in its intention rather than predicated on teleologies. The wishful choice maps more accurately onto our normal conception of choice in everyday language, as well as onto traditional descriptive notation. And yet, Scotus finds that efficacious choice, in its reliance on instantiated action embedded in the world, avoids the pitfalls of teleological misapprehension.[25] By predicating an action on a predicted or intended outcome, there is in some way a greater chance of miscalculation or perversion, which Scotus sees as less possible in the more immanent nature of an efficacious choice. From a musical perspective, as criteria for judging precision are questioned by pieces like Cassidy's *Because they mark the zone*, it can be useful to return to Scotus's philosophy in order to embrace the simplicity of efficacious choice. The haecceities—the relations and entanglements of actions—produce precision, in contrast to a learning strategy that attempts to approximate or tend towards a limit of accuracy set out wishfully by a descriptive notation. And in particular, as inheritors of a Western tradition that has tended to prioritize descriptive notation (i.e. wishful choice), it can be valuable to embrace what Scotus views as the more immediate and simple value of efficacious choice—the efficient and straightforward embarking-upon-action.

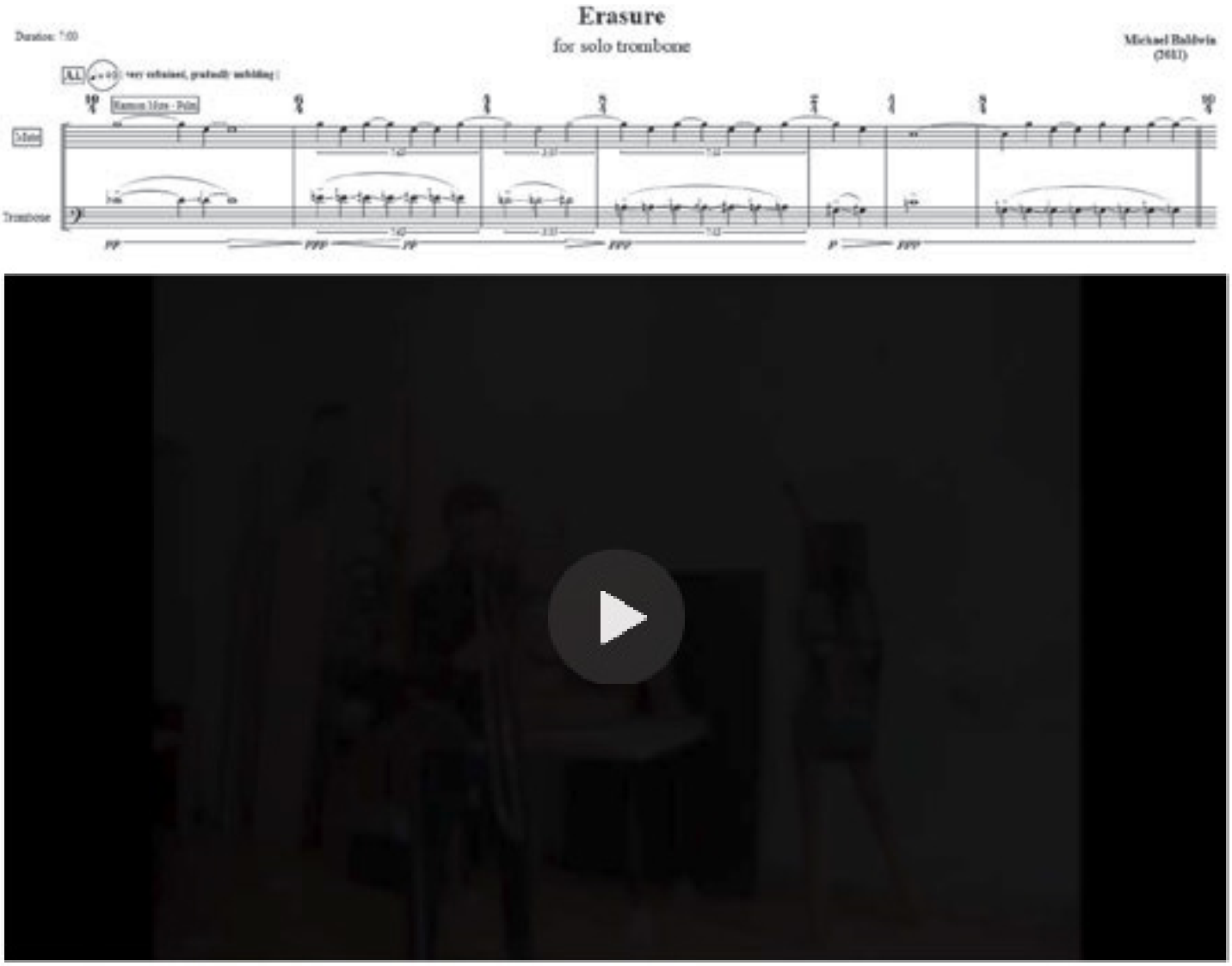
Eventually, prescriptive notations such as these become inviting, welcoming, even if many performers do not experience that in their first encounters. The haecceity of the piece is like a personality, in the end, and it is the key to a performer's ability to intuitively interact with the notation, to confront the often extreme performative demands and thereby collaborate on the realization of a unique and interesting phenomenological document: the eventual performance of the piece itself in real space and time. The piece demands that you learn not just its denotative gestures, but even more so its identity and individuality. The performance of the piece is a presentation of the history of learning the piece. It can become a document itself bearing the history of encountering—and embracing—a piece's haecceity.



25 At the risk of belaboring the point, one can note that it is wishful choice that Scotus identifies as the source of the first evil choice, that of Lucifer to (attempt to) rival God. Were Lucifer to have attempted this as an efficacious choice, it would have been the result of a great misapprehension, of which a perfectly reasonable being (i.e. an angel in a Scholastic worldview) would be incapable (cf. Pini, 2013).

2.2 Agential Realism and Michael Baldwin's *Erasure*

I. Position 1



How does *Erasure* sound?

How does *Erasure* transform from a set of potential notations, motions, ideas, and intentions into the piece that is heard as *Erasure*? How is it that the sound—as a physical, actualized event—and the relationships between that sound and the litany of agents surrounding it spatially and temporally become a crucible for the coming-into-being of a piece of music? In *Erasure*, these webs of interaction are laid bare. Baldwin incorporates into the body of the work all of the fragility of the interconnected physical and mental processes that form the core elements of the production, or realization, of the piece.

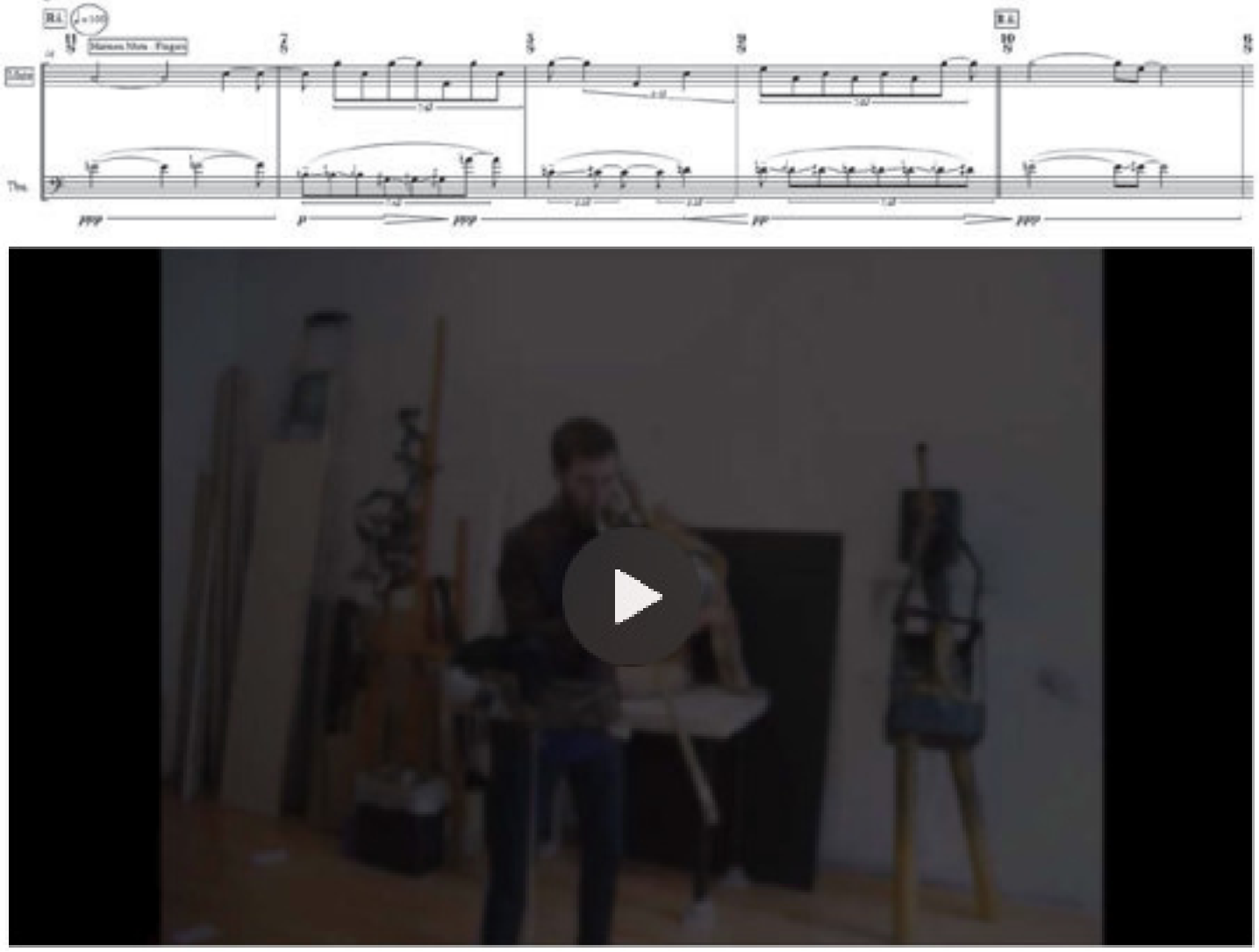
How, then, does *Erasure* sound? To begin: what does it sound like? The opening gesture: a thin note in the upper register of the trombone that creeps into audibility, slowly and subtly modulated by the performer's palm on the wawa mute. In the first position of the piece, these minor fluctuations of palm movement constantly modulate the formant content of the slow, microtonal glissandi effected by the performer's embouchure and slide arm. These subtle changes in overtone content are layered over the constantly shifting microtonal texture of pitches, obscuring and alienating the audible piece from the clear and complex metrical and rhythmic notation that guide the performer's

traversal of this sonic topography. The precise notation metamorphoses into a shimmering mirage of formant and microtonal waves superposed over each other, flickering in and out of each other's shadows, alternately reinforcing or obfuscating each other's gestures in constantly shifting balances of influence.

This interplay of influences, audibly appreciable, is an intrinsically physical phenomenon. The actions notated by Baldwin are physically dissociated, and theoretically removed from each other. Yet superposed and performed within the single body of the performer and their prosthetic instrument, these actions are in constant relation to each other. Static actions become immediately complex situations of constant fluctuation in the context of the holistic physicality of the performer: as noted, a single unaltered pitch constantly undergoes transformation by the superposition of the wawa mute-cum-filter. In later positions, as further parameters are introduced and more complex actions are prescribed in the score, these elements become ever more apparent. The air stream is constantly modulated by other actions, such as the mute (both wawa and cloth), valve, and slide motions, and the resultant interplay is increasingly foregrounded in the audible musical material as timbral, pitch, and dynamic changes. These qualities of transformation effected by air resistance and other concatenations of physical events are, of course, present in any similar trombone-playing situation, but what distinguishes *Erasure* is the extent to which these elements, conventionally minimized or overlooked, are allowed to command aural and theatrical presence as the loci of attention and centers of musical evolution. Indeed, the piece as conceived by Baldwin takes the resultant aural transformations inherent in these physical superpositions as its primary musical material. The web of dependencies and affects present in the overlaying of these physical gestures constitutes, through their notated dissociation and physicalized reencounter, the essential aural material of the piece. The extremely soft dynamics and relatively subtle visual gestures that characterize *Erasure* encourage the allocation of prominence to these otherwise easily overlooked (or overlistened) aural textures.

In this sense, then, *Erasure* sounds through the superposition of waves of activity, ostensibly quasi-independent though in constant interference with each other. *Erasure* begins to sound in the moment of intersection of these disparate but inseparable strands of physical material, interwoven into the constantly transforming aural material of the piece. This web of interference, referenced in the title as erasure, can also be constructively conceived through a variety of other theoretical tools. Donna Haraway's conception of diffraction, in particular, assists a productive reading of Baldwin's work, and Karen Barad's own diffractive reading of Haraway alongside her agential realist ethico-onto-epistemology provide profound and useful avenues for a performative analysis of *Erasure* and its materialization as a sounding phenomenon.

II. Position 2



Barad, following Haraway, proposes diffraction as a concept in direct opposition to reflection, and by extension, to an inherited Western tradition of binary oppositions. Scientifically, "Diffraction does not produce 'the same' displaced, as reflection and refraction do. Diffraction is a mapping of interference, not of replication, reflection, or reproduction. A diffraction pattern does not map where differences appear, but rather maps where the *effects* of differences appear" (Haraway, 1992a, p. 300). Theoretically, this also liberates objects or events from being analytically tied to one-to-one relations and simplistic semiotic representations, as is the case in much musical analysis. For example, rather than seeing the relationship of notation to a physical performance as a direct translation, that is, as a one-to-one reflection or representation of a set of denotatively prescribed actions, a diffractive reading allows for the possibility that the two events, notation and performance, are both related and in cooperation and interference with one another, with the performance "mapping" these interferences between the notated and physical aspects of a piece. The traditionally hierarchical relationship between notation and physicalization is problematized by Barad's proposal of performativity, which uses this concept of diffraction to liberate actions and things from a reflexively consequential reading:

> A *performative* understanding of discursive practices challenges the representationalist belief in the power of words to represent preexisting things. Performativity, properly construed, is not an invitation to turn everything (including material bodies) into words; on the contrary, performativity is precisely a contestation of the excessive power granted to language to determine what is real. Hence, in ironic contrast to the misconception that would equate

> performativity with a form of linguistic monism that takes language to be the stuff of reality, performativity is actually a contestation of the unexamined habits of mind that grant language and other forms of representation more power in determining our ontologies than they deserve. (Barad, 2003, p. 802, emphasis in original)

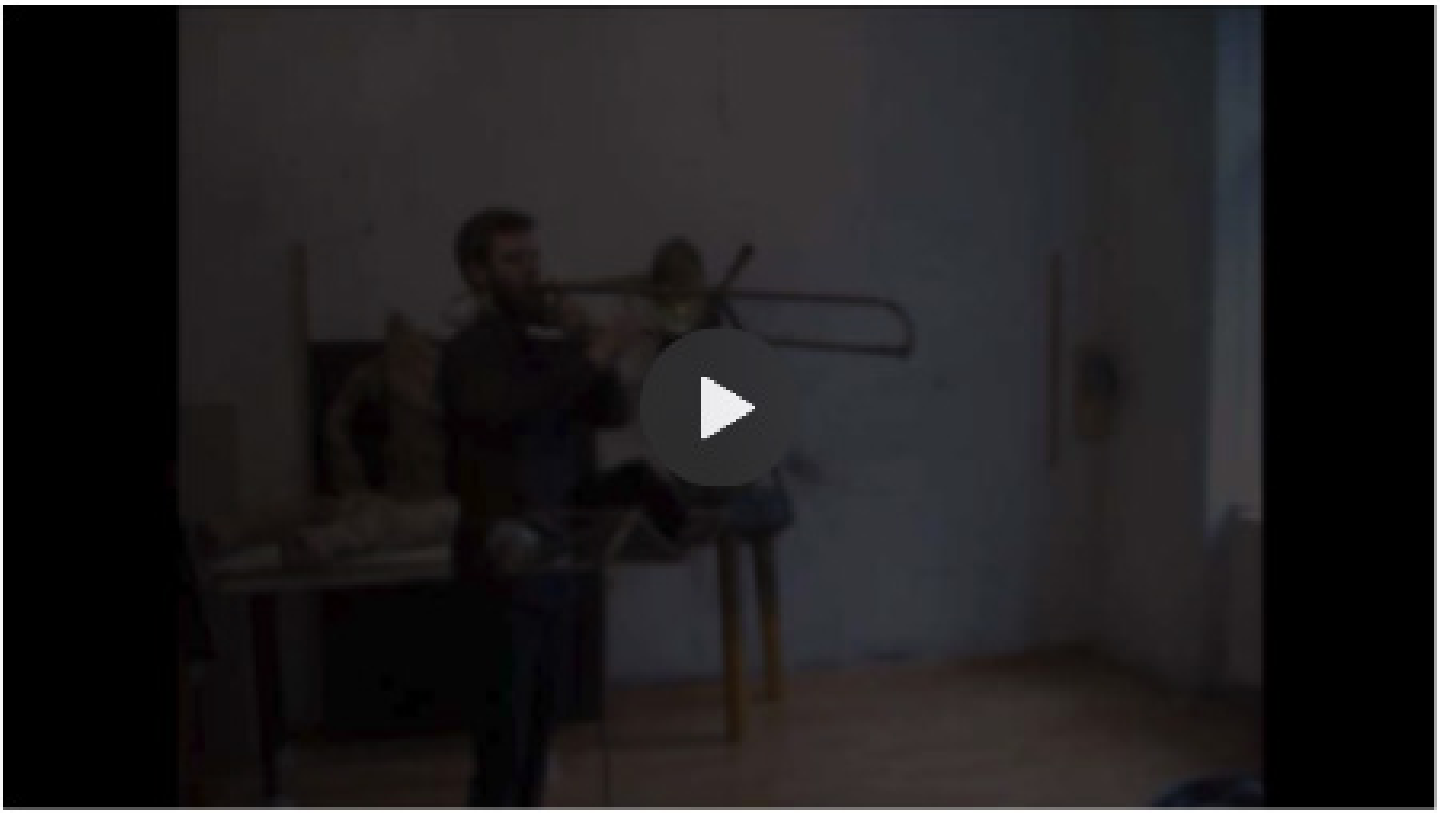
Ideally, wresting control from language (or in musical analysis from notation) does not constitute an attack on language or discount it from mattering as a potentially crucial element within a web of diffractive interferences. It does, however, constitute a deprivileging of the linguistic and notational habits that underlie a hierarchical relationship between composer and performer, instrument, listener, or other agents. All of these agents are involved performatively, i.e. actively within the spatio-temporal constraints of a particular version of a piece. This runs the obvious risk of exaggerating some minor agents' role in the piece, and yet is also a profoundly necessary corrective to more traditional, representationalist hermeneutic methodologies. As Barad emphasizes, "First and foremost, as Haraway suggests, a diffractive methodology is a critical practice for making a difference in the world. It is a commitment to understanding which differences matter, how they matter, and for whom. It is a critical practice of engagement, not a distance-learning practice of reflecting from afar" (Barad, 2007, p. 90). What is most crucial, then, is the heightened commitment from performatively engaging with a piece. The traditional composer-performer and score-performance dichotomies atrophy responsibility, allowing for a simplistic and reductive representationalist methodology that hinders the recognition of other agents that effect interferences and differences within a piece. Barad's "commitment to understanding which differences matter" is an invitation to use the theoretical model of diffraction to reveal and examine the complex set of relationships and interdependencies that contribute to the materialization of any phenomenon, musical or otherwise.

Barad's agential realism applies this diffractive methodology to understand how matter comes into being. It is a scientific account of quantum reality, the exposition of which leads her to coin the term *intra-action*, which highlights the interdependency of agencies within the localization of phenomena as critical aspects of the coming-into-being of things.

> The notion of *intra-action* (in contrast to the usual "interaction," which presumes the prior existence of independent entities/relata) represents a profound conceptual shift. It is through specific agential intra-actions that the boundaries and properties of the "components" of phenomena become determinate and that particular embodied concepts become meaningful. A specific intra-action (involving a specific material configuration of the "apparatus of observation") enacts an *agential cut* (in contrast to the Cartesian cut—an inherent distinction—between subject and object) effecting a separation between "subject" and "object." That is, the agential cut enacts a *local* resolution *within* the phenomenon of the inherent ontological indeterminacy. In other words, relata do not preexist relations; rather, relata-within-phenomena emerge through specific intra-actions. (Barad, 2003, p. 815, emphasis in original)

The implications for music are clear: entities do not preexist the relations by which a phenomenon (piece of music, performance) comes into being, or as Barad phrases it, comes to matter.

III. Position 3



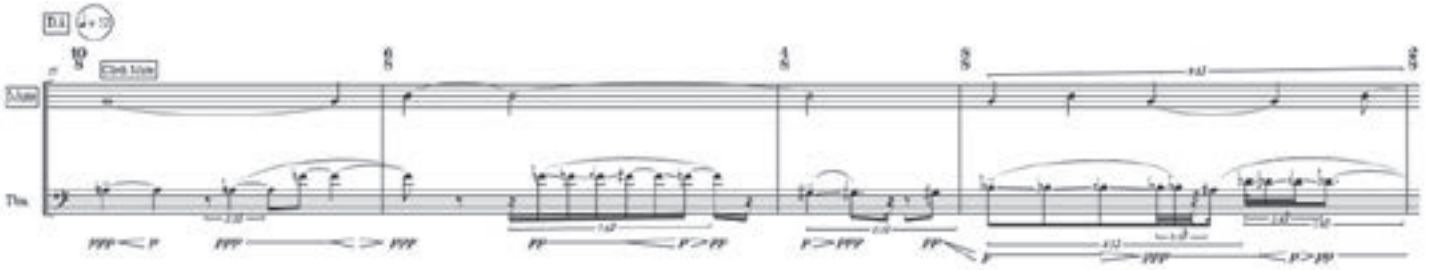
For Barad, the reappraisal of the world in terms of phenomena as opposed to independent objects is a *sine qua non* feature of agential realism. She posits that "[t]he primary ontological unit is not independent objects with inherent boundaries and properties but rather *phenomena* … phenomena do not merely mark the epistemological inseparability of observer and observed, or the results of measurements; rather, *phenomena are the ontological inseparability/entanglement of intra-acting 'agencies'*" (2007, p. 139, emphasis in original). Objects, then, are entangled, and they emerge from their intra-action within phenomena, rather than *vice versa*. Barad conceptualizes this as "exteriority-within-phenomena," (2003, p. 815) indicating the clear and obvious capability of the participant and observer to distinguish elements and agencies while still acknowledging that they are part of a reality created immanently in and through their intra-action. This immanence is a consequence of a quantum reality, first theorized decades ago in the work of Niels Bohr and slowly being confirmed experimentally. Transferring the implications of quantum reality to the dimensions of the observable, everyday world is a slippery task, but also a necessary one. As Barad notes, the old conception that Newtonian physics holds for the macrocosmic world and quantum physics for the microcosmic is not confirmed by experimentation and observation; rather, the implications of quantum physics are often miniscule enough in the macrocosmic world that Newtonian physics is merely an aptly accurate-enough model. How, then, do we examine a piece of music in the context of these quantum discoveries?

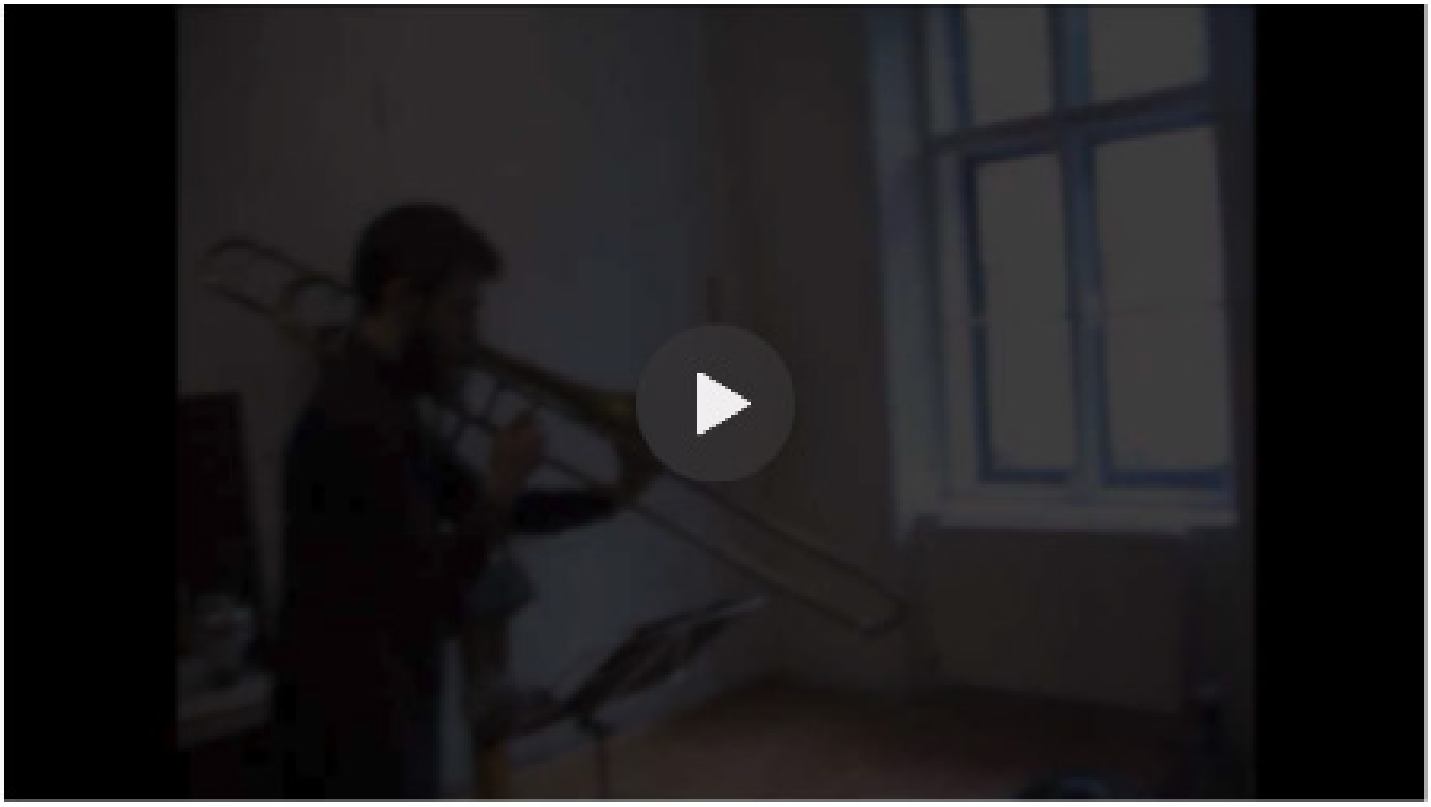
The sound of *Erasure* provides an avenue. The sound is the phenomenon that conventionally becomes understood as the communicative element of the piece. The sound, emanating from all of

the compositional, learning, productive, physical processes, is the physical phenomenon in which these agencies congeal and diffract through one another, intra-acting in the materialization of a recognizable piece of music. Examining the production of sound in the piece, the instrument and the space (as will be discussed at more length below) enlarges their respective realms of diffractive influence. Exaggerating the role of these elements often considered more ancillary or external to the act of musical production is risky, and yet *Erasure* foregrounds these elements consistently and purposefully. The instrument itself becomes a more active agent in the intra-active phenomenon of the piece largely through the dissociated actions of the mutes and valve, which are, as was previously demonstrated, constantly modulating and metamorphosing the sound waves produced by the performer in the instrument. In a normal piece of music written for the trombone, the instrument is essentially a megaphone, amplifying and reinforcing the pitch produced by the performer's lips buzzing. This function is, itself, an interesting intra-active process, but also relegates the instrument to a more obviously supporting role—it is very really a mere mouthpiece for the performer. In *Erasure*, though, these roles are subtly reversed. The lips produce a buzzed pitch, and Baldwin indicates in the performance notes that "[t]he pitch stave is to be performed 'ordinary', with the mute and trigger actions altering the pitch stave. The pitch stave can be seen as the main pivot stave by which all of the other parameters act upon (sic)" (Baldwin, 2011, p. 4). Therefore, the buzzed lips are being directly affected and physically changed, not merely amplified. In position 3, the wawa mute has been discarded and the valve is constantly shifting between states of open, closed, and half-valve, with abrupt, gradual, and trilled transitions between valve positions. These valve positions radically alter not only the pitch produced, in spite of the performer's physical input into the instrument, but also alter the timbre and air resistance, and thus the entire response of the instrument.

The resultant sound waves are dependent on the instrument in many crucial ways. For example, the difference in response and resistance of the half-valve playing varies, sometimes drastically, from instrument to instrument. The aural qualities of this movement will necessarily be different with each different trombone. In conventional classical music performance, these variations from instrument to instrument are usually minimized, even when remarked upon or admitted as a factor in the overall performance quality. In *Erasure*, Baldwin has constructed an environment in which the instrument's unique characteristics can exert an agency that in some instances rivals that of the performer. In position 3, the performer's input into the instrument is largely less complex than in the previous positions, and the role of the instrument is then further foregrounded, as the valve action, although enacted by the performer, takes precedence in the resultant sound. The sound waves, although not quite quantum in scale, are nonetheless an essential expression of the phenomenon that is agentially enacted in the performance of the piece. *Erasure* maximizes the possibility for agencies often consigned to ancillary roles to become intra-actively co-responsible and responsive in the production of sound.

IV. Position 4





By opening up agential responsibility to all matter, Barad embraces a form of posthumanism, which for her entails "taking issue with human exceptionalism while being accountable for the role we play in the differential positioning of the human among other creatures (both living and nonliving)" (2007, p. 136). Accounting for the deprivileging of the human in assessing the coming-into-being of *Erasure* requires understanding the types of agency and intra-active responsibility that the nonhuman elements embody. Barad's description of the material-discursive practices that contribute to the constitution of reality allows us to understand the intricate and powerful role played by the nonhuman without unnecessarily siphoning agency or responsibility from the human actors within the process. Material-discursivity is an extension of concepts of discourse developed by previous philosophers—notably Michel Foucault, a major influence on Barad's work. Expanding this conception of discourse's role in shaping and controlling what it is possible to express or perform, Barad notes that matter itself embodies discursive properties. The material-discursive is the posthuman account of how matter shapes and transforms reality constantly and unceasingly. Every moment, every agential cut takes place intra-actively within the material-discursive: "[d]iscursive practices are not human-based activities but specific material (re)configurings of the world through which boundaries, properties, and meanings are differentially enacted. And 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).

The previous discussion of the instrument already opened up my analysis of *Erasure* to the post- and nonhuman, but *Erasure* embraces and problematizes many further facets of the posthuman, as well. Position 4, with the introduction of the cloth mute, marks the agency of increasingly distant and nonhuman elements. Foremost, the cloth mute itself exerts an even greater force of change on aspects of pitch, air resistance, and response than either the wawa mute or the valve alone. The dynamic reshaping of the pitch material in the piece by the constant and occasionally quite drastic modulations effected by the cloth mute come ever more to the fore of the piece, displacing musical and aural attention away from the trombonist and reallocating it to the mute. Further, position 4 also marks the continuation of the gradual removal of the trombonist from the audience: in live performance, the stands are placed in a semicircle, with the trombonist moving from position to position along the curve until the final position, facing directly away from the audience. (In the video performance of *Erasure* presented in this chapter, this effect is replaced by the gradual displacement of the audience itself, as both the camera and microphone rove parallel to the trombonist's displacement in live performance.)

This displacement of the performer removes the traditional focal point of attention and reinforces the visual elements of the piece, as occurs at the end of position 4 when the mute motion is performed solo, without any other activated parameters (namely, pitch production). Similarly, the sound, continuously ephemeral and soft, also changes character as the bell of the instrument moves gradually away from the audience. The location also takes on a notably active role in the piece, as the music's aural fragility renders it exceptionally susceptible to changing acoustics and ambient noise; these effects, though foregrounded from the onset, encroach more and more on the receding imposition of the trombone sound as *Erasure* progresses. The role of the mute and especially of the receptive space of the location of performance slowly become more primary containers and agents of musical content and transformation. *Erasure* opens itself up, displaying a porousness and vulnerability that invites not just the prosthetic elements of the instrument and the mute but all of the human and non-human agents present to perforate the musical process and engage intra-actively in the performance of the piece. The material-discursive becomes far more than a mere tacit force exerting control on the productive process, but is actually elicited as an appreciable musical agent of the piece.

V. Position 5

The audience, the location, and the recording devices used (as in the video presented here) all embody part of the observational apparatus, a factor hugely relevant to the world of quantum physics (in which agential realism was developed) and a major preoccupation of the philosophy-physics of Niels Bohr (another primary influence of Barad's). The role of the apparatus (experimental, observational, etc.) is difficult to understate in this context: "*[a]pparatuses are the material conditions of possibility and impossibility of mattering*, they enact what matters and what is excluded from mattering" (Barad, 2007, p. 148, emphasis in original). There can scarcely be greater power than that accorded here to the apparatus, the very agency that enacts or excludes matter, or existence. This, though, distracts from the fact that the apparatus is merely one more element that is cooperative within the diffractive interference of superposed agencies that intra-act the agential cut. By examining and expanding on Bohr's own philosophy of the apparatus, Barad arrives at several key features that reveal the apparatus's unique role in constructing reality:

> (1) apparatuses are specific material-discursive practices (they are not merely laboratory setups that embody human concepts and take measurements); (2) apparatuses produce differences that matter—they are boundary-making practices that are formative of matter and meaning, productive of, and part of, the phenomena produced; (3) apparatuses are material configurations/dynamic reconfigurings of the world; (4) apparatuses are themselves phenomena (constituted and dynamically reconstituted as part of the ongoing intra-activity

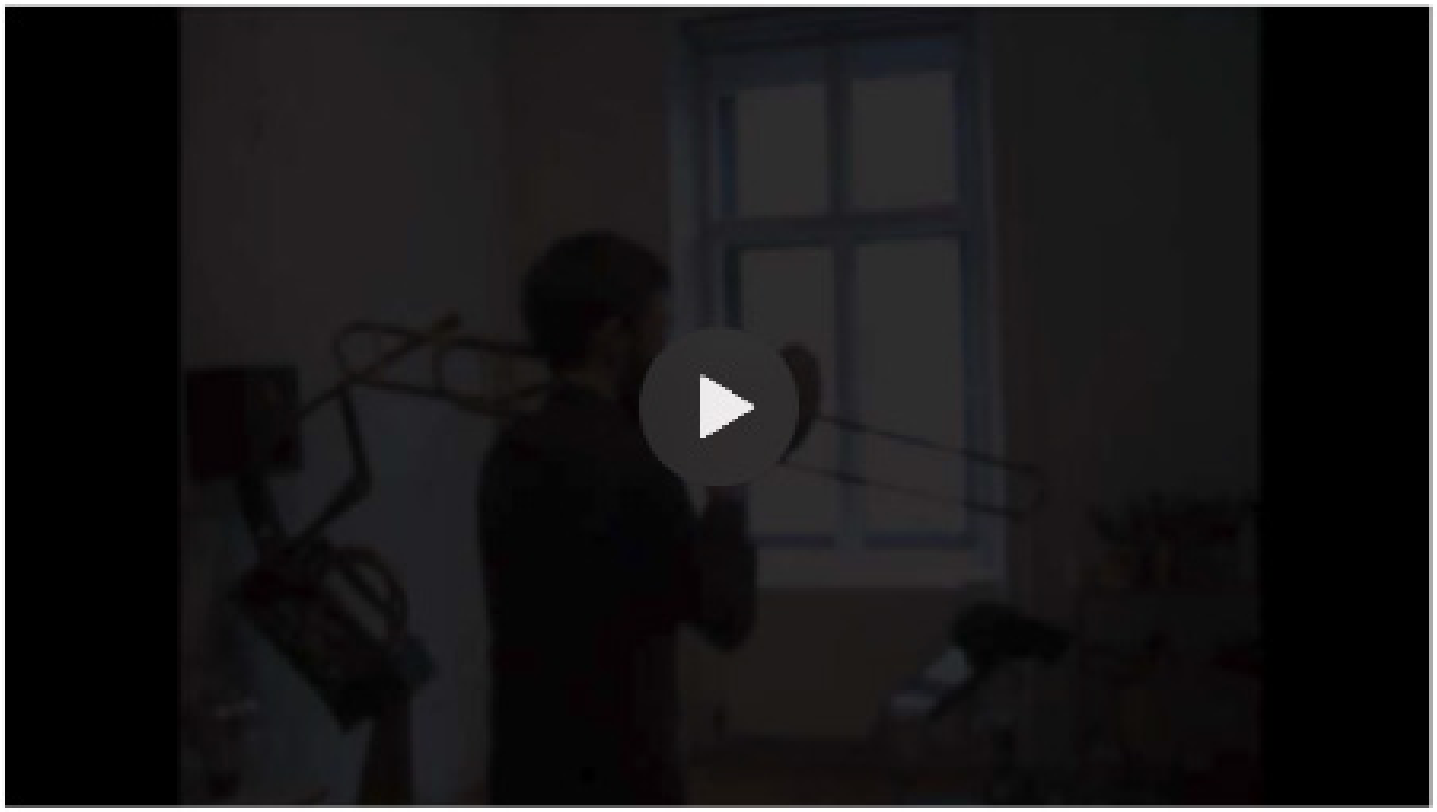
> of the world); (5) apparatuses have no intrinsic boundaries but are open-ended practices; and (6) apparatuses are not located in the world but are material configurations or reconfigurings of the world that re(con)figure spatiality and temporality as well as (the traditional notion of) dynamics (i.e. they do not exist as static structures, nor do they merely unfold or evolve in space and time). (Barad, 2007, p. 146)

The apparatus produces "differences that matter." The recording devices, and the observational capacities of the audience, are implicated in the boundary-making practices inherent in apparatuses. Baldwin's music often inhabits the ephemeral realms between audibility and inaudibility, replicability and unrepeatability, physicality and conceptualism (Baldwin, 2012). As *Erasure* progresses from position to position, these boundaries are increasingly blurred, and can only be enacted by the observational capacities of the audience and recording devices. Their agency becomes critical in the discursive act of creating what is and is not *Erasure*, in which process they become implicated even more fully in the piece itself, and not only in its reception or documentation. Barad writes,

> Apparatuses are not inscription devices … set in place before the action happens … They are neither neutral probes of the natural world nor structures that deterministically impose some particular outcome. In my further elaboration of Bohr's insights, apparatuses are not mere static arrangements *in* the world, but rather *apparatuses are dynamic (re)configurings of the world, specific agential practices/intra-actions/performances through which specific exclusionary boundaries are enacted*. Apparatuses have no inherent "outside" boundary. (Barad, 2003, p. 816, emphasis in original)

The observational agents in *Erasure* are intra-actively involved in the piece. The constant metamorphosis engendered by the superposition of physical actions leads to the ephemeral shimmering of encounter between performer, location, and observers, forcing the "external" agents to become active within the piece, a part of the agential cut and exterior only within the intra-active process of mattering in the time and space of the performance. Bohr notes precisely the spatial and temporal ramifications of the observer's activity within the materialization of phenomena. "Temporality and spatiality emerge in this processual historicity. Relations of exteriority, connectivity, and exclusion are reconfigured. The changing topologies of the world entail an ongoing reworking of the notion of dynamics itself" (Barad, 2007, p. 141).

VI. Position 6



The reconfiguring of space and time implicates not only the observational apparatuses of audiences and recording devices, but also reveals crucial aspects of the intra-active entanglement of the performer and composer. The hierarchical model of conventional composer-performer conceptions is temporally deterministic: the work of the composer exists first and, through the medium of the score, determines the role of the performer and dictates the terms of the performance. Bohr's indeterminacy undermines the very notion of determinism in this sense—the performance is a result not of temporally hierarchical relationships, but of complementary intra-active processes that encounter and interfere with one another in both temporal directions of the process, upstream as well as downstream. Baldwin, quite aware of this, writes:

> The work, and its authorial origin, is gradually evolving and re-contextualizing itself as a result of interacting with a growing number of performative forces, each of which further obscure and dematerialize the work's ontological identity. Additionally, there is an element of democratization … performers of this work play a significant role in shaping the work's trajectory and contribute to the performative baggage of each subsequent performance. Through this democratization and the ongoing dematerialization of the score's ontological identity, the work, in both a physical and aural sense, takes on a lifespan of its own. (Baldwin, 2012, p. 39-40)

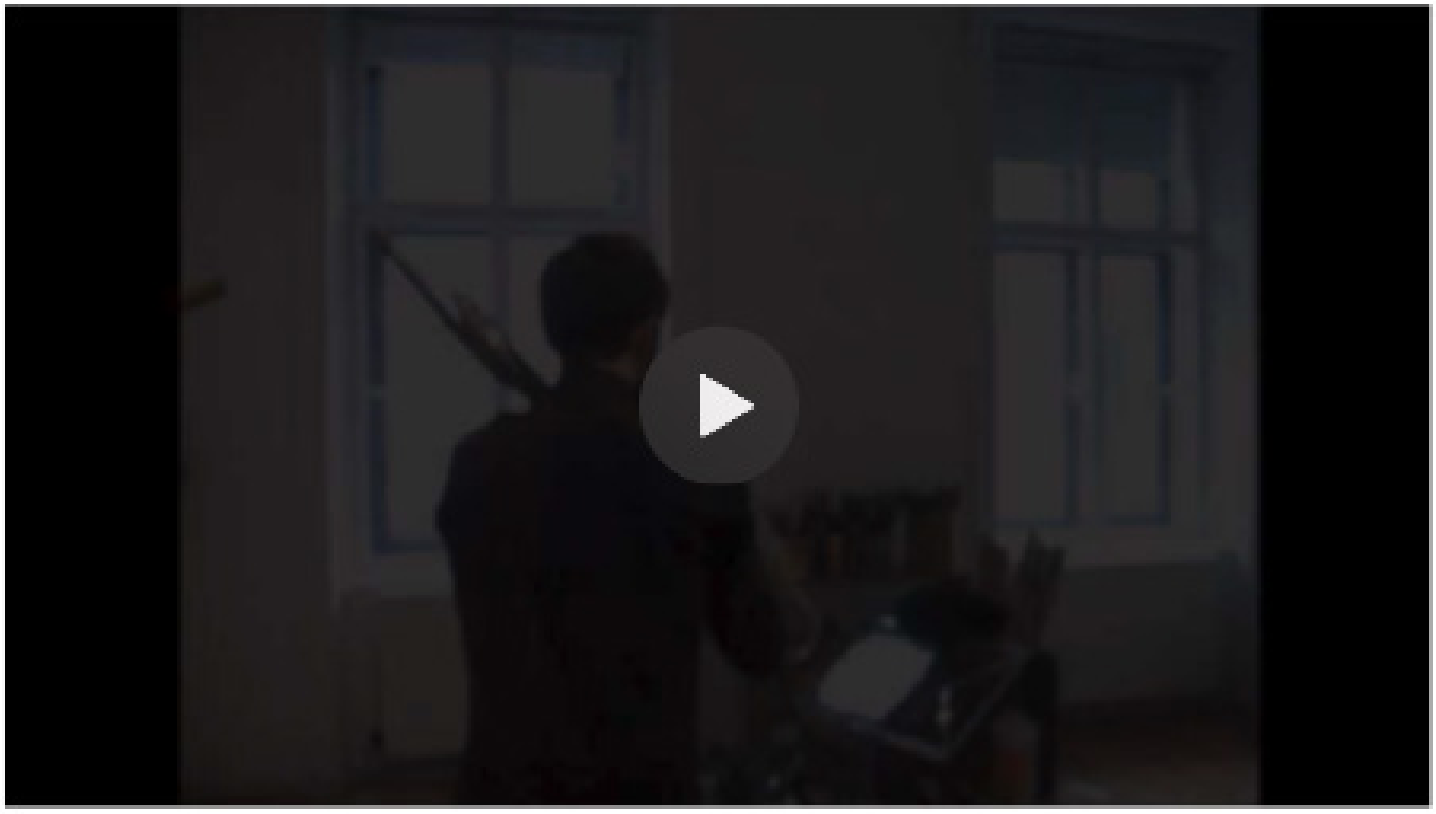
In *Erasure*, given the incorporation of the physical dimensions that transform the sound so drastically, the performer is present already in the act of conception and notation. In creating the score for

Erasure, Baldwin interacts with the physical demands of the dissociated and superposed strands of physical material even before they begin to be embodied by the performer. Baldwin recognizes that the "authorial origin" of the work is "evolving," that the role and work of the composer is altered retrospectively by its intra-action with the work or with the performer. His work is superficially a dense, complicated score of polyrhythmic, dissociated physical actions, but within that lies a more complex entanglement with the ephemeral metamorphoses that these superposed actions enact upon each other and the subtly rich role of external factors in contributing to any realization of the piece. As Barad notes, "knowing, thinking, measuring, theorizing, and observing are material practices of intra-acting within and as part of the world" (2007, p. 90). In examining *Erasure* we must add to this list composition, notation, and documentation.

The score becomes a crucial medium and agent in the intra-action of composer and performer. In grappling with the precise and challenging rhythmic and coordinational demands of *Erasure*, the performer must also engage with the composer directly. Just as Baldwin entangles himself with the physical constraints of performance as he composes the situations from which *Erasure* will emerge, performers must also entangle themselves with Baldwin's curation of that physicality. In coming to terms with the challenges of the piece, it becomes necessary not only to learn the denotative execution of its precisely-notated actions, but also to embody its vocabulary of physical activity and sonic metamorphosis. There is far more to *Erasure* than a set of gestures, something Baldwin refers to in later work as a "becoming-document:" "[b]y embracing a process of becoming-document … the human subject is increasingly capable of being composed, and thus manipulated and situated, along lines of musical thinking" (Baldwin, 2016, p. 120-1). The performer and composer are both imbricated directly in each other's work. The performer must learn to embody Baldwin's documentation beyond the level of mere execution if the resultant sonic language of the piece is to successfully emerge, and Baldwin must preemptively submerse himself in the performer and the performance if his demarcation of boundaries in the piece's realization are to emerge. "'[E]mergence,' in an agential realist account, is dependent not merely on the nonlinearity of relations but on their intra-active nature" (Barad, 2007, p. 393).

This, then, is how *Erasure* comes to sound. The subtle, ephemeral dynamics of the piece that emerge in unpredictable and ever-fluctuating sonic transformations are enacted intra-actively by the composer and performer in a complementary aspatial and atemporal discourse, inviting in a host of nonhuman elements in the process. The performer is situated within this web of agencies and is created herself within this agential cut. The work of the performer in preparing and realizing the piece is never solitary or external, but is consistently and palpably codependent on other agents in every facet of realization. "Intra-actions effect what's real and what's possible, as some things come to matter and others are excluded, as possibilities are opened up and others are foreclosed. And intra-actions effect the rich topology of connective causal relations that are iteratively performed and reconfigured" (Barad, 2007, p. 393). It is only within and through this entanglement of agencies that the sound of *Erasure* emerges. The sound is the phenomenon of diffraction enacted and intra-acted performatively and created audibly, perceptibly, and consequentially in the world.

VII. Position 7



Embracing this "rich topology" is the first step for a performer in approaching this piece. Recognizing the complex web of intra-actions that enable this piece to come into being entails recognizing the responsibility that comes with being a crucial and irreplaceable agent within that process. It means recognizing that these agents all bleed into one another, cooperating and interfering diffractively. Barad insists that

> edges or boundaries are not determinate either ontologically or visually. When it comes to the "interface" between a coffee mug and a hand, it is not that there are x number of atoms that belong to a hand and y number of atoms that belong to the coffee mug … what one sees is not a sharp boundary between light and dark but rather a series of light and dark bands—that is, a diffraction pattern. (Barad, 2007, p. 156)

Herein lies Barad's insistence that the ontological and epistemological ramifications of agential realism are also, necessarily, ethical. She reminds us that

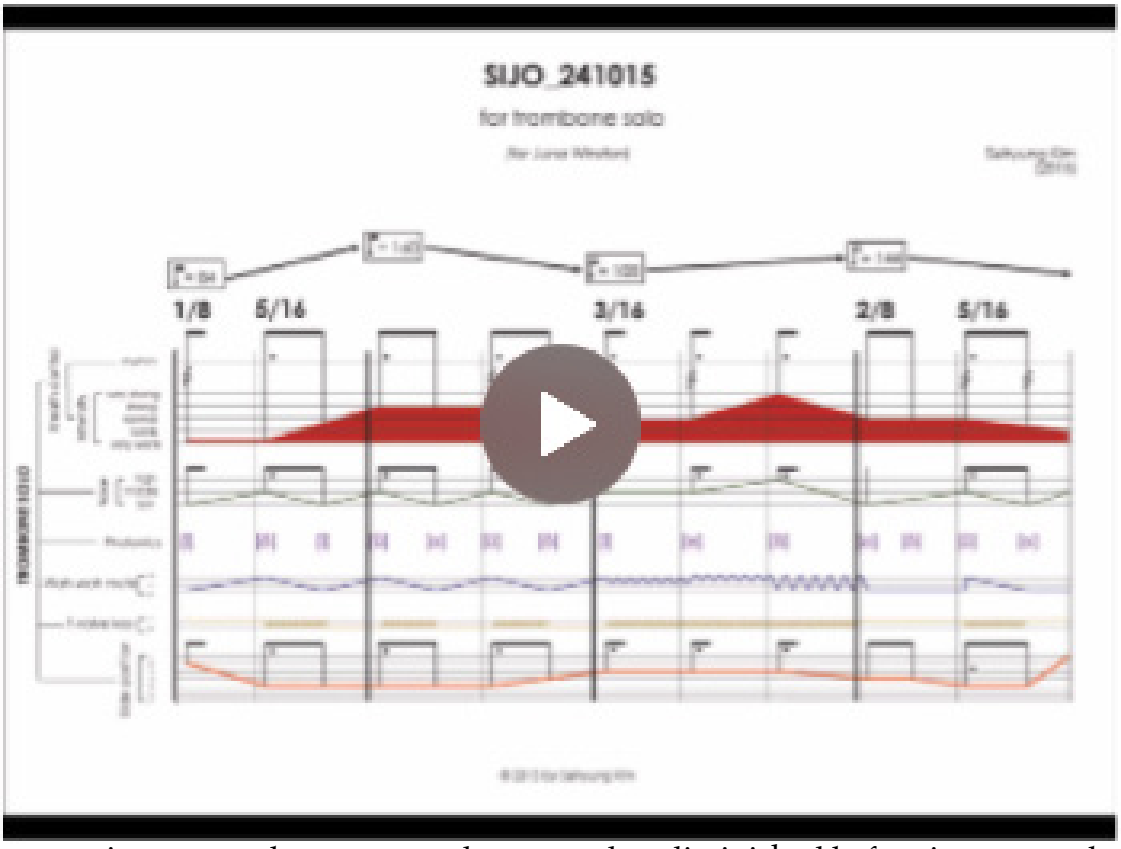
> consequentiality, responsibility, and accountability take on entirely new valences. There are no singular causes. And there are no individual agents of change. Responsibility is not ours alone. And yet our responsibility is greater than it would be if it were ours alone. Responsibility entails an ongoing responsiveness to the entanglement of self and other, here and there, now and then. (Barad, 2007, p. 394)

As performers, Barad considers our obligation to act responsively and response-ably to the agents that surround us as an ethical one. In approaching *Erasure*, a performer must engage with the whole system in which *Erasure* emerges, and that means that from the first moments of slowly embodying the complicated rhythmic motions of the piece, the performer must engage responsively with the entire network of composer and situation with which she is codependent. It is impossible to accurately or precisely embody the prescribed actions of the piece without first and foremost approaching and engaging this web of intra-actions.

Baldwin himself recognizes this, writing that "there is a certain degree of responsibility towards the subjectivity of musicking bodies that I consider when treating human persons as scores" (2016, p. 120-1). He acknowledges that in the process of creation, notation, and even conception, there are already complex implications for the other agents entangled in the work. The performer must meet Baldwin within and engage with the piece constructively. The responsibility of embodying the complex physical superpositions that create the unique and fascinating sonic world of *Erasure* requires that the performer engage principally with those gestures as a holistic system, as part of a larger web of intra-activity. At that point, the execution of the piece and its precisely layered actions become a fluid act, a dynamic entanglement in which the gestures and sounds of the piece emerge, rather than being merely executed. In this final movement of the piece, position 7, as the trombonist is turned fully away from the audience and playing with a practice mute, this fluidity is most concretely embodied. Layered over the fluttering valve motions, in a metrical grid that has underlaid the piece from its very first measures, the trombonist alternates singing and playing as seamlessly as possible. The varieties of sound production diffract through the valve, mute, and situation, melding one into the other and erasing distinctions. The erasure of aural identity and subsumption of superposed techniques in this passage embodies *Erasure*'s total entanglement of creative processes: compositional, performative, bodily, mental, theoretical, situated. In *Erasure*, the intra-active demands and responsibilities do not appear retrospectively in performance but are implicated in the very first as well as final moments of creation and coming-into-being. Performing *Erasure* means performing the entire material-discursive network within which it materializes in the world. Whether this awareness is interpreted metaphorically or, as is posited here, as a fundamental part of the reality of the piece is ultimately unimportant. What matters is that the embodiment of the piece emerges from the performer's entanglement with the piece rather than from an attempt to be an exterior or independent actor. Barad writes, "There is no such exterior position where the contemplation of this possibility makes any sense. We are of the universe—there is no inside, no outside. There is only intra-acting from within and as part of the world in its becoming" (2007, p. 396).

2.3 Autopoiesis and Sehyung Kim's *Sijo_241015*

I. *Dramatis personae*

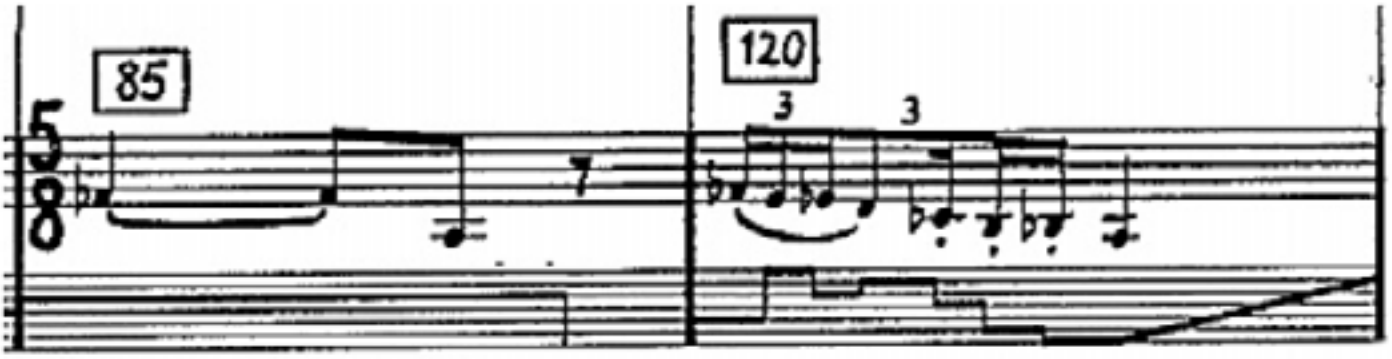


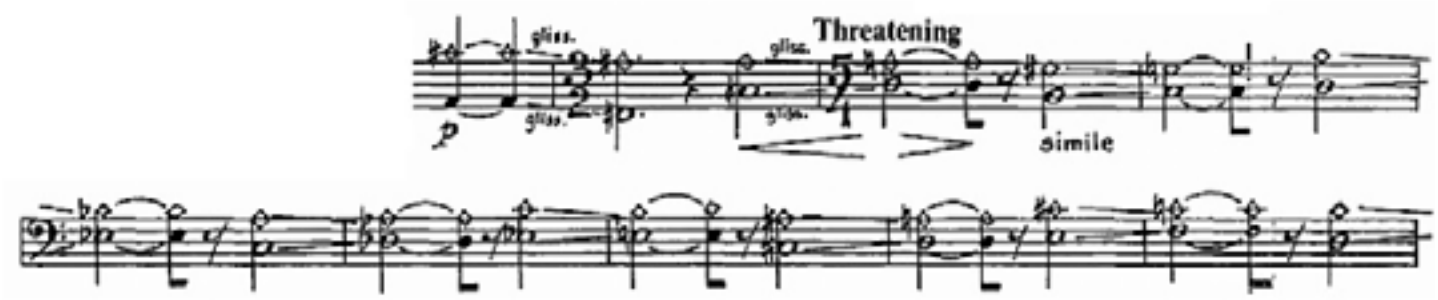
How much can an instrument be augmented, prepared or diminished before it ceases to be the same instrument? To what extent can a notation replace, exchange, and remove parameters before its internal consistency as a notation vanishes? To which extremes can a performer dissociate their physical and mental actions before their existence as a holistic performing body is threatened, perforated, disintegrated?

In a traditional performing practice, the barriers and boundaries to the edges of technique, notation, and instrumentation are sacrosanct. Even the common expression "extended techniques" states implicitly that there is a limit to normal, traditional, or proper technique, a limit that, once overstepped, is replaced or enhanced by a technique that is inherently and fundamentally other. Such characterizations of technique—bounded, delineated—plague the discussion of instrumental techniques and notations. Both technique and notation are subject to implicit assumptions about what may be normal, traditional, or proper, words which can all too easily become synonymous with the expectable and the predictable. But if standard instrumental technique or music notation is somehow bounded, and other techniques or notations exist somehow external to that standard, then where precisely are these boundaries? Attempting to accurately place these limits quickly becomes an exercise in Zeno's paradox: a limit ever more closely approached but never reached, never realized. Nonetheless, the difference between traditional and extended techniques can seem intuitively, if deceptively, clear from a casual perspective. Despite the lack of any rigorous definition in this boundary-drawing exercise, the realm of the "extended" technique and the "nonstandard" notation remain implicitly separate, quarantined, externalized.

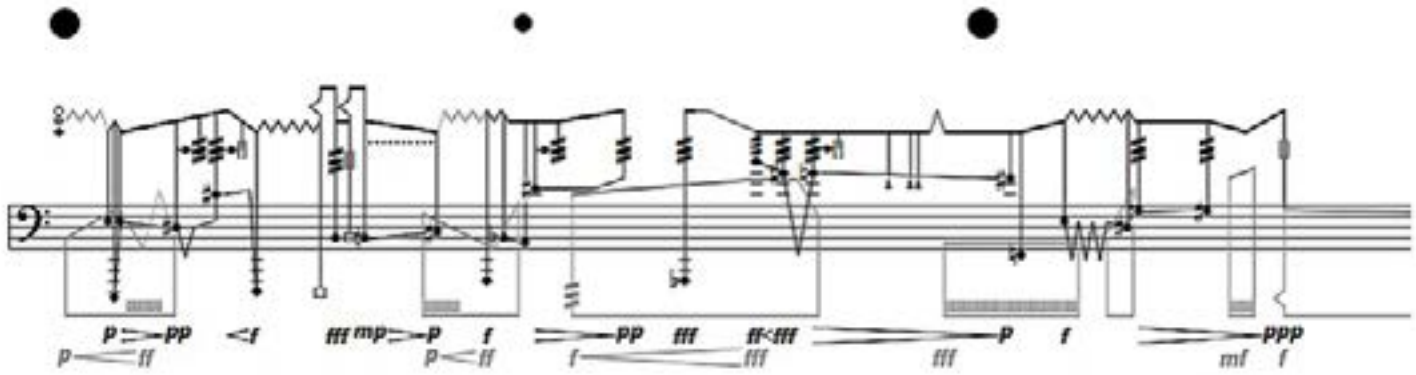
In many cases, this externalization and these implicit demarcations can be navigated with a minimum of fuss. When a performer needs to engage with a single nonstandard notation, with an extra parameter here or a graphic, descriptive element there, the demands can be relatively

easily incorporated into a traditionalist approach. Often, the traditional practice facilitates the internalization of the more standard material in a more embodied, subconscious way, thus opening up the primary foci of the performer's attention and deliberation for the less standard material. Extended techniques are often treated similarly, which is to say, as extensions applied to the traditional technique and not as truly incorporated elements. They are additions, plastered to the outer shell of technique like a layer of make-up on an actress.

Fortunately or unfortunately as the case may be, such an approach is often extremely functional. In situations where a musical parameter is separated to allow a greater degree of complexity, but remains synchronous with other (more standard) actions, it is quite simple to, after a few minutes of practice, even easily divert attention to the isolated parameter and incorporate the extra information into the general performance action.

Karlheinz Stockhausen: *Michaels Reise*, Station 3, mm. 154-155
The dynamic indications (the lower staff) are given as a separate parameter in order to facilitate rapid changes from note to note or within a note. This allows Stockhausen to achieve a very high degree of specificity in both dynamic level and placement. Stockhausen uses this dynamic notation quite sparingly and the dynamic indications are always synchronous with the played notes.

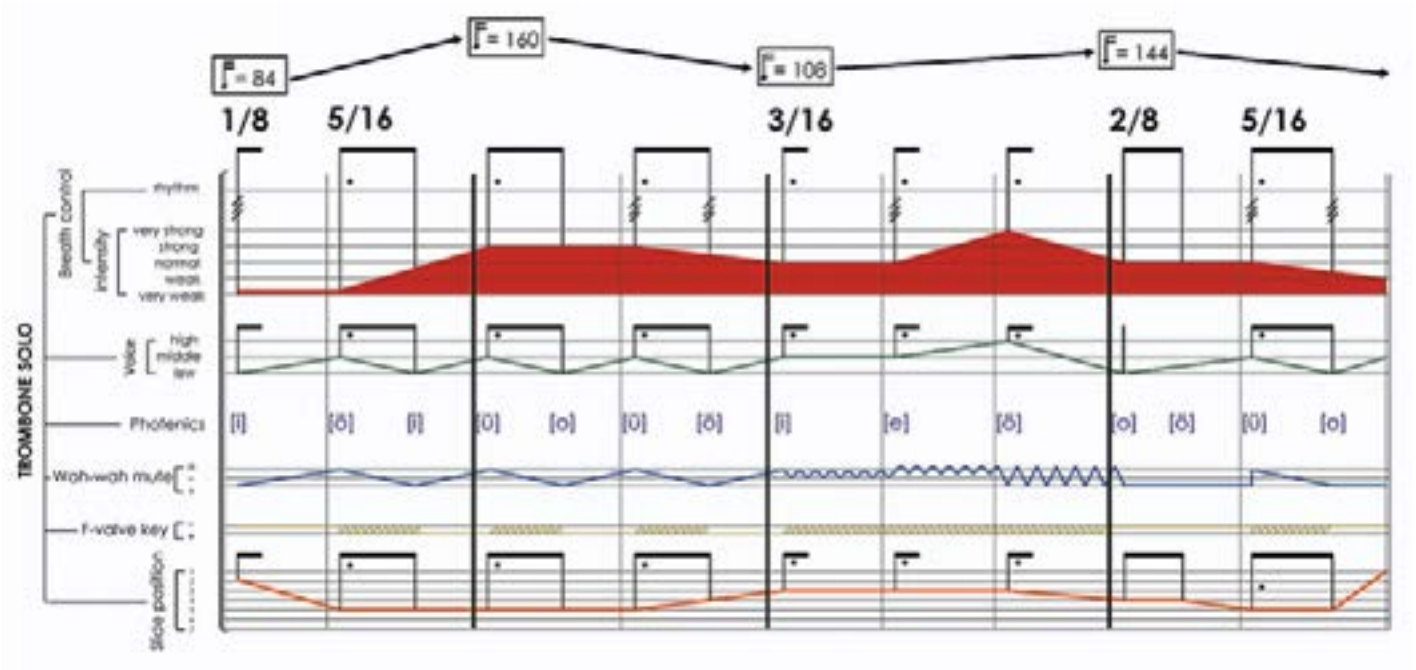
Similarly, the addition of an extended technique can often be quite easily incorporated into the general performance fabric when it is synchronized with other more standard material and can be mentally treated as an ornament or addition thereto.

Folke Rabe: *Basta*, mm. 43-51
The upper, diamond note heads indicate pitches sung by the voice to produce a multiphonic with the lower, played pitch. The sung pitches occur always synchronously with the trombone and can be seen in that respect as fundamentally ornamental, particularly given the consonant intervallic structure of the multiphonics (excluding, of course, the transitions through glissandi).

However, in other cases, the borders between notatable parameters such as played and sung notes can be obscured, smudged, or even completely burnished out. As elements become dissociated and intertwined, the learning strategy of relying on a foundational, standard set of techniques upon which the less standard techniques are layered loses its utility.



Timothy McCormack: *HEAVY MATTER*, opening
The notation indicates both played and sung pitches executed alongside a variety of other techniques (mute actions, flutter-tongue, vocal fry, audible inhalation, ingressive singing). One can see that the overlapping actions are at times asynchronous, particularly between the played and sung pitches, rendering the transformations of effect far more blurred and interwoven than in the previous two examples.

The balance of elements that may or may not be considered standard varies from piece to piece, but in the evolution of experimental repertoire over the course of the late 20th and early 21st centuries, the deprivileging of any particular set of elements becomes increasingly clear. There is a constant flux of balance between various parameters, with particular notational strategies, extended techniques, instrument preparations, and physical gestures interchangeably foregrounded, minimized or altogether excised. Sehyung Kim's *Sijo_241015* presents a fascinating range of such notational, technical and instrumental demands, combining polyphonic treatment of physical actions, constant variation of information, augmentations, and preparations of the instrument, and essentially nothing but extended techniques (with traditional tone production potentially viable, but in virtually all cases practically and effectively excluded).



Sehyung Kim: *Sijo_241015*, opening
The notation indicates tempo, rhythm, breath control, voice, phonetics, mute action, valve action, and slide position. Given the physical limitations of the performer, not all actions can be performed simultaneously and are indicated to be interchanged over the course of a performance.

The trombonist performs the piece multiple times per performance, each time with a different type of mouthpiece: bassoon, oboe, saxophone, duck call, without mouthpiece, etc. (the composer suggests those listed, but does not limit valid interpretations to these few possibilities). Kim uses reiteration as a means to provoke new explorations of the score's topography, describing it as "a kind of labyrinth, where each time the performer, no matter which way [she] is choosing, is coming to the same place" (Kim in Fairbairn, 2016, p. 4). As stated above, the eight parameters of tempo, rhythm, voice, phoneme, dynamic, slide, valve and mute are impossible to simultaneously perform. That alone is a radical departure from traditional notational strategies, and the demand that the performer engage in selecting and curating which parameters are present at which times, and thus also how they intersect and relate to one another, is a gigantic departure from norms of the Western classical tradition. Rather than performing all sets of information simultaneously, the performer is instead instructed to select different parameters for each iteration of the score, and is in fact also expected to move back and forth between parameters during and within a single iteration. Each performance consists, as previously noted, of several iterations of the score, itself quite short, during which the various parameters shift and modulate each other kaleidoscopically; sometimes as many parameters as possible are executed, while at other times fewer are engaged, as the texture of the piece undergoes constant metamorphosis. Indeed, even when a subset of parameters is performed, omitting one or several at a time, many details seem to interfere with one another, such as the relative imperceptibility of the tempo fluctuations once several other parameters are overlaid (appreciable particularly in the slower tempo passages, wherein the persistent density of musical material counteracts the deceleration). Accentuating the details of each parameter while navigating these potential contradictions present the performer with one further technical and interpretive hurdle. An initial glance at *Sijo_241015* reveals its superficial dissimilarities to standard notational traditions, but upon closer inspection, the true departure lies in the dynamic role demanded of the performer in executing this tapestry of fluctuating actions.

The instrumental technique itself is similarly dynamic and experimental. Changing from mouthpiece to mouthpiece for each iteration of the score, each different one requires a new technique and a unique and individualized practice regimen. Such foreign mouthpieces are occasionally used in late 20th and early 21st-century pieces, and have even occurred in solo pieces, but were always used fleetingly, and were never isolated from other techniques to this degree. In the most extensive previous use of such foreign mouthpieces, Vinko Globokar's *Echanges*,[26] the performer frantically swaps and changes a wide assortment of mouthpieces and mutes. But even in this instance, it is the interchanging and dovetailing of the effects that constitutes the primary notational and technical content of the piece, and not the extended exploration of particular, discrete augmentations of the trombone. For Globokar, it is the activity surrounding these changes that is given primacy; in other pieces, these foreign mouthpieces are interpolated as fragmented phrases surrounded by more standard techniques, such as in Gerard Grisey's *Partiels* (1975). In contrast, Kim's *Sijo_241015* augments the trombone with a different foreign mouthpiece in each iteration, which succeed one another musically as short movements. Although each such quasi-movement is quite short (less than one minute), this still leaves each mouthpiece temporally and sonically isolated from the others, providing space for appreciable distinctions between them. Because the trombonist is not being asked to add a mouthpiece for an isolated or transitory effect within a longer passage, as had been done before, she must be prepared to practice and to perform on each mouthpiece as an isolated, distinguishable instrument.

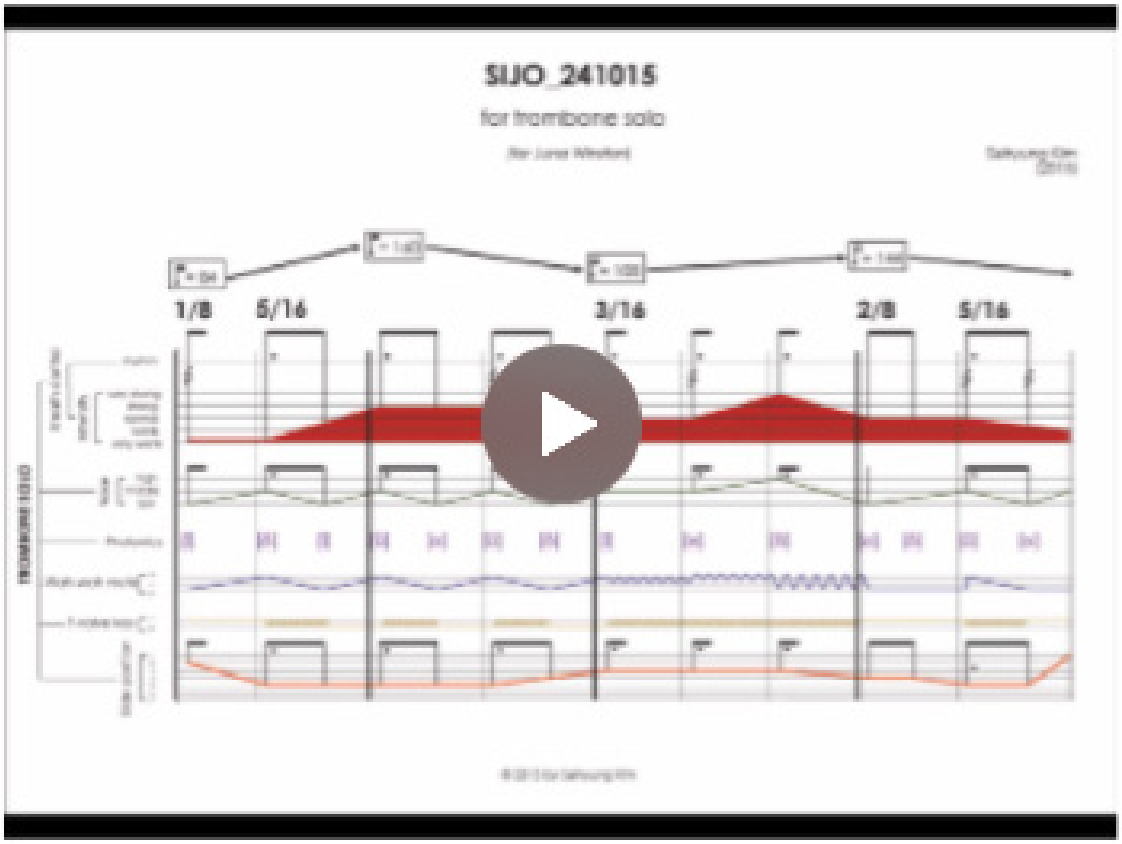
Sijo_241015 is, therefore, very much a series of solos to be performed on different instruments—trombone with bassoon reed, trombone with saxophone mouthpiece, trombone with oboe mouthpiece, and so on—each with a different technique, and each with a different preparation and

26 See 1.2 Poiesis as Musical Method.

learning strategy from the performer. Studying and learning other instrumental practices such as those of bassoon, saxophone, and oboe is already an extended technique by common definitions (see Dempster, 1979; Sluchin, 1995; Svoboda and Roth, 2018), but as these techniques' role in a piece is expanded and comes to envelope the majority or entirety of the instrumental technique required in the whole piece, the distinction between what is extended and what is not becomes increasingly meaningless. *Sijo_241015* essentially discards standard trombone technique entirely, forcing the performer to come to terms with conceptions of the instrument (and their own role in using it as a tool for sound production) that render traditional and normalized conceptions of the instrument not only useless but impertinent.

And yet, the piece is performed with a trombone, and it has a notation—a notation which is, in fact, quite Western in its presentation of rhythmic and polyphonic material. Far from being a complete and radical departure from Western classical art music, it actually satisfies many of the technical and notational expectations of that genre. Although it problematizes notation and instrumental technique, it is nonetheless still firmly placed within a field of contemporary classical music. And despite the disintegrations of traditional expectations of standard notation and technique, which force the performer to imagine and develop practice and performance strategies that answer to the specific demands of this piece, the departure is not so radical that it must be conceived and executed in an entirely new realm, by a new type of performer or a new type of artistic presentation. By no means is this the case: it can easily be executed by any trombonist willing to engage with the notational intricacies and the augmentations of the instrument. This is in itself also radical—a reimagination of the instrument and performer to an extreme that dissolves traditional expectations and techniques, and yet one that is still firmly housed within and open to performers of that same tradition. In confronting this paradox, *Sijo_241015* poses a series of questions that allow performers to reimagine their own body, practice, mind, instrument, and performance in a dynamically and radically altered context, not merely rejecting traditional strategies but rendering them locally incomprehensible.

II. Autopoiesis



Having unmoored the performer from traditional learning strategies and instrumental techniques, the question then arises, what will fill this void? Having witnessed a situation that absents or even annihilates standard interpretive strategies, is the performer then adrift in a sea of solutions in which anything and everything is valid? Or are there certain strategies that may prove more efficacious than others in assimilating the specialized demands of the situation? The responsibility lies ultimately with each individual performer to answer these questions independently—a responsibility that is equally and crucially also an opportunity—but herein I will demonstrate one such approach, one which uses a non-musical theoretical model to develop a learning strategy that can undergird a coherent approach to *Sijo_241015*, the rigors of its notation, and its varied technical demands. This theoretical model, autopoiesis, is an example of a different hermeneutic paradigm that may be incorporated into practice and performance, and as an example, is designed to show the nature of the search rather than an ideal (or single) solution.

The biologist, cognitive scientist, and cybernetician Humberto Maturana developed the concept of autopoiesis in the 1960s, first presented in *Biology of Cognition* (1970), and later with the psychologist and biologist Francisco J. Varela in *Autopoiesis* (1972) and *The Tree of Knowledge* (2008). Later publications and experiments have continued to elucidate and expand the principles and implications of autopoiesis, but the fundamentals of the concept are presented clearly and explicitly in these original works. Autopoiesis provides a means of conceiving systems of relationships that allow for the recognition and identification of unities (entities, organisms, etc.) dynamically. For Maturana and Varela, there is no established, Parmenidean truth or entity that is then engaged with the environment around it. Unities are established and maintained by the preservation of relationships, and any unity can be described by the organization of relationships that contributes to the maintenance of its homeostatic nature: such an entity is "organized (defined as a unity) as a network of processes of production, transformation and destruction of components that produces the components which … through their interactions and transformations regenerate and realize the network of processes (relations) that produced them" (1972, p. 135). The perforation or disintegration of homeostasis indicates the termination or limit of the autopoietic unity. Crucially, autopoiesis is a description of how reality and identity are continually and constantly enacted dynamically. For Maturana and Varela, autopoiesis is characterized by the construction and preservation of homeostasis within an internal set of relations. It is by examining how these sets of internal relations are preserved over time (both despite and because of changes and adaptations along the way) that one can identify an object, entity or system as an autopoietic unity.

One of the chief advantages of an autopoietic conception is its assimilation of change. "The domain of interactions of an autopoietic unity is the domain of all the deformations that it may undergo without loss of autopoiesis" (Maturana and Varela, 1972, 119). In the course of phylo- or epigenetic evolution,[27] conceivably every single aspect or feature of an entity may change over the course of time, but if the maintenance of homeostasis is never disturbed, then the unity remains intact and the autopoietic entity retains its identity and cohesion over this period of time.

Maturana and Varela's system of autopoiesis rejects static and fixed conceptions of what an entity may be, whether it be a member of a biological species, a single organism, a single cell, or a much larger system such as a social community. In redefining a concept of unity, autopoiesis thus also redefines all of these entities that may be determined as independent (i.e. internally unified). There is conceivably unlimited flexibility in the identification of entities so long as homeostasis and the

27 Phylogenesis refers to the evolutionary drift of a whole species, whereas epigenesis refers to the genetic changes that accrue within a single individual's lifetime. Maturana and Varela draw a distinction between phylogeny, encompassing the broader structural drift of generations, and ontogeny, which encompasses only the phenomenological experience of a single individual (however that may be defined). See, for example, Maturana and Varela, 1972, pp. 98-99.

consequent set of internal relations are preserved. This limit provides both possibilities to account for growth and evolution, but also constrains what may be considered unified based on the efficiency of integration of change and external stimuli. The balance between maintaining a set of internal relationships and processing stimuli from the environment is fragile and yet unfathomably rich in possibility, a fascinating combination that Maturana describes as "both bounded and infinite" (Maturana and Varela, 1972, p. 50). Autopoiesis provides a framework to navigate this distinction and a discourse with which to describe the consequent changes, adaptations, interactions, and dissolutions.

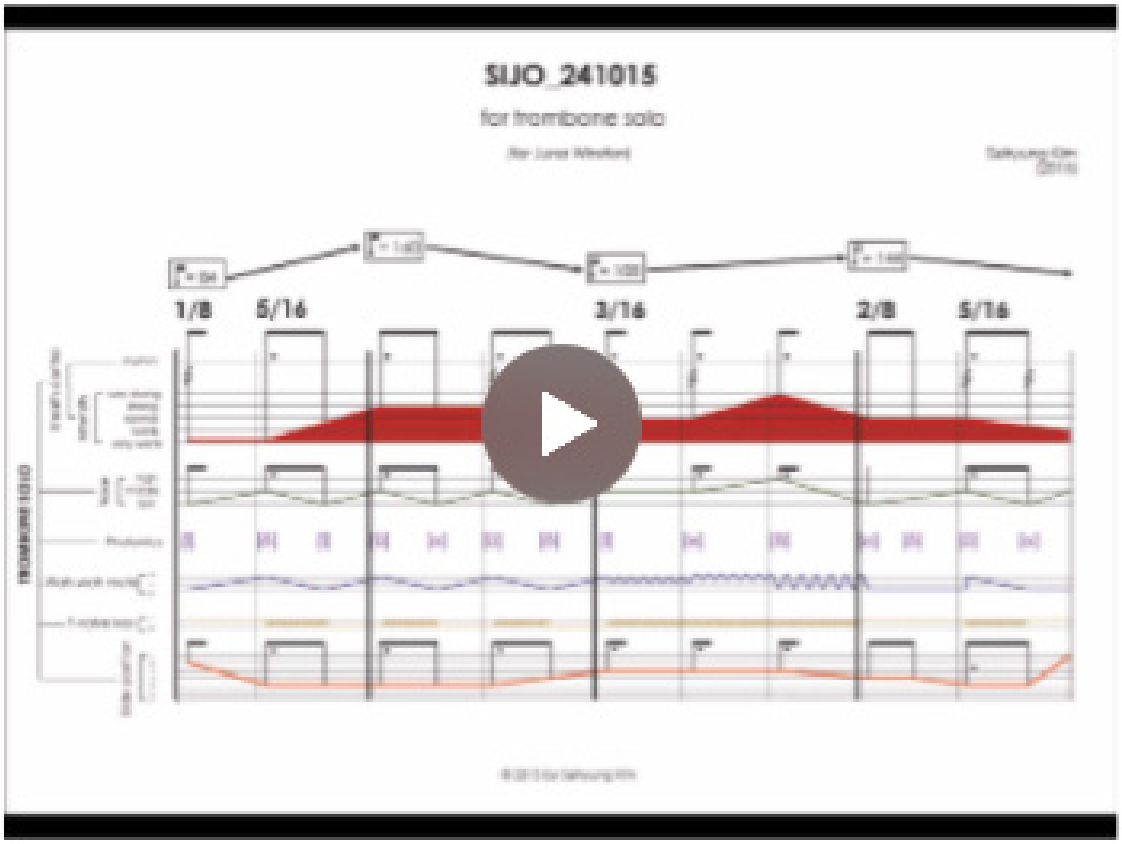
It is precisely this facility for describing variation and transformation within homeostatic systems that makes autopoiesis a useful theoretical grating through which to examine Kim's *Sijo_241015*. Beyond the complexity of the notation and the varied technical demands, the most apparent complications of the piece are the fluctuations and metamorphoses of these notational, technical, and ultimately sonic components. Before even attempting to execute a local passage of the piece, a global perspective of how these drastically different sets of information and technical demands can be assimilated into a single performance or performer must be in place (either by decision or through intuition). By viewing the performer and notation as autopoietic unities singly but also together as they collide during the learning process, this extreme variability manifests itself as part of a temporally dynamic system encompassing both fixed notation and fluid performative learning. In part because of the labyrinthine variability of the shifting parameters in the notation, both the score and the performance can, at times, be agents of either flux or stability. The player's engagement with this score, by building practice tools to variably incorporate all of the various interchangeable parameters, is autopoiesis in practice: the reaction to and assimilation of constantly shifting information while maintaining a holistic embodiment that preserves the relationships of each parallel component in a homeostatic unity.

This combination of both flux and stability can perhaps be most easily examined in the notation itself. It is in many ways a stable object, printed on a sheet of paper and unrevised since its first performance in 2016. This score also remains the same from iteration to iteration within a single performance. The parameters remain fixed. Nonetheless, as has been previously described, it is written such that all parameters can never align at once. The interchanging of parameters and fluctuation of content is built into the demands of the piece, yet even as the performer shifts from parameter to parameter within and between iterations, the boundaries of the notation remain undisturbed (no parameters are renotated or modified). Although the performer must shift between variable constellations of parameters, there is a strict limit within the notation and within the physical capabilities of the performer that determines which constellations may occur and which may not. In theory, other relationships between the parameters and actions of the piece can be imagined. That is, the prescribed actions and gestures of the piece could be recombined in other formations than those that actually occur on the page, which would inevitably lead to sounds beyond those implied by *Sijo_241015*, however similar or different they may be. But these other constellations are not, in fact, reachable through the interpretation of this notation; there is a limit to Kim's notation that precludes these other sounds and shapes. This is the "labyrinth" that he describes, where the performer can drift through any of a seemingly endless series of parametric permutations, but always arrive in the same place. It is the exploration of a map, but of a map as an object, in which the edges of the page circumscribe a set of possibilities that is, nonetheless, still infinite and open-ended. These limits help define what we can describe, in autopoietic terms, as the homeostatic unity of the notation.

The instrumental technique is similarly both open and bounded. For a performer unused to the augmentations and techniques stipulated, suggested, and allowed by Kim, the vast array of new actions, techniques, and sounds can be overwhelming. However, by working with the score, the

richness of these new terrains is also bounded by the types of actions and relationships of material that Kim builds. That is to say, the techniques, even with the many different mouthpieces, are bounded and therefore homeostatic within the context of the physical demands of this particular piece (both the polyphony of actions and the extensive use of non-traditional mouthpieces). In order to execute and embody *Sijo_241015*, the performer will have to explore both the possibilities and opportunities of the technique built and elaborated in the piece as well as the boundaries to this technique that inevitably result from both the notational constraints as well as the physical constraints of the instrument, the player, and the available combinations of parameters. By experimenting and feeling their way into the unique demands of the piece,—by exploring both the expanse and the edges of the map,—a performer can build a recursive intuition within the techniques of the piece. The resultant sonic world delineates the autopoietic unity that is the instrumental technique of *Sijo_241015*. It is not standard trombone technique, and is also not simply extended technique. An altogether different technique is instead present, one that is coherent, limitless yet bounded, and consequently both homeostatic and autopoietic.

III. Language and Communication



This thought experiment, exploring the autopoietic qualities of performers, notations, and techniques, is largely superficial if they are viewed in isolation. After all, it is little more than a slightly non-traditional way of defining a simple, organic unity, with an emphasis on homeostasis and the preservation of relations rather than on a formal structure. Heretofore, the choice of one or another of these theoretical lenses is purely a matter of taste or a hermeneutic sleight-of-hand. However, Maturana's and Varela's autopoiesis begins to take on especial significance precisely at this point, where autopoietic unities come into contact with one another. Autopoiesis is a description of how an entity creates its environment and existence through the preservation of its own internal relations as it responds and adapts to the environmental stimuli that surround and interact with it. Autopoiesis is by definition not a static set of structural relations, but a processual way of responding and interacting, and Maturana and Varela demonstrate how this leads also to a redefinition of language and communication.

For Maturana and Varela, there is no information as such. Language is not a vessel of content, nor is it a medium by which information is transmitted. In an autopoietic sense, language and communication are no different than any other stimulus from the environment. As a natural extension of that, they also see the role of cognition in ordering, processing, and parsing a linguistic stimulus as no different from the way in which any other environmental stimulus is processed.

> Linguistic interactions orient the listener within his cognitive domain, but do not specify the course of his ensuing conduct. The basic function of language as a system of orienting behavior is not the transmission of information or the description of an independent universe about which we can talk, but the creation of a consensual domain of behavior between linguistically interacting systems through the development of a cooperative domain of interactions. (Maturana and Varela, 1972, p. 50)

Language is essentially orientational, according to Maturana and Varela. One utterance directs the attention of another, who responds, and if this succession of interactions builds a mutual intelligibility, then they have built a "cooperative domain of interactions." Language as orientational rather than informational draws its impetus from the role information plays as part of a fluid system of mutual intelligibilities. And if language can be seen as orientational, then communication can similarly be viewed as an exercise in orientation, reaction, and the cultivation of mutually predictable or parsable sets of relations.

For Maturana and Varela, a communicative gesture engages in coordinating the interactions of distinct autopoietic unities. Stimulus, orientation, and the building of mutual intelligibility form the building blocks of interaction. In Kim's *Sijo_241015*, the shifting parametric relationships necessitated by the technical demands of the piece serve as similarly orientational stimuli. The map Kim provides, replete with its variable lacunae, builds fluid relations with the performer who learns to navigate its shifting contours. The performer, in turn, provides stimuli to the notation, by choosing a particular mouthpiece and a particular set of parameters, each of which in turn begins to open up or preclude the permutations than can or do ensue in the following bars and pages. The performer, the notation, the instrument and its technique all provoke each other, in a circle of stimuli and response, interactively creating a "cooperative domain of behavior."

One of the advantages of Maturana and Varela's concept of autopoietic unities is their ability to scale up and down as one examines different forms of interaction. Homeostasis can occur on an atomic, cellular, or organism level. When looking at musical elements of notation, technique, performer, performance, etc., this scalability is aided by the conception of orientational communication as the collaborative construction of mutual domains of behavior. In some ways the notation is an autopoietic unity, with clear boundaries and a replicable identity in spite of its embrace of variability. The same could be said of the performer, who has to assimilate new methods of playing the trombone and of reading music, but who remains, thereafter, a homeostatically stable entity. As has been detailed above, they can also be seen as forming an autopoietic unity together, because as they pose fluid questions to each other, they contribute to a mutually defined performance in each new iteration of the piece. The mutuality of this process results from the extreme variability of the notation, which builds a more radically foregrounded agency of notation into any performance, even as it remains—like a map—a seemingly static, stable object. This scalability can apply to any level at which orientational communication occurs, whether in performance as just described, or earlier in the learning process. In fact, this can be used to develop effective learning templates for the unique technical demands of the piece, as well. The assimilation of new and 'non-trombone' mouthpieces

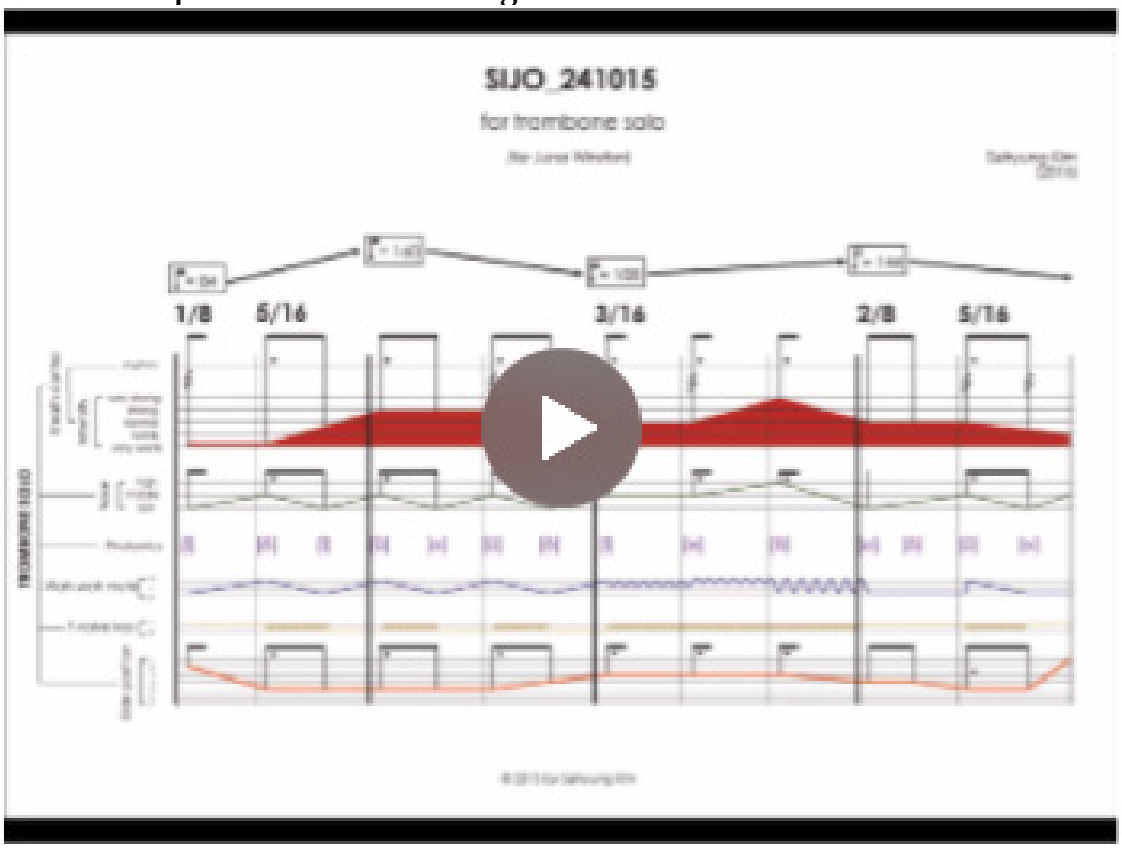
offers an opportunity to use this idea of orientation as a gateway to new forms of mutually intelligibility.

All three of these entities—notation, performer, and technique—are both discrete and united in a mutual dance of orientational communication. The notation and the performer are both posed certain problems by the technique of the instrument. Most obviously, every input from the notation and the performer is filtered through a giant megaphone (the trombone), and is thus subjected to amplification, timbre and pitch modulation, the reinforcing of particular overtones and harmonic structures, and varying degrees of air resistance, among other factors. The response of the instrument, in particular as it changes from mouthpiece to mouthpiece and with the interchanging of parameters, has a profound effect on both the performer, as is quite obvious, but also on the notation. The notation, after all, is extremely intimately tied to the response of the instrument in these variable circumstances. In the act of notating by the composer, before the piece has even begun to be practiced in its terminal state, these considerations are constantly informing the process and provoking alterations and evolutions within the notation, such as what levels of activity are too active or too inactive to be perceptible alongside other parameters or in the context of the piece. These underlying reactions and responses to technical considerations are perhaps quite obvious, and yet their overwhelming role in determining the nature of the piece and the eventual orientational stimuli given to the performer merits attention. These stimuli and responses (from technique to notation), are not easily definable temporally and spatially: they may occur very locally as Kim meets with a performer or experiments with the instrument personally, or they may cut across space and time because separate meetings, interactions, and imaginations can diffract through one another. These cross-pollinations of temporally and spatially isolated processes are part and parcel of the lengthy process of honing specific technical demands that will eventually be present in the piece (honed in this case by the composer and the performer, no less than by the instrument itself). The instrumental technique and the inherent and very physical constraints and potentialities that it embodies play a very crucial role in provoking actions and reactions from other autopoietic entities. The piece could not emerge purely intellectually, isolated from the embodied instrumental technique (or at the very least, could not emerge in the state that it does, which is precisely the point). The experimentation with and imagination of the instrument and its technique are not results of the notation, but are critical and irreplaceable stimuli and preconditions to the notation. These stimuli continue to orient one another even after the notation has been finished. The relationships between notation and physical technique (both constraining and expanding) have direct and appreciable impacts on the performer, and in particular on how the performer learns to process the notation. The internal logic that is built up between notation and physical technique builds a cooperative linguistic domain that allows for the growth of a recursivity within the language of the piece. The performer is responding to this, and the variably minute or drastic assumptions and decisions that accompany the process of learning the notation and combining it with the instrument are invariably a product of the orientational input of the physical dimensions of the instrument and its technique (again, both constraining and expanding). The precise potentialities and limitations imposed by these physical considerations are inseparable from the performer's act of responding to the input of the notation, and it is the set of relationships already built up between technique and notation that build the linguistic domain that will become stimulating, intelligible, and eventually responded to by the performer. It is precisely the analysis of these variably remote and juxtaposed interactions that is made possible by an autopoietic learning method.

Communication as orientation allows for the evolution of extremely varied linguistic domains. The relative complexity or simplicity of these domains depends on the range of potential interactions between different entities. These domains are continually enacted and reenacted in the course of contact between entities. In this case, each of these autopoietic unities identifiable within the context

of *Sijo_241015* is in contact with each of the others, and the linguistic domains that are thereby collaboratively constructed vary for each set of interactions. The communication between the performer and the composer is different from the communication between the performer and the notation, or that between the performer and the instrument. Nonetheless, each of those situations has very clear points of contact through which any two or more unities confront each other, engage in orientation and proposal of stimuli, and reach a homeostatic concurrence. They build an entangled interaction that allows their cooperative domain to survive from one moment to the next. This continually reenacted linguistic exchange could be described, in Maturana's words, as a "consensual domain of behavior" (Maturana and Varela, 1972, p. 50). Autopoiesis allows us to analyze how these linguistic domains differ from one another as we simultaneously see how they function similarly and how they are each in constant interplay with each other, engaged in interwoven webs of homeostatic exchange and discourse. The more intertwined these discrete entities become as they build ever wider realms of mutuality, the more refined becomes each of their respective homeostatic unities.

IV. Second-Order Autopoietic Unities and Cognitive Domains



As previously mentioned, one of the most fascinating implications of Maturana's and Varela's autopoiesis is its scalability. By taking the construction, enactment and preservation of a homeostatic system of relations as the fundamental definition of a unity, many different levels of organization can be viewed through the same criteria. Autopoietic unities can be identified at all levels of the human organism, from atoms to cells to organs, as well as to systems of organs, the whole body and even social bodies. Maturana and Varela refer to these higher scale interactions as "second and third order autopoietic unities" (1972, p. 107). This is to say that, as two or more autopoietic unities come into contact with one another, whether they be two or more cells or human beings, if they are able to engage in a cooperative exchange of stimuli and to build a consensual linguistic domain, then they can be viewed together as a second-order autopoietic unity. There is, theoretically, no real limit to how far this concept can scale up or down. Any level of micro- or macro-scopic entities can be analyzed as autopoietic unities, provided only that they demonstrate the necessary criteria of constructing and maintaining a homeostatic domain of interrelation.

In order to describe how such second-order autopoietic domains are created, it is helpful to first examine Maturana's and Varela's definition of cognitive domains, which is more or less an extension of what was previously examined as a linguistic domain. According to Maturana and Varela, cognitive domains encompass "all of the deformations that [the closed system] can undergo without loss of autopoiesis," (1972, p. 119), or "the domain of all interactions in which [it] can enter without loss of identity" (1972, p. 136). This is, of course, intricately related to the most basic characteristics of autopoiesis. The boundaries between linguistic domains and cognitive domains can become blurred as one begins to examine second- and third-order autopoietic unities; as orientational networks of mutual organization, language and cognition can begin to be seen as scaled-up or -down versions of each other. A linguistic domain describes "a consensual domain in which the coupled organisms orient each other … through interactions that have been specified during their coupled ontogenies" (1972, p. 136) These domains are so intimately related that, as Maturana and Varela describe the way in which a cognitive domain interacts with itself in a cycle of self-recursion (self-consciousness), they refer to it as a "closed linguistic domain" (1972, p. 121). That is to say, that an entity within its own cognitive domain is able to open up a consensual domain of linguistic interaction with its own states, thus developing a linguistic domain within its cognitive domain. As we look at autopoietic unities and begin to build second- and third-order autopoietic unities, it becomes clear that, from a purely functional, autopoietic frame of reference, the interactions built up between the various elements involved in a piece of music generate both a linguistic domain and, as a higher-order autopoietic unity, a cognitive domain as well.

The network of unities that we have been focusing on, from the composer through to the score, the performer and the instrument, reveal many ways in which overlapping and non-overlapping linguistic and cognitive domains are constructed. In fact, viewing this entire web of forces as a single autopoietic unity with its own cognitive domain allows a performer not only the freedom to become a true collaborator in the holistic process of producing the piece, but also highlights exactly how and why the preservation of their own, individual cognitive domain and homeostatic internal relations is simultaneously of critical importance. Scaling up and down through various levels of autopoietic unities reveals also the importance of preserving homeostasis on all of these different levels. The performer must preserve their own internal balance when confronting the augmented trombone (with all of its foreign mouthpieces) and the notation (with its diverse array of dissociated physical actions). The preservation of the self and its self-recursive domains of cognition is paramount to being able to then interact as a consensual member of a higher-order autopoietic unity.

Learning, then, and learning as epigenetic adaptation, becomes the crux of maintaining autopoiesis. Maturana and Varela describe the "dispensation of teleonomy" (1972, p. 85), noting rightly that in this context, there is no goal-oriented growth. Each cognitive domain is a product of a sequence of individual, localized, and relatively minor actions, each of which contributes to the assimilation of stimuli and the preservation of autopoiesis. They rightly point out that "[i]nstruments enlarge our cognitive domain" (1972, p. 38), because the incorporation of prosthetics is a natural extension of the cognitive domain when viewed in this way. As such, we can expand each autopoietic unity to include the others as linguistic partners and even prostheses, depending on their respective modes of interaction. Ultimately, even these distinctions are unimportant. After all, each of these individual actions is not determined by its linguistic content or prosthetic application alone, but when seen rather in a non-teleological framework, they are only responsive to very localized autopoietic demands, and the long-term ontogeny of the autopoietic unities is constructed out of this continuum of bounded actions. Maturana comments that the cognitive domain is "bounded and infinite" (1972, p. 50). It constructs a state of long-term adaptation that responds and evolves to stimuli while maintaining its own coherence. There is no goal and there is no destination, only the continuous

recursion of homeostasis. Autopoiesis provides a template for a process- and action-based system of organizing the learning process. This then allows one to examine both an individual's role within the system, the system's inter-agential collaborative process, and the long-term adaptive patterns that contribute to the eventual form that a piece of music takes as it enters the world of sound and action.

The interplay between these alternately independent and codependent unities allows us, as performers, to access a piece like *Sijo_241015* in a completely new way. The role of the performer becomes less rigid, and is no longer contained within a hierarchy bridging the inspired realm of compositional intent and the didactic role of interpretation in public performance. One can still choose to see compositional intent as rigorously definable, or respectively, to see the act of interpretation as didactic and content-oriented. But an autopoietic approach shifts the relative importances of those elements and makes them ultimately ancillary to more critical issues of communication and the mutually-constructed evolution of interactive systems. The performer abdicates the role of hermeneutic curator and becomes just one homeostatic element within a diverse environment of musical agencies. This is not a matter of claiming performance as a co-compositional act. Rather, an autopoietic method hopes to build the tools by which seemingly isolated components such as composers, scores, performers, and instruments both assume but also abrogate responsibilities in a mutual entanglement of agency.

As a performer, I work to construct a system by which the orientation and response to stimuli from all of these agencies can work fluidly. I attempt to help initiate varied linguistic domains with the instrument and the notation, so that we can evolve together towards a point of cooperative domains of interaction. This effort to build mutual intelligibility between composer(s), notation(s), instrument(s), etc., leaves the exact nature of these interactions and domains of intelligibility very open—and that is precisely the point. By working without a teleological hermeneutic oriented towards an approvable interpretive product, the performer is instead working in very localized situations and sets of stimuli, constantly building a conversation between different elements. This is a very natural and, in fact, simple way to approach what is a complex, complicated, and difficult score containing a huge amount of information and requiring a high degree of flexibility and response-ability. Learning to engage within autopoietic linguistic and cognitive domains and reacting to particular stimuli embodied by the notation and filtered through the instrument, I as a performer can foster an organic learning process that cooperatively creates and recreates the piece alongside the composer, the notation, and the instrument. The growth and development of the collaborative potential within this autopoietic learning process allows for a very simple and straightforward learning technique that blossoms into a rich and rewardingly complex network of musical and sonic co-creation.

More precisely, it allows for a contextualization of the performer's role that embraces her importance to the overall project of producing the piece while also avoiding the trap of exaggeration, in this case by acknowledging the production of this role in a continuum of specific, localized embodiments of the piece. It is a vision of the learning process that unfolds over time without succumbing to teleonomy, one that encourages agency but reacts to the bounds that confine the process. The performer's body and her bodily practice are incorporated into the production of the piece, utilizing both her general, foundational technique as well as her continual and ever-changing practice regimen. As a performer, I must approach each practice session with the knowledge that I can only react bodily and mentally with the particular parameters and technical issues that present themselves in each particular moment. I must remain aware of the over-arching process by which these actions engage with and co-create the work. Each different practice session, with each different mouthpiece, is an exercise in experimenting with the constraints of the instrument and the variable combinations of parameters. Only so can I continually learn and relearn how to interact with the score and the

sounds while maintaining my personal coherence as an autopoietic entity. Practically, this means working slowly and response-ably with all of the various parameters, constantly combining them in different ways, to slowly allow my body to internalize and entangle with the orientational stimuli that they propose. I learn to react to their constraints adaptively, in unexpected ways, rather than working to slowly approximate a predetermined, fixed concept of how the piece should sound based on my prior experience or assumptions.

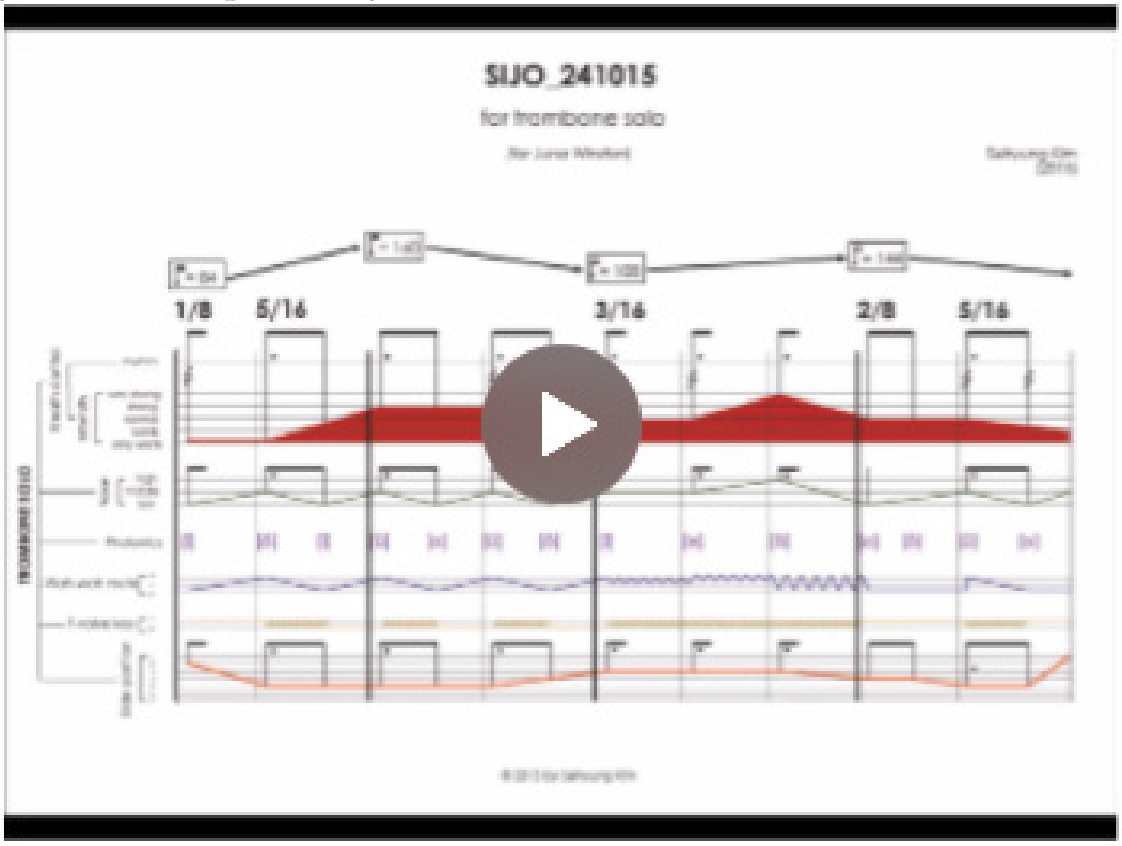
The notation and the body must communicate, and that can only happen by actually diffracting parameters through each other and through different mouthpieces to allow them to create and re-create the domains of interaction. The sound world of *Sijo_241015* is built from these interactions, and not from a preconceived ideal. I work slowly but holistically with the technical and notational constraints to build a practice that maintains my individual autopoiesis and contributes to the construction and preservation of a higher-order autopoietic unity that encompasses the other musical agents surrounding me. There can be no hierarchy of elements here, or there will be a discontinuity in autopoiesis as one element subordinates the others. This means adopting a practice strategy that does not, under any circumstances, isolate layers as separate elements. Rather, from the very outset I prioritize the entanglement of parameters, practicing them carefully but always together (although always in variable combinations). I find that I learn to slowly embody the particular physical conditions of the piece, exploring the "unlimited but bounded" domains of action that result from a working process that strives to maintain an internal set of structural relations throughout. The alternative, which presumes a hierarchy of parameters and techniques, subverts the process by which the linguistic domains of the piece emerge.

These concerns about learning slowly and holistically are not indulgent. An over-zealous rigidity of traditional trombone technique will inevitably fall apart in the face of the ever-changing mouthpieces, and the unity of the performer and the piece will suffer accordingly. Given the radical disorientations of technique that *Sijo_241015* proposes, it is simply not possible to begin with a rigid trombone technique and slowly introduce other elements thereupon. The accrual of parameters will promptly break the continuity of traditional technique; when I attempted to learn in this way, I found myself facing a blank slate every new morning, trying to relearn everything from the day before in an endless cycle. Only by shifting to a different learning method, what I have described here as autopoietic, was I able to invite the piece's technical demands into my own personal practice. Similarly, hierarchizing notated parameters will also lead to eventual problems in the piece. Because parameters shift in and out of focus and in and out of use so quickly and ephemerally, even the ever-present parameters, such as the tempo fluctuations, cannot be excessively prioritized. Learning autopoietically means building all of these parameters into a holistic linguistic domain, response-able to one another.

On one hand, the methods I am describing constitute only a few minor adjustments to practice regimens, and yet, in other ways, they are a radical departure from standardized norms of interpretation in the classical music world. A piece like *Sijo_241015* does not allow one to easily choose one or other. The extent of its disorientation demands a more collaborative participation from the performer. It is constructed in such a way that the extended techniques and the tablature notation must be handled as dynamic and organic elements within the piece, not as external attachments to be pasted on top of a pre-existing, static foundation. The interplay and mutual adaptation of all of these notational and technical elements together *is* the piece. *Sijo_21015* is realized in the adaptive process of learning it, not in the eventual performance. The performer's sensitivity to their role in this co-production of the piece will determine whether they are able to learn the piece without sacrificing themselves or the piece itself to some static teleonomy. A patient, collaborative commitment to

the preservation of homeostasis within the production of the cognitive and linguistic domains of the piece is necessary in order to eventually build a practice that stands any chance of holistically enacting its kaleidoscopic notational and technical texture.

V. Living Systems and Responsibility



> [A] physical system if autopoietic, is living. In other words, we claim that the notion of *autopoiesis is necessary and sufficient to characterize the organization of living systems*. (Maturana and Varela, 1972, p. 82, emphasis in original)

Maturana's and Varela's claim is about the essential nature of life from a biological standpoint. They argue that more traditional definitions rely on teleological structures, focusing on an organism's organization towards a purpose. They point out that even the individual in this context becomes subsumed in a larger, evolutionary phylogenetic drift. Apart from the glaring anthropomorphic fallacy lurking inside, this view fails to accurately accommodate epigenetic change and the nature of an individual's own localized organization of living. Similarly, definitions of living systems that rely on reproduction also fail to sufficiently account for the diversity of organization of living systems. Instead, Maturana and Varela propose that autopoiesis is the essential marker of a living system, that is, that a system, if capable of maintaining a set of homeostatic internal relations while interacting or responding to stimuli from the environment without loss of autopoiesis, thereby demonstrates the necessary and sufficient characteristics to be deemed a living system.

This interpretation is quite fertile, allowing one to observe very localized situations and use non-teleological markers to identify characteristics that indicate whether an individual system can be considered a living one or not. Furthermore, change and adaptation across long periods of time are also easily accountable for. Autopoiesis clarifies how a living system can conceivably change or replace every single internal element or set of relations over time without ever losing homeostasis and while maintaining, throughout, its own boundaries and identity—something we all do

throughout our lives as humans, as our cells die and new ones replace them. Autopoiesis allows for the reconciliation of these personal (epigenetic) and general (phylogenetic) adaptations within a non-teleological framework that avoids the pitfalls of the more traditional notions of living systems described above. By reconceiving the criteria by which we make these designations, autopoiesis expands the question of what is a living system in some surprising and even troubling ways. After all, if autopoietic unities can engage in consensual linguistic and cognitive domains to form larger-order autopoietic unities, as is the case with multicellular organisms like humans, does that then mean that all larger-order autopoietic unities are also living systems?

This consideration leads to one of the most fascinating passages in *Autopoiesis and Cognition*. In the Foreword, Humberto Maturana designates human societies as autopoietic unities and, thereby, living systems. In so doing, he further claims that this state of being, in which individual humans are components within a consensual interactive domain that comprises an autopoietic unity, implicates humans in a series of ethical considerations, which he proceeds to outline. He acknowledges, though, that this extrapolation of larger-order autopoietic systems to *ethical* implications is not shared by his colleague, Francisco J. Varela. In fact, that is why his thoughts on these implications appear in the Foreword and not in the text of *Autopoiesis* itself. At the point at which the biological considerations of their theory of autopoiesis suggest possible social implications, the two authors part ways, one unwilling to press this claim as part of their scientific work, and one considering it an inevitable and unavoidable consequence of proposing the theory in the first place.

Autopoiesis, though, also provides a framework by which these ethical considerations can be viewed in a totally different manner. As noted earlier, at a certain point, the distinctions between different orders of autopoietic unities and between certain elements of linguistic and cognitive (especially self-reflexive) domains become pedantic. What is truly at issue is just the continual (re)creation and preservation of autopoiesis. Maturana and Varela's "dispensability of teleonomy" demands that global issues, whether of evolution or of ethics, are not privileged *in any way* over localized interactions, in both of which a homeostatic set of internal relations can be preserved. This means that whatever broader claims can be pressed (for Maturana, ethical claims), they cannot assert a teleological constraint on the system, living or not.

These ethical issues also appear if we use autopoiesis as a lens for examining Kim's *Sijo_241015*. After all, if we are to extrapolate from the types and qualities of interactions between the various components of the productive act that there are larger-order autopoietic unities, the same issues of ethics and responsibility that troubled Maturana and Varela arise in this context as well. It is inevitable, as linguistic and cognitive domains are identified or postulated, that questions of responsibility and obligation emerge. If the interaction between a performer and the notation or the instrument involves the engagement in a consensual and mutually intelligible linguistic or cognitive domain, then what obligations are inherent in that process? If one chooses to see this larger-order autopoietic unity as a living system in itself, then what responsibilities fall accordingly to a component of that living system? And, more importantly, what are the consequences of failing to maintain autopoiesis in the process of learning or performing this piece? Is a poor performance literally the death of a living system?

It is a troubling thought. Moreover, it can be a truly paralyzing thought for a performer faced with these problems in real life, for not only would a poor performance be the death of a living system, but even a poor practice session could be. How ought one to approach a tricky passage, replete with layered parameters of complicated, polyphonic physical actions and unfamiliar apparatuses of sound production, if one is simultaneously obligated to the preservation of a healthy autopoietic unity? The response-ability demanded by an autopoietic method leads to a very slippery slope.

This is really only a mirage, though, generated by a teleological misconception of the autopoietic process, wherein the domain of relations becomes too asymmetrical and one entity exerts inflexible control over the whole. In musical terms, this would perhaps most readily be the power exerted by the notion of textual fidelity. This slippery slope only occurs if there is an ideal conception of the piece that demands a certain fidelity. The goal of opening up the performance process to ideas of cooperative orientational communication can provide a balance between response-ability to another and response-ability to oneself. Both the notation and, as described above, the performer's personal instrumental practice make demands. It is for this reason that I explored so extensively the way that performative, instrumental demands can reach backwards into the compositional process and provide stimuli well before they later respond to that selfsame notation. It is implicit in this that both will have to respond to the constraints of the other, but they can also allow other criteria to evolve around and within those constraints. The slippery slope is a product of what Maturana and Varela call a self-reflexive cognitive domain, a type of self-recursivity that can occur naturally as part of a system that is capable of interacting with its own internal states as both a participant and an observer. As noted, Varela does not co-sign these ethical concerns, and this may be why. Although the exact reasons for his reticence are not clearly stated, since he continued in his career to explore many forms of embodied and enactive cognition,[28] one imagines that it was not because he lost faith in the fundamental tenets of autopoiesis, but because he recognized that these somewhat simplistic fears of being trapped in an asymmetrical autopoietic unity were not the primary issue. It seems certain that any such asymmetry would perforate any semblance of autopoiesis, and that if such a power imbalance were to develop, it would occur in another way.

The same is true in the case of Kim's *Sijo_241015*. The risk of killing a living system is rather too exaggerated. When learning the piece, the real risk is not that one cannot learn to adapt to the needs of the score, but rather the opposite, that the performer will suborn the piece to an instrumental practice that cannot or prefers not to accommodate the uniqueness of the piece. The notation, the instrument, the technical demands and the composer's work and intentions all play roles in the production of the piece, and they all contribute to how the piece eventually comes to sound. The performer's role involves listening to these fellow collaborators. Just as the composer listens to and responds to the technical issues of the instrument and its various augmentations, thus implicating the performer directly in the compositional process, so must the performer also remain responsive to the implicit demands of all of these members of the system. When the performer applies pre-conceived notions of musicality and interpretation to a work, particularly to a work with such unique demands, then they allow for the possibility that the work itself is silenced in that act of bringing it to performance. There is no clearly-defined, correct way to interpret the score. The performer and all of these other elements collaboratively construct an environment in which a 'correct interpretation' (only one of many potential ones) results from their considered interaction, a state we have been calling a consensual linguistic domain here. The consensuality at play is one that allows for the preservation of each element's homeostasis, which is to say, for the preservation of each element's internal set of relations and internal balance. For the performer, that is their ability to make any sound on the instrument at all, however augmented or not. For the notation, that homeostasis resides in the balance and simultaneity of the parameters, during and as part of their interchanging. For the instrument, it is the relationship of the various augmentations to the trombone itself, and a technique that marries fundamental aspects of both the trombone's and the mouthpiece's techniques to produce a functional method of sound production. These are all very basic concerns, almost trivially so, and yet, the balance between them and the practice and performance methods that produce that balance over time require thought and energy to enact if they are to lead to a response-able learning process.

28 See 3.1 Introduction to Embodied Cognition; Enactive Learning; Enskilment.

The risk, as it were, is that a performer approaches the piece without being responsive to the balances inherent in these various components. In beginning this subchapter, I asked to what extent an instrument or a performer or a notation could be deformed before losing its identity. In the end, I find that I can be deformed almost limitlessly as a trombonist, so long as the notation and my own learning process allow me to approach those extremes in sensitive ways. I have attempted to describe how one such learning process has evolved with Kim's *Sijo*. The title comes, after all, from a Korean poetic form in which a predetermined number of syllables may be combined and recombined in a variety of ways to provoke a kaleidoscopic reimagining of the surrounding world. But just as the syllabic form remains in place, so does the same old world remain, and so does Kim's labyrinth lead me—the trombonist—always back to the same place. Even as the instrumental technique cuts across time and space to interact with the composer and the notation, it also expends itself in a performance of set duration, as a particular instantiation of finite sound erupting from a trombone bell. Maintaining the balance of these temporal and extra-temporal elements is part of the homeostasis sought by an autopoietic method. It is not only the discovery of new facets and entanglements of a learning process but also the *re*discovery of the sound as it is executed in time and space that this learning method attempts to enable.

Autopoiesis gives a clear idea of how these various components exist as entities or elements in their own right, and also how they become part of an interactive system that exists between and includes them all. It provides a framework for the ebb and flow or orientation that makes discovery and rediscovery coextensive. Initially, autopoiesis was presented merely as a response to the disruption of non-standard notations and techniques, but as has subsequently become apparent, it is not quite so simple. Just as the standard practices are themselves disrupted by a piece like *Sijo_241015*, they also, when used as a blanket guide to interpretation and learning, deform every other aspect of the piece and its productive process to meet their own, pre-conceived and teleological needs. Whether this has any ethical ramifications, whether it involves a living system or merely a complex one … these questions will invariably be answered differently by different people, just as Maturana and Varela both had different conceptions of comparable issues in their own collaboration. There can be no doubt, though, that the choices of practice and learning strategies do have the capability of deforming a piece, and that a notation or a piece have the capability to dissolve the efficacy of an instrumental practice. Autopoiesis provides an extremely flexible and functional theory through which to diffract a piece such as Kim's. It gives us the tools necessary to engage thoughtfully with these issues and plot an individual course of action receptive to a unique piece and situation. It allows us to develop learning and performance strategies that are open to the internal balance and evolving needs of all of the collaborative elements which contribute to the realization of a sounding piece of music. As a tool, it is one of many possible avenues through which to enter a piece, but as can be seen clearly in this study of Sehyung Kim's *Sijo_241015*, it can prove an extremely invaluable one in pursuit of this variety of challenges.

2.4 Interliminaries

> What if, as I'm suggesting, precarity *is* the condition of our time—or, to put it another way, what if our time is ripe for sensing precarity? What if precarity, indeterminacy, and what we imagine as trivial are the center of the systematicity we seek?
> (Tsing, 2015, p. 26)

Maturana and Varela couch their conception of autopoiesis in scalability, exposing the idea of the *auto-* to the kind of commingled multiplicity that Tsing and Haraway demand. This scalability allows for a localized sense of autonomous music learning to scale upwards into inter-agential relationships between composers and listeners, alongside performers, equally as it facilitates the scaling down into the interwoven strands of physical activity within the performative body. This more-or-less artificial construction of centrality to a particular situated knowledge gives it some advantages as a methodological tool, but nonetheless elides the messiness—the precarity—of the entangled agencies intra-acting in these processes of musical creativity. In an attempt to elucidate problems and potential solutions within learning and interpretation of physically polyphonic scores, the previous subchapters succumbed to an unfortunate focus on the singular entities of performer and composer as they collide through the mediation of notation. I have attempted to use the contextualization of ecological polyphonies and disturbances to underscore the potential of these theoretical aids—haecceitas, agential realism and intra-action, and autopoiesis—to situate these seemingly individualistic struggles in wider and less human-centric conceptions of the creative act of learning and performing music. Nevertheless, this artificial centrality persists.

For Haraway, sympoiesis signals a way beyond this impasse. As she writes, "Sympoiesis enfolds autopoiesis and generatively unfurls and extends it" (Haraway, 2016, p. 58). For M. Beth Dempster, who coined the term in 1998, "collectively-producing" (Dempster, 1998, p. 25) sympoiesis contrasts with a "centrally controlled, homeostatic, and predictable" autopoiesis (Dempster, 1998, p. v), and Maturana and Varela's insistence on bounded systems with "self-produced boundaries"—however scalable—are countered by unbounded sympoietic systems that are "organizationally ajar" (Demptser, 1998, p. 33-34). Dempster acknowledges that the exact nature of boundary-drawing in practice renders these distinctions between auto- and sympoiesis as a spectrum rather than a binary opposition. Certainly, for Maturana, the scalability of autopoiesis would seem to include many if not all sympoietic systems. The distinction that emerges from an emphasis on the "organizationally ajar," though, relies perhaps more on the precarity of these relations. Tsing envisages precarity itself as a systematicity. In proposing the various diffractions of the previous three sections (2.1-3), I have attempted to find ways for the precarious and the ajar to congeal into methodologies and localized performance practices. Tsing writes, "Precarity is the condition of being vulnerable to others. Unpredictable encounters transform us; we are not in control, even of ourselves. Unable to rely on a stable structure of community, we are thrown into shifting assemblages, which remake us as well as our others … A precarious world is a world without teleology" (Tsing, 2015, p. 6).

In mining precarity for systematicity, a lot can be learned from the messiness of overlapping, intra-acting sympoietic systems in the more-than-human world. Haraway in particular revels in the muddiness of this "material-semantic compost," proposing even that "[w]e are humus, not Homo, not anthropos; we are compost, not posthuman" (Haraway, 2016, p. 55).[29] Sympoiesis provides a framework for the balance between the constant, organic metabolisms that maintain homeostasis and the similarly unceasing assimilation of the ajar, the stimuli for new, poietic tools that create spaces for response-able intra-action. As with the notion of disturbance-upon-disturbance as a state of being,

29 In selecting this terminology, Haraway stretches the term compost from its simple connotations of organic renewal to also embrace the etymologies of both com (with) and post (temporally consequent).

Tsing also redefines this ecological balancing maneuver by contrasting proliferation, the pursuit of growth at all costs, such as agricultural monocrop plantations, with resurgent "assemblages of multispecies livability in the midst of disturbance" (Tsing, 2017, p. 52). By accepting the continual and inevitable role of many scales of disturbance, resurgence can operate as a hallmark of a sympoietic, open-ended, response-able engagement. In ecological terms, this response-ability entails the coalescing of multispecies networks on varied planes of time and space, coordinating long-term cycles of survival and evolution directly through the unfolding of their entangled intra-actions. Tsing points to the way that a forest may resurge after a fire, as "the cross-species relations that make forests possible are renewed in the regrowing forest" (Tsing, 2017, p. 52), although often in different constellations of multispecies assemblages as new symbiotic and sympoietic relationships are reinforced by the shifting ecological conditions. New patterns of growth and symbiosis develop across species in instances of resurgence, creating the diversity of biological life that enables further resurgence and balanced, sympoietic ecosystems. These patterns of growth resist easy predictability, but result in richer, more resilient tapestries of multispecies entanglement.

The resurgence that typifies these multispecies assemblages bears striking resemblance to what embodied cognition researchers describe as emergence. Emergent cognition occurs on a much smaller scale, within the body of an individual (however one chooses to define that, whether as a single-species entity with clearly defined boundaries or as a sympoietic holobiont). The following chapter will trace research on embodied cognition and situated learning to find avenues for emergent cognition to guide the learning and performance practice of physically polyphonic musical notations. As I leave the theoretical methodologies of this chapter behind and move into the realm of embodied cognition, it is worthwhile to retain the intellectual attitudes of Tsing's resurgence and Haraway's compost. The extreme variability between notations and their physical demands of the performer problematize the role of the music-learner as a confluence of agencies responding to the disturbance of a new situation. However a musical notation de- or re-constructs the traditional physical practices of instrumentalism, whether dramatically or subtly, as response-able agents attempting to learn music, we can couch the following forays into emergence as continuous with the rather more hopeful language of Tsing's resurgence.

When Tsing posits that precarity and indeterminacy might undergird a more productive systematicity, she indicates a systematicity that emerges from flexibility and adaptation, rather than from mechanistic predispositions. By opening up to precarity, the possibility for renewal presents itself, but that initial step towards precarity is no easy task. It is the nature of self-consciousness and self-reflection to respond conservatively, by relying on patterns and habits that have proven useful at some point in the past. Better safe than sorry. It is for this reason that we, as nominally individual agents in a circumscribed musical situation, can stand to learn from the examples of multispecies assemblages in sympoietic coordination, of forests regrowing in freshly emergent patchworks of interdependent growth. Because they lack an obvious centralized computing mechanism coordinating this behavior, these networks do not seem to choose precarity and resurgence so much as they simply unfold it in real time. As we face our own fears of the unknown in musical and instrumental practices, we can embrace precarity as the assumption that practices must evolve in real time, in contextual situations, no matter how new or old the techniques that might surface from an attempt at response-ability may be. The inherent conservatism of reflection is natural, given that the only available body of knowledge is the past. As regrowing forests demonstrate, there are certainly old patterns and symbioses that can emerge in new situations—they do not constantly reinvent evolution after every burn. Nonetheless, the elision of a centralized, reflective/reflexive choice means that the particular patterns that resurge in response to the perpetual ballet of disturbance are emergent behaviors responsive to a given situation, to both its constraints and its opportunities. As will be explored in the following chapter, much research into the direct action-

perception relations of embodied cognition mirror this systematic precarity, allowing for response-able behaviors to emerge contextually, drawing from previously learned lexica of behavior as well as evolving new ones. Sympoiesis, precarity, resurgence, and emergence: these concepts do not question the beingness of entities (whether multispecies assemblages or individual musicians); they question the constant unfolding of relations over time, shifting focus to the active entanglements and intra-actions that supersede static conceptions of agents, practices, behavioral lexica, and so on. It is these dynamic relations that define learning and growth, resurgence and emergence. As Haraway writes, "The question here is not how animals hold themselves together at all, but rather, how they craft developmental patternings that take them through time in astonishing morphogeneses" (Haraway, 2016, p. 66). That is, indeed, the question at hand! How do we accomplish the astonishing tasks of virtuosity in physically polyphonic scores, all while maintaining the homeostasis of an instrumental performance practice? After Haraway, I ask myself: how do we hold ourselves together at all in these circumstances? As with these multispecies sympoieses, I proceed in the hope that a response-able commitment to developing poietic learning tools can also enable constellations of emergent, resurgent music learning to blossom.

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

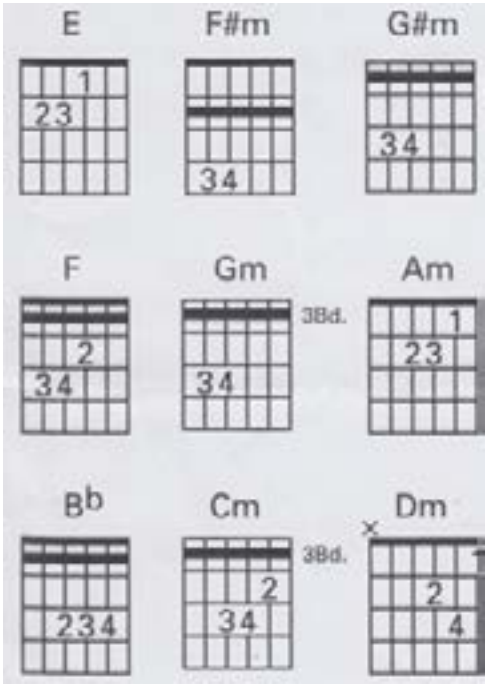
it has never been embodied at all until the point at which it is *re*embodied, post-notation, in the performer. Even (or especially) in the absence of a pre-existing body of knowledge, the performer is, nevertheless, engaged in an apprentice-like relationship to the embodied knowledge being developed. 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*

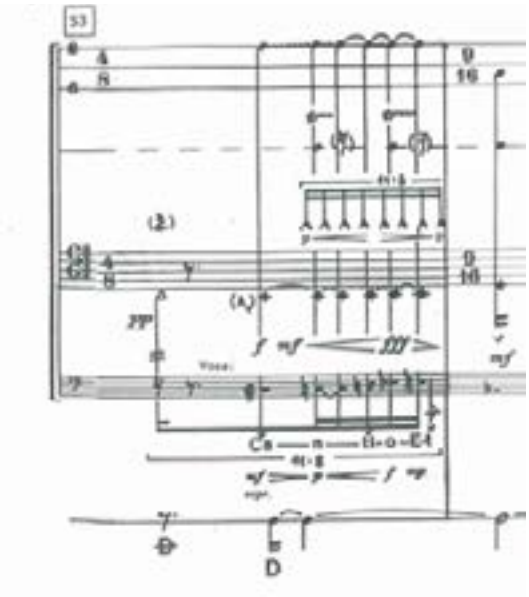
Tablature notation offers a conundrum for interpretation. On the surface, a tablature appears to micro-manage the performer, extending the reach of compositional intent to small, isolated components of the performer's body. Even as it exerts this control, though, through an increased incidence of one-to-one 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)

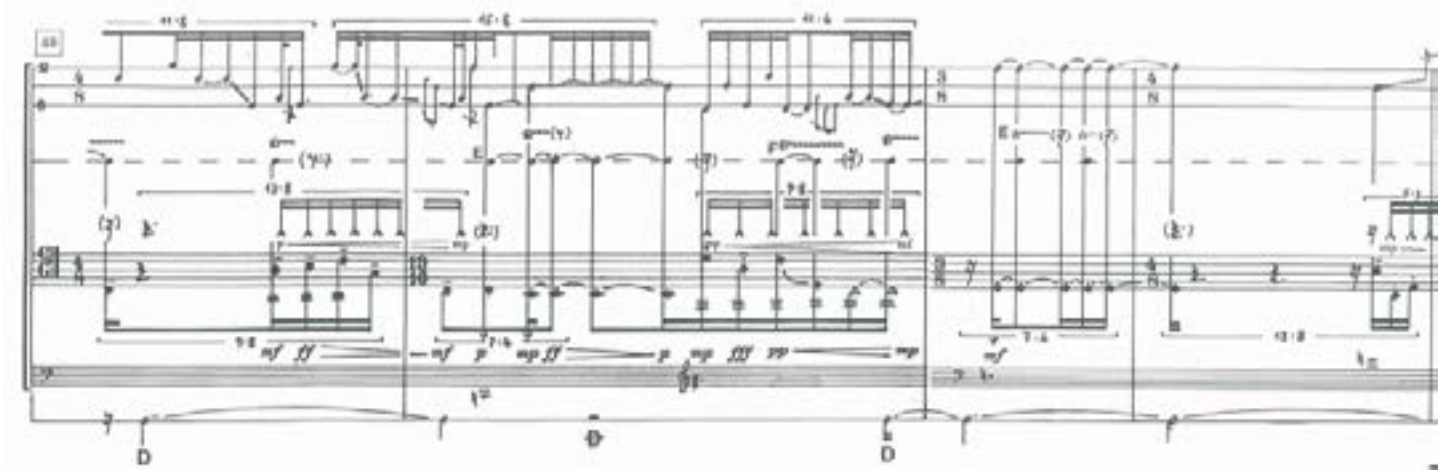
Taken to a greater extreme, though, tablature can become more involved, even intrusive, as in Klaus K. Hübler's *Cercar*, wherein the trombonist is given separately notated staves for a catalogue of physical components of trombone playing: slide position (right hand), valve action (left hand), overtone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



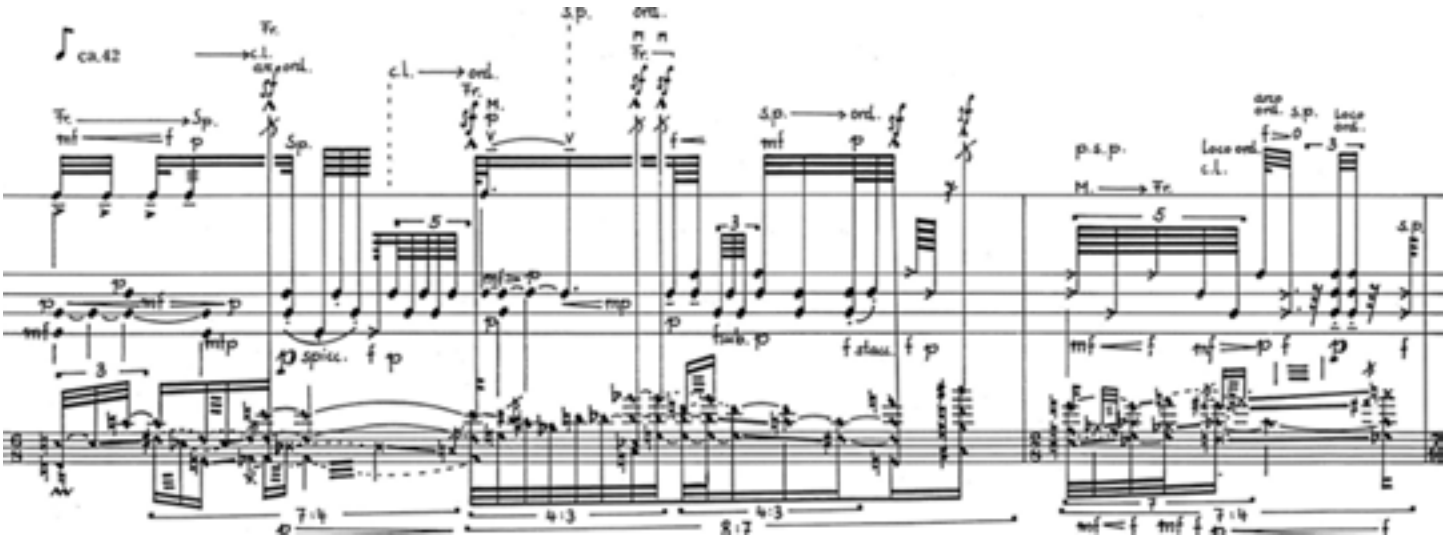
Klaus K. Hübler: *Cercar*, m. 53
systems indicate (top to bottom): slide position (right hand), valve action (left hand), diaphragm vibrato, overtone series (lips and oral cavity), vocal actions, and mute

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.

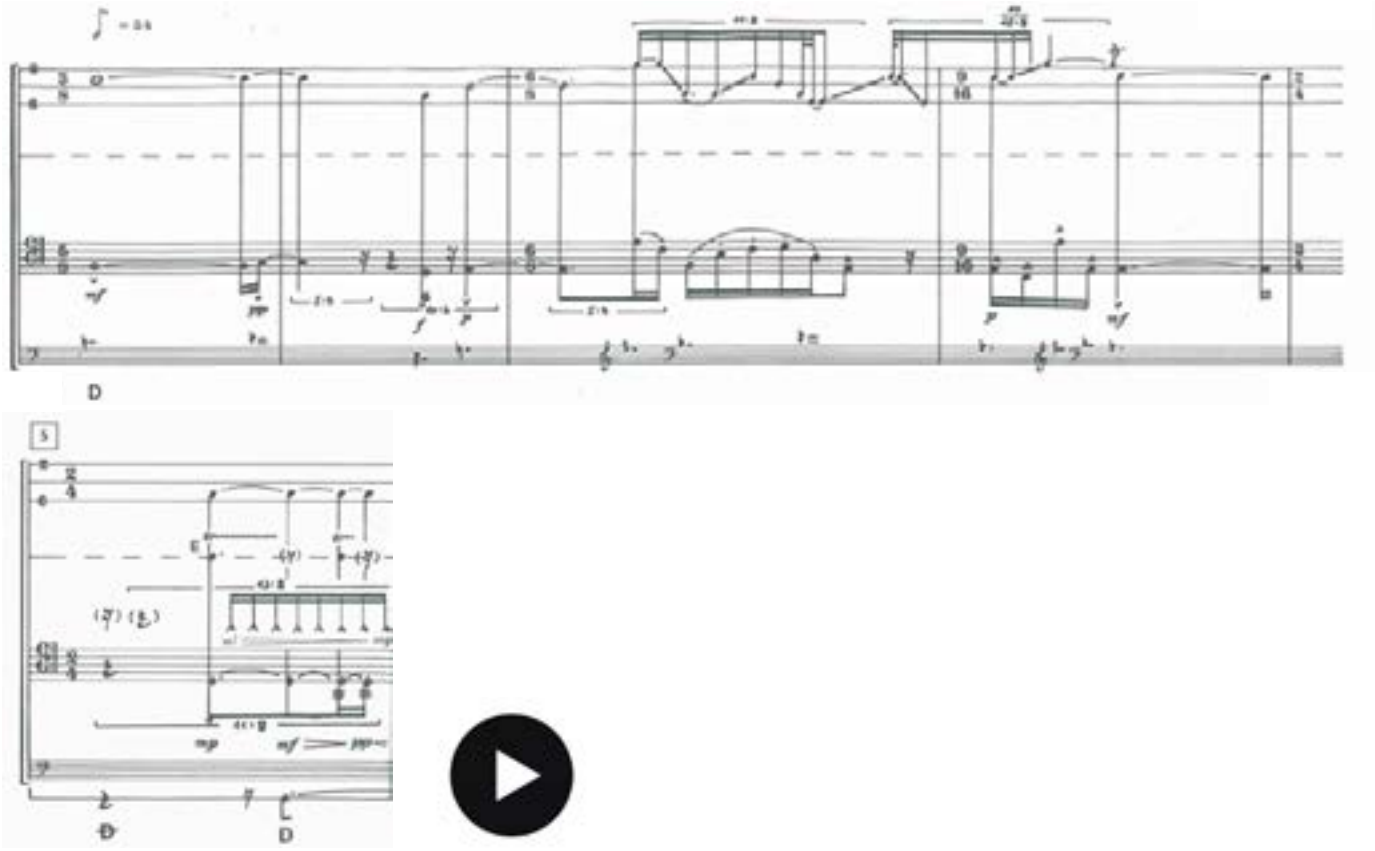
execution and firmly within the craft world of context- and tool-building. Inasmuch as this sets up a quasi master-apprentice relationship between the notation and instrumental practice, aspects of Lave and Wenger's way-in learning and Ingold's guided rediscovery emerge as extremely pertinent frameworks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

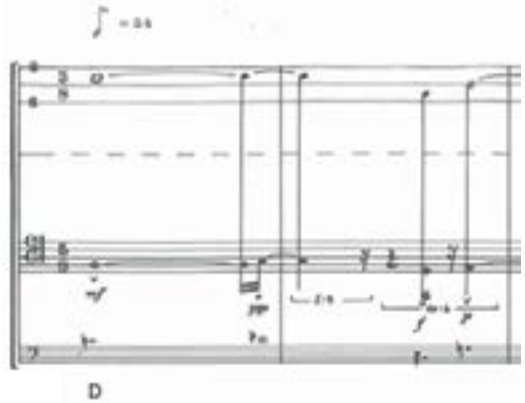
For the performer learning *Cercar*, this presents a conundrum. The notation presents such an extreme degree of dissociation, with almost every element of playing notated distinctly and in its own system. The resultant sound is, though, paradoxically quite monophonic, despite even the modulations of 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.



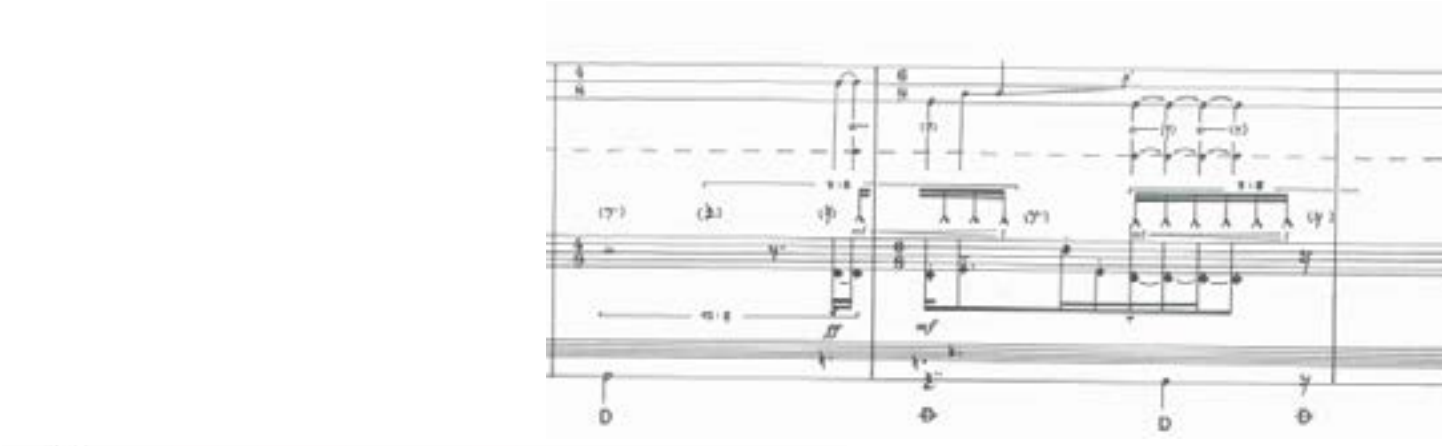
Klaus K. Hübler: *Cercar*, mm. 1-5

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?

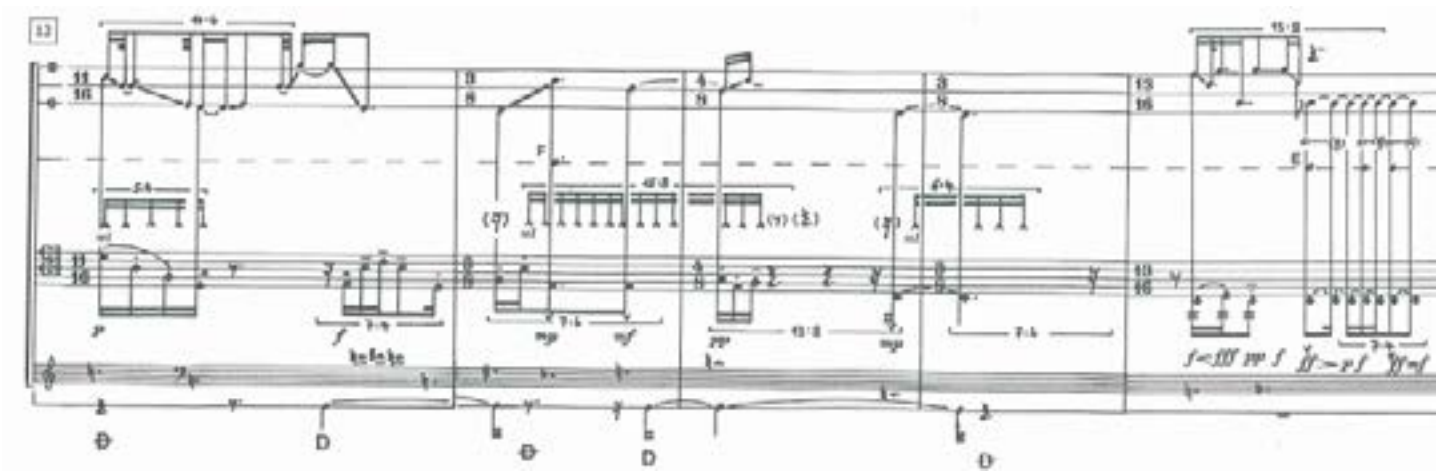
I approach this as an impulse to craftsman-like enskilment. The rhythmic polyphony can be interpreted as embodied cues, indicating orientational directions to a practiced craftsperson. In *Cercar*, rhythmic polyphony occurs in many varying degrees (see below): passages of simple, homophonic rhythms; 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.



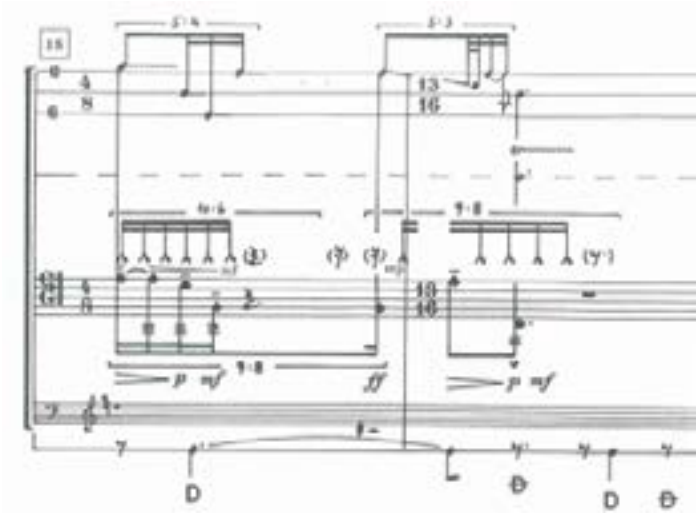
Passage 1: mm. 1-2
simple, homophonic rhythms

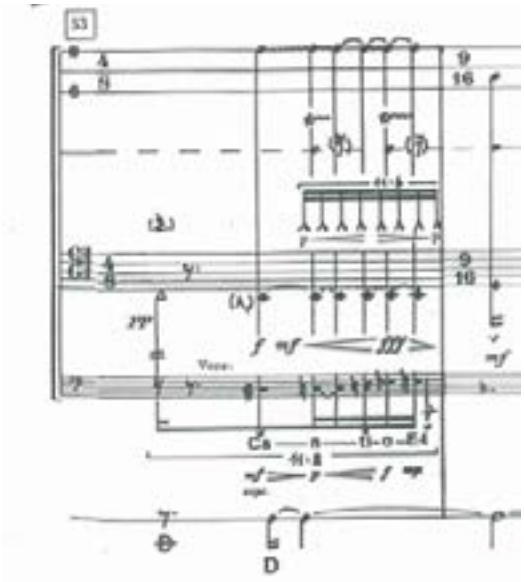


Passage 2: mm. 27-30
rhythmic homophony in more than one parameter accompanied by other rhythmically distinct strands



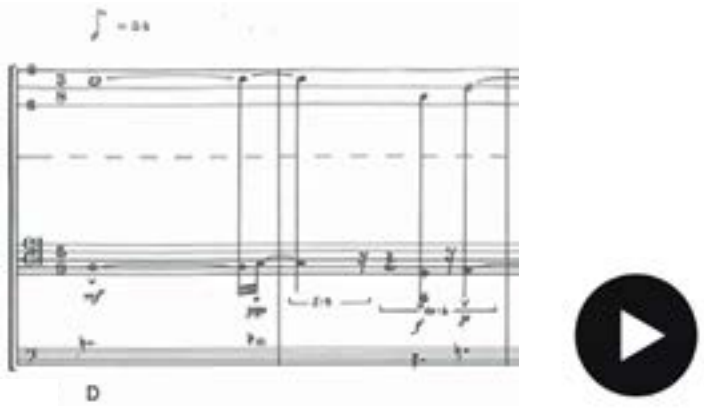
Passage 3: mm. 13-17
relatively few parameters overlaid but with high degrees of rhythmic dissociation



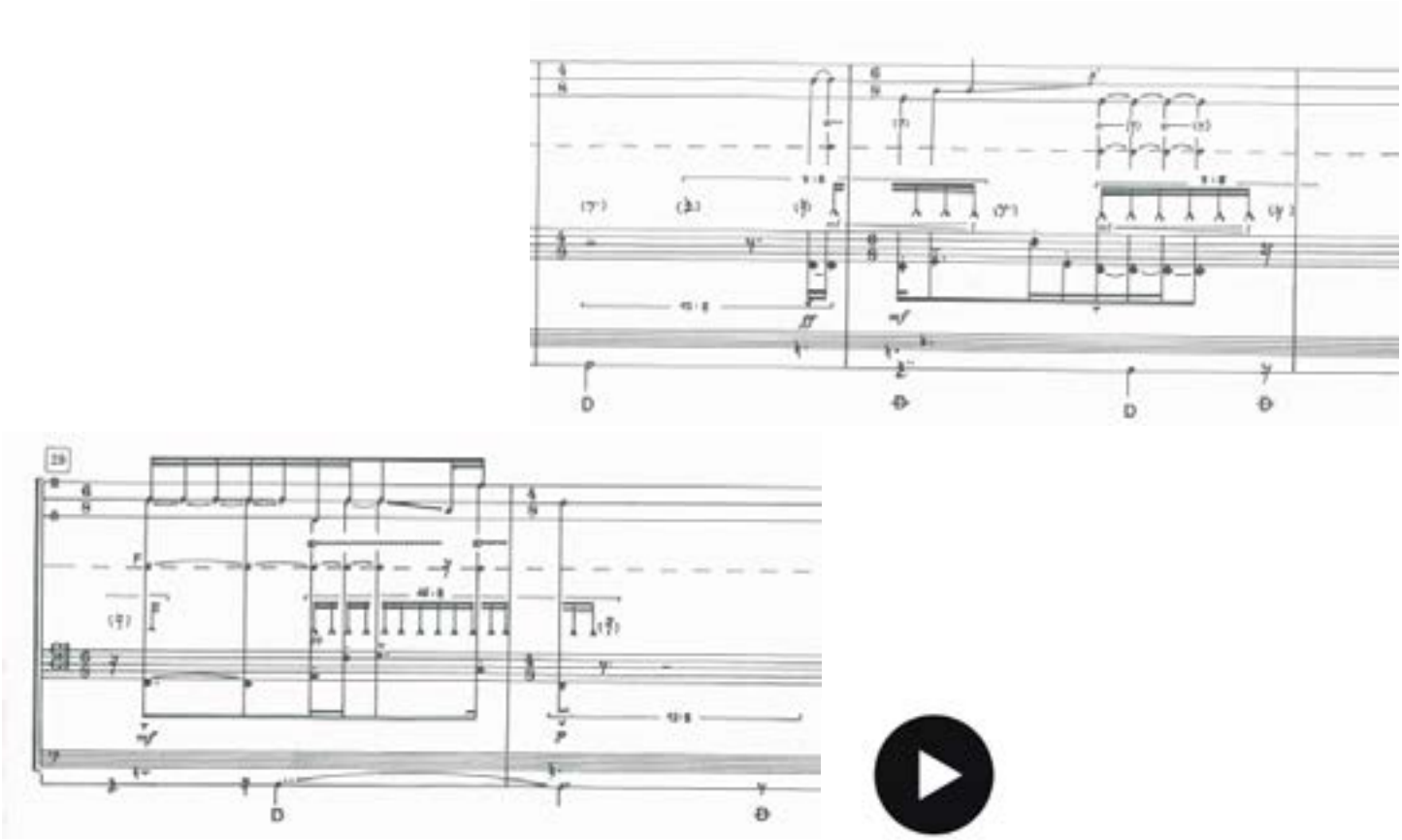
Passage 4: mm. 18-19
high density and completely distinct rhythmic lines

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

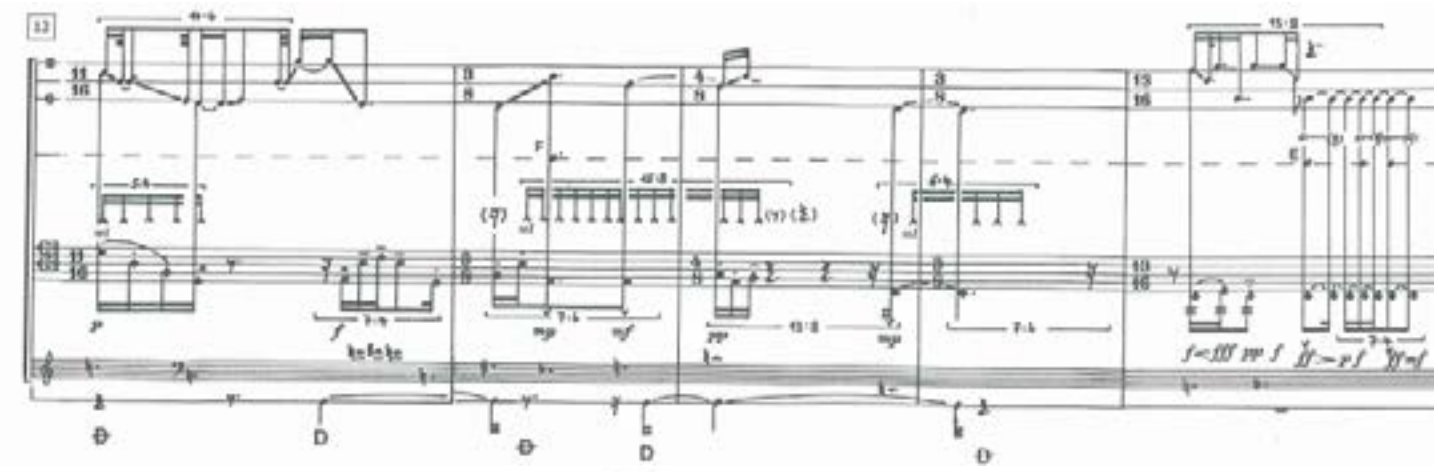
Although learning passages in this order removes the performer from the strict chronological progression of the piece, it does allow slow and progressive learning while maintaining a connection to the holistic embodiment of parameters, all without separating strands of rhythmic material. This order of 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.

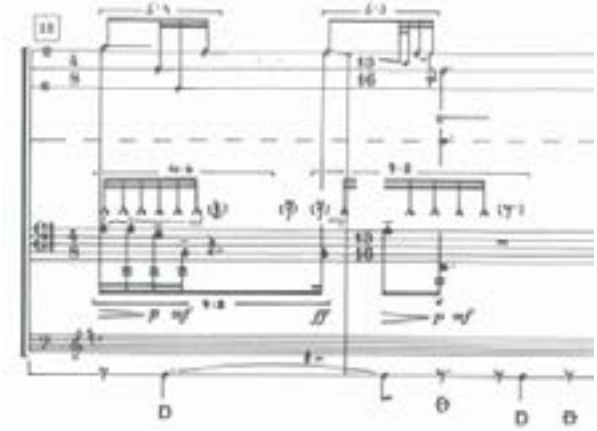


Passage 3: mm. 13-17
relatively few parameters overlaid but with high degrees of rhythmic dissociation

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

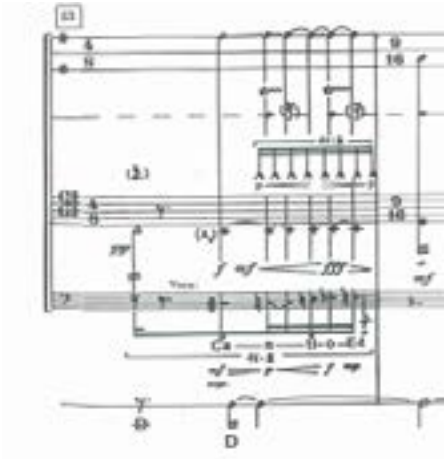
localized, situated knowledge to develop new tools of embodied craft, thus liberating the body for communication with the composer, the audience, and their own musicality.

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.

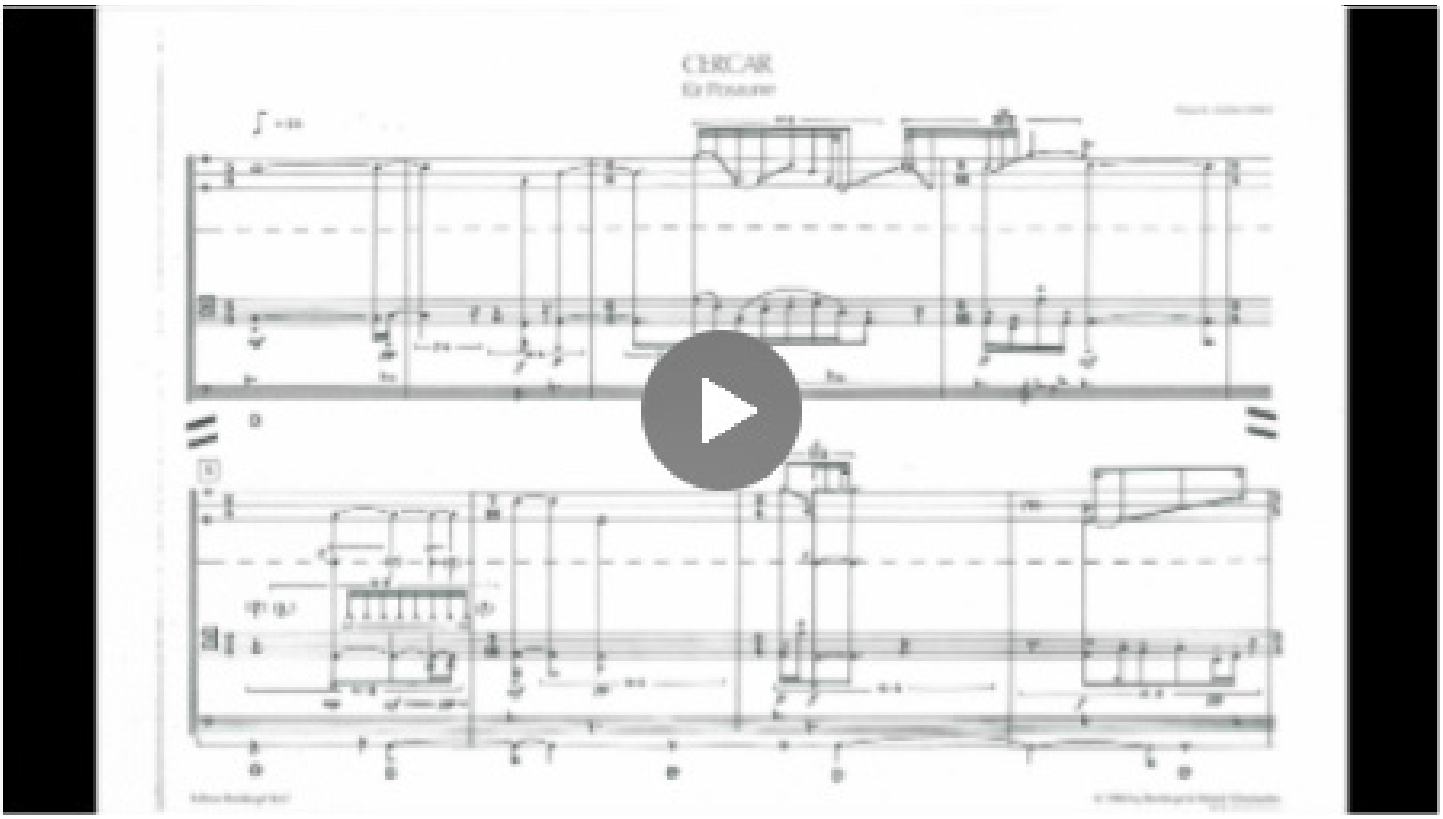
Hübler works within this space by way of his prior exploration and development of new embodied techniques with the trombone. The performer accesses it through the portal of the notation. Between them, this shared space allows for the abductive step to occur, and both Hübler's notation of specific passages 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.

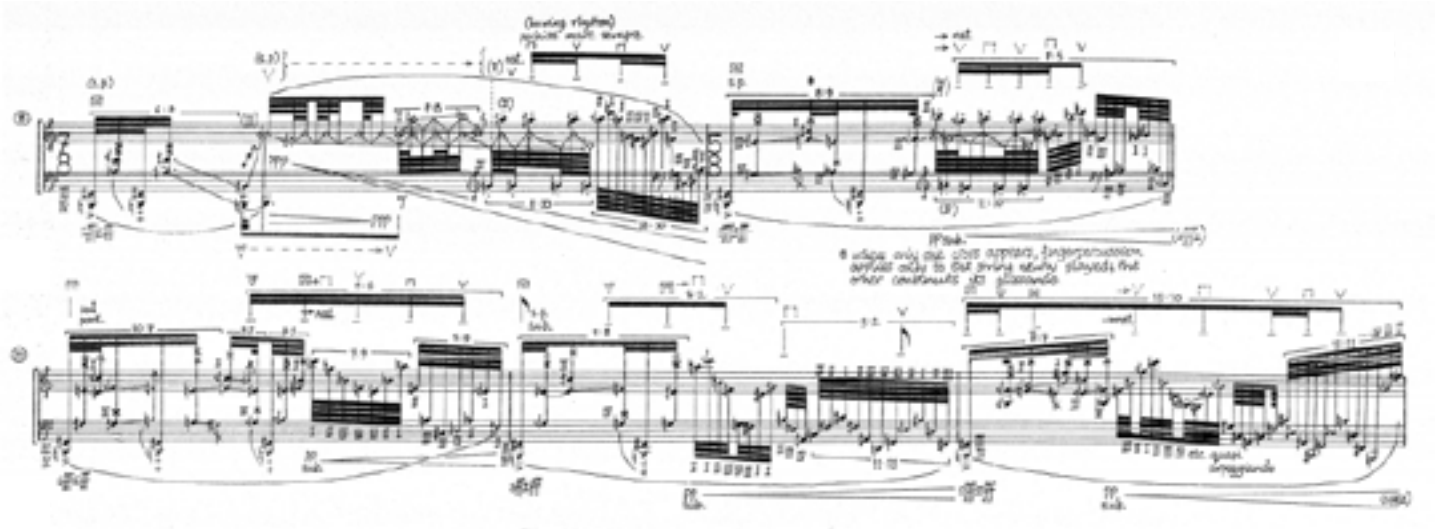
Richard Barrett, Ecological Niches, and the Radically Idiomatic

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.)

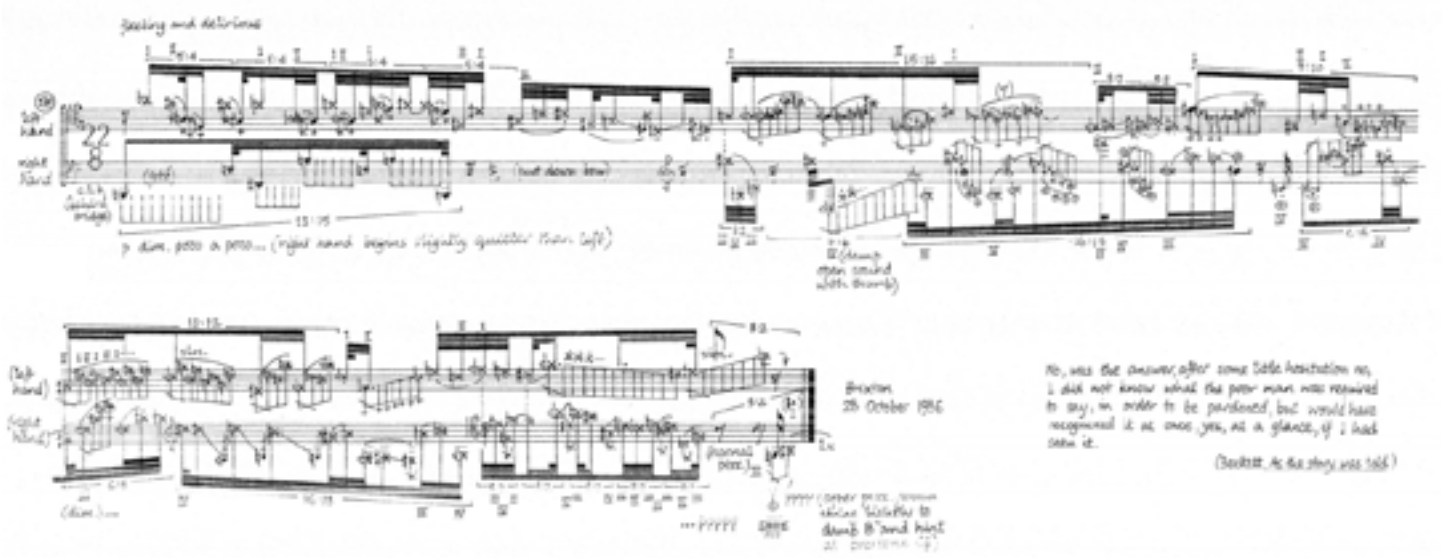
This idea of provoking the instrument proves vital to his music. From *Ne songe plus à fuir* onwards, his works, and in particular his works for solo instrument,[41] begin to engage more and more with this idea that the confluence of performer and instrument can "excite" the technique itself. This is 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

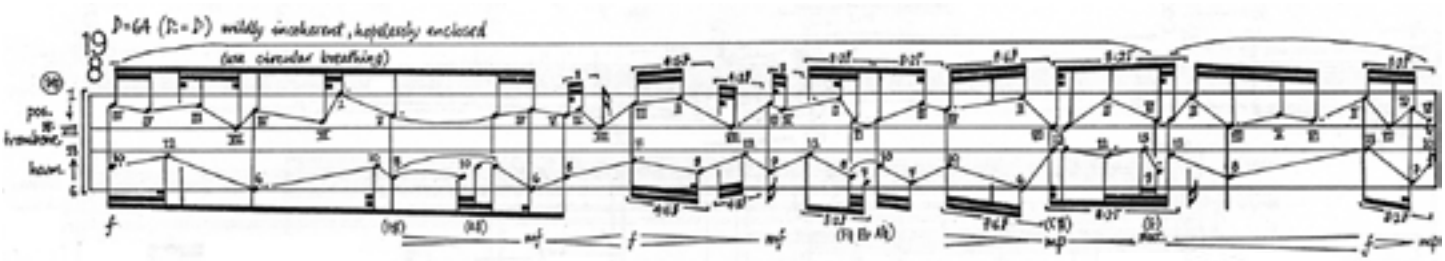
Later, the division of left and right hand is taken to even greater extremes, as the bow's decoupled actions become far more complex and rhythmically intricate.

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).

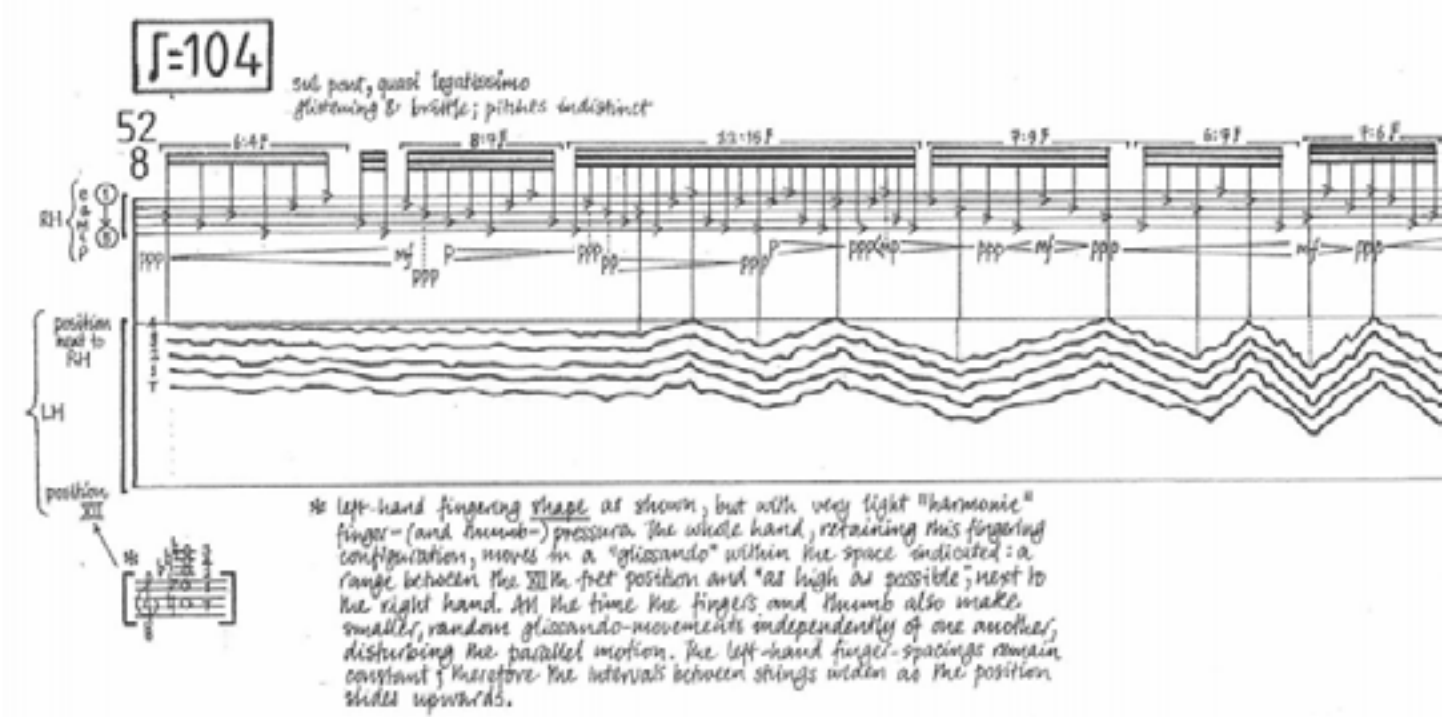
Emergence is a tricky concept, and one that Pfeifer and Bongard admit is "an art rather than a hard-core engineering discipline" (Pfeifer and Bongard, 2007, p. 87). The right balance of perceptive capabilities will provoke the emergence of a skill or seemingly organized, goal-oriented behavior, as was 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]

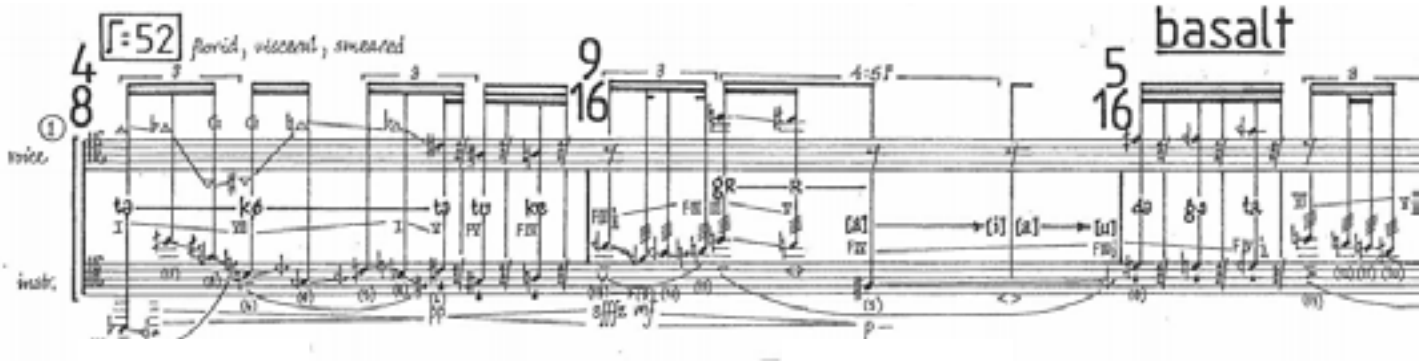
When learning music, then, these liminalities must also be explored if any hint of the imagination is to survive. To accept in any way the reimagination of the instrument and its idiomatic qualities means accepting that there can be even more, other forms of idiomaticism, as well. It means accepting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

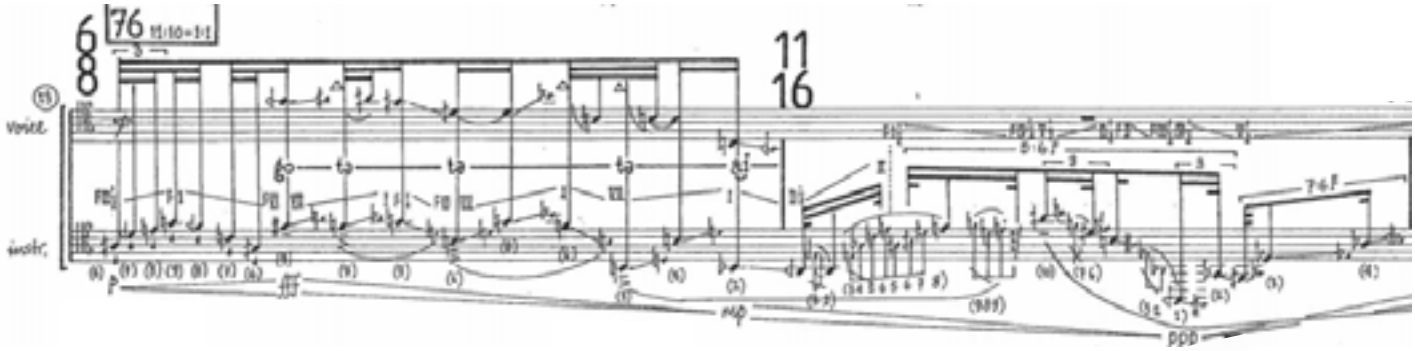
In *basalt*, though, this actually never becomes polyphonic. The notation of the voice on a separate stave seems to be dictated by the complexity of actions and the crossing of voices. If they were all to be notated on one staff, the overlapping information would be almost illegible. Displacing the vocal 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).

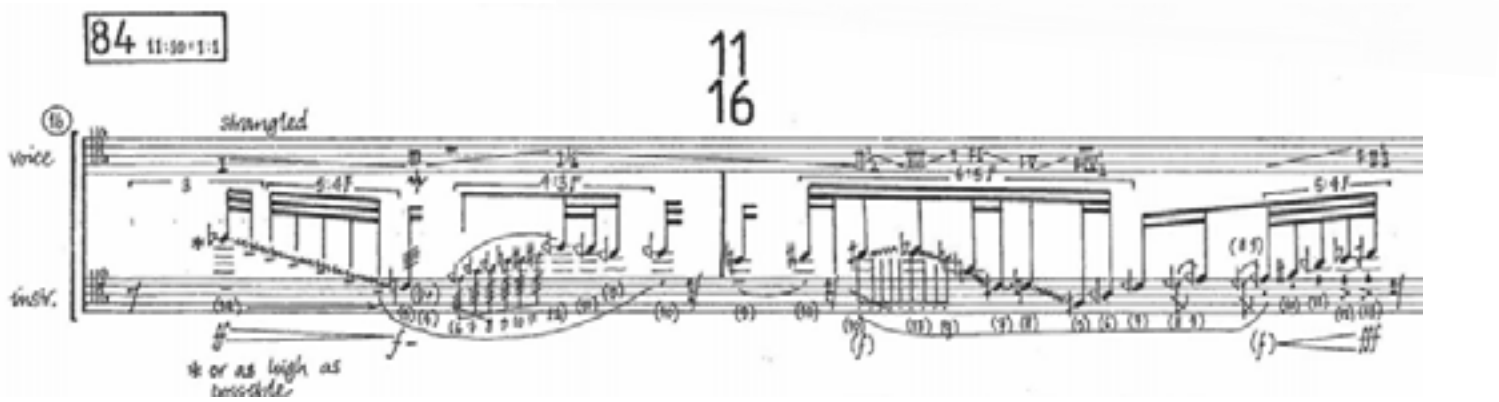
Even so, one might be forgiven for thinking that, given the plethora of information on the page, a radically embodied learning style may not really be necessary or advantageous. After all, if there is only one discrepancy, and that one now knows to correct, how much difference can there be between a 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:

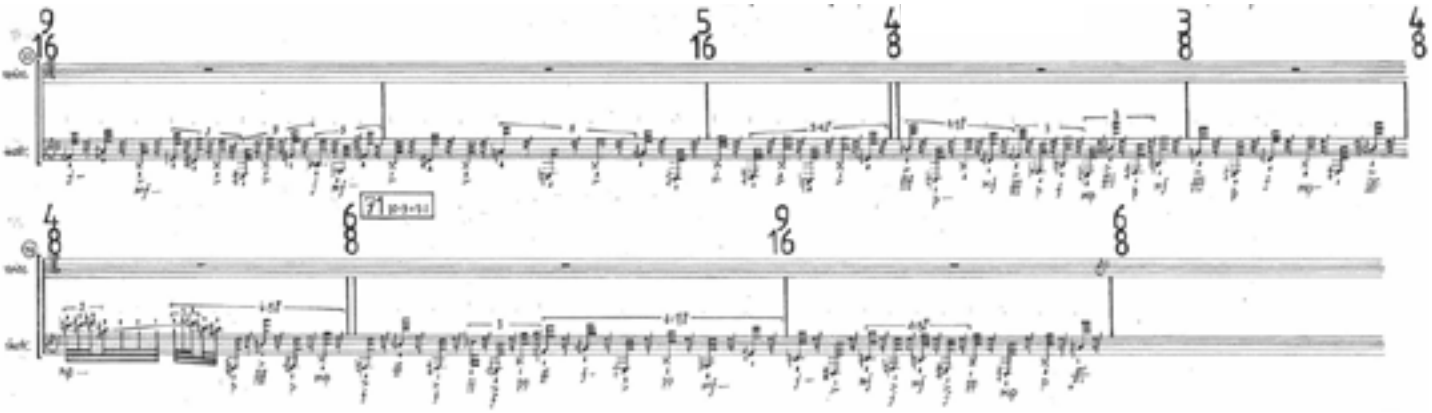
> 1. What is the task to be solved? …
>
> 2. What are the resources that the organism has access to in order to solve the task? …
>
> 3. How can these resources be assembled so as to solve the task? …
>
> 4. Does the organism, in fact, assemble, and use these resources? (Wilson and Golonka, 2013, p.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

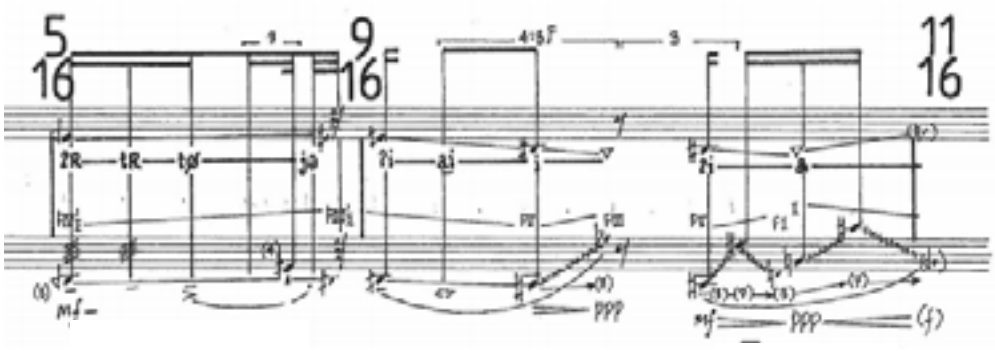
In applying this task analysis to music, the first three questions translate fairly easily. The fourth question is less straightforward. In laboratory experimentation, there will never be as many active variables as in the learning process of virtuosic music like Barrett's. It is impossible to verify 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?

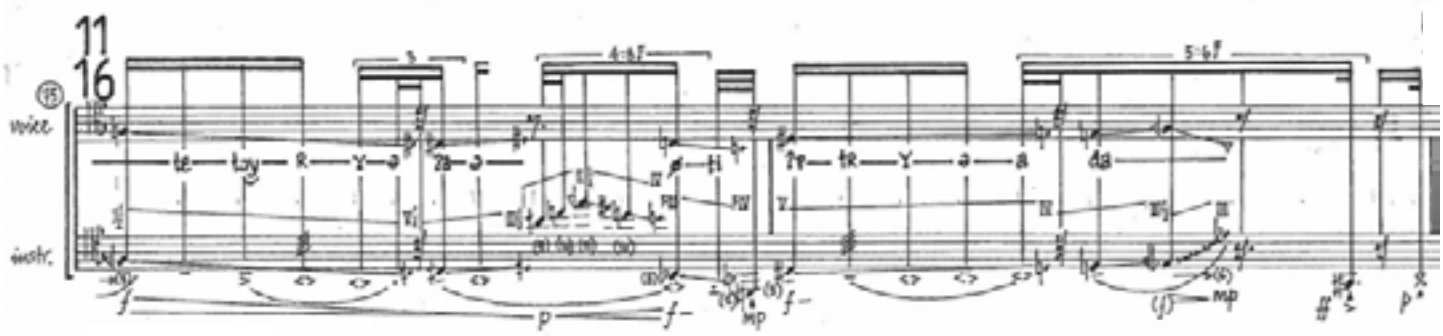
basalt provides us with ample material to apply these four questions to the embodied questions posed by Barrett's radically idiomatic notation. There are three basic types of material that occur in the piece, each of which poses distinctly different challenges to the performer, demanding not only a virtuosity 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.



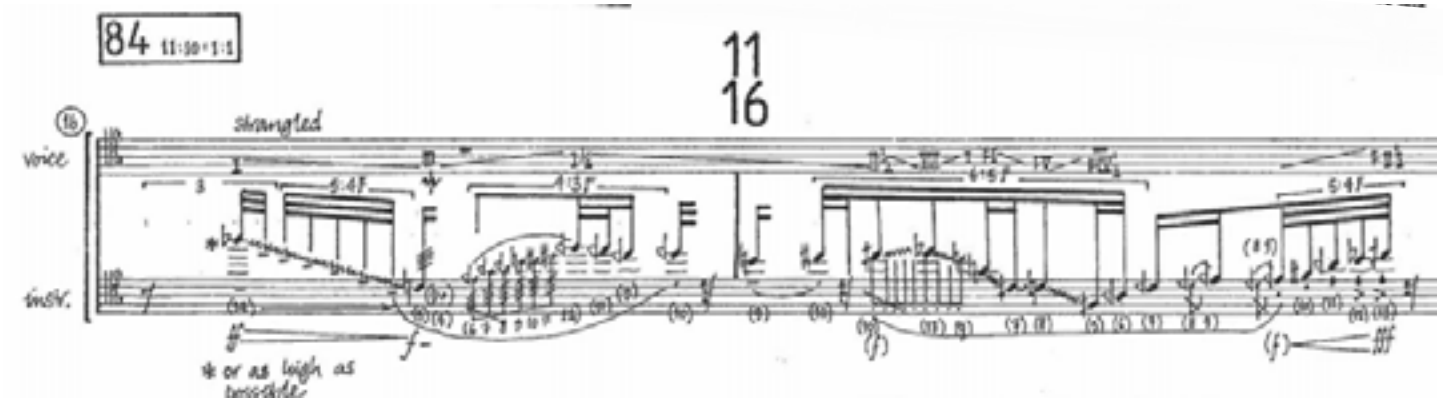
Passage 1: mm. 16-17

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.



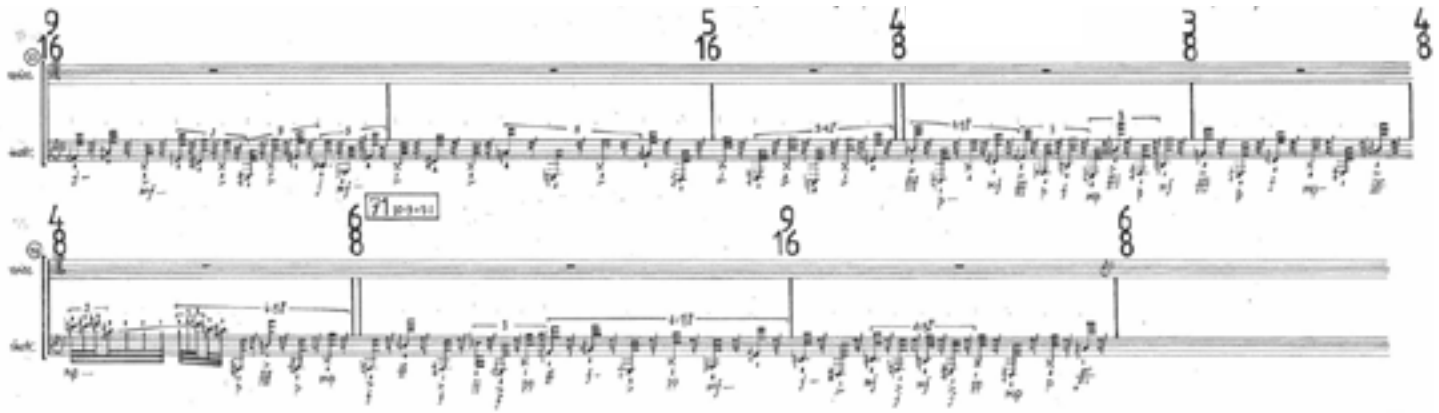
Passage 1: mm. 16-17

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.

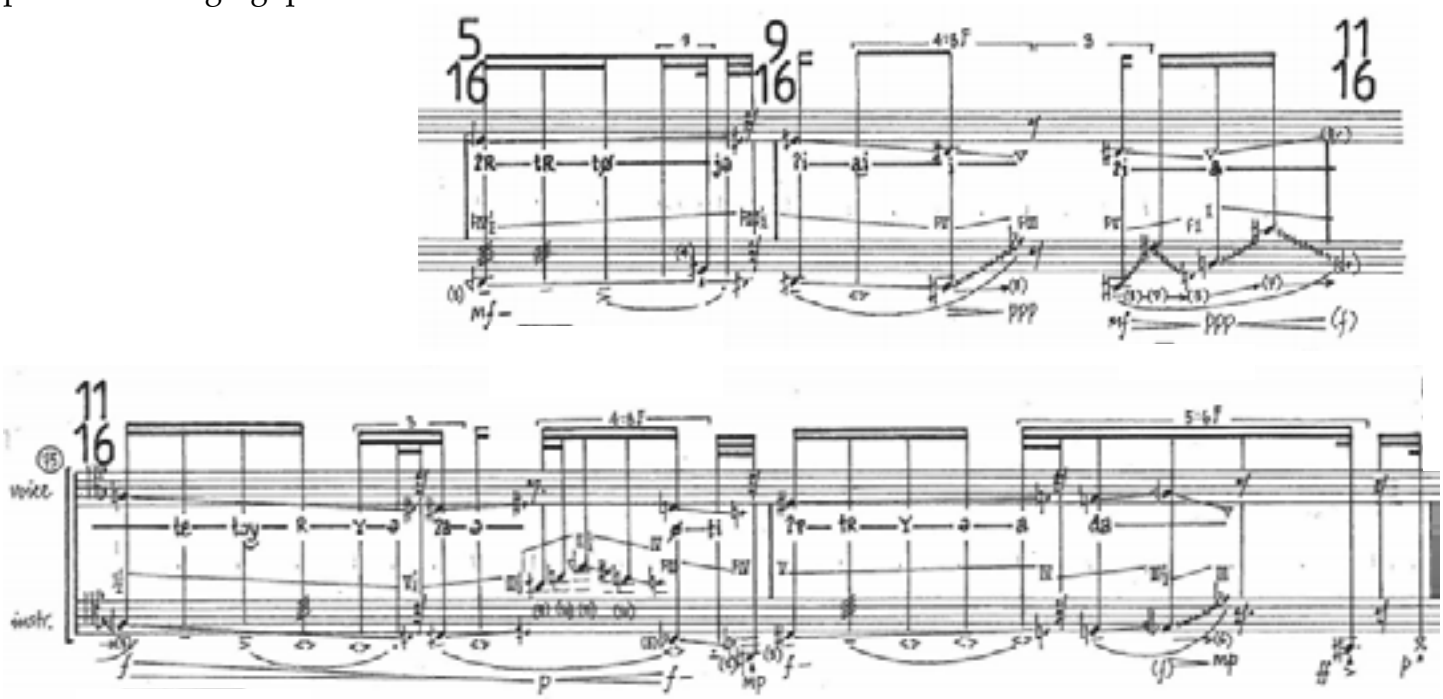
Passage 2 (mm. 32-39) provides a whole different array of challenges, though, and therefore poses an interesting and complementary challenge to the embodied learning strategies so far examined. After all, here, the slide motion is not notated, and in the course of picking out the microtones in the low 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.

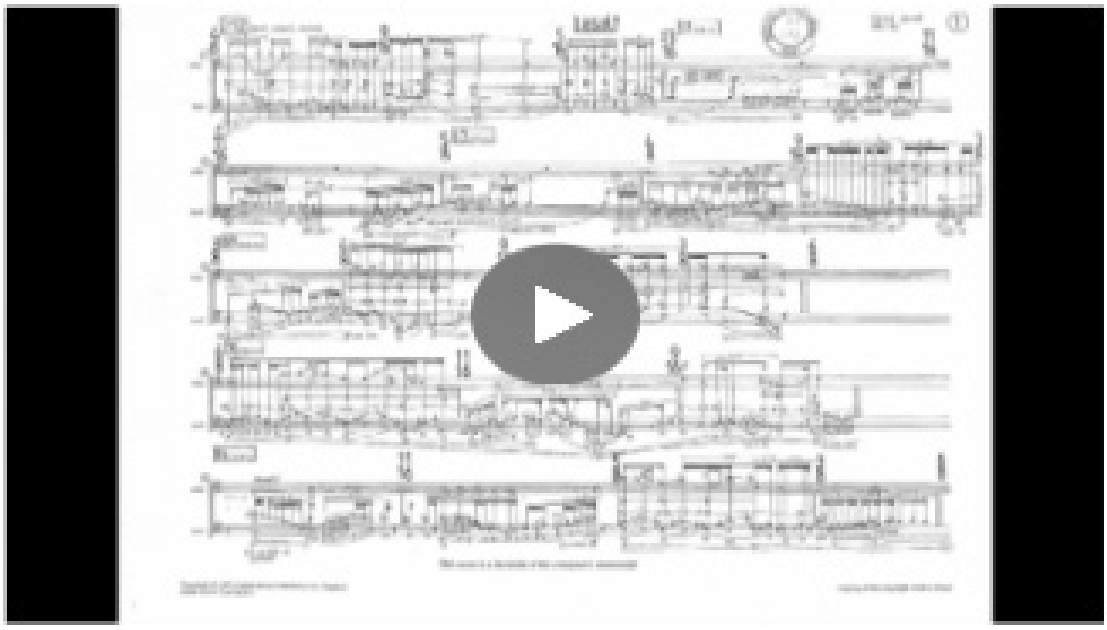
In all of these examples, the task analysis can never be completely accurate, and all of this is purely anecdotal. And yet, in the scheme of artistic research, these personal experiments are invaluable. It is only by doing so, by engaging personally with the methods hinted at by radical embodied cognition, 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*.

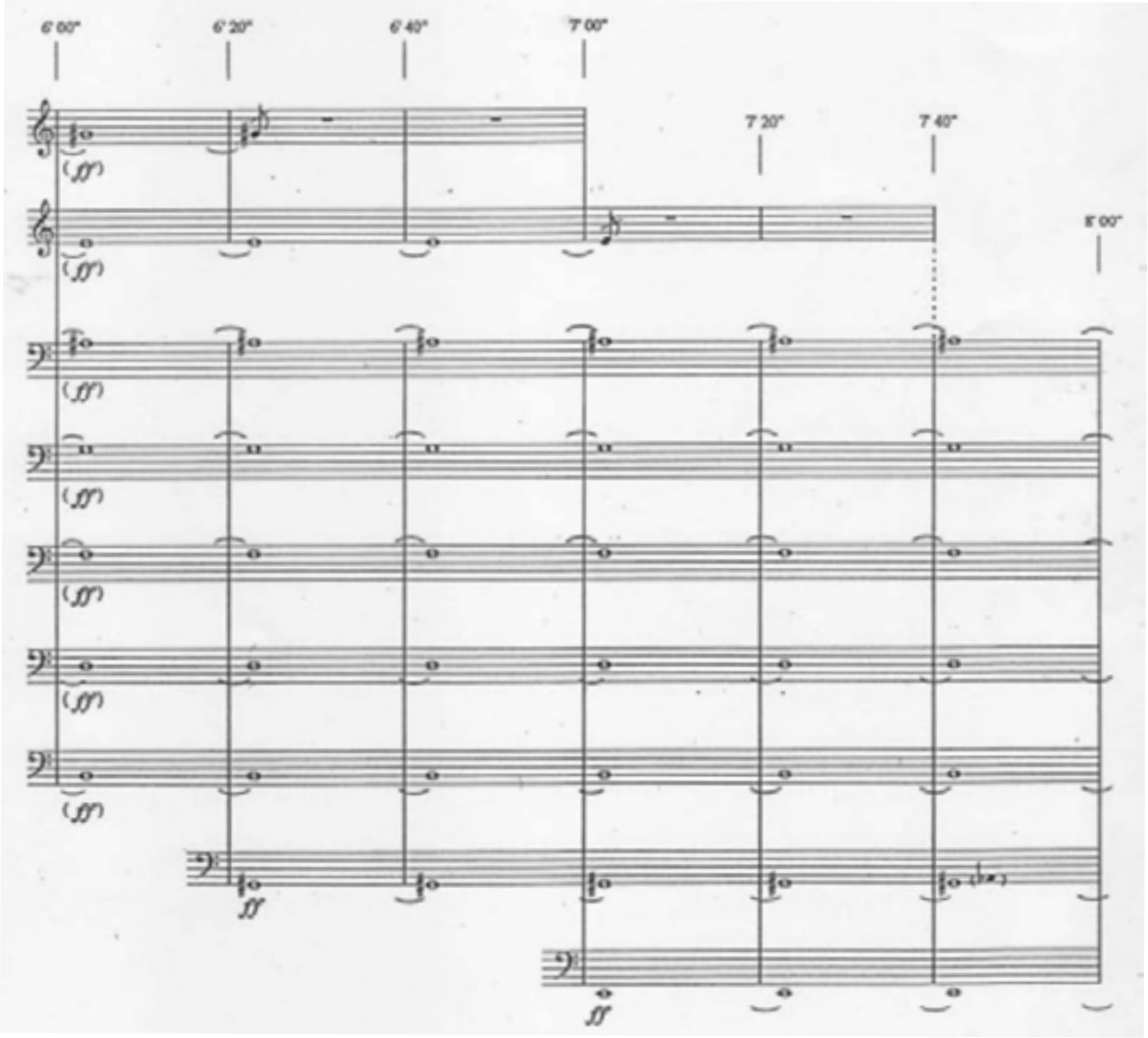
Music notation is inherently representational, even in graphic or text scores that avoid the traditional formats of Western notation. The attempt to codify and transmit information seems to necessitate it,

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.

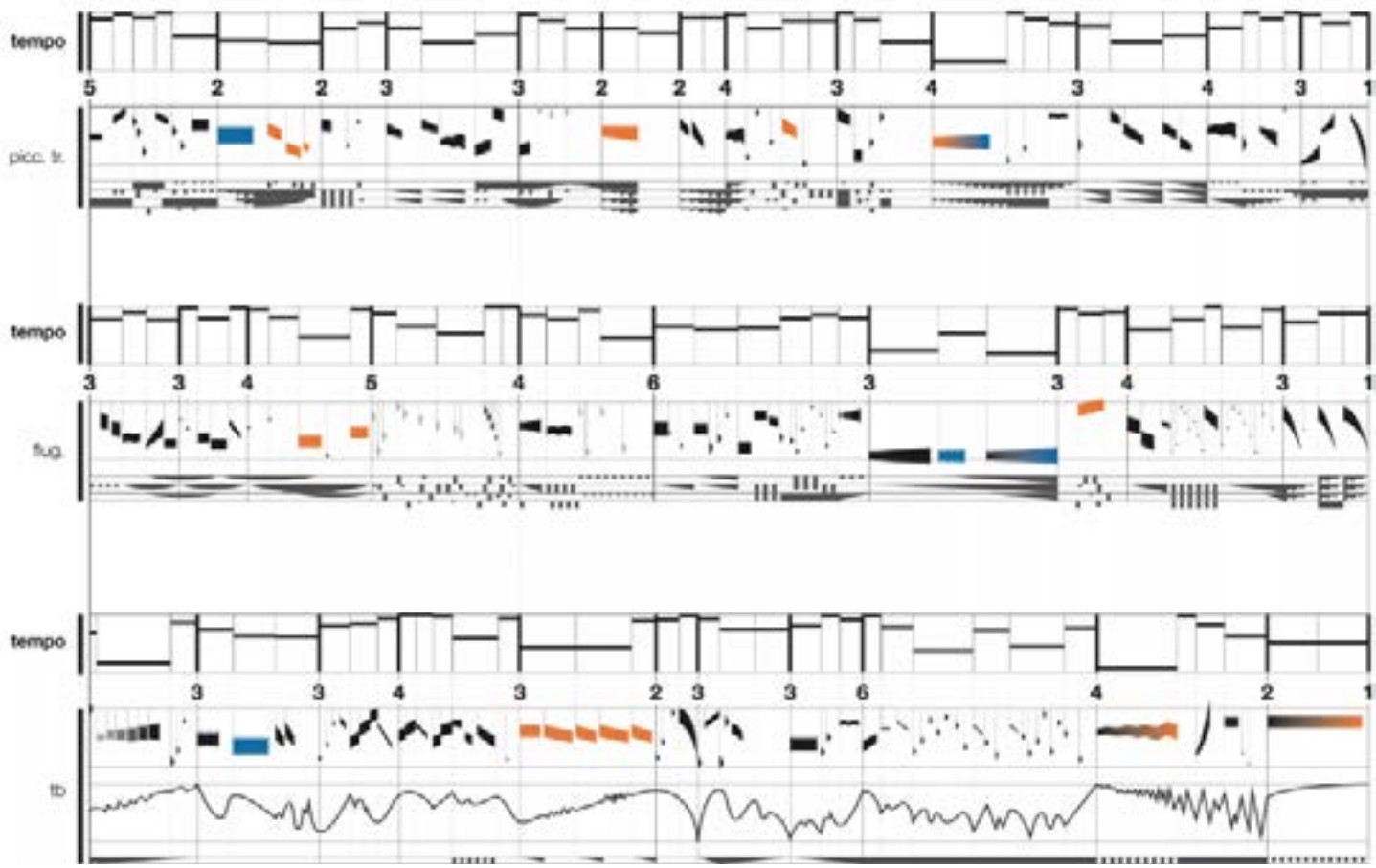
3.4.1 Nonrepresentational Rhythm and Timothy McCormack's *HEAVY MATTER*

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

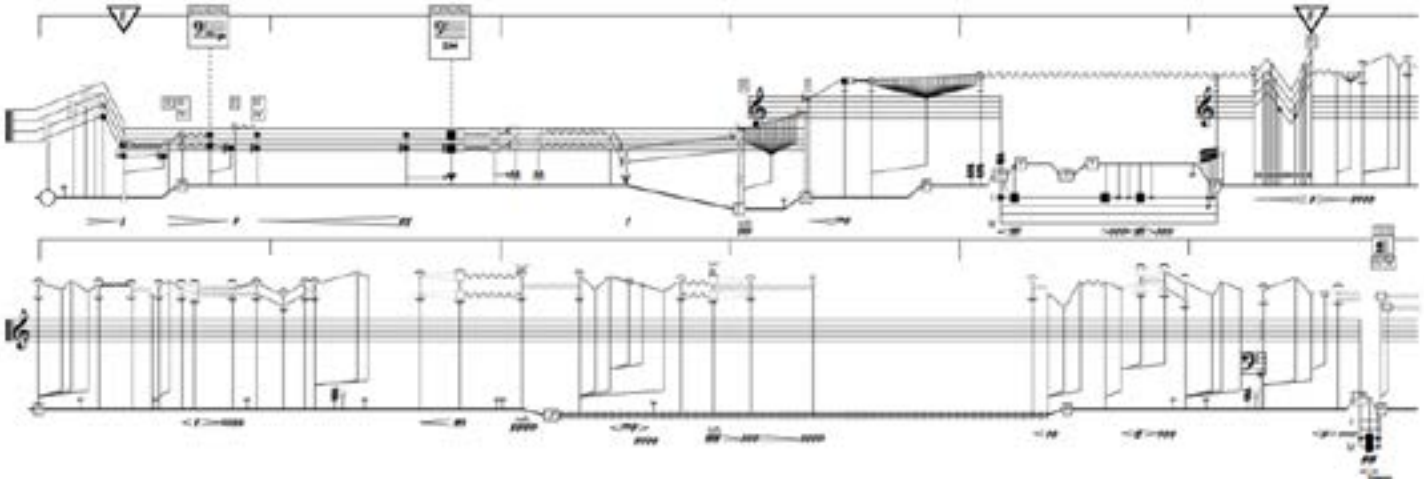
McCormack also relies heavily on the physical embodiment of notated gestures. His radically embodied synthesis of performer and instrument rejects outright any pretension of precisely preconceiving almost any element of a piece of instrumental music. This coming-into-being in the act of musicking implicitly 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

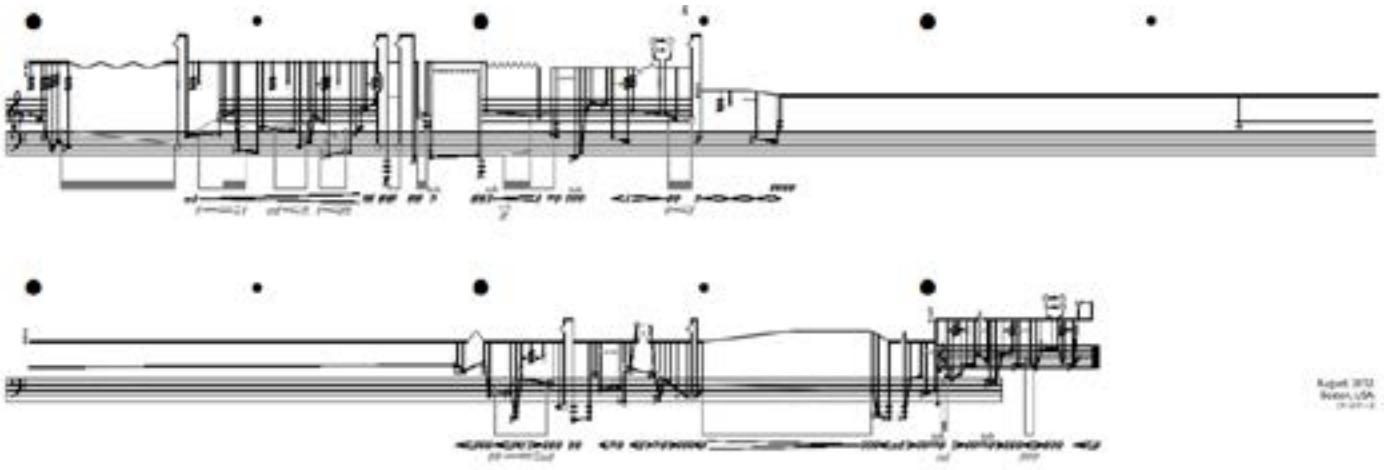
Although technically the second of the *MATTER* solos by some months,[54] *DRIFT MATTER* for solo cello feels in some ways to precede *HEAVY MATTER*, as it is far more continuous with McCormack's previous work for strings than is *HEAVY MATTER* with his previous work for brass. *DRIFT MATTER* expands 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.).

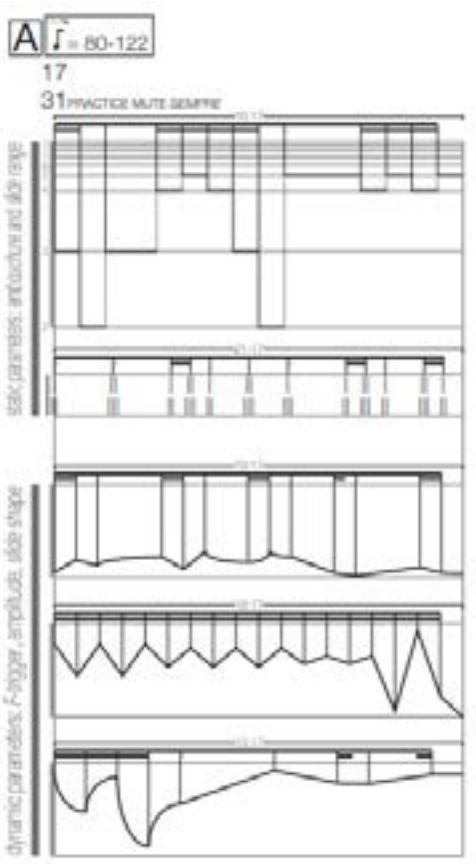
In the introduction to this research, Pàmies's concept of noise-interstate(s) was explored as part of a poietic practice strategy in his *[Vltbn]^4 (o quatre panells per a trombó sol)*.[55] The noise-interstate seeks to take advantage of the naturally-occurring noise in any interaction or communication, 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

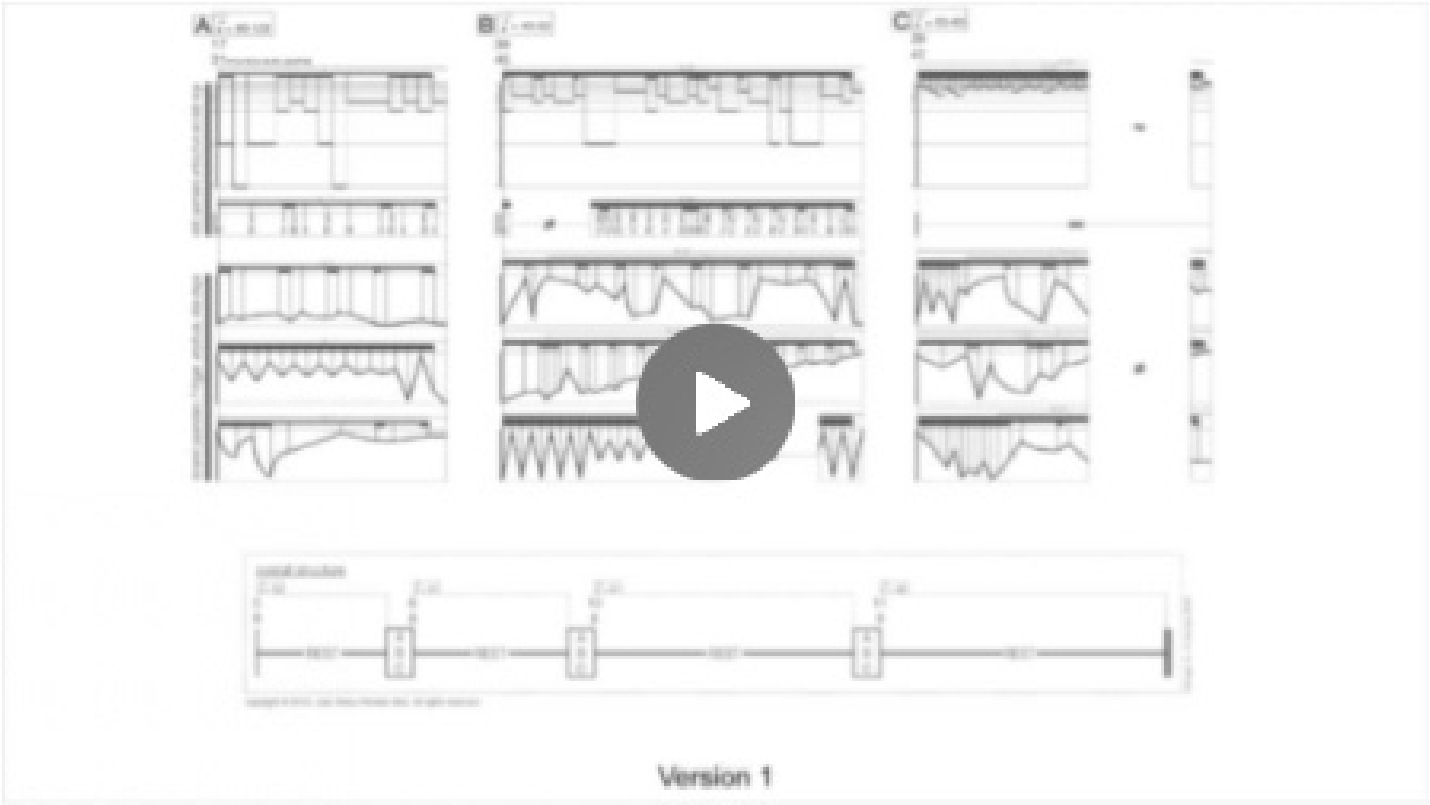
This requires not only a dynamic treatment of parameters in performance, but also a dynamic practice strategy that builds the requisite interpretive tools that enable the constant alternation of parameters. Given that the three sounding areas can also be combined in a myriad of different ways,[56] rote 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

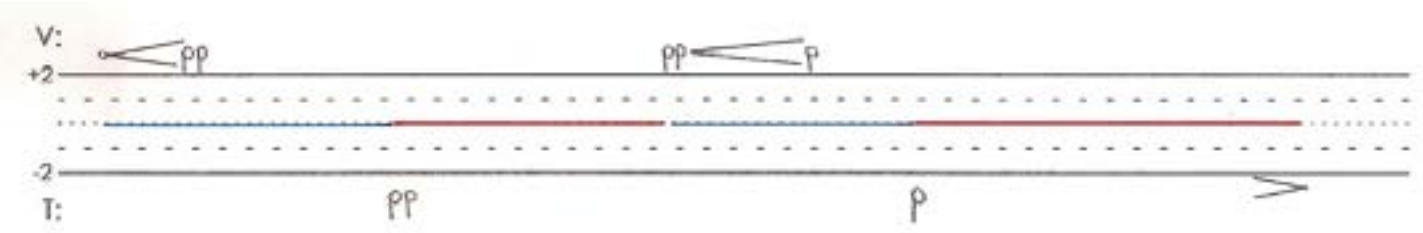
62 Cf. Klein 2014

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*.

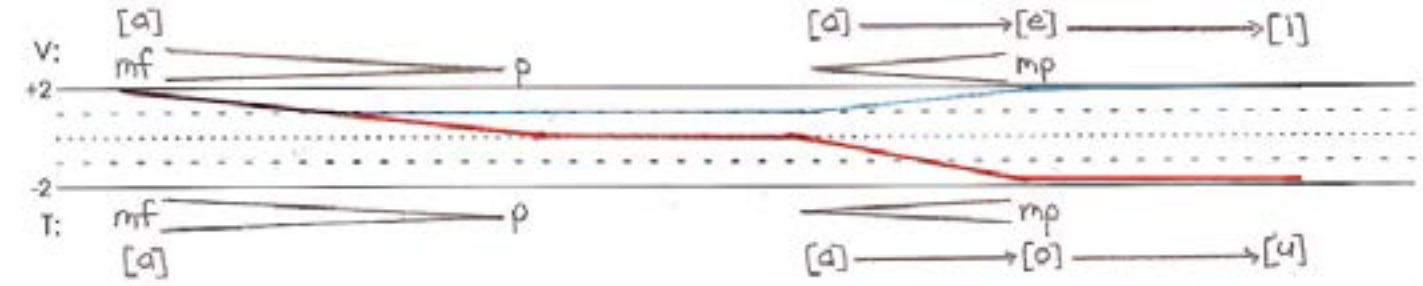
stratum. As Bök, quoting Jarry, notes: "'the function of navigators was to make land'--not to find it'" (Jarry, 1965, p. 199; in Bök, 1997, p. 65). Politically, this relates to the collectivities discussed above in subchapter 3.3, wherein social creativity is distinguished by the emergent capacity to 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)

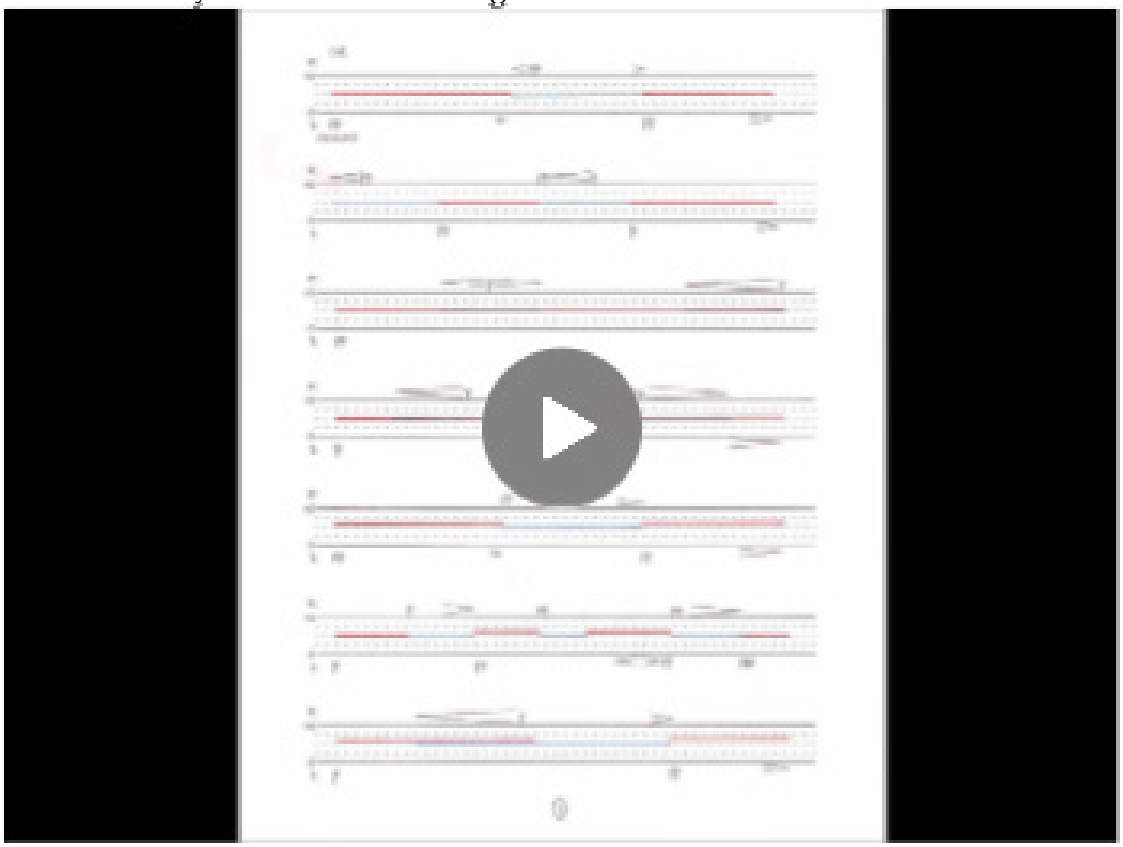
Clearly, although he is using what many may consider the simplest and most fundamental building block of Western music, Kumpf defines pitch as a dynamic and relational phenomenon. He contends that this dynamic notion of pitch alongside the contextual profile derived from its performative referentialities 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."

4. Conclusion

4 Conclusion

> Action … is never possible in isolation; to be isolated is to be deprived of the capacity to act. (Arendt 1958, p. 188)

The previous two chapters have focused on two discrete angles of performance practice: chapter 2 featured investigations of case-specific learning strategies based on non-musical theoretical templates, and chapter 3 examined the way that learning filters through the performative body and emerges from a dialogue between conscious (re)action and embodied cognition. As such, they explored two discrete forms of research: the personal practice of learning individual pieces (by way of whatever theoretical grating allows for the most efficacious approach) and the more general knowledge we can explore about how human cognition enfolds itself into its environment and produces (or contributes to the producing) of new behaviors and practices. What unites these two strands is the shared importance of *emergence*. Emergent practices rely on the complex polyphony of agents and environmental stimuli to contribute to the production of behavior; in the case of learning music, it means that the giant mess of variables at play in any moment (performers, instruments, composers, notations, scores, pencils, metronomes, rooms and acoustics, listeners, audiences—all variable and context-dependent, and often if not always wildly dynamic and contingent upon each other) can be viewed altogether as part of a domain that produces a particular piece or performance. The presence of so many variables makes it nearly impossible to approach these issues by isolating discrete factors one by one—even were one to do so, the isolation of one factor out of context changes it irrevocably. Rather, the complex, pluralistic system must be embraced as a polyphonic assemblage and tested in practice, as I have sought to do in the preceding chapters, in a variety of ways. In such practice-based work, concrete judgments and objective conclusions may be impossible (if not moreover, as I have repeatedly argued, also undesirable); nonetheless, by working in this way, the fault lines that underlie the learning process emerge, thus indicating the lines of research that most fruitfully accommodate the unique constraints of learning experimental music notations, while also suggesting response-able practice strategies for performers engaged with the real-life difficulties of these scores. The marriage of individually-tailored analyses (chapter 2) with more general knowledge derived from the last several decades of study in enactive learning and embodied cognition (chapter 3) provides a platform for tackling the entangled polyphony of variables contingent in learning physically polyphonic notations, thereby allowing new learning practices to emerge.

Emergence is intrinsically tied to the other concepts that have undergirded this endeavor: polyphony, precarity, plurality, diffraction, storytelling, and (last but not least) poiesis. The concept of diffraction, as utilized by Haraway and Barad, reminds us that inherent in the entangled polyphonies of these agents are the twin phenomena of amplification and interference (which are intrinsic to the superposition of any diffracted waves or, in this case, agents). Polyphony is a messy business, which is why it is so ripe to be thought through the idea of emergence: no two things placed in polyphony to one another form a purely cumulative sum of their parts, and the result can be either an amplification or an interference of one, the other, both, or something else entirely—an idea encapsulated so beautifully by Cassidy's phrase "polyphonic byproducts."[64] When Tsing proposes polyphony as a useful analogy for the ecosystems she studies, it is no accident that she relies equally on the concepts of precarity and resurgence, referring to the variable and unpredictable interplay of both balance and imbalance. Haraway goes furthest in embracing this messiness by extrapolating polyphony (for her, sympoiesis) to the idea of compost.

64 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).*

My research on physically polyphonic notations has attempted to chart similar courses through the maze of difficulties that face the performer intent on learning these experimental and entirely inconsistent notations. In chapter 2, I proposed a series of theoretical gratings that contributed to the learning process for particular pieces. Rather than proposing that other pieces use these particular models, I hope to have demonstrated a more fundamental framework of intellectual and practice patterns that might allow other models to emerge from similar points of departure. I have returned throughout to the idea of tool-building, and the subchapters of chapter 2 (2.1-3) are intended to provide templates by which new (music learning) tools can be built, rather than old tools repurposed. This idea may seem at first rather vague—after all, it is still just a person sitting in a room with a piece of music and a trombone; how *new* can a new set of music learning tools really be? To that end, chapter 3 attempted to show just how naturally emergent cognitive strategies in localized situations (and constraints) unfold. I have attempted to demonstrate both how a performer can cope with the practical demands of these notations while also questioning the myth of individualism that lies beneath the solipsistic act of practicing an instrument. Filtering this seemingly isolated act through these rich theoretical and practical frameworks, I hope that these investigations of the learning process can provide some proofs-in-practice of the polyphonic, intra-active potential of the theories and methodologies I have introduced. By applying these learning and cognitive strategies that were discovered or developed in non-musical disciplines in the last few decades, I have attempted to demonstrate the high degrees of creativity that can be brought to bear in these learning situations, which in turn enable the creative emergence of new idiomaticisms, instrumentalisms, and musics.

The concept of tool-building derives directly from Hannah Arendt's conception of work in her *Vita Activa*. For Arendt the poietic act is the fundamental expression of work, the tool-building process that enables the other two forms of activity to emerge: labor and action. Action, in this sense, is the existence of the body in plurality. As with the polyphonies within Tsing's ecosystems,[65] Arendt's plurality is defined by the necessary existence of humanity as a plural, as social groups in which political interactions (on some level) emerge as a matter of course. Arendt is adamant about the *sine qua non* nature of man's embedding in this plurality. Even the most isolated man (a philosophical Socrates deep in contemplation, for example) can construct this contemplative isolation only in the context of a human plurality that surrounds him.[66] Although Arendt's work predates the turn towards the posthuman, her plurality still presages the messy, cross-contaminating sympoietic assemblages envisioned by so many of the other writers in these chapters: Haraway, Tsing, Barad, Maturana. Arendt writes that "action and reaction … never move in a closed circle and can never be reliably confined to two partners … the smallest act in the most limited circumstances bears the seed of the same boundlessness, because one deed, and sometimes one word, suffice to change every constellation" (Arendt, 1958, p. 190). Arendt's boundlessness is a precursor to Barad's intra-action, an intimation of the interrelated web of disturbances that Tsing describes, and the fertile ground in which Haraway's material-semantic composting may mature. This is why the idea of plurality as a natural state of sorts, not as a secondary consideration external to the individual's body and consciousness, becomes so profound. For all of the metabolistic productivity of labor and the creative fruit of poietic work, they are all contingent upon the web of perpetual, interwoven relations within the field of action. "Action, moreover, no matter what its specific content, always establishes relationships and therefore has an inherent tendency to force open all limitations and cut across all boundaries" (Arendt, 1958, p. 190).

65 See 2.0 Preliminaries.

66 This resonates with the Scholastic notion of contingency of Duns Scotus and his contemporaries, for example that non-being as a concept is contingent on some concept of being that is negated. In this sense, the isolation of a Socrates is not only materially supported by his human neighbors (the plurality in which he is physically embedded), but is also conceptually dependent on a state of plurality that is then negated by his isolation.

A poietic methodology is embedded in this plurality. In building tools that enable new practices to emerge, a poietic approach has to assimilate the unique contextual demands of new situations, which is to say, it has to accommodate the vast array of factors that come to bear in each moment of musical material. The complex web of factors that accrue around any musical gesture are problematized by physically polyphonic repertoire, in which familiar comforts (notations and techniques) are elided. It is only in finding ways to successfully stitch these factors together that a methodology for learning can emerge. This means also embracing the messiness of these polyphonies, replete with all of the amplifications and interferences that emerge for the superposition of actions and agencies. "Otherness, it is true, is an important aspect of plurality, the reason why all our definitions are distinctions, why we are unable to say what anything is without distinguishing it from something else" (Arendt, 1958, p. 176). By taking this act of distinction as an initial impulse to work, one can use this confirmation of plurality and otherness to situate new practices responsively to their respective relations. The models for enactive learning, shared performance, and emergent embodied cognition show how this occurs in real life situations. The previous chapters have explored how this poietic tool-building works to contextualize and instantiate response-able performance practices for a repertoire that resists the stagnation of a continuous interpretive strategy. As a learning method, this means embracing the precarity of inter-relatedness that (re)situates each new notation and each new performance, and then using that vulnerability as an invitation to develop emergent, enactive assimilations of each new notation directly into the performer's body. Thus, emergence becomes a platform for new practices: new frameworks for perception, new forms of action, and consequently new patterns of direct perception-action relations.

This methodology relies on redefining entities not by their individual qualities but rather by the way in which their intra-action across time and space reveals them as continually-emerging relationalities. This reorientation towards dynamism embedded within plurality—rather than towards isolated singularities and denotators of content—means that the tool-making creativity of work is always placed within the fluid web of action. Arendt calls this the "in-between:"

> Action and speech … retain their agent-revealing capacity even if their content is exclusively 'objective,' concerned with the matters of the world of things in which men move, which physically lies between them and out of which arise their specific, objective worldly interests. These interests constitute, in the word's most literal significance, something which *inter-est*, which lies between people and therefore can relate and bind them together. Most action and speech is concerned with this in-between. (Arendt, 1958, p. 182)

It is perhaps for this reason that the concept of stories becomes so important. Arendt deliberately identifies story-telling as the aspect of action (that is, man's action in the pluralism of society) that emerges from the more isolated tool-building poiesis of work. Story-telling becomes the fundamental expression of both social myth-making and political imagination, beyond its role as an essential form of communication and expression in the most isolated and mundane circumstances. This is part of why it is such a fertile term for describing methodologies. Stories are necessarily emergent, unfolding in time, dependent upon ideas that weave and unravel directionally. Stories take time; punchlines, morals, and denouements are dependent upon contextual cues that accrue incrementally over the course of a story, and they lose their valence outside of that context. For practice-based research, which embraces contextually-dependent exploration of isolated knowledge production, stories are a productive and efficient framework for understanding how these practices emerge. In the case of physical polyphony, story-telling also helps to show how these learning practices emerge from the practice room and enter the world. After all, that is what fascinated Arendt so much: not only how these tools are produced, but how they are then *used* within the plurality of social relations, which is to say, not only how the story is conceived, but also how it is subsequently *told*.

Thus far, I have focused on solo pieces for trombone. Given my own limitations as a trombonist, these pieces have allowed the most efficient laboratory for exploring the concepts I have introduced. However, as this study comes to a close, I propose that these ideas for learning music can live beyond the confines of purely physically polyphonic notations, and to that end I present a few final musical examples to help demonstrate how these concepts can radiate outwards into other repertoires. Physical polyphony, itself, is undergoing some similar transformation. Following the (extremely relative) burgeoning of interest in this type of notation in the early 21st century, the possibilities that physical polyphony enables have also contaminated other notations and aesthetics. If the solo pieces that I have examined have focused on the interstices between composer and notation and performer and listener, I hope to now look briefly at how these interstices stretch out also in chamber music (with the introduction of extra performers) and into other notations. As the previous chapters were purposefully circumscribed so as to isolate physical polyphony as a notational strategy, these final examples all look at composers who have been influenced by physical polyphony (or have written directly physically polyphonic works), but who have since drifted into more contaminated notations, wherein the strategies of physical polyphony perforate other notational means—variably, inconsistently, and with radically different effects. These final examples aim to sketch a few initial steps by which the strategies explored in these pages for learning a circumscribed genre of solo music can also extrapolate outwards to other notations and to larger ensemble situations. In the spirit of story-telling and emergent worlding, this dissertation has relied on the idea that demonstration supersedes discussion, as in the dictum that showing is better than telling. In that same spirit, I rely once more on a few examples from the polyphonic wilderness to demonstrate the potential that physically polyphonic notations and emergent learning strategies hold for other musics. These three pieces of chamber music by Chikako Morishita, Timothy McCormack, and Michael Baldwin each bear some kernel of physical polyphony but simultaneously, and critically, diverge therefrom. In these scores, physical polyphony serves as an impulse to embodied bewilderment, a tactile curiosity contaminating other notations and physical vocabularies even as it submerges itself in them.

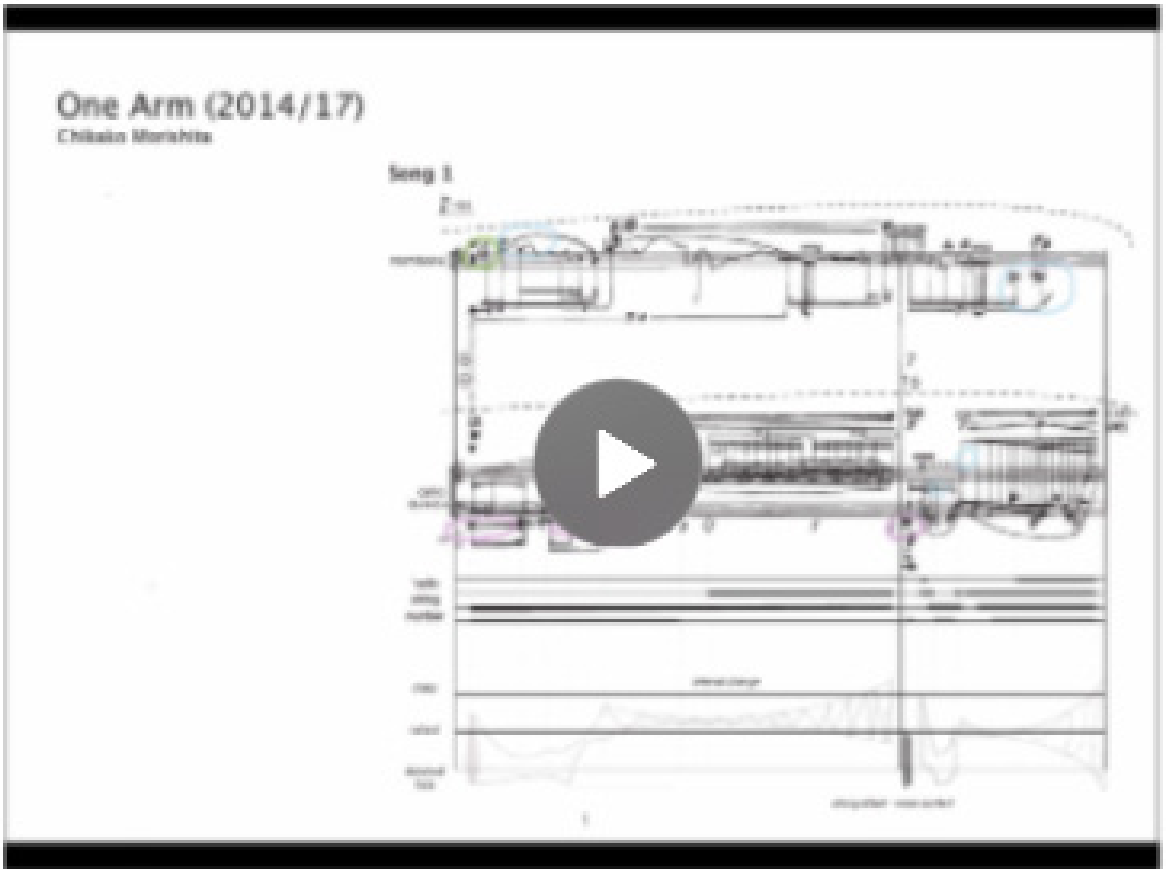
Chikako Morishita has developed a rather idiosyncratic method of writing physically polyphonic passages: she notates multiple simultaneous lines of music for a single performer, the simultaneous performance of which are very literally impossible.[67] Morishita writes strands of traditionally-notated material that are then layered and superposed upon each other as though they were simply sound waves to be diffracted through one another. She leaves these passages with instructions both elegantly concise and cryptic: the "score includes multiple layered phrases: in absolutely no case [should] the performer ignore the presence of materials on the page even if it is not literally playable" (Morishita, 2013, p. ii).

This notational strategy problematizes quite a few aspects of performance practice, and presents a brazen challenge to traditional classical conceptions of textual fidelity. In *One Arm 5*,[68] for instance,

67 Whether these passages are truly physical polyphony, and not merely polyphony for one voice, is up for debate. Personally, I argue that they are. The performer may attempt to hocket back and forth between voices, perhaps even delaying or anticipating the proper temporal placement of gestures to aid in playing as many notes as possible, and in so doing may be quite successful in rendering polyphonic lines as a monophonic gesture. Nonetheless, it remains necessary to develop types of mental and physical gymnastics in order to maintain awareness of the multiple strands of material and to maneuver the various physical components of the body in a way to facilitate the rapid or instantaneous alternation from voice to voice. It is rather the bodily preparations, poised always for multiple actions and directions of motion at once, that come to embody physical polyphony in these passages, for it is these bizarre contortions of potentiality that are in fact demanded by the notation, rather than just the intellectually distinct strands of polyphonic material. This form of single-instrument polyphony is quite similar to some of the notations that Wieland Hoban resorts to in *Zerscherbter Wahn* (2002) (cf. 1.3 Physically Polyphonic Notations).

68 *One Arm 5* grew out of Morishita's *One Arm 1* for trombone and cello (as did *One Arms 2, 3,* and *4*). Although *One Arm 1* is the original material, I work here with *One Arm 5*, as that was my personal introduction to the cycle and the one I have performed.

for e-guitar and trombone, both performers execute such braided single-instrument-polyphonic passages throughout the first half of the piece (Song 1). These polyphonic passages are interpolated by moments when the two performers abruptly cease performing, look up to the audience, and voice excerpts of a text in unison. This alternation provides quite a chamber music challenge: performers alternate between the feelings of running frantically in opposite directions of a room while juggling multiple balls falling every which way, to that of suddenly stopping and sharing a single body to perform a slow, ritualistic gesture. This alternation alone is enough to give a performer interpretive whiplash, but the additional challenges of the polyphonic strands within each voice add even further complications to otherwise normal considerations of coordination.



Chikako Morishita: *One Arm 5* (2014/2017/2018) (color-coded markings in original); with Coleman Goepfert, e-guitar

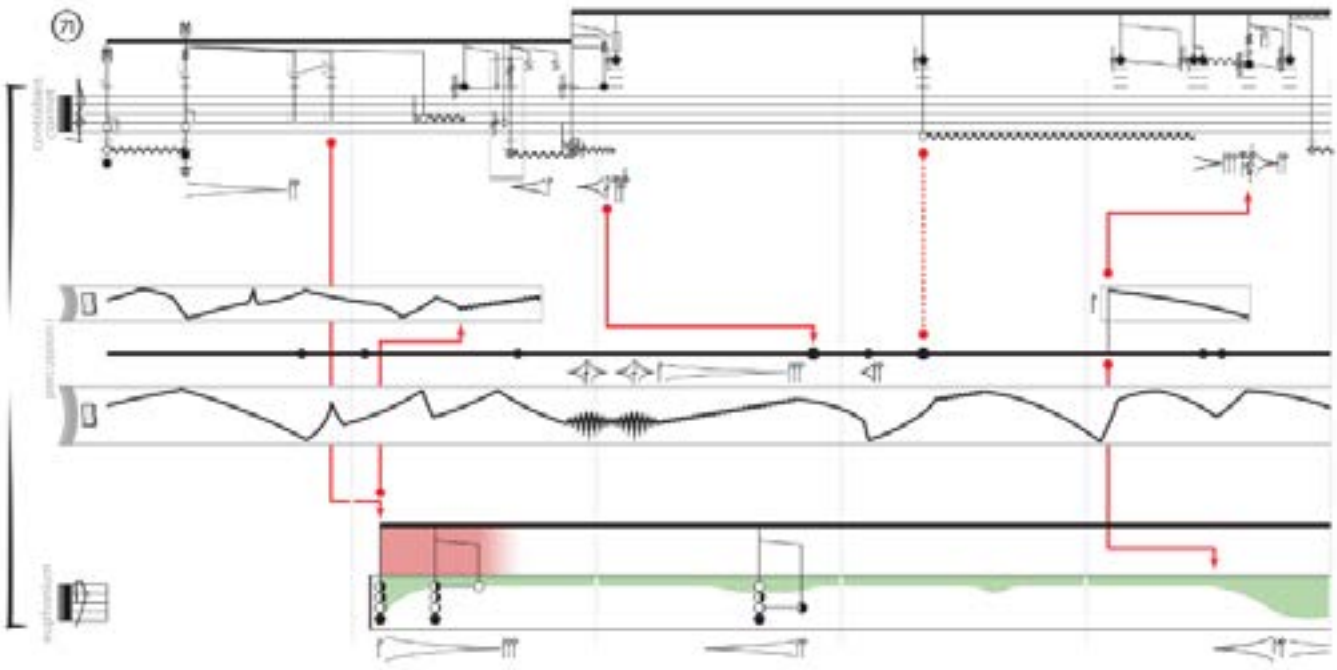
As noted before, this type of notation resonates very strongly with the concepts of superposition and diffraction that emerged in Karen Barad's agential realism.[69] In fact, it would appear to explore two extremes of intra-action in chamber music. Because performing these strands of single-voice polyphony tends to play weird games with temporal and rhythmic expectations, performers must learn to reach out their antennae to each other in various ways (less contingent on strict awareness of vertical score expectations), building patterns of awareness that allow for the fact that the set of potential gestures is greater than the set of actuated gestures. Building a cohesive chamber music relationship within the confines of a score where any single gesture may or may not be voiced alone or swallowed up by another requests of the performers a particular type of intra-activity, in which they have to maintain multiple simultaneous strands of non-verbal communication so that the realization or omission of any expected musical gesture is quickly enfolded into another, allowing for a seamless trajectory of duo playing even as the individual voices may vary (perhaps even vary wildly) from iteration to iteration.

All of that then alternates suddenly with moments when the performers have to quickly jump

69 See 2.2 Agential Realism and Michael Baldwin's *Erasure*

out of the gymnastic, juggling mindset, and seamlessly enter a theatrical moment, wherein they superpose themselves on one another, reciting the unison text. Unison recitation is problematic enough, but its juxtaposition with the other forms of polyphony that Morishita uses force performers to simultaneously inhabit multiple versions of themselves as well as each other, initiating an unavoidable intra-active potential that then reaches out tendrils in the direction of composers, performers, spaces, and beyond. In Morishita's music, intra-action becomes the means by which these seemingly insolubly distinct musical materials can succumb to and ignite a Baradian "congealing of agency" (Barad, 2007, p. 184). Her use of superposition encourages a thickness of texture, an increasing viscosity of voices melding into one another as clear divisible lines are slowly kneaded into a single body. These mutual amplifications, interferences, and distortions encourage the viscerality with which such entanglements—in the words of Barad—"come to matter" (Barad, 2003, p. 824).

Timothy McCormack's recent chamber music embodies an altogether different sort of congealing of agency. With notations strongly reminiscent of *HEAVY MATTER*,[70] *KILN I* (2014/17) shows how these physically polyphonic notations can branch out from one performer's body into another's. As examined in *HEAVY MATTER*, McCormack's more recent notations have eschewed traditional rhythmic notations for less representational, more embodied temporal organization. As the music scales upwards from solo to ensemble, McCormack maintains this commitment to emergent, embodied temporal organization. By indicating moments where one voice triggers or intersects with another voice, McCormack successfully coordinates divergent strands of musical material within an immanent rhythmic framework. It is, in fact, very possible for the separate strata of the voices to shift in relation to one another while still maintaining a rigorous rhythmic trajectory through these points of contact.



Timothy McCormack: *KILN I* (2014/17), m. 71 (color-coded markings in original)

McCormack's system of embedded cues, wherein the consequential rhythms of one player cascade into the activities of another, are distinctly different than the separate but equal strands of polyphony that characterize much Western music. McCormack's pieces encourage the collision and confluence of

70 See 3.4 On Non-representational Notation.

musicians as they amplify, resist, and resonate alongside one another. These cascading impulses that jump from performer to performer like electrical energy reveal a polyphony that emerges from the embodied implications of McCormack's solo, physically polyphonic notations and extrapolates this commitment to interstitial superposition to the level of multiple performers.

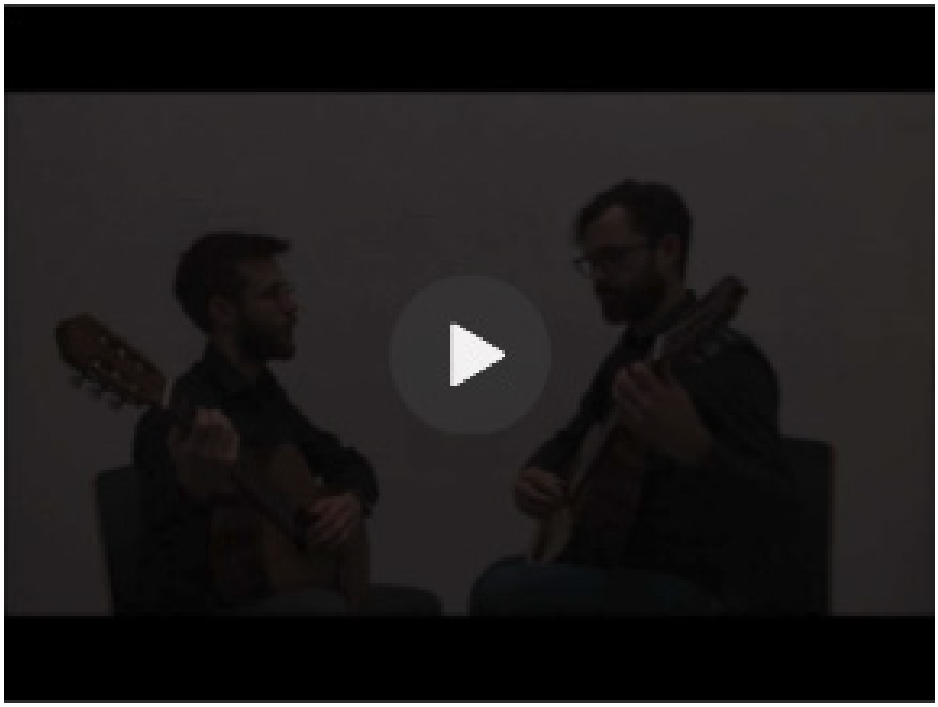
This imagination of polyphony as a form of energy sharing and transfer expands on the aspects of shared performance examined in subchapters 3.1 and 3.2. Here, though, the shared performance follows the trajectories of musical material from the composer through the notation to the performer, but also from performer to performer in real-time. It is a cognitive act in which the trio of performers must learn to brace themselves within and between each other, building the embodied cognitive strategies by which to cooperate in expressing the music that emerges from the interstices between them.

By embodying these larger-order cognitive acts, the performers in a piece like *KILN I* also reveal how a conception of haecceitas can scale upwards from a single performer's intra-body awareness to a multi-performer conglomerate.[71] Multiple strands of material not only abut each other, but initiate literal transfers of energy from strata to strata, a fairly literal manifestation of the type of rhizomatic strata-jumping that Deleuze and Guattari extrapolate from their own conception of haecceitas. McCormack's ensemble writing finds new ways for musical notations to ignite these processes of shared performance and, ultimately, identity, by building polyphonies that cascade from voice to voice and necessitate the intra-active embodiment of multiple strata of musical material along with all of the spaces and intersections in between them.

As a final foray into physically polyphonic chamber music, I come to the only piece in this study without a trombone. Michael Baldwin's *a kind of nostalgia* is a type of solo guitar piece for two performers. At the time of this piece's writing, Baldwin had an established personal practice writing physically polyphonic notations,[72] but *a kind of nostalgia* turns his previous explorations of physicality entirely on their head. The piece embarks from a fairly simple conceptual framework. Two guitarists sit facing each other, one holding the guitar in normal position, the other in an exact mirror position (an inversion of normal guitar posture, with the left hand on the body and the right on the fretboard). The first performer then plays a simple, standard piece from the classical repertoire. Any piece will do; in the example here, one hears a famous pearl from Francisco Tarrega. At the beginning of the piece, the second performer merely imitates the motions of the first, moving their hands silently into mirrored placements on the fretboard and body. However, as the piece progresses, the second performer begins to layer other motions on top of this mirror-activity. Even as the second performer follows the musical trajectories of the first, particularly the trajectory of the hand on the fretboard, they also begin to move their hands slightly: the hand on the body shifts sometimes towards the bridge, sometimes away; the hand on the fretboard migrates upwards, away from the strings, or downwards, more forcefully into the strings. The first performer then mirrors these actions, even as they continue to perform the classical piece. In mirroring the second performers' actions, the first performer subjects the classical piece to a series of unpredictable transformations, with articulations and pressures shifting and sometimes disappearing entirely. Simultaneously, the position of the second performer's upper body begins to dictate tempo fluctuations. Even as the first performer continues to provide an embodied score for the second, who continues to mirror aspects of the traditional classical performance, the second performer also becomes an embodied score for the first, providing the notation for a series of transformations to the basic musical material in real-time.

71 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).*

72 See 2.2 Agential Realism and Michael Baldwin's *Erasure.*



Michael Baldwin: *a kind of nostalgia* (2014); with Coleman Goepfert, guitar

In this conceptual piece, the musical material is over time superseded by the performers' embodiment of physically polyphonic notational material for each other. In the end, the traditional material is indeed swallowed entirely, as the second performer's final notating gestures literally extinguish the base material. In some ways, this seems to be a natural limit to which physical polyphony must at some point tend: the almost inevitable extreme of the performer's body as notation, physical polyphony embodied in its most literal way, radically emerging from the page and inhabiting the body. For me, as a trombonist who has engaged over many years with a variety of physically polyphonic scores, there was a compelling catharsis when I first performed *a kind of nostalgia* (as the second performer). Abdicating entirely my practice as a trombonist, I was thrust instead into a role personifying embodied notation, breaking a bizarre fourth wall in this intra-active web of cross-spatial, cross-temporal agencies that have occupied so much of this study's considerations.

In many ways, this is fitting. The stories that inhabit the interstitial intra-actions that have occupied this study do always continue, and it is perhaps inevitable that physically polyphonic notations migrate at some point off of the page, for both the composer and the performer, and hopefully also the listener. As a compositional tool, physically polyphonic notations emerged relatively recently and have, since then, offered a variety of unique tools to composers and performers seeking to reimagine their relationship to notations and instruments. *a kind of nostalgia*, *KILN I*, and *One Arm 5* are only signposts vaguely indicating the various ways in which these notations have now begun to merge more and more with other compositional forms, from traditional notation to conceptual performance art. As a performer, my experience in overtaking the role of notation itself in *a kind of nostalgia* helped to reinforce my understanding of poietic methodologies as a means to continually recontextualize newly situated embodied practices.

The situatedness and continual re-situatedness of knowledge also emerges as one of Arendt's primary conclusions in her long elucidation of the *Vita Activa*. In examining the ways in which labor, work, and action coexisted and co-evolved over the last few centuries of modern history, she charts the ways in which humankind's frame of reference for itself has continually changed, and moreover drifted further and further externally to first humankind and later even the planet and the solar

system. She calls this the Archimedean point, after that famous early step towards external, scientific self-referentiality. Archimedes was one of the first to posit a frame of reference for the earth external to it, but the course of Western science has seen that point of reference drift ever further away into the solar system and the universe, both spatially but also temporally. Arendt sees this same migrating distance of referentiality at play in the entire Western intellectual project:

> It rather signifies that we have moved the Archimedean point one step farther away from the earth to a point in the universe where neither earth nor sun are centers of a universal system … the general relativism that results automatically from the shift from a heliocentric to a centerless world view [is] conceptualized in Einstein's theory of relativity with its denial that 'at a definite present instant all matter is simultaneously real' and the concomitant, implied denial that Being which appears in time and space possesses an absolute reality. (Arendt, 1958, p. 263)

One only wishes that Arendt had survived to see the celebrations of relativity in Haraway and Barad! Arendt's diagnosis of the "implied denial of Being" augurs the posthuman composting and polyphonic ecosystems of Haraway and Tsing, as well as the intra-active entanglement of Barad. Arendt embraces the skepticism of this worldview, and makes it a cornerstone of how humans interact with each other and their environment, part of the storytelling methodology that emerges from her poiesis. In a stark assessment of this pattern in its most germinal forms, she proposes a reformulation of the Cartesian anxiety: "The famous *cogito ergo sum* ('I think, hence I am') did not spring for Descartes from any self-certainty of thought as such—in which case, indeed, thought would have acquired a new dignity and significance for man—but was a mere generalization of a *dubito ergo sum*" (Arendt, 1958, p. 279).[73]

This doubt encapsulates the commitment to situated and emergent knowledge that enables a poietic practice. In the traditional sense of Cartesian anxiety, perhaps this doubt served as a source of trepidation, but certainly for Arendt and the others cited here, it is a far more hopeful doubt. It is a doubt that liberates one from the shackles of traditionalism and encourages the thoughtful pursuit of new frames of reference, response-able to new situations as they arise. It is a doubt that recognizes precarity and disturbance as opportunities to foster new ecosystems of knowledge, practice, stories, and lives. In music, it is the doubt that liberates each new notation to be an opportunity to resituate knowledge, to welcome new agents into a shared performance. As performers, we can enable these (re)situated practices by developing tools for learning and practice that emerge processually, which is to say, poietically. Each new piece, each new notation, each new performer and each new performance are equally calls to doubt, as also calls to resituate and to act.

For me, that has meant finding new theoretical frameworks to liberate the creative potential of learning, so that new notations can emerge as healthy expressions of the contexts in which they are germinated, rather than as repurposed adaptations of old techniques and practices. I have sought to demonstrate a response-able approach to learning notations, framed as a poietic tool-building geared towards new instrumental idiomaticisms. These learning tools mine the polyphonic entanglements of performer, notation, and composer to build practices that can continually (re)emerge, sustainably over time. The pursuit of poiesis, for me, entails embracing a layer of doubt that underlies all pre-supposed learning and performing practices, thus liberating the situated potential of performers and notations to collaboratively foster unique, emergent practices.

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73 Interestingly, this *dubito ergo sum* is perhaps the only instance in the entire book in which Arendt deliberately does not translate from the Latin; whether this is a quirk of its proximity to the translation offered previously in the same sentence or some more deliberate attempt to introduce an element of dubiousness to proceedings, I will for now leave the phrase as she does, emergent from the discussion but unmoored from explicit explication.

Appendix

Appendix: A short note on diversity of method

The following reflections were compiled following interviews with other performers experienced with repertoire covered in this dissertation. The performers—Matt Barbier, William Lang, Benjamin Marks, Stephen Menotti, and Weston Olencki—have all incorporated physically polyphonic notations into their public and performance personas to varying degrees.

In performing physically polyphonic repertoire over many years, and in developing a coherent and consistent practice related to it, I have been aided and guided throughout by the inestimable benefit of the small community of other performers engaged with these notations. These notations are by no means the norm within classical contemporary music; nonetheless, it is quite difficult to find a new music specialist who has not, at some point, had to engage with physical polyphony. Despite this, many do not specialize in it, and so even within the relatively small and close-knit new music community, there is an even smaller subset of performers who have specialized to varying extents in physically polyphonic repertoire. Although that subset remains relatively small, it is an invaluable learning and psychological aid. Personally, I found it heartening and motivating to see that there were other performers out there also willing to engage on this level and able to execute this music to such a convincing degree.

As a submission of doctoral work in artistic research, this dissertation has focused primarily on the forms of practice building that I have been able to research both scholastically as well as filtered through the crucible of my personal artistic practice. At the outset of this study, I remarked that I would be discussing only works for solo trombone, as those were the only works that I could honestly research as a performer. As has hopefully become clear by now, I have indeed developed a committed, holistic, and thoughtful learning practice when dealing with physically polyphonic notations, one that bleeds also into all other music that I play. However, I am far from the only one to do so, and I am deeply indebted to the community of other performers that helped to create and foster these pieces and the musical environment that produced them. Some of these other performers have also recorded their engagements and explorations with experimental notations. Although none engage specifically with physical polyphony, several performers have discussed complexity and virtuosity in close detail in ways that overlap with many of my own concerns. Grahame Klippel's doctoral dissertation from 2015 provides a very informative review of other performers' contributions to the discourse (Klippel, 2015, pp. 51-89), as does a 2007 issue of the Contemporary Music Review devoted to the topic (see Redgate, 2007; Webb, 2007). Two forerunners of the field, in particular, have written valuable and well-known contributions, namely Franklin Cox (Cox, 2002) and Steven Schick (Schick, 1994; Schick, 2006). Cox advocates for the use of computers to aid in the internalization of increasingly complex parameters, and his own work as a composer and performer bears out the validity of his approach. Schick offers an alternative somewhat closer emergence and embodiment. Precursing to some degree my own discussion of values and precision in chapter 1, Schick wrote of performing Brian Ferneyhough's Bone Alphabet in 1994 that "meaningful gesture is the ultimate measure of a committed performance, a kind of Richter Scale of the musical tectonic forces underlying the composition," and that in living with the piece he strove for "a kind of prolonged adolescence where the malleability of learning coexists with mature manifestations of performance" (Schick 1994, p. 152). These two attitudes fall in some ways on opposite ends of a spectrum, but as I will show in a closer examination of some of my fellow performers, there is no inherent conflict between these two attitudes. Rather, they readily coexist, and different performers use the tools that they provide to develop a variety of learning strategies for maneuvering through the difficulties inherent in complex and physically polyphonic scores.

After the long ruminations on poietic learning practices, I wanted to offer a short journey into the world of other contemporaneous performers as a palette cleanser of sorts. In the course of this research, I have augmented my own personal research and practice by reaching out to some members of this community, to other trombonists who have also performed some of the pieces that were examined in this dissertation. I tried to identify a set of performers who had not merely approached this repertoire at some point, but who had moreover allowed it to become a long-standing and constructive part of their overall performance practice and musical identity. To precisely what extent that is true varies from performer to performer, of course, but ultimately, all five of the trombonists addressed in this addendum have played a variety of physically polyphonic pieces over the course of their careers, successfully integrating them into their artistic personas. I approached them about both their general responses to these notations as a family, but also about specific pieces and learning patterns that emerged through the presence of these pieces in their long-term, evolving musical diet. This has been a particularly intriguing parallel line of inquiry since these performers were also inspirations and models for me as I first approached this repertoire.[74]

In comparing their experiences with these pieces, both when first learning them and when relearning them, I discovered much about myself, and some of the insights that I have attempted to share thus far were sparked from the dialogues that I have been so lucky to have experienced with this small community of adventurous artists. After all, these are also the contaminations and disturbances that Haraway and Tsing celebrate, and without their superposition and interpolation in my own life, I could not have developed the practices described herein. And, much like with the unique spatiotemporal relationships that intervene in the composer-performer relationship, the fact that most of the performer-performer contamination that occurs transpires at similar removes (through recordings and concerts) means that the types of influence that run between performers can be augmented and diminished, as well, by the noise that inevitably bleeds in over such temporal and spatial separation. One performer's recording might very well influence a practice strategy of my own, as I attempt to emulate some desirable character, and yet what I interpret could easily be diametrically opposed to what that performer envisioned themselves. In this way, performer-performer communications are akin to the shared utterances examined in 3.2, as context allows one actor to predict and interpret and "hijack" some bit of content, which might then filter back to the original source in a new form, only to be "hijacked" once again. I hope that such contaminations and hijackings can be celebrated.

In addressing this sense of non-verbal, extra-temporal communication, I also hope to underline how interesting it has been to finally speak to some of the performers with whom I have been otherwise contaminating for all of these years! Having a serious verbal (or in some cases written) dialogue has been a fantastic complement to the years spent listening and responding to their work. Sometimes it was easy to see a connection between their descriptions of learning and the resultant performances with which I have previously been acquainted; other times, I found myself very surprised by these short glimpses behind-the-scenes. That alone stands to demonstrate that, as much as I may espouse a poietic learning practice (or as much as someone else may espouse some other strategy), the function lies much more in the qualitative experience of learning than it does in the pursuit of a particular resultant sound quality. Subjectively, I do believe that a conscientious learning practice must reap desirable aural effects; but in real world situations with many cross-contaminating variables in play, such one-to-one relationships are not always so easy to parse. All the more reason to learn a little bit about others' learning practices, then.

74 All but one are older than myself, and their recordings were the signposts and touchstones that guided me in my first forays into physically polyphonic repertoire.

Everyone seems to agree about the importance of holistic performance. Whatever one thinks, it is incontrovertible that at the end of the day, a physically polyphonic notation will be performed by a single body, and that that requires some sense of holism at the performative stage. Performers begin to diverge, though, when it comes to how they arrive at that holism, and to what degree they hold that in balance to a more cumulative strategy (i.e. treating physical parameters as discrete; to be layered, rather than entangled). I believe that for many performers, one of these practice strategies—either a cumulative or holistic approach to the polyphonic layers—seems to be the obvious solution. I heard performers say that they have to begin with separate strands of activity and slowly layer them (cumulative to holistic). But others also related that they have to begin from slow attempts at holistic reading and can only isolate parameters later in the process, as the most efficacious moments for doing so become apparent during the course of learning (holistic to cumulative). Already, the inversion of these strategies begins to suggest that, for all of the overlap between resultant effects, there are rather profound differences in approach.

William Lang, for example, begins from a holistic perspective. Despite experiencing a large transformation of his learning process over time (as any player would), from first encountering such a piece to a decade or more later, Lang has, nonetheless retained a framework of commencing by approaching the notation holistically. When recounting his first experiences with physically polyphonic repertoire, Lang describes excursions into the notation looking for sound worlds. For him, this entailed looking at the beginning of each (or successive) measures, finding the sound worlds that emerged from these vertical core samples of the notation. He would then isolate them to build a strong relationship to the resultant sounds of layered parameters before beginning to investigate the transformations and transitions to which those sounds are subsequently subjected. In the beginning, this takes more time, but by some years later, it becomes a much more fluid process. Although at the beginning, Lang might invoke such a practice strategy for the bulk of or for an entire piece, now he can spend such energy more intensively on the opening of a piece, until the sonic and physical vocabulary of a notation becomes more intuitive, and then proceed learning with a greater sense of reading the notation as one would read traditional notation. Notably, it seems that, through the skills accrued by working through this strategy of holistic sound samples slowly stitched together, the ability to more quickly reach a plane of intuitively parsing a new notation accelerates. Careful work welcoming the variability of a notation in one piece can (productively) contaminate the learning process of a completely different, unique notation years later. It is the skills of adaptability that survive as much as or more than any specific concatenations of parameters.

This idea of building the ability to internalize vocabularies is essential to Lang's working process. In speaking together, he repeatedly paid homage to situations from his non-musical life that built the fundamental skills of adaptability that enabled him to retain this intellectual attitude when confronted with experimental music. Additionally, he also couched his descriptions of the learning process in non-musical analogies, particularly from sports. For Lang, the skills that allow someone to play tennis, raquetball, or badminton interchangeably are directly related to the skills needed to parse a variety of musical notations (physically polyphonic or not). The combination of retained skills (e.g. racquet control, anaerobic stamina) and sport-specific constraints (e.g. varying raquet, court, and ball sizes) provide a framework for him to mentally accommodate the constant interchange of traditional and situation-specific performance practices. These analogies then infect his rehearsal strategies when approaching the often very athletic demands of the pieces in question.

Others, of course, have developed other strategies for maneuvering this spectrum between holistic and cumulative practice strategies. Matt Barbier, for example, starts also from a very holistic point, placing parameters together slowly and allowing the piece to indicate to him, over time, which elements seem fore- or backgrounded. In particular, as he progresses, he describes finding particular

passages with interesting duos and trios of parameters. These could be passages with only two or three parameters active, with others momentarily tacet, or they could be sections where two or three parameters seem more entangled, and the others momentarily ancillary. In both cases, he will isolate the sections, even if they include non-sounding elements, and practice them in these duo or trio settings. This is particularly interesting because it marries a key element of a cumulative approach (the identification of foregrounded material on which other elements may be layered hierarchically) but practices the foregrounded material in a locally holistic way (maintaining always some entanglement of two or three parameters, rather than isolating solos).

Barbier's approach relies heavily on a sense of emergence, in that physical practice over time leads to a tactile sense of which material is most critically entangled, in direct contrast to a purely intellectual approach, wherein an analytical perusal of the score would identify primary material and project a practice plan accordingly. Benjamin Marks suggests something very similar in his own approach. In his early work with Klaus K. Hübler's *Cercar*, he describes "a long process of translating sounds (again still quite pitched based in my learning when I started this), sketching in ideas, leaving some 'complexes' of sounds more or less untranslated and building up an idea of the piece's structure" (personal communication with the author). This initial reliance on pitch, though, evolved over time, as he became increasingly preoccupied with "exploring the breath accents and the interruptions they create. I remember being quite finicky with rhythmic alignments to find all these awkward points where actions collide and remake the sound" (personal communication with the author). Finding the interruptions and collisions can hijack the primacy of pitch, such that an equality begins to form, and he "could 'read' the Hübler as it was written, without a need to translate to a pitched line the combination of effects" (personal communication with the author).

Although not his first excursion into physically polyphonic repertoire, learning the Hübler was still one of the first, and (for anyone) one of the more intense. Over time, though, this process begins to accelerate. Marks, similarly to Lang, describes his learning process shifting to a period of intense work on the opening of a piece, in which he gains a sense of fluency with the notation, before proceeding to learn the remainder of the piece more quickly and intuitively. The preoccupation with interruptions and disturbances continues to inform this practice, forcing the parameters into relationships of collision and entanglement, and mining those situations for musical expression. Nowadays, he describes a learning process geared towards finding "the cracks in the music, which might suddenly expose the voice or some other sonic element," satisfying his "desire to find in the physical collision of processes sounds which somehow speak more directly to my own experiences and understanding of the world" (personal communication with the author). In this sense, the cracks create the doorways by which the different parameters may come into contact, disturbing each other, contaminating each other, and forcing themselves into the performer's physical practice as a holistic collision of gestures rather than a strictly cumulative layering of effects.

Stephen Menotti, on the other hand, speaks rather less of collisions, but focuses instead on finding the language away from the trombone. This stands in rather stark contrast to much of what I have developed and espoused myself, but there is perhaps more kinship between these approaches than first meets the eye. In discussing his learning process, Menotti remarked at one point on the choice between "renotating or renotating and then playing from the original score" (personal communication with the author). This in itself stuck out to me dramatically, as I work very hard to avoid renotation, especially with these pieces. Naturally, then, his framing of his practice strategy as one inevitably utilizing renotation but only potentially returning to the original piqued my curiosity. Upon further discussion, several interesting sides to this question, emerged, though. First of all, Menotti uses the term renotation rather loosely: it could be anything from a complete renotation of parameters into a more traditional notation, or it could just be a more streamlined format, or it could

mean merely the minor additions or elisions of material to aid efficiency of information parsing. In fact, it could be almost any annotation of the score, in his usage. Although someone like me will proceed very slowly with instrument in hand, rigorously maintaining entanglement, Menotti is far more likely to extrapolate parameters and explore them without the instrument. In some ways, this seems far preferenced to a cumulative approach, since it requires identifying some strand of primacy (or at least interestingness) in the parameters and then proceeding to isolate and explore those parameters. However, what struck me most in Menotti's description of this work was how much of it takes place away from the instrument. It seems that for him, the role of the renotation resides rather more in the intellectual engagement with the score away from the instrument than in the ability to more efficiently pick up the instrument and jump into a version of the piece. In fact, with at least one piece, he described also working on the pitch elements at a piano instead of with the trombone. This externalization of parameters through renotation before recombining them holistically in the (trombone-holding) performative body reveals another very fascinating way to navigate these two approaches. The interplay of these learning styles allows for a lot of cumulative work that isolates and hierarchizes parameters, and yet still allows for the reintegration of parameters in the instrumental practice to foster the development of holistic, idiomatic practices, unique to each piece and their variable physical polyphonies.

Perhaps the only player to describe a more purely cumulative approach is Weston Olencki. He also describes his process beginning more visually. Olencki analyzes the score beforehand, isolating the chief parameters, which he states is nearly always pitch, and then proceeds from that parameter as an attack point in the piece. In this case, he proceeds cumulatively, beginning from one parameter, isolated in its importance in advance of physically holding the instrument, and then layers other effects thereupon, in a loosely hierarchical order. Over the years, having learned a number of such pieces, Olencki's ability to accomplish this more quickly and intuitively has increased, such that now the initial steps of hierarchizing material are enfolded into the process of reading the music, effectively marrying the cumulative and the holistic in an idiosyncratic manner.

One of my chief interests in speaking to these performers was the way in which the learning processes change and streamline over time. I have organized this brief representation of others' learning practices around the poles of cumulative and holistic approaches precisely because, in speaking to all of them about the ways in which their methods have evolved over years-long engagements with these pieces, all of them ended up describing some way in which these two poles became enmeshed, like double helixes intertwined. Each performer has a different way of threading these intertwinings together, and yet each also finds a way to progress beyond a merely cumulative or merely holistic approach. In speaking with one composer whose work has been performed by all of these players (myself included), he relayed to me how fascinating it had been to see how divergent different performers´ interpretations were, even as, while following along in the score, they all seemed very precise and accurate. This seems to sum up one of the chief advantages of physically polyphonic repertoire: by elevating the prism of the performative body to such a high level of engagement with the creative process, it allows each performative body to create a different diffraction of the notation. New forms of accuracy evolve as new bodies encounter a score. The conversations that we had in the course of this research continually circled around questions of why exactly some of us end up drawn to this repertoire. Much of the allure does seem to reside in the intimacy of engagement, in the way that the pieces demand so much from a performer, bombarding them with new stimuli, and yet also emerge at the end from within the performer's body, radiating a unique and personal idiomaticism. And just as a single performer's body becomes a kaleidoscope, shifting with each new notation to develop new angles and patterns of embodied activity, so also do multiple performers' bodies scale up that process, interweaving through shared pieces to similarly provoke the development of broader instrumental practices based in precisely these variable,

contingent physicalities. We are contaminants and contaminated. In performing these pieces, we diverge and converge physically, entangling ourselves in corporeal notations that provoke further creative responses from the world around us, diffracting through notational practices well beyond physical polyphony and evaporating into the world of sound around us. I count myself lucky to be in their company.

Summary

This thesis sets out to examine the learning process in music through the lens of a unique and relatively recent notational trend, physical polyphony (herein defined as notations of dyssynchronous physical actions within a single performative body). These notations sprang up in the latter half of the 20th century and, through the decoupling of different physical actions, posed radical new questions to previously existing instrumental performance practices. My research during the course of this study has used physical polyphony as a means to experiment with performance practices as embodied skills and the way in which those practices develop and metamorphose in new situations. While decoupled notations have garnered attention in musicological discourse, particularly with respect to their relationship to burgeoning trends of notational complexity, very little attention has been paid to the relationship that these notations have to performers and their individual instrumental practices. By isolating these notations' role in fostering freshly embodied idiomaticisms, I hope to illuminate both the performance practice of this trend in contemporary music as well as certain elements of the learning process as it pertains to music in general.

The first chapter of this dissertation begins with an exploration of the concept of poiesis, informed chiefly by Hannah Arendt's use of the term in *The Human Condition* (1958) to indicate a form of creativity married to craftsmanship. This poietic framework will then be used throughout the dissertation to inform a practice-based analysis of the learning process involved with physically polyphonic notations. Despite polyphonic asynchrony, the unifying performative demands of these pieces are the learning strategies necessary to accomplish this eventual *re*assembly of instrumental practice within a single, performing body. The following chapters explore the physically polyphonic repertoire of the trombone specifically as a laboratory for testing this poietic approach. In order to focus on the learning process relevant to these unique, recently-developed notations, the following chapters are not analyses focused on the compositions themselves, but instead examine the works in question as they pertain specifically to the situated challenges of learning, enskilment, and practice-building. Arendt's poiesis is closely tied to the concept of tool-building, wherein new practices and tools are designed and constructed to enable further development of human activity in both laboring and social environments. I examine this concept closely and propose ways in which it can be used as a means to build flexible value systems that can adapt to the unique interpretive demands of physically polyphonic notations. In chapter 1, this takes the form of two very different pieces, Vinko Globokar's *Echanges* (1973), the first piece to engage physical polyphony as a notational tool for trombone, and Joan Arnau Pàmies's *[Vltbn]^4 (o quatre panells per a trombó sol)* (2012), a more recent addition to the repertoire. Both pieces will be examined specifically through the lens of poiesis, mining the notations to find interpretive strategies that facilitate responsive practice strategies capable of developing new technical and interpretive skills answerable to the unique demands of each individual notation. In the case of these two pieces, my personal experiences with these notations will serve as a laboratory for how this process may occur.

Chapter 2 offers a series of theoretical templates that have proven useful in my own artistic practice. These templates are not prescriptive of successful learning strategies. Nonetheless, when taken together, they suggest the outlines of a methodology that can take advantage of the entanglement of conflicting strands of physically polyphonic actions to rediscover the unity of the body with the instrument and its environment. In doing so, these theoretical approaches aim to undergird specific learning strategies that help the performer to holistically learn and execute notations that seem, at first glance, to demand rather more fragmentation. The three essays that comprise the bulk of this chapter will be prefaced by a short excursion into the concepts of contamination and resurgence, after Donna Haraway and Anna Löwenhaupt Tsing (respectively). Their work helps outline a space in which variability itself becomes a necessary and welcome methodological tool.

Haraway appropriates the term "contamination" and interprets it as a positive attribute, a means by which ecological cohabitors entangle with and renew each other. Tsing refers to similar progressive interactions as "resurgence," a phenomenon both directional while still ateleological. In this study, I tie their calls for situated, practice-based experimentation to older proposals of storytelling as a methodology. Storytelling, as a primarily singular and linear format, has proven a useful tool for developing research tools that take advantage of the primary benefits of artistic practice: namely, the individuality of the instantiations that emerge. In outlining a poietic approach to learning and performing music, I rely on this history, and also tie it to the focus on horizontalities and interdependencies of Haraway's and Tsing's work, preparing a space for the following essays to present necessarily singular but nonetheless generalizable learning strategies. As these notations request an embodied and enactive approach to discovering the poietic tool-building process, the essays in part 2 will explore not the physical anatomy of these tasks' execution, but will instead offer a series of theoretical templates that have proven useful in my own artistic practice. The first theoretical template (2.1) traces the notion of *haecceitas* from its coinage by John Duns Scotus in the scholastic era to its appropriation by Gilles Deleuze and Félix Guattari in the 20th century, using it as a diffraction grating for learning the superposed technical demands of Aaron Cassidy's *Because they mark the zone where the force is in the process of striking* (2008). The second theoretical template (2.2) mines Karen Barad's agential realism for learning strategies that help access Michael Baldwin's *Erasure* (2011). Barad's scientific realism embraces real-world, non-metaphorical implications, and when considering the holistic embodiment of physically-polyphonic notations, the capacity her concepts demonstrate to transversally bridge mental learning strategies and their real-world enaction proves invaluable. The third theoretical template (2.3) traces the process of learning Sehyung Kim's *Sijo_241015* (2015) alongside Humberto Maturana's and Francisco J. Varela's concept of autopoiesis, which explicates the organic processes by which complex, interdependent unities can be formed, revealing the nature of the learning process as a form of growth and symbiosis.

Chapter 3 takes a closer look at the physical implications for the holistic execution of decoupled actions. By exploring the history of embodied cognition and enactive learning (3.1), the experiences of learning Klaus K. Hübler's *Cercar* and Richard Barrett's *basalt* are examined through the lenses of shared performance (3.2) and radical embodied cognition (3.3). Together, these two subchapters will help to explain the cognitive and physical tasks that cohere in the learning of these dissociated practices, thereby also examining the nature of emergent enskilment. This emergence is dependent on the role that situated knowledges play in crafting the variable instrumental idiomaticisms necessary to adapt to different pieces and situations both fluidly and efficiently. The concept of shared performance draws on Trevor Marchand's work exploring how shared utterances (borrowed from the discourse of dynamic syntax) can become useful and necessary components of situated learning. This idea of shared performance and embodied communication helps to reveal how tablature notations can provoke the emergence of new physical techniques by way of the learning and performance process. This discussion invites, in turn, a larger discussion of radical embodied cognition and the ways in which learning strategies (can or must) bypass centralized cognitive control and embrace more distributed embodiments of cognitive cooperation. I examine closely the current research on how this transpires in the human learning process and then filter those ideas through my own learning processes with physically polyphonic notations, indicating ways in which an understanding of this process can streamline and improve the learning process. This discussion inevitably points towards the political implications that radical embodied cognition and variable, situated learning strategies imply to the traditional performance practice of the Western classical conservatory tradition. The final essay in this section (3.4) will examine the role that the anti-representational strategies central to many of these theories play in the notational process itself. A brief diversion from performance practice will comprise an examination of notations by Timothy McCormack, Joan Arnau Pàmies, and Kenn Kumpf, each of which demonstrates ways in which different critical notational

parameters are elided and presented in non-representational forms that provoke their emergence rather than prescribe their execution.

Throughout, Arendt's poiesis will provide a basic framework for addressing these disparate learning strategies. Chapter 4 returns to her poiesis as a unifying concept for these strategies. In so doing, her own extrapolation from poiesis to the broader domains of political action and social interaction is used to contextualize these learning strategies in a broader musical environment.

A short appendix offers insights gleaned from other trombonists who have performed some of these same pieces, indicating as well the variabilities of approach that these notations elicit.

Samenvatting

Dit proefschrift heeft als doel om bepaalde leerprocessen te onderzoeken door de lens van een unieke en relatief recente trend in muzieknotatie: *physical polyphonic notations* (hier gedefinieerd als het noteren van asynchrone fysieke acties voor één uitvoerend lichaam). Deze notatietechnieken zijn ontstaan in de laatste helft van de twintigste eeuw en stelden, middels het van elkaar loskoppelen van verschillende fysieke acties, een aantal radicale vragen bij bestaande instrumentale uitvoeringspraktijken. In mijn onderzoek is *physical polyphony* een middel om te experimenteren met die uitvoeringspraktijk, die ik beschouw als een belichaamde activiteit, en met de manieren waarop die praktijk zich ontwikkelt en transformeert in nieuwe situaties. Hoewel deze *decoupled notations* de nodige aandacht hebben gegenereerd in het musicologische discours – vooral daar waar het hun relatie met de opkomende trend van genoteerde complexiteit betrof – is er nog weinig aandacht besteed aan wat deze notatietechnieken betekenen voor uitvoerders en hun individuele instrumentale praktijk. Door de rol van deze notatietechnieken te betrekken op het musicerend lichaam, hoop ik meer inzicht te verschaffen op zowel de uitvoeringspraktijk van deze hedendaagse muziek, als op bepaalde elementen in het leerproces van muziek in het algemeen.

Het eerste hoofdstuk van dit proefschrift begint met een verkenning van het concept *poiesis*, hoofdzakelijk geënt op Hannah Arendt's gebruik van deze term in *The Human Condition* (1985), om een vorm van creativiteit aan te duiden die nauw verbonden is met ambachtelijkheid. Dit poietische raamwerk zal vervolgens doorheen het gehele proefschrift gebruikt worden om een op de praktijk gebaseerde analyse van het leerproces te introduceren, die te maken heeft met polyfone notatie. Ondanks de polyfone asynchroniciteit vereisen dit soort composities dat de afzonderlijke elementen uiteindelijk in een uitvoering opnieuw met elkaar verbonden worden; daarvoor zijn dus leerstrategieën nodig waarbij de instrumentale praktijk in één uitvoerend lichaam samen komt. In de afzonderlijke hoofdstukken onderzoek ik in een soort laboratorium setting het *physical polyphony* repertoire voor de trombone om zodoende deze poietische benadering te testen. Omdat de nadruk dus ligt op het leerproces dat nodig is om deze unieke, recent ontwikkelde notaties tot klinken te brengen, zijn er in dit proefschrift geen analyses te vinden van de composities zelf; het onderzoek richt zich daarentegen op de specifieke uitdagingen die zich tijdens het studeren aandienen, op de ontwikkeling van vaardigheden en het opbouwen van een praxis. Arendt's *poiesis* is nauw verbonden met het principe van het ontwikkelen van een instrumentarium waarin nieuwe praktijken en dingen worden ontworpen en geconstrueerd om verdere ontplooiing van menselijke activiteiten, zowel op het gebied van werk als op het gebied van sociale interactie, mogelijk te maken. In dit proefschrift stel ik verschillende manieren voor waarop *poiesis* ingezet kan worden als middel om tot flexibele waardesystemen – systemen die zich kunnen aanpassen aan de unieke, interpretatieve eisen van *physically polyphonic notations* – te komen. In hoofdstuk 1 krijgt dit bijvoorbeeld concreet gestalte in en via twee zeer verschillende stukken: *Echanges* van Vinko Globokar (1973), het eerste stuk voor trombone waarin *physical polyphony* als notatietechniek werd gebruikt; en *[Vltbn]^4 (o quatre panells per a trombó sol)* (2012) van Joan Arnau Pàmies, een recentere toevoeging aan dit repertoire. Beide stukken worden onderzocht via *poiesis*, om zodoende te kunnen reflecteren op de gebruikte notatie en om interpretatieve, technische en praktische strategieën te ontwikkelen die tegemoet komen aan de specifieke eisen van elke individuele notatietechniek. In het geval van deze twee stukken zullen ook mijn persoonlijke ervaringen dienen als test voor hoe dit plaats kan vinden.

In hoofdstuk 2 presenteer ik een reeks theoretische sjablonen die bruikbaar zijn gebleken in mijn eigen artistieke praktijk. Deze sjablonen schrijven echter geen succesvolle leerstrategieën voor. Ze geven (slechts) de contouren aan van een methodologie die een oplossing kan bieden om, in de kluwen van conflicterende acties die *physical polyphony* in zich draagt, de eenheid van lichaam, instrument en omgeving te (her)ontdekken. Daarmee richten deze theoretische benaderingen zich

op het verstevigen van specifieke leerstrategieën die de uitvoerder helpen om de notaties holistisch te benaderen en uit te voeren, notaties die op het eerste gezicht juist meer fragmentatie lijken te bevatten. De drie essays die samen dit hoofdstuk vormen worden voorafgegaan door een korte tekst waarin de concepten "contaminatie" van Donna Haraway en "resurgence" (herleving) van Anna Löwenhaupt Tsing worden geïntroduceerd. Hun werk helpt om ruimte te scheppen waarin veranderlijkheid een noodzakelijk en welkom methodologisch hulpmiddel wordt. Haraway gebruikt de term "contaminatie" en doordenkt die positief, namelijk als iets waardoor *zijnden* die naast elkaar leven zich met elkaar verbinden en elkaar daarmee vernieuwen. Tsing refereert aan vergelijkbare progressieve interacties middels het begrip "resurgence", een fenomeen dat weliswaar richting geeft maar zonder een vooropgezet doel. In deze studie verbind ik hun pleidooien voor gesitueerde, praktijkgerichte experimentatie aan minder recente ideeën aangaande *storytelling* als methode. *Storytelling*, vooraleerst een enkelvoudig en lineair format, sluit goed aan bij het ontwikkelen van onderzoeksmethoden die zich enten op de artistieke praxis, namelijk met aandacht voor de particulariteit van concrete situaties. In het beschrijven van een poietische benadering van het studeren en uitvoeren van muziek steun ik op deze geschiedenis van *storytelling* en verbind ik die met de nadruk op horizontaliteit en wederzijdse afhankelijkheid in het werk van Haraway en Tsing. Zo schep ik een ruimte om in de daaropvolgende essays noodzakelijkerwijs singuliere, maar desondanks generaliseerbare leerstrategieën te presenteren.
Omdat deze notatietechnieken een lichamelijke benadering vragen teneinde het poietische proces bloot te leggen, zullen de essays in dit tweede hoofdstuk niet de fysieke anatomie die nodig is voor de uitvoering tot onderwerp hebben, maar een serie theoretische sjablonen bieden die succesvol zijn gebleken in mijn eigen artistieke praktijk. Het eerste sjabloon (2.1) vertrekt van de notie van *haecceitas* – allereerst naar voren gebracht door John Duns Scotus in het scholastische tijdperk, en in de twintigste eeuw verder doordacht door Gilles Deleuze en Félix Guattari – om het in te zetten als *diffractierooster* voor het studeren van de gestapelde technische vaardigheden die Aaron Cassidy's *Because they mark the zone where the force is in the process of striking* (2008) vraagt. Het tweede theoretische sjabloon (2.2) ontgint Karen Barad's *agential realism* voor leerstrategieën die toegang geven tot Michael Baldwin's *Erasure* (2011). Barad's wetenschappelijke realisme heeft concrete, niet-metaforische implicaties. Als we uitgaan van een holistische belichaming van *physically polyphonic notations*, is de kracht van haar concepten om mentale leerstrategieën te verbinden met concrete problemen onmisbaar. Het derde theoretische sjabloon (2.3) tast het leerproces van Sehyung Kim's *Sijo_241015* (2015) af in relatie tot Humberto Maturana's en Francisco J. Varela's concept *autopoiesis*, een organisch proces waarbij complexe, onderling afhankelijke eenheden gevormd kunnen worden; het leerproces wordt zo als een vorm van groei en symbiose voorgesteld.

Hoofdstuk 3 gaat dieper in op de fysieke implicaties voor de holistische uitvoering van van elkaar losgekoppelde acties. Via het verkennen van (de geschiedenis van) *embodied cognition* en *enactive learning* (3.1), worden de ervaringen van het studeren van Klaus K. Hübler's *Cercar* en Richard Barrett's *basalt* onderzocht. In 3.2 ligt de nadruk op het beschrijven van een uitvoeringspraktijk waarin de afzonderlijke onderdelen weer bij elkaar moeten worden gebracht, in 3.3 voornamelijk op het perspectief van een radicale *embodied cognition*. Bij elkaar genomen verduidelijken deze twee subhoofdstukken de cognitieve en fysieke taken die samen moeten komen in het leren van deze van elkaar losgekoppelde praktijken, waarbij ook de aard van zich ontwikkelende vaardigheden onderwerp van onderzoek is. Bepalend hierbij is de rol die specifieke kennis speelt in het creëren van variabele instrumentale idiomen, die nodig zijn om je als uitvoerder zo makkelijk en efficiënt mogelijk aan verschillende composities en situaties aan te kunnen passen. Het concept van de *shared performance* (de uitvoering waarbij de afzonderlijke delen weer bij elkaar worden gebracht) is afkomstig van Trevor Marchand. Hij ging na hoe gedeelde uitingen (overgenomen van het zogenaamde *dynamic syntax* discours) nuttige en noodzakelijke componenten van een specifiek leren kunnen worden. Het idee van *shared performance* en van lichamelijke communicatie helpt om te laten

zien hoe tablatuur notatie nieuwe fysieke technieken kunnen doen ontstaan door middel van het leer- en uitvoeringsproces. Dit idee nodigt op zijn beurt uit tot een grotere discussie over radical embodied cognition en de manieren waarop leerstrategieën gecentraliseerde cognitieve controle (kunnen en moeten) omzeilen en meer inzetten op afzonderlijke manifestaties van een cognitief op elkaar inwerken. Ik analyseer hedendaags onderzoek over hoe zoiets ontstaat in het menselijke leerproces, toets deze ideeën aan mijn eigen studeren van physically polyphonic notations, en geef aan hoe het begrijpen van dit proces het leren kan stroomlijnen en verbeteren. Daarbij laat ik ook zien wat de politieke implicaties – onlosmakelijk verbonden met deze radicale embodied cognition en variabele, specifieke leerstrategieën – inhouden voor de traditionele uitvoeringspraktijk van de Westerse klassieke conservatorium traditie. Het laatste essay in dit hoofdstuk (3.4) gaat in op de rol die anti-representatie strategieën, die centraal staan in veel van deze theorieën, in de act van het noteren zelf spelen. Met een verkenning van notatietechnieken van Timothy McCormack, Joan Arnau Pàmies en Kenn Kumpf wijk ik (kort) af van de vrijwel exclusieve aandacht die ik tot nu toe heb geschonken aan de uitvoeringspraktijk. Deze drie componisten tonen ieder op hun eigen manier hoe in notatie verschillende parameters worden genegeerd of op een manier kunnen worden gepresenteerd waardoor ze als het ware kunnen ontstaan, in plaats van dat hun uitvoering wordt voorgeschreven.

Doorheen de hele dissertatie vormt Arendt's poiesis het fundamentele raamwerk om de hierboven gepresenteerde, ongelijksoortige leerprocessen te onderzoeken. In hoofdstuk 4 keer ik terug naar poiesis als een overkoepelend concept voor deze processen. Ik maak gebruik van Arendt's eigen extrapolatie van dit concept naar de bredere domeinen van politieke actie en sociale interactie om deze leerstrategieën te contextualiseren binnen een groter muzikaal domein.

In een bescheiden appendix zullen de inzichten van andere trombonisten, die enkele van deze stukken eveneens uitgevoerd hebben, naar voren gebracht worden om daarmee te laten zien dat zich een grote verscheidenheid aan benaderingswijzen met betrekking tot deze notatietechnieken voordoet.

Works Cited

Agamben, G. (1994). *The man without content* (Trans. unknown). Retrieved from http://www.thebestrevenge.info/3126-the_man_without_content.pdf

Antonelli, R., and Etterlin, P. (2009). *Schulpraktisches gitarrenspiel: Für den musikalischen alltag*. Zürich: Pestalozzianum.

Arendt, H. (1958). *The human condition: A study of the central dilemmas facing modern man*. New York: Doubleday and Co.

Baldwin, M. (2011). *Erasure*. Publisher: Author. Retrieved from https://michaelbaldwincomposerfiles.wordpress.com/2011/08/erasurenotes.pdf

Baldwin, M. (2012). *Reflections on ephemerality and notation in my recent work* (Masters thesis). Retrieved from https://michaelbaldwincomposer.files.wordpress.com/2013/01/repository_thesis_baldwin.pdf

Baldwin, M. (2013). Musical expression through notation: The formal constructs of Klaus K. Hübler. Retrieved from https://michaelbaldwincomposer.files.wordpress.com/2013/04/musical_expression_through_notation_klaus_hubler.pdf

Baldwin, M. (2016). *Effaced reflected being: musicking bodies and/of/as documentation* (Doctoral dissertation). Retrieved from http://eprints.hud.ac.uk/id/eprint/31494/

Barad, K. (2003). Posthumanist performativity: towards an understanding of how matter comes to matter. *Signs: Journal of Women in Culture and Society, 28*(3), 801-831.

Barad, K. (2007). *Meeting the universe halfway: quantum physics and the entanglement of matter and meaning*. London: Duke University Press.

Barad, K., Dolphijn, R., and van der Tuin, I. (2012). Matter feels, converses, suffers, desires, yearns and remembers: Interview with Karen Barad. In R. Dolphijn and I. van der Tuin (Eds.), *New Materialism: Interviews & Cartographies*. University of Michigan: Michigan Publishing. Retrieved from https://quod.lib.umich.edu/o/ohp/11515701.0001.001/1:4.3/--new-materialism-interviews-cartographies?rgn=div2;view=fulltext

Barnes, D. (1937). *Nightwood*. New York: Harcourt, Brace and Company.

Barrett, L. (2015). Why brains are not computers, why behaviorism is not satanism, and why dolphins are not aquatic apes. *The Behavior Analyst*, *39*(1), 9-23.

Barrett, R. (1996). Standpoint and Sightlines provisional 1995. In N. Polaschegg, U. Hager and T. Richtsteig (Eds.), *Diskurse zur gegenwärtigen Musikkultur* (21–32). Regensburg: Con Brio Verlagsgesellschaft.

Barrett, R. and Obermayer, P. (2000). Statement for Nicolas Collins. Retrieved from https://furtlogic.com/node/7

Barrett, R. (2002). *Blattwerk*: composition / improvisation / collaboration. Retrieved from http://richardbarrettmusic.com/BlattwerkEssay.html

Barrett, R. (2014). Notation as liberation. *Tempo, 68*(268), 61-72.

Barrett, R. J. (2017). Portfolio of original compositions: Music of possibility (doctoral dissertation). University of Leeds, Leeds.

Barthes, R. (1973/2002). *S/Z* (R. Miller, Trans.). Oxford: Blackwell.

Bök, Christian. (1997). *Pataphysics, the poetics of an imaginary science* (Doctoral dissertation). National Library of Canada (Bibliothèque nationale du Canada).

Brooks, R. A. (1991). Intelligence without representation. *Artificial Intelligence, 47*, 139–159.

Bruner, J. (1991). The narrative construction of reality. *Critical Inquiry, 18* (Autumn, 1991), 1-21.

Cann, R., Marten, L., and Kempson, R. M. (2005). *The dynamics of language: An introduction*. Bingley: Emerald Group Publishing Limited.

Cassidy, A. (2002). Interconnectivity and abstraction: *metallic dust* as a testing ground for monophonic and structural polyphonies. In C-S. Mahnkopf, F. Cox, and W. Schurig (Eds.), *Polyphony and complexity* (New Music and Aesthetics in the 21st Century, vol. 1, pp. 147-161). Hofheim: Wolke Verlag.

Cassidy, A. (2008a). *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)*. Publisher: Author.

Cassidy, A. (2008b). Determinate action/indeterminate sound: Tablature and chance in several recent works. In C-S. Mahnkopf, F. Cox, and W. Schurig (Eds.), *Facets of the second modernity* (New Music and Aesthetics in the 21st Century, vol. 6, pp. 17-32). Hofheim: Wolke Verlag.

Cassidy, A. (2015). Imagining a non-geometrical rhythm - inaugural professorial lecture. University of Huddersfield: Retrieved from http://eprints.hud.ac.uk/id/eprint/27077/

Chemero, A. (2011). *Radical embodied cognitive science*. Cambridge: MIT Press.

Chopin, H. (1967). Why I am the author of sound poetry and free poetry. Retrieved from http://www.ubu.com/papers/chopin.html

Clark, A. (1997). *Being there*. Cambridge: MIT Press.

Cobussen, M. (2017). *The field of musical improvisation*. Leiden: Leiden University Press. Retrieved from https://openaccess.leidenuniv.nl/handle/1887/52784

Cone, E. (1962). Stravinsky: The progress of a method. *Perspectives of New Music, 1*(1), 18-26.

Cook, N. (1990). *Music, imagination, and culture*. Oxford: Oxford University Press.

Cox, F. (2002). Notes Toward a Performance Practice for Complex Music. In C-S. Mahnkopf, F. Cox, and W. Schurig (Eds.), *Polyphony & Complexity*(New Music and Aesthetics in the 21st Century, vol. 1, pp. 70-132). Hofheim: Wolke Verlag.

Cross, R. (2003). Duns scotus on divine essence and the trinity. *Medieval Philosophy and Theology, 11*(1), 181-201.

Cummings, S. (2012). Giving voice to the indescribable: Aaron Cassidy - the crutch of memory. *5:4*. Retrieved from http://5against4.com/2012/05/28/giving-voice-to-the-indescribable-aaron-cassidy-the-crutch-of-memory/

Deforce, A. and Barrett, R. (2014). The resonant box with four strings. Retrieved from https://issuu.com/arnedeforce/docs/the_resonant_box_with_four_strings

Deleuze, G. and Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia* (B. Massumi, Trans.). Minneapolis: The University of Minnesota Press.

Dempster, M. B. L. (1998). *A self-organizing systems perspective on planning for sustainability* (Doctoral dissertation). Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.180.6090&rep=rep1&type=pdf

Dempster, S. (1979). *The modern trombone: A definition of its idioms*. Berkeley: University of California Press.

Deutsche, R. (1996). *Evictions: Art and spatial politics*. Cambridge: MIT Press.

Evens, A. (2005). *Sound ideas: Music, machines, and experience*. Minneapolis: University of Minnesota Press.

Fodor, J., and Z. Pylyshyn (1988). Connectionism and the cognitive architecture. Cognition, 28, 3–71.

Førisdal, A. (2017). *Music of the margins: Radically idiomatic instrumental practice in solo guitar works by Richard Barrett, Brian Ferneyhough and Klaus K. Hübler* (Doctoral dissertation). Retrieved from https://nmh.brage.unit.no/nmh-xmlui/bitstream/handle/11250/2431027/Forisdal_Avhandling.pdf?sequence=3

Globokar, V. (1975). *Echanges: Für einen Blechbläser*. Frankfurt: H. Liftolff.

Graeber, D. (2001). *Toward an anthropological theory of value: The false coin of our own dreams*. New York: Palgrave.

Graeber, D. (2015). *Revolutions in reverse*. London: Minor Compositions (Autonomedia).

Haraway, D. (1991). *Symians, cyborgs, and women: The reinvention of nature.* New York: Routledge.

Haraway, D. (1992a). The promises of monsters: A regenerative politics for inappropriate/d others. In L. Grossberg, C. Nelson, and P. Treichler (Eds.), *Cultural Studies* (pp. 295-337). New York: Routledge.

Haraway, D. (1992b). *Primate visions: Gender, race and nature in the world of modern science*. London: Verso.

Haraway, D. J. (2016). *Staying with the trouble: Making kin in the Chthulucene*. Durham: Duke University Press.

Hoban, W. (2005). *Zur Musik Klaus K. Hüblers*. Saarbrücken: Pfau-Verl.

Hoban, W. (2000). Instrumentengeister in zwangsjacke: Klaus K. Hüblers drittes streichquartett. *Musik & Ästhetik 4*(15), 27-43.

Hockley, L. J. (2018). Performing complexity: Theorizing performer agency in complexist music (Doctoral dissertation). University of British Columbia, Vancouver.

Hübler, K. K. (1983a). *Cercar*. Wiesbaden: Breitkopf & Härtel.

Hübler, K. K. (1983b). *Cercar (1983)*. Retrieved from http://www.klaushuebler.de/

Hübler, K. K. (1984). Die polyphone posaune. *Brass Bulletin, 45*(1), 31-33.

Hübler, K. K. (1987). Die freiheit des interpreten vor der partitur. *Das Orchester, 4*.

Hutto, D. D. and Myin, E. (2012). *Radicalizing enactivism: Basic minds without content*. Cambridge: MIT Press.

Ingham, M.B. and Dreyer, M. (2004). *The philosophical vision of John Duns Scotus*. Washington, D.C.: The Catholic University of America Press.

Ingold, T. (2000). *The perception of the environment: Essays on livelihood, dwelling and skill*. London: Routledge.

Ingold, T. (2011). *Making growing learning*. Retrieved from https://www.ufmg.br/ieat/wp-content/uploads/2015/06/Tim-Ingold-Making-Growing-Learning1.pdf

Jarry, A, Shattuck, R. and Watson Taylor, S. (1965). *Selected Works of Alfred Jarry.* New York: Grove.

Kempson, R., Meyer-Viol, W., and Gabbay, D. M. (2001). *Dynamic syntax: The flow of language understanding*. Oxford: Blackwell.

Kim, S. (2015). *Sijo_241015*. Publisher: Author.

Kim, S. (2016). Sijo_241015 (2015). In Fairbairn, K., *Juna Winston Trombone Recital* (p. 4). Publisher: Author.

Klein, N. (2014). *This changes everything: Capitalism vs. the climate*. London: Penguin Books.

Klippel, Grahame J. (2015) Rhythmic accuracy in the new complexity repertoire : its assessment and role in performance practice with specific applications to the guitar (Doctoral dissertation). University of Surrey, Surrey.

Kumpf, K. (2013). Pitch objects and performative referentialities: An examination of notated pitch and vocal intonation mechanisms in Heinz Holliger's *Die Jahreszeiten* (Doctoral dissertation). Northwestern University, Chicago, Illinois.

Lave, J. (1988). *Cognition in practice*. Cambridge: Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lee, D. and Reddish P. (1981). Plummeting gannets: A paradigm of ecological optics. *Nature*, *293*, 293-294.

Marchand, T. (2010). Embodied cognition and communication: Studies with British fine woodworkers. *The Journal of the Royal Anthropological Institute, 16*, S100-S120.

Marchand, T. H. J. (2011). *Making knowledge: Explorations of the indissoluble relation between mind, body and environment*. Malden, Mass: Wiley-Blackwell.

Maturana, H. (1970). *Biology of cognition*. Reprinted in H. Maturana and F. J. Varela, *Autopoiesis and cognition: The realization of the living* (1980, pp. 5-58). Dordecht: D. Reidel Publishing Co.

Maturana, H. and Varela, F. J. (1980). *Autopoiesis and cognition: The realization of the living*. Dordecht: D. Reidel Publishing Co.

Maturana, H. and Varela, F. J. (2008). *The tree of knowledge: The biological roots of human understanding*. Boston: Shambhala.

McCormack, T. (2010). *Instrumental mechanism and physicality as compositional resources* (Masters thesis). University of Huddersfield. Retrieved from http://eprints.hud.ac.uk/id/eprint/9290/1/tmccormackfinalthesis.pdf

McCormack, T. (2012) *HEAVY MATTER*. Publisher: Author.

McCormack, T. (2013). *DRIFT MATTER*. Publisher: Author.

McCormack, T. (2015). *BODY MATTER*. Publisher: Author.

McCormack, T. (2016). *RAW MATTER*. Publisher: Author.

Menary, R. (2010). Introduction to the special issue on 4E cognition. *Phenomenology and the Cognitive Sciences*, *9*, 459-463.

Miles, L., Nind, L., and Macrae, C. (2010). Moving through time. *Psychological Science, 21*, 222–223.

Minsky, M. (1988). *The society of mind*. London: Pan Books.

Morishita, C. (2013). *Skin, gelatin, soot*. Publisher: Author.

Nyffeler, M. (1987). Bis das Instrument seinen geist offenbart. Klaus K. Hübler im gespräch. *MusikTexte* 20, 4-7.

Nyffeler, M. (2018). Zum schaffen von Klaus K. Hübler: Nicht pathos, sondern heiterkeit. *Beckmesser*. Retrieved from https://www.beckmesser.info/nicht-pathos-sondern-heiterkeit-klaus-k-huebler/

Orning, T. (2015). The ethics of performance practice in complex music after 1945. In E.E.

Guldbrandsen and J. Johnson (Eds.), *Transformations of Musical Modernism* (299-318). Cambridge: Cambridge University Press.

Pàmies, J. A. (2013a). Noise-interstate(s): towards a subtextual formalization. In A. Cassidy & A. Einbond (Eds.), *Noise in and as music* (pp. 173-188). Huddersfield: University of Huddersfield Press.

Pàmies, J. A. (2013b). *[Vltbn]^4 (o quatre panells per a trombó sol)*. Publisher: Author.
Pàmies, J. A. (2015). *1≈∞ (EoM)*. Publisher: Author.

Pàmies, J. A. (2016a, June 6). New music: a product of modernity (and capitalism). *New Music Box*: retrieved from https://nmbx.newmusicusa.org/new-music-a-product-of-modernity-and-capitalism/

Pàmies, J. A. (2016b, June 27). Towards the future: new music in the 21st century. *New Music Box*: retrieved from https://nmbx.newmusicusa.org/towards-the-future-new-music-in-the-21st-century/

Pàmies, J. A. (2016c). *Alternative means of musical operation: Repurposing sonic creativity within and beyond capital* (Doctoral dissertation). Northwestern University, Chicago, Illinois.

Pédauque, R. T. (2003). Document: Form, sign and medium, as reformulated for electronic documents. Retrieved from https://pdfs.semanticscholar.org/d17f/92b352848e43297c6bcb8ff554fa41de17ce.pdf?_ga=2.156671931.1814113534.1568461809-2040051213.1568358641

Pfeifer, R. and Bongard, J.. (2007). *How the body shapes the way we think: A new view of intelligence*. Cambridge: MIT Press.

Pini. G. (2013). Anselm, Aquinas, and Scotus on the object of the first evil choice. In R. Pasnau (Ed.), *Oxford Studies in Medieval Philosophy* (vol. 1, pp. 61-82). Oxford: Oxford University Press.

Purver, M. and Kempson, R. (2004). Context-based incremental generation for dialogue. In *Proceedings of the International Conference on Natural Language Generation (INLG)* (pp. 151-160). Brockenhurst, UK: Springer.

Raatikainen, P. (2015). Gödel's incompleteness theorems. Retrieved from https://plato.stanford.edu/entries/goedel-incompleteness/

Redgate, C. (2007). A discussion of Practices Used in Learning Complex Music with Specific Reference to Roger Redgate's 'Ausgangspunkte.' *Contemporary Music Review 26(2)*, 141-149.

Restle, F. (1970). Speed of adding and comparing numbers. Journal of Experimental Psychology, *83*(1), 274–278.

Runeson, S. (1977). On the possibility of "smart" perceptual mechanisms. Scandinavdian Journal of Psychology, *18*, 172–179.

Rutherford-Johnson, T. (2010). Rambler roundtables: ELISION ensemble. *The Rambler.* Retrieved from https://johnsonsrambler.wordpress.com/2010/02/01/rambler-roundtables-elision-ensemble/

Schick, S. (1994). Developing an interpretive context: Learning Brian Ferneyhough's Bone Alphabet. *Perspectives of New Music, 32(1)*, 132-153.

Schick, S. (2006). The percussionist's art: Same bed, different dreams. Rochester, N.Y: University of Rochester Press.

Shahane, V. (1983). Translation as Art. *Indian Literature, 26*(4), 5-19.

Sluchin, B. (1995). *Introduction pratique aux techniques contemporaines du trombone ; traits de trombone du 20ème siècle* [*Practical introduction to contemporary trombone techniques: 20th century trombone excerpts]*. Paris: Paris Éd. Musicales Européennes.

Svoboda, M. and Roth, M. (2018). *The techniques of trombone playing*. Kassel: Bärenreiter.

Tenney, J. (1993). *Form 1: in memoriam Edgar Varèse*. Lebanon, NH: Frog Peak Music.

Tsao, M. (2016). Dialectical Composing. *Perspectives for Contemporary Music in the 21st Century*. Retrieved from http://www.academia.edu/29091544/Dialectical_Composing

Tsing, A. L. (2015). *The mushroom at the end of the world: On the possibility of life in capitalist ruins*. Princeton: Princeton University Press.

Toop, R. (1988). Four facets of the new complexity. *Contact: a journal of contemporary music*, *32*, 4-51.

Tutschku, H. L'application des paramètres compositionnels au traitement sonore (Doctoral dissertation). Université Paris-Sorbonne, Paris.

Van Gelder, T. (1995). What might cognition be, if not computation? *The Journal of Philosophy, 92*(7), 345-381.

Varela, F. J., E. Thompson, and E. Rosch. (1991). *The embodied mind: Cognitive science and human experience*. Cambridge: MIT Press.

Webb, B. (2007). Richard Barrett's 'imaginary trombone.' *Contemporary Music Review 26(2)*, 151-177.

Wilson, A. and Golonka, S. (2013). Embodied cognition is not what you think it is. *Frontiers in Pschology, 4*(58), 1-13.

Biography

Kevin Toksöz Fairbairn performs regularly throughout central Europe and the eastern United States, and specializes in the performance, improvisation, and composition of experimental music. His commitment to exploring sound has led to many unique projects both within notated music and beyond.

Since 2013, he has performed regularly with Klangforum Wien, with whom he has appeared as a soloist numerous times, and Collegium Novum Zürich, of which he is a member. He collaborates frequently with young and emerging composers, and advocates extensively to develop new and experimental chamber music for the trombone. His duos with long-standing musical allies João Carlos Pacheco (Blechtrommel) and Coleman Goepfert (Winston/Goepfert Duo) have served as principal laboratories for these engagements.

Kevin also maintains an active practice as a researcher, academic, and teacher. With respect to his work on experimental notations that explore the physical entanglements of music-making, he has given masterclasses and guest artist recitals at universities in America, Europe, and Asia.

He is also an accomplished brass instrument maker, following a long apprenticeship with master craftsman George McCracken. He performs on trombones and other instruments of his own design and construction.