

**UCSD Department of Music**

**DMA Qualifying Examination  
in  
Performance**

**For**

**Alexander Alexandrovich Ishov**

**March 18, 2022**

**Oral Examination**

Friday, April 1<sup>st</sup>, 2022

4:00 PM

[Zoom Meeting](#)

Copyright

Alexander Alexandrovich Ishov, 2022  
All rights reserved.

## Translated

Introduction.....	6
Objects Create Interaction.....	9
Objects Affect Perception.....	13
Habits Enable Performance.....	19
Instrumental Affordances.....	27
Feedback.....	36
Instrumental Topography.....	41
Instruments as Compositional Tools.....	46
Transcription in Practice.....	50
Conclusions.....	55

## Altered

Introduction.....	59
Habit and Musical Creativity.....	64
Comfort and Instability.....	72
Alteration as a Mediator.....	79
Electroacoustic Mediation.....	93
Conclusions.....	104

## Designed

Introduction.....	108
Design Foundations.....	111
Artful Design.....	122
Jace Clayton.....	135
Khyam Allami.....	151

Works Cited.....	164
------------------	-----

DMA Qualifying Exam Question 1  
For **Alexander Ishov**  
Submitted by  
Professor Wilfrido Terrazas, Chair

You have been exploring the intricate connections between performers, musical instruments and musical scores, in particular, the way these connections are affected whenever one or several of the components change. You have conceived these processes under the general idea of transcription. In your research, you have come across the work of important authors like Jonathan De Souza, whose book *Music at Hand* has given you an important framework of reference to explore this fascinating topic. Please discuss at length your explorations regarding this topic, including concepts like the kinds of interaction between humans and objects, agency / ownership, the relevance of habits in performance, instrumental affordances, feedback, instrumental topography and others that have proven relevant to your research, while at the same time connecting these concepts with your own practice and experiences as a musical performer.

Transcribed

## Introduction

As a performer, my primary mode of interaction with music is via my instruments: the piccolo, the concert flute, the alto flute, and the bass flute. As an interpreter of contemporary music, the music I perform requires a diverse range of playing techniques, mediated by various notational practices.

In my performance practice, I am constantly reevaluating the relationship between my body and my instruments, and how my habits mediate this relationship. I seek to better understand how the materiality of my instruments affects my interpretation of music. I am often jumping between different instruments belonging to one instrument family, and I am curious about the ways my habits map onto the unique characteristics of each of my flutes.

Habits are intertwined with the instruments a performer plays. I am interested in exploring what happens when performers interpret works originally written for other instruments, particularly when the source and target instruments navigate the physicality of sound production in significantly different ways. This paper explores how instrumental transcription acts as a multilingual dialogue between performer, instrument, and musical score. I explore how instruments serve as translators of meaning. I seek to understand how that meaning is altered when the object we use to access music is changed.

In order to better understand the processes involved in instrumental transcription, I first explore the fundamental mechanics involved in human-object interactions. Jonathan De Souza's *Music at Hand: Instruments, Bodies, and Cognition* uses music theory, phenomenology, and cognitive science to investigate body-instrument interaction. I unpack De Souza's discussion of instrumental affordances, instrumental topography, technical and motor agency, instrumental

idioms, and instruments as compositional tools. I use the terminology and concepts presented by De Souza to guide my exploration of transcription's effect on interpretation.

In my experience, the context in which instrumental practice is situated significantly alters the perception of my technique. The perception of my actions are influenced by the social structures that frame them. Paul Dourish's *Where the Action is: The Foundations of Embodied Interaction* explores a perspective on the relationship between people and systems. I apply Dourish's model for understanding the effects of interaction design on the interpretation of music. The context within which instrumental transcription is framed affects our perception of it. I use Dourish's concepts of *space* and *place* to situate instrumental transcription within specific contexts. I believe the reasons a performer transcribes a work of music affects the transcription process, alters musical interpretation, and therefore affects the final musical result.

I recently expanded my practice to include the bass flute, which was a reminder that each instrument I play has a unique feedback signature. Even though many of my flute playing habits transfer over to the bass flute, they are remapped in a way that alters the overall experience. Altered feedback guides technique in a new way, and creates unique habits that are tied to each instrument. Therefore, instruments mediate the way I interact with music. The choice of instrument determines the type of feedback a performer gets while playing music, and alters the way we feel ownership and/or agency over our performances. I believe identifying the specific ways that a piece of music activates instrumental feedback allows an instrumentalist to be more intentional in their interpretation. Finding the balance between an instrument's voice, the composer's voice (as expressed via notation), and the performer's voice is the mechanism

that forms interpretation. I seek to better understand how increasing my perception of this balancing act unlocks new spaces for creativity.

By exploring the mechanisms by which objects affect my perception, I believe that I can better understand the reasons a composer writes for a specific instrument. Using this process, I intend to widen the space I have to critically engage with a composer's choice of instrumentation, creating more opportunities for composers to take advantage of my unique balance of action, perception, and habit within my performance practice. By going through this process, I ultimately make my playing more integrated into the sum total of my life experience, increasing feelings of intentionality within the performer-composer interactions I am involved in.

I seek to address the question of whether or not there is an in-betweenness to music, i.e., can a musical idea exist without selecting the object that it is expressed with? Is all music transcribable, and what does it mean to judge a piece's *transcribability*? Everything is a transcription, translation, or an adaptation. It's just a matter of understanding the context within which transcription is framed, and how that context shapes the creation of meaning and interpretation. By understanding the processes involved, we begin to break free of the binary opposition of musical meaning and musical technique.



## Objects Create Interaction

In order to understand the role that instruments play in forming musical interpretation, I will first explore how objects are used to interact with the world around us, and how the qualities of those objects mediate our interactions. I am interested in understanding how the context in which we interact with our instruments reveal goals, and how those goals affect our perception.

The use of objects requires technique. Interaction involves an interplay of techniques and technologies (De Souza, 2). Technique can highlight or obfuscate the qualities of technology, while the use of technology can emphasize, modify, or create entirely new techniques or modes of interaction. As De Souza puts it, “the instrument, together with my action, reveals a world” (24). What role does an instrument’s qualities have in determining what our goals are? How far we can push our instruments to accomplish musical goals that are not built-in the design of the instrument? How do instruments anticipate potential action?

As an interpreter of contemporary music, I sometimes feel as though composers write for the technology (the instrument), *or* the technique (their perception of the instrument’s potential actions), but not necessarily the interplay of the two. I believe that good performances occur when performers are able to navigate this interplay between technique and technology. Successful collaborations between performers and composers also highlight this interactive dialogue, and push against the idea of the score as a static object. To me, environments that acknowledge the nuanced dynamics of interaction a performer goes through when interpreting music are much more interesting, engaging, and empowering.

## Objects and Goals

The use of music requires tools, and the qualities of those tools affect the way that we access music. Therefore, the choice of instrument affects the way that we perceive music.

There are different ways we can orient ourselves towards objects. Different modes of interaction alter the way we approach musical goals.

For Martin Heidegger, we interact with objects in two distinct ways. *Zuhanden*, or “ready-to-hand” is when we act *through* an object, and when the focus is on the action we wish to complete using that object. *Vorhanden*, or “present-at-hand” is when we act *on* the object, and when our actions are focused on the object itself (Dourish, 108-09). Paul Dourish, in *Where the Action Is* uses the example of the computer mouse to demonstrate the distinction between present-at-hand and ready-to-hand. Picture yourself using a mouse connected to a computer. Your focus is on manipulating screens, and not on the motion of the mouse. The action of moving your arm to move the mouse to then move the cursor is all compressed into a unified focus on manipulating the GUI [Graphical User Interface]. In this moment, you are acting *through* the mouse, and therefore the mouse is *ready-to-hand*. Suddenly you reach the end of the mousepad, and you need to pick up and move the mouse. The focus is now on the mouse as the object of activity, and therefore becomes *present-at-hand* (Dourish, 109).

Dourish applies Heidegger’s distinction between these two modes of interaction to the way we perceive technology: “...as we act through technology that has become ready-to-hand, the technology itself disappears from our immediate concerns. We are caught up in the performance of the work” (109). I am constantly shifting between these two modes of interaction, and it is difficult to pinpoint exactly at what point my interaction with the flute shifts between ready-to-hand and present-at-hand. For example, when a piece of music asks me to play

a *pianissimo* note in the upper register, it requires me to act *on* my body to align it with what the music requires. Once my technique is aligned, I can then play *through* the flute. Habits, built up over years of practicing, shorten the time required to switch between these two modes of playing. Eventually, this distinction fades from the performer's perception entirely.

Sometimes a composer intentionally asks a performer to adopt a present-at-hand mode of interaction. For example, a score I recently worked on asked me to very slowly shift between different finger positions in a way that emphasized the subtle movement of fingers, as opposed to movement between notes. The composer was specifically interested in exploring how shifts between finger positions reveal moments of instability, and how staying in this space of instability generates curiosity to keep exploring technique. I was not playing *through* the flute to access the music. Instead, the notation invited to act *on* the flute. In this example, acting *on* my technique was the vector by which I generated feedback from my instrument.

### **Framing and Reframing**

The objects through which we choose to interact with the world are always framed in relation to other objects. Martin Heidegger's concept of *Geworfenheit*, or "thrownness," explains how we are thrown into a world that already has its own culture and history (Heidegger, 2010, 127-28). My instrumental practice is informed by my own experience, but is also influenced by the collective history of my instrument's performers, the work of composers, as well as the social and cultural associations built up over time. The knowledge of this history informs my own perception of the instrument. Therefore, my flute technique does not exist in a vacuum, and is informed by the sum total of my experiences, my knowledge, my habits, my perception of them, and the feedback I get from others. Bernard Stiegler's concept of

*thrownness* supports this, which enables me to access the past experiences of a musical object that I have not necessarily experienced myself (Steigler, 1998, as cited in De Souza, 2017, 26-27). I really like this idea, because it means our instruments allow us to access the knowledge of others. Notation allows me to use my instrumental practice to connect with musicians of previous centuries, or with contemporary musicians on the other side of the world.

Instruments are framed in relation to other instruments (De Souza, 119).

Therefore, the choice of object used to engage with music has a framing effect. The actions associated with objects conditions the way we hear. I see a connection between De Souza's exploration of objects, and my discussion of instrumental transcription. As discussed earlier, we learn about the world through the process of interacting with it. Changing instrumentation alters action, therefore revealing an altered world. Changing instrumentation reframes music. This also applies to the process of learning music:

We learn how to play an instrument by doing it, not by merely reading a book or watching others. Leonard Meyer compares this to riding a bike (1973, 15-16).

This bike cannot ride itself without the person. The world is felt *through* the bike - the feet never touch the ground. The human is the bicycle's engine. Riding a bike is a way of being in the world, for it transforms the experience of space, of speed, and of body. A bike converts action into momentum, a musical instrument converts action into sound. (De Souza, 28)

So far we have established it is impossible to perceive something without first choosing the tool through which it is perceived. The choice of tool alters our perception of the world. We will now explore the mechanisms by which the qualities of an instrument alter our perception of music.

## Objects Affect Perception

In the previous section, I established the ways objects enable interaction with the world, and how interactions are broken into the two modes of *ready-to-hand* and *present-at-hand*. I am curious about the ways these two modes alter the perception of instruments. In this section, I will discuss how objects prime action, and how they change the way we *grip* and *reach* the world around us.

What exactly forms musical interpretation: My actions, my grip of the flute, the flute's grip on me, or some other process? How does changing the object we use to reach music affect interpretation? In what ways does music reach *us*?

### Priming Action

I recently started working with an adult flute student who had prior musical experience with singing and piano. Her ability to read notes and rhythms was excellent, but I found that she was having difficulty connecting pitches to the fingering system of the flute, which seemed rather arbitrary when compared to the piano. We tried an exercise in which I asked her to sing the song we were working on using note names as syllables, while simultaneously holding the flute on her shoulder and doing the fingerings for those notes as she sang along. However, this proved challenging; even though she could sing in tempo and at pitch using the proper syllables, the time it took to transfer those pitches to flute fingerings was preventing smooth performance. Because she did not have experience singing *and* moving fingers, this was too much to process at one time. One aspect of technique was preventing the others from functioning.

My solution was to ask her to imagine her right hand was playing notes on an imaginary piano that was levitating in front of her. In flute technique, the resting position of the right hand is similar to piano. I suggested that we try singing with note names as before, but instead of using flute fingerings, we would imagine the right hand playing an imaginary piano. Her singing transformed instantly, becoming much smoother. By accessing the pitch mapping of an instrument with she was more familiar with, she could practice the sensation of singing, and moving fingers in time. Because flute playing, like singing, involves blowing air, her body could get used to coordinating these two physical processes using more familiar actions. This example demonstrates how accessing the memories we associate with objects affects the way our minds process information, alters our perception, and affects performance.

My anecdotal experience of accessing a virtual piano is confirmed by scientific studies which demonstrate that even imagining an object alters our perception (Mike Tucker and Rob Ellis, 1998, 2001, 2004, as cited in De Souza, 78). De Souza connects these studies to Maurice Merleau-Ponty's *The Phenomenology of Perception*, in which Merleau-Ponty states that "the gesture of reaching one's hand out toward an object contains a reference to the object, not as a representation, but as this highly determinate thing toward which we are thrown, next to which we are through anticipation, and which we haunt" (Merleau-Ponty 2012, 140, as cited in De Souza, 79). In the example above, my student's hand was *reaching* out towards an imaginary piano, which allowed the rest of her senses to gravitate to this reference point. My student's embodied habits and memories associated with piano were then much stronger than with the flute. Focusing around a strong reference point improved my student's perception of technique, increased confidence, and improved performance.

Objects prime the actions they afford and alter perception. Merleau-Ponty describes this process as *gripping*, in that each object affords a unique *grip*. What we reach affects the quality of how we reach it. Changing the mechanism by which we reach reveals a transformed object. In other words, how and what we reach are inherently tied to our perception of the overall experience. Instruments have unique ways of gripping sound, which means the way music is reached is affected by the instrument that we use. Merleau-Ponty describes this as “being-toward-the-thing,” which means that the body is directed towards a particular object (De Souza, 79). By orienting finger movements towards the piano, my student was able to effectively practice unfamiliar sensations. Over time, we replaced the imaginary piano with a real flute, and began exploring how to translate and re-map the grip of the piano onto the flute. Actively engaging with a student’s unique perception and experience creates a much more productive learning environment, and for me personally is also a far more interesting experience.

### **Changing Grips**

Instrumental transcription involves changing our grip on music. I recently added bass flute to my instrumental practice. The way that I grip the music of J. S. Bach is different on bass flute than it is on concert flute. Bach did not have the bass flute in mind when composing, simply because it did not exist at the time. Transcription is therefore a prerequisite for allowing me to access Bach’s music *through* the bass flute. Without transcription, I cannot make the music ready-to-hand. Historically-informed performance practice seeks to solve the issue of altered grips by employing original instruments of the period, and/or modern replicas of them. But even in the case of historical performance, the experience and knowledge of a modern musician will

still be different than that of Bach's contemporaries. Therefore, a performer's grip and reach of music is unique to every time, place, and context in which performance occurs.

The way my body reacts to the bass flute is very different than the way it reacts to concert flute—not only is it held differently and has a different response, but I have much less experience on bass than I do with my regular flute (1 versus 17 years, respectively). Different instrumental topographies and associated habits will alter the way I interpret music of the same composer on these two different instruments. Additionally, the way I play Bach on bass flute is framed by my prior experience with Bach on concert flute. This means that even as I play bass, I access memories of playing the same music on my other flute, which further alters my perception. Further complicating matters is the fact that at a young age I was also playing Bach on piano, and later in college would sing Bach chorales in theory class. Therefore, any experience I have with a musical style is informed by the sum total of my experience and memory of musical objects. This creates a unique and nuanced signature to the experience of reaching and gripping the same music via different tools.

### **Agency and Ownership**

As discussed in the previous section, objects prime our perception. Our experience level with an instrument affects the way we grip it, which alters the degree to which we feel as though we can reach music. De Souza highlights an important distinction between a sense of *ownership* and a sense of *agency*. Ownership is: “my body is mine,” while agency is: “I am causing or controlling action” (79). To me, these two ideas are interconnected, with one affecting the perception of the other. My student was not feeling agency in her actions, saying that her fingers were not responding the way she wanted them to. Loss of agency resulted in a loss of



ownership. Taking ownership over technique with the imaginary piano exercise allowed her to grip with a more familiar method, resulting in increased feelings of agency.

In my experience talking with woodwind players, closeness between instruments of the same instrument family sometimes leads to feelings of frustration, because there is not always the same feeling of agency on each instrument. While the overall interface of the instruments are similar, there are enough differences in their affordances that the instrument does not respond in a predictable way. The performer's habits are not fully compatible with the instrument. I would argue that it is in these moments of exploration that we learn the most about our instrumental practice.

For example, I was getting frustrated with the bass flute and how it was not responding the way I wanted to when slurring up to high E / high F# (in the upper register of the instrument). The way I gripped the bass flute was informed by my past experience on the other flutes. I reached towards a musical phrase, and had an expectation of how the instrument would respond which was not aligned with the specific affordances of this particular bass flute. The fact that this particular interval is more difficult on the bass flute also affects my interpretation of musical gestures containing these notes. I really have to *go for it* on high notes on the bass and make sure I am blowing fast air, while also keeping a focused, yet relaxed embouchure. The note ended up coming out quite loudly, which reminded me of what it is like working with a young student who has difficulty playing high notes softly. But in this scenario I could tell that while yes, I am still a beginner on bass flute, I am a professional flutist, and can make a clearer distinction of what is me, and what is the instrument.

This makes me think about how when Bach's music was played on traverso, some of the notes in the sonatas are pretty much at the top of the register. Players would have to really go for those notes to ensure they spoke. The musical affect was really different on the original instrument, since the timbre of the notes was quite piercing. On the modern flute, we learn how to play really softly in the upper register, so I am able to play those notes completely differently from the way Bach imagined the flute sounding in that register. This is an example of how auditory feedback changes the way we form our interpretation, and how changing the tool we use allows us to access new paths of navigating musical figures.

## Habits Enable Performance

In my discussion of how *grip* and *reach* affects perception, I brought up how the memory and experience of objects affects the way we use them. Habits support the way performers grip instruments, and enable the development of technique. Therefore, technique enables performance. The following discussion explores how the formation of habits alters our perception of objects, how habits become unconscious, and how habits can be re-mapped between objects. I unpack how the collective habits of a community create external memories for objects that affect the way we interact with them.

My instrumental practice involves continual reassessment of how my habits (conscious and unconscious) affect performance. Pedagogy involves demonstrating methods for identifying, developing, and modifying habits. I seek to better understand the role that habit plays in perception, in order to account for its effect on interpretation. At what point are our habits not really *ours*? Meaning, how does the concept of *thrownness* affect our individual habit-forming agency?

### Habits and Objects

Habits involve objects, and support the way we use them to enable human performance (De Souza, 18). As De Souza puts it, objects “afford particular kinds of motor and perceptual habits; they reveal certain possibilities, while concealing others” (23). Habits have limits, and apply only within a certain genre of action. Unlike reflexes, habits are acquired. Habits can stagnate. Habits can be unlearned and relearned. Habits are dynamic (22-23). I agree with De Souza’s assessment that habits are always in a state of movement. I believe that physical and mental tension is sometimes caused by allowing our habits to become fixed, and/or

perceiving them as static. What happens when our assumptions of what our habits are do not correspond with what is happening in reality? What happens when habits change outside of our zone of awareness, and how does that alter a performer's sense of ownership and agency?

Merleau-Ponty uses the example of walking with a cane to demonstrate the effect of habit on the perception of technique. Once the cane becomes familiar, it withdraws from the attention of the user. The person feels the world *through* the cane's tip. One is not necessarily thinking about all of the data the cane is giving (e.g., pressure, position of tip, position of environment). Habit relieves the person from doing this work. "The pressures on the hand and the cane are no longer given, the cane is no longer an object that the blind man would perceive, it has become an instrument *with* which he perceives" (2012, 154). Once someone becomes habituated to using a tool, it becomes *in-hand*. This explains why musicians sometimes claim that their instrument feels like a part of their body (De Souza, 48). When I translate my flute technique from concert flute to bass flute, I am much more aware of the data the flute is giving me, because I have fewer habits associated with it. Therefore, it never fully withdraws from my attention. I feel as though I am more often acting *on* the bass flute, when compared to the concert flute. One potential of practicing is therefore the development of habits that will allow this new instrument to become a part of my body.

Related to the earlier concept of *thrownness*, the collective habits of a community develop an *external memory* for objects. Instruments do not exist in a vacuum, and therefore cannot be neutral. External memory creates musical idioms, which are used by performers to draw on larger, ready-made sequences to perform. Idioms allow performers to offload some of the processing required to navigate musical gestures. Idioms are not universal, and can be unique

to a musical genre, or even a specific composer. Performers and composers do not always share the same concept of what an instrument's idioms are. The development of idioms is a social process: they are produced, maintained, and negotiated in communities (De Souza, 77-78). Because idioms are rooted in social groups (Stiegler, 67), there is a degree of untranslatability between them, even if idioms have a degree of overlap (84). Therefore, changing the tool used to play a piece of music will access an external memory that was not initially intended for the piece.

The interplay between an instrument's external memory and an individual performer's technique and habit perhaps creates an *internal memory* as well. Classical musical education prioritizes learning of an instrument's external memory first. Once a student learns how to analyze their own perception, it becomes easier to take ownership of their own technique. The stronger a student's sense of agency, the more enjoyable the overall experience becomes. This incentivizes practice, which strengthens habit, which enables technique. Internal memory is developed when an object's external memory meets an individual's technique, habit, and experience.

### **Unconscious Navigation**

As discussed earlier, not all decision-making involves a conscious process. Professional musicians rely on habits and idioms to navigate musical gestures without controlling each individual aspect of technique. Merleau-Ponty uses "motor intentionality" to describe automatic movements (2012, 113).<sup>1</sup> Sometimes, it can feel as though the body is

---

1. Studies have shown that quick responses can outpace conscious thought, leading to a dissociation between action and awareness (Jeannerod 2006, 46–49). For example, a driver responding to something in the road before realizing what it is. Therefore, actions aren't always caused by self-conscious decision-making (De Souza, 79).

improvising on its own, or that the body is being played by the instrument (De Souza, 78). Therefore, unconscious decision-making plays a role in the development of musical interpretation. When I translate technique from my different flutes, certain aspects of my technique that are unconscious on one instrument need to be consciously managed on the other. Because of the fact that different instruments manage technique in different ways, this influences what aspects of music we focus our attention on. Consider how translating something into a different language might require a great deal of time thinking about a linguistic aspect that might not be necessary in the original (e.g., navigating verb conjugations that do not have an equivalent in the target language). This applies to music. For example, a performer will need to determine how to navigate double-stops on a monophonic instrument. Remapping technique alters the perception of an instrument's affordances, which I will explore later in the paper.

Habits allow performers to require less conscious management of their technique. Becoming fluent with fingering systems is an example of this. "In performance, the fingering feels automatic. After all, how could they [performers] perform the piece fluently if they needed to consciously initiate every finger movement? The action must become habitual, so playing the scale feels like a single flowing gesture" (De Souza, 19). The exercise I invited my student to try with the imaginary piano was a stepping stone towards being able to move with this "single flowing gesture."

Difficult music requires conscious attention. For every performer this bar of unconscious/conscious navigation is different. When something is difficult or unusual, we have to act *on* the fingerings, as opposed to acting *through* them (De Souza, 18-19). The more

---

experienced a performer is, the quicker they can respond to unfamiliar music and new instruments. In my experience, certain kinds of music never reach the stage of fully unconscious navigation. Recall my earlier example of the piece in which I was asked to move my fingers slowly between different positions. Perhaps at a certain stage this way of moving my fingers would become an unconscious process, at which point I could distance myself from the actual technique, instead engaging with these unexpected sounds. The music of Brian Ferneyhough represents the opposite experience: everything is very clearly outlined, but there is such a vast amount of information to process that a performer must choose which are processed consciously, and which are left to unconscious habit. In Ferneyhough's case, I find his music to be written in an incredibly idiomatic way for the flute. The more experience I gain with his music, the more memories I have associated with the actions required to navigate it. Perhaps it is then a matter of combining a composer's and performer's understanding of instrumental idioms lies, and then analyzing how conscious and unconscious processes can be utilized to enable fluent performance. In the next paper of this series, "Altered," I discuss a performer-composer collaboration that successfully navigates this space.

An experiment by Caroline Palmer and Rosalee Meyer (2000) showed that professionals focus more on sound, while beginners focus more on hand movements. It demonstrates that professionals develop instrumental skills to the point that they require minimal attention when playing patterns. Therefore, technique becomes in-hand because it withdraw's from awareness. The performer's focus is on the work, not the tools. This is only possible when a tool can be fully trusted. A common example of this is of using a hammer. The focus is not on the hammer itself, it is instead being used as a means to an end. (De Souza, 20-21). Applied to my

imaginary piano singing exercise, the reason the exercise was effective was because it leveled the playing field in the interaction between skills of varying experience level (high degree of experience with singing and note recognition, very low experience with finger-breath coordination). Successful teaching requires recognizing these potential moments of multi-modal integration.

De Souza highlights an example from Merleau-Ponty's *Phenomenology of Perception* that demonstrates the way experienced performers navigate instrumental space:

An experienced organist is capable of playing an unfamiliar organ, whose keyboards are more or less numerous, whose stops are differently arranged than those on his customary instrument. He needs but an hour of practice to be ready to perform his program.... He sits on the bench, engages the pedals, and pulls out the stops, he sizes up the instrument with his body, he incorporates its directions and dimensions, and he settles into the organ as one settles into a house. He does not learn positions in objective space for each stop and each pedal, nor does he entrust such positions to "memory." During the rehearsal—just as during the performance—the stops, the pedals, and the keyboards are only presented to him as powers of such and such an emotional or musical value, and their position as those places through which this value appears in the world. Between the musical essence of the piece such as it is indicated in the score and the music that actually resonates around the organ, such a direct relationship is established that the body of the organist and the instrument are nothing other than the place of passage of this relation. (2012, 146–47, translation altered, as cited in De Souza, 22)



This example highlights how experience, strengthened by habit, allows a performer to navigate an unfamiliar instrument with relative ease. The establishment of the “direct relationship” between body and instrument is the key phrase here. What I like about this example is how experience allows a performer to make decisions about what they will consciously control, and what they will leave up to habit. I relate to this description strongly, because it is similar to the process I have adopted to learn Ferneyhough’s music.

The way we unconsciously navigate our first language, or our first instrument, means that perhaps there is a more direct connection to the essence of what we are saying. When those thoughts are translated to another language or instrument, there are more conscious steps involved in deciding how exactly we wish to express that idea. In my own experience, translating my thoughts into different languages occasionally gives me the sensation of having a thought or emotion before it is associated with a specific language. This, combined with my multi-instrumental training, gives me the feeling of having more space to consciously decide what to do when using a musical object, instead of just “saying” the thing I want to say.

### **Remapping Habits**

Melodies are accessed *through* the instrument. Melodies therefore do not exist without an instrument. Playing the same melody on multiple instruments allows you to access different dimensions of the music. Instrumental transcription is a way for performers to break free of the habits of one instrument, and re-map it to the affordances of another. Every experience you have of playing a work of music is really your experience playing it *on that particular instrument, at that particular time.*

Instrumental transcription disrupts the mapping between action and habit.

Depending on the instrument, there may or may not be a direct translation between these different mappings. Mappings rely on a certain degree of similarity between source and target.

De Souza cites Lawrence Zbikowski and introduces the idea of *cross-domain mapping*, “a process through which we structure our understanding of one domain (which is typically unfamiliar or abstract) in terms of another (which is most often familiar and concrete)” (Zbikowski, 2002, 13, as cited in De Souza, 141). De Souza applies Zbikowski’s ideas to “intra-musical” mapping, which allows for mapping to occur between two different instruments (141).

Different instruments organize pitch materials differently, therefore, a similar musical task might result in a different set of transformations. Differences in cognition between instruments have to do with the ways pitch materials are organized, and not necessarily the mode of sound production. The physicality of an instrument has an effect on a player’s perception of the pitches. (De Souza 50-51)

The differences in cognition between playing instruments will therefore alter the interpretation of transcribed works. The choice of what instrument to compose a piece for has an immediate affect on the piece itself, its interpretation, and the player’s freedom of choice.

Transcribing for another instrument unlocks new spaces for interpretation, sometimes to the point of radically remapping its tonal and instrumental idiomacy.

## Instrumental Affordances

In the earlier section on interaction, I established that we encounter how habit, combined with technique, supports the way performers use musical objects. I discussed how the qualities instruments affect our perception of the music, and also how memory and experience prime the way we *reach* and *grip* music. The perception of an object's potential actions are described in terms of its *affordances*, which mediate our experience with the world (Östersjö, 18).

What are the processes by which performers learn about an instrument's affordances, and how does social conditioning affect what we consider to be an instrument's perceived use? How does this terminology aid my performance practice, and how does it inform my pedagogy? To what degree are instrumental affordances universal? How do habits strengthen or obfuscate the perception of affordances, and how does this overlap with the concept of agency and ownership?

### Tuning to Objects

Affordances are the link between action and perception, between organism and environment. James J. Gibson, the founder of ecological psychology, uses the term *resonance*, or *tuning* to describe this coupling. Objects are seen in terms of their *affordances*, perceived as things that can be used (1979, 134). Gibson believes that "the object offers what it does because it is what it is" (Gibson, 1979, 139, as cited in De Souza, 52). Using Heideggerian language, this perspective is oriented towards an object's *handiness*, as well as its possibilities of action (De Souza, 12-13).

While an object's affordances are potentially endless, memory and social conditioning create an expectation of how objects are used. Certain interpretations of an object's potential uses will come more naturally than others (De Souza, 52). Notation implies processes that go far beyond what is marked on the page, further influencing a performer's interpretation. For example, *pianissimo*, *molto espressivo* within an idiomatic gesture in the upper register of the piccolo immediately triggers a set of memories and associations. Effective notation practices take into account this complex web of interaction between an instrument's built-in qualities, and a performer's process of interaction. Different composers have different ways of activating external memory and social conditioning, and sometimes need to describe their unique expectations using words in the form of performance notes. Ideally, these notes allow a performer to re-map their own expectations in a way that still leaves room for creative agency. In my opinion, the more steps a performer has to take to make the notation make sense to them, the less effective the notation is. It is crucial that performer-composer interactions have discussions about notational practices built-in from the start of the collaboration.

Debates about technology and agency are framed around two theoretical poles: Voluntarism or Social Reductionism, and Technological Determinism (De Souza, 51-52). Voluntarism and Social Reductionism believes that tools are vehicles for human intentions. A common example associated with this belief is "guns don't kill people, people kill people." From this perspective, instruments are merely tools for the performer to use to create their interpretation. On the other hand, technological determinism believes that tools shape or control

their users.<sup>2</sup> In the words of Marshall McLuhan, “the medium is the message” (1994, 7, as cited in De Souza, 52). Applied to music, this implies that the instrument itself creates the interpretation of the work. What is the role of the performer within this dichotomy?

De Souza suggests that ecological perceptual theory allows us to avoid these two polarized perspectives. Because affordances and abilities are always codefined, it is difficult to determine the border between an object’s qualities, and the qualities projected onto it through action. De Souza compares Gibson’s *affordances* with Gestalt philosophy’s (Kurt Koffka) *valences*. “Affordances are not produced by agents’ intentions, nor are they merely projected onto an object” (De Souza, 52). Therefore, playing a piece on a particular instrument might more naturally highlight certain characteristics, but on its own the instrument does not define the interpretation. The context in which a collaboration is presented alters the balance between instrumental affordances and performer agency. It is my belief that performer-composer disagreements, as well as socially-uncomfortable moments in rehearsals are primarily caused by the fact that one or both parties within the collaboration are unwilling to unpack these nuances. In the next paper of this series, “Altered,” I discuss a collaboration that successfully navigates these challenges.

### **Instrumental Landscapes**

At the beginning of this paper, I introduced how interaction involves an interplay of techniques and technologies (De Souza, 2). David Kirsh’s idea of the *enactive landscape* is the space in which this interplay occurs. Musical instruments “provide musicians the physical

---

2. For further discussion of such debates, see Ihde (1990, 4–5) and, in a musical context, Taylor (2001, 25–31). (as cited in De Souza, 51-52)

landscape necessary to change their possibilities—to create a perfect niche for making music” (Kirsh, 2013, §2.6). Different musical contexts create different musical landscapes. Instruments can support multiple landscapes (De Souza, 53). The idea of multiple landscapes is what enables me to use an instrument with fixed affordances in a wide range of performance contexts and musical aesthetics. I became interested in contemporary music because I felt it provided me with the widest landscape possible. I gravitate towards performance environments in which I am expected to jump between different modes of interaction with my instrument. This desire for variety informs the way I practice: while I have a core of techniques that support all of my music-making, I pick and choose what to practice based on the landscape I have ahead of me. I believe this is one of the key benefits of a classical education, because it offers a wide yet sturdy technical foundation upon which a performer can then build their personal performance practice. Unfortunately, this method of education also leads to a high degree of social conditioning that sometimes creates a fixed understanding of an instrument’s potential roles. Unpacking this issue goes beyond the scope of my discussion.

Instrumental affordances, combined with social conditioning, inform the way that performers navigate musical landscapes. Instrumentation defines the landscape in which performers navigate. Transcription changes the navigational tool by which that landscape is navigated, thereby altering the landscape itself. Jonathan De Souza cites Edwin Hutchin’s book *Cognition in the Wild* (1995), a case study of the way that navigational tools are used on the US Navy amphibious helicopter transport ship U.S.S. Palau. The specific tools used affect the way that raw data is processed, sometimes radically changing the task at hand.

For example, sailors must often calculate interrelated quantities of distance, rate, and time (147–55). A pencil and paper may be used to record the numbers, holding them in a kind of external memory while the navigator focuses on algebraic and arithmetic operations. Alternatively, the calculations can be done with a three-scale nomogram, a kind of nautical slide rule. Since the appropriate mathematical relations are encoded in the slide rule, the navigator’s task then involves lining up indices with numbers on scales. Computational constraints are built into the physical structure of the tool (96). It embodies cultural knowledge and strategies, and precludes certain kinds of mistakes. In this sense, instruments may know things for their users. (De Souza, 24)

Constraints are built into the tools we use to accomplish tasks. They are either built into their design, or established through the social setting in which they are used. What does my flute *know* when I work on music? Perhaps interpretation involves a conversation with the instrument in which performers discover what happens when knowledge of the object is balanced with the knowledge of the notation, and the knowledge of the composer.

### **Discovering Affordances**

Affordances are discovered via an instrument’s *effectivities*. This term was coined by John von Neumann (1966, 78), and represents “the potentiality to do things.” It’s connected to the idea of affordances, but specifically focuses on how learning “is to discover (sometimes with the guidance of others) and become attuned to, more and more subtle affordances” (Windsor and de Bézenac 2012, 109, as cited in Östersjö, 18). Stefan Östersjö is a guitarist and author whose collaboration with composer Richard Karpen in *Strandlines* is centered around creating a shared

language for unpacking a guitar's effectivities. I discuss this collaboration at-length in the next paper in this series, "Altered."

Developing a personal performance practice involves developing new pathways for discovering an instrument's effectivities. Put another way, creative development involves finding new ways to be creative with your instrument, which in turn generates new musical energy. As De Souza points out, sometimes this uncovers possibilities for action that were not envisioned by the instrument's original designers (Windsor and de Bézenac 2012, 110). This connects with how I interpreted the following passage in Paul Dourish's *Where the Action Is*: "Users are less predictable than planned-out systems. Users have different goals, and different ways of using the system" (Pg.83). While composers can use their knowledge of an instrument's external memory and idioms to predict certain aspects of how a performer will interact with their score, they cannot foresee all potential outcomes. Instrumental transcription is one way that users (performers) demonstrate their unpredictability when working with an interface (a score).

These interactions are much more fine-grained within musical contexts. Swedish folk-music flutist Markus Tullberg (2018) discusses flute alternative fingers, and how the effectivities (intentions and abilities) define the affordances of a fingering.

The alternative fingerings require more from the player far beyond a particular finger combination. As mentioned above, these fingerings might have been thought of by the maker, and perhaps even documented by someone like Fürstenau. However, **a musician may also discover new fingerings through exploration**. These fingerings each have their own potentials of timbre, volume

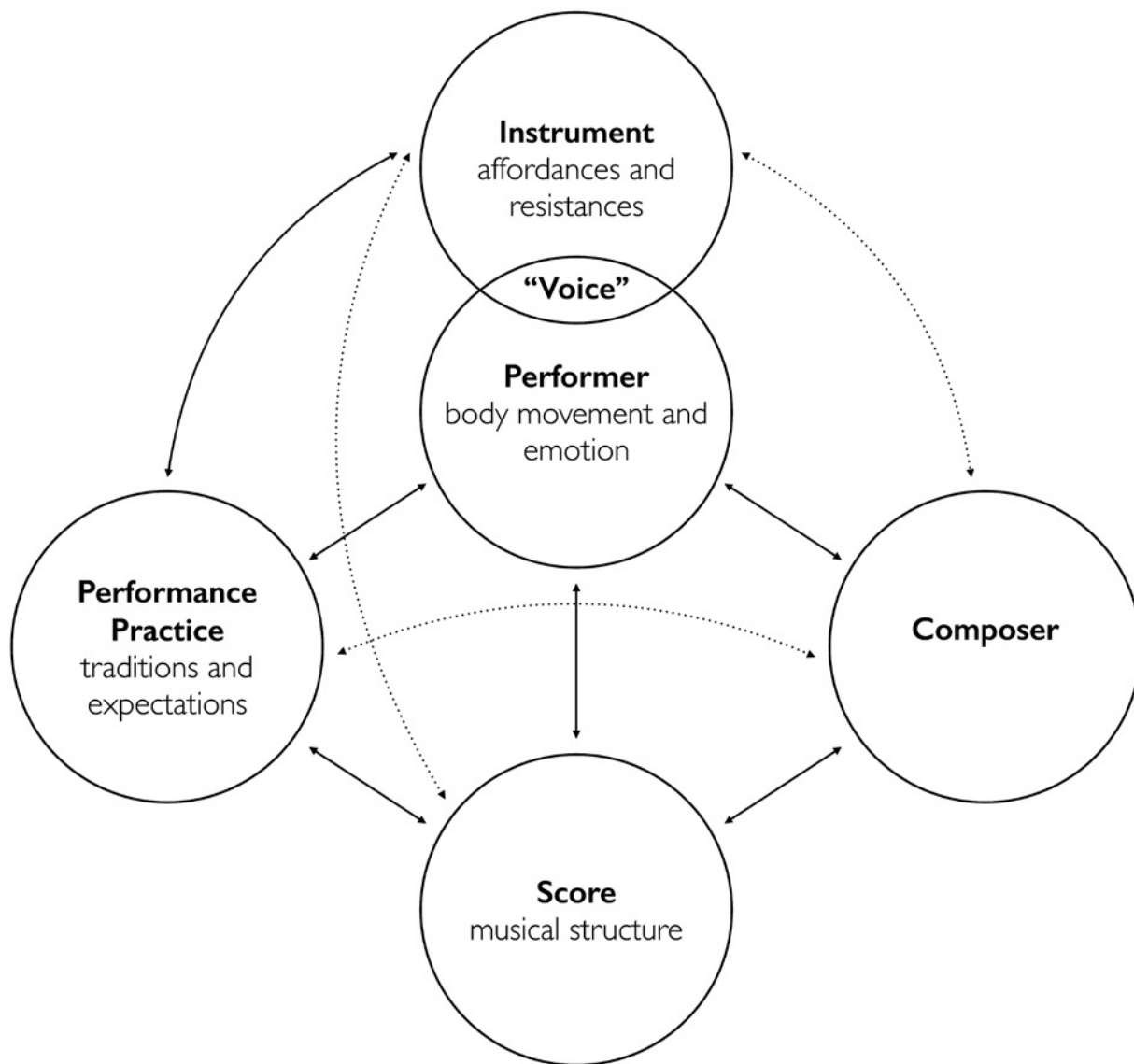


and intonation. Thus it is possible to talk about the affordances of each fingering combination as well as its character, which depends on both the flute and the player. One example of this is the affordance of the cross fingering for F (234/24). When Benzosiuk is playing her Thibouville flute (FL BE 2), this fingering affords Benzosiuk the production of F natural (providing the solution to the problem of D-F-Ab). However, for Roussel, while playing a Rudall & Rose type flute made by Morvan (FL RO 1), the same fingering affords an intentionally flat F#, which she sometimes uses when she plays Swedish traditional music. (Tullberg 2018, 97, as cited in Östersjö, 20)

In this example, notice how Tullberg emphasizes a musician's personal exploration of their instrument. When analyzing a different player's performance style, they take into consideration how this other performer is also going through their own exploration process. I remember a masterclass in which I performed for a very famous professor from a very famous music school. After playing a passage in which I personally felt very comfortable, they chose to focus on the fact that I had apparently used the wrong finger on one of my trill keys. They did not ask why I had chosen that fingering, nor did they provide a musical or technical reason why I what I did was wrong, other than to say that it was not the *proper* fingering. Looking back at this moment, it feels even more ridiculous than it did at the time, because now as a performer of contemporary music I know of countless musical examples of fingerings that, according to the standard-issue fingering chart, are most certainly *improper*. This is not to say that a teacher should not point out potentially incorrect techniques and bad habits in their students, especially when they might lead to more problems down the line. However, not every deviation from standard technique is a

mistake that needs fixing, and teachers must exercise their own judgement to determine what truly needs to be corrected, what needs slight modification, and what can be left alone for the student to explore on their own.

The affordances of an instrument and a player's intention affect each other. As Östersjö points out in *Listening to the Other*, "every detail of the performer's embodiment is decisive in choosing individual solutions to such issues, which arise from a combination of musical conventions and their physical realization on a particular instrument" (22). This interaction also creates a space of resistance between a "musician's acts and the cultural space with which he or she interacts." (22). "First, resistance is experienced in the interactions between musicians and cultural tools, and how this resistance is managed is decisive in the development of voice" (22). Instruments have affordances, but players don't always go down the path of "least resistance." Players "often go to great lengths to overcome bodily and instrumental constraints in order to achieve particular aesthetic or functional goals" (Windsor and de Bézenac 2012, 110, as cited in Östersjö, 18). Resistance is related to the idea of a *sweet spot*, where an object's affordances converge with the agent's abilities. In this space, there is less resistance and more expressive possibilities (De Souza, 74). In Figure 2.1 from "Listening to the Other," Östersjö represents the complex interplay between these forces.



## Feedback

Action and technique, strengthened by habit, enable performance. Habits are guided by conscious and unconscious processes that highlight and obfuscate instrumental affordances. Technique and technology coexist within an enactive landscape. An instrument's effectivities, or its possibilities for action, are mediated by the context in which performance occurs.

Performers rely on feedback to perform. Feedback is the crucial mechanism that enables the formation of habits, and is the vector by which a performer learns information about their instrument's affordances. Conversely, an instrument's affordances define the type of feedback a performer gets from their instrument. Changing the instrument used to navigate a work of music alters the way that action relates to feedback. Intentionally re-mapping the links between action and sound by playing a piece on a different instrument has the potential of radically altering the way that the piece is interpreted.

I learn about my practice through feedback. I perceive the results of my actions through feedback. Acknowledging the role that feedback plays in developing interpretation enriches my performance experience. What happens when performers actively push back against the feedback their instruments give them? What happens when there is a disconnect between the body's feedback, and the instrument's feedback? Is it possible to entirely perform without feedback? How much of a conscious process is analyzing feedback?

### Feedback is a Two-Way Street

Sound production is a two-way process because it provides feedback, which can manifest in several forms. Intonation is a continuous parameter that requires constant feedback in

order to control. Without feedback, there is less accuracy. For example, a study by (Chen et al. 2013) showed that if cellists shift along the fingerboard but do not bow, over time their left hand shifts away from the correct position. The control pathway cannot function without the activation pathway. Even with years of practice, motor performance still depends on auditory feedback (De Souza, 45).

Managing airspeed also requires feedback. A common habit among flutists is to not follow through with their airstream all the way through notes. In my opinion, this is caused by the fact that it is difficult to notice the feedback that occurs while in the midst of processing other musical tasks. This is why one of the best exercises for developing a stable airstream are long tones, as well as simple sequential patterns. The former entirely removes the issue of moving fingers, while the latter incorporates finger motion in a way that requires minimal attention. Another trick flutists use is to practice musical phrases while flutter tonguing. Because fluttering the tongue requires consistently fast air, this act provides the flutist with a very clear feedback system that shows where in the musical phrase there are inconsistencies in the airstream.

Developing technique requires consistent feedback. When that consistency is removed, it is much more difficult to form habits. Invariance allows performers to create specific mappings between actions and musical materials (De Souza, 15). De Souza cites a neuroimaging study by Marc Bangert and Eckart Altenmüller (2003) that tested pianists' development of auditory-motor coactivation. While one group practiced on a keyboard where mapping between pitch and key changed randomly after every piece, the other group practiced on a regular keyboard. Their brain activity was measured by EEG during this five-week process. The first

group never developed this auditory-motor coactivation. Therefore, with highly variable instruments, the links between hand and ear did not appear (De Souza, 16).

To me, the study cited above explains why learning any technique, musical or otherwise, requires the development of routines, as well as the incorporation of feedback. Based on this, it is clear that when feedback is altered, it affects our performance. I believe that over time, altered feedback would lead us to develop a different interpretation of the music. Because affordances are tied to specific instruments, changing instrumentation affects interpretation.

### **Feedback and the Senses**

Different instruments provide different kinds of feedback, emphasizing control in different areas of a piece. A musical gesture on one instrument that provides tactile feedback might only give auditory feedback on another. Therefore, transcribing a piece creates feedback systems that might not be present in the original. This means that in transcribed music, control is exerted over an aspect of music that might not be possible with the original instrumentation. For example, a wind quintet arrangement of what was originally a piano piece allows for much greater control over intonation, tone color, and dynamics. An interpretation could go beyond what was musically possible in the original. I wonder at what point an interpretation is so distant from the original, that it is considered to be a separate work entirely.

Alternatively, the transcribed instrument(s) might completely lack a feedback system that exists in the original instrumentation. *Resistances* are the conceptual constraints placed on an instrument by its affordances and social conditioning. Sometimes, performers overcome the resistances of one instrument by simulating the instrumental space of another (De Souza, 72). Take the earlier example of a wind quintet transcription of a keyboard work. What

happens in a keyboard transcription of a wind quintet? In this case, the piano loses control over intonation, is limited to one instrument's tone color, and has less control over sustained dynamics. How would imagining the feedback that exists in the original alter the pianist's interpretation?

What happens when instruments that rely on visual feedback are transcribed for those that do not provide it? For example, the flute is only seen peripherally by the performer, while a harmonica is completely hidden from the eyes (De Souza, 45). Visual feedback is an element that guides performance. Changing the visual feedback through transcription would alter the perception of the music. As I perform a transcription of a Bach cello work on bass flute, what happens if I imagine the visual movement of the cello as I play, without actually having experience playing the cello? It is very common for flute teachers to use string performance imagery in their pedagogy, describing notes as "down bows" and "up bows." I have personally experienced how imagining this movement can transform the way someone plays the flute, even though there are no actual bowings in flute playing. This is why metaphors are so powerful in instrumental pedagogy, because they allow us to access spaces that go beyond the limitations of our own instruments. Another issue with flute playing is that, unlike string instruments, flutists cannot release a gesture in a way that allows our instrument to ring. Instead, flutists simulate the instrumental space of a string instrument by using embouchure and airstream to taper notes in a way that sounds as if a bow is being released off of the strings.

Tactile feedback is also essential to performance, and it is distinguished from kinesthetic or proprioceptive feedback, which involves bodily movement but not touch (De Souza, 46). Flute playing requires more kinesthetic/proprioceptive feedback, since touching the

keys does not really give us that much feedback. Tactile feedback allows for resistance. Feedback is also important for temporal regulation. Tactile feedback can pass through a mediating implement. A study by Palmer et al. (2009) showed that clarinetists strike keys more forcefully as tempo increases, even though their fingers do not affect note onset or volume. (De Souza, 46). When transcribing a work originally for cello to bass flute, the tactile feedback a cellist has in the original is remapped to a different part of my body. This remapping is another vector by which transcription alters the perception of a piece, thereby affecting a performer's interpretation for it.

When I think about my own technique, I do so many things that do not directly make an impact on the sound. For example, moving together with the beat in an up-bow/down-bow gesture does not directly impact my sound. However, this motion generates feedback that primes the rest of my technique, altering the overall way that I play. Feedback is an important part of instrumental technique. Performers use feedback to communicate with their instruments, and use their instruments to communicate with the music. Transcribing a piece alters the perception of the work by remapping feedback, thereby affecting musical interpretation.



## **Instrumental Topography**

Performers use their technique to navigate the affordances of an instrument, and are guided by feedback. Instrumental topography is the way that a performer perceives the how instruments organize their musical dimensions. Instruments resonate with human physiology. Different instruments lead to different ideas of motion and physicality.

An instrument's topography enables certain modes of navigation for a performer. For example, going up in range on the piano from left to right might result in a different motion on a clarinet. A performer might move across a fingerboard, or across the strings. In a woodwind instrument, hands are in place, while the mouth does work (De Souza, 13).

I am interested in how subtle topographical differences in the instruments that I play affect habits on each of my flutes. What happens when music is transcribed between instruments with vastly different topographies, and how is topographical knowledge communicated? How does knowledge of instrumental topography mediate listening?

### **Knowing the Map**

As discussed earlier, the attributes of an object affect the way we perceive its potential actions. A performer's prior experience with a particular instrument's topography affects their perception of the instrument. Knowledge of affordances is strengthened by habit. The more a performer embodies the topographical map of an instrument, the stronger the instrument's topography affects a performer's perception. This effect was demonstrated in an experiment by Drost, Rieger, and Prinz (2007), which showed how instruments can affect the perception and reaction of a performer.

In the experiment, guitarists were given visual prompts to play chords with a musical representation of that chord. When a chord was shown on screen, it was paired with an audio cue that sometimes matched the sound, and sometimes did not. When it did not match *and also* had the timbre of a guitar, it slowed the reaction times of the players. If it sounded like a different instrument, it did not affect their performance. When testing pianists, they were influenced by piano *and also* organ sounds. This is evidence that when we can kinesthetically relate to sounds, they have a stronger overall effect on us (De Souza, 51). Performers rely on feedback; altered feedback alters performance.

To me, it would be interesting if a follow-up study looked at how performers whose practice anticipates unexpected feedback. For example, testing the reactions of keyboardists who are used to synthesizers that can play a wide range of sounds. Contemporary electroacoustic compositions sometimes involve generative patches that respond to materials played in real-time. Electronic musicians often work with feedback loops that sometimes are intentionally designed in a way to create unexpected and/or uncontrollable results. To me, the results of the study cited above are not surprising at all, because it centers exclusively on performers of invariable instruments who are used to relying on fixed feedback in their performances.

### **Topography Affects Navigation**

Instrumental topography affects the way that performers navigate instrumental space, and therefore impacts instrumental interaction. Performers can utilize this topographical knowledge for musical effect. For example, the piano has a topography that provides performers with a tactile reference of twos and threes. De Souza brings up Lang Lang's parody of Chopin's

Étude in Gb, in which he uses an orange to play the right hand notes. It works because so much of the melody is written for the black keys. Therefore, the étude is aware of keyboard's topography (25).

There is a relationship between the physical form of an instrument and possible action. The design of an instrument impacts the way that a performer will physically interact with it. In *Where the Action Is*, Paul Dourish describes how designers create artifacts that lead users through the process of working with designs, and how each decision in design unlocks a set of possible steps a user can take to navigate (Dourish, 52). Applied to instruments, instrumental topography also affects navigation. Changing the physical configuration of an instrument (by choosing a different instrument) transforms the relationship between player and musical object (the score), leading to an altered performance.

There is a connection between the way De Souza describes how pieces can be aware of an instrument's topography, with how Dourish describes how designs have built-in artifacts. De Souza and Dourish both connect to my experience interpreting notation. One of my favorite aspects of interpreting music is searching for these built-in artifacts and topographical knowledge within the pieces I learn, and using that awareness to guide the development of my interpretation.

### **Guiding Others**

Music pedagogy involves teaching a student how to navigate an instrument's topography. As discussed earlier in the section on affordances, effectivities help a student learn the affordances of their instrument. Habit and technique allow a student to create their own

topographical map of their instrument. By this metric, successful teaching can be evaluated by the degree to which it enables opportunities for a student to discover effectivities.

Pedagogy involves creating an experience for a student. Learning how to navigate an instrument's topography is an experience that requires intentional design. Therefore, pedagogy requires knowledge of how design choices affect experience. Notated music provides a map outlines a series of steps that suggest a way for navigating an instrument's topography. The design implies a series of possible physical steps. Teaching involves guiding a student through this obstacle course. Over time, technique transforms these obstacles (e.g., difficult musical passages) into opportunities for creative exploration.

The musical score is an interface through which we train our students to use their eyes to analyze musical information, which is then translated into physical movement. By marking up a score, we add additional layers that help create a clearer path through the map. Each instrument will have its own specific technical challenges and unique navigational methods. Playing the same piece on a different instrument transforms the obstacle course. Instrumental transcription creates a family of interrelated works that on one level are still moving towards the same goal. And yet, at a certain point, transforming the steps involved in navigating through a work of music may reveal an entirely different piece.

### **Topographical Memory**

Memory shapes our perception of instruments, and shapes our interpretation of musical works. As discussed earlier, we are more strongly affected by sounds that are more familiar. Going by this logic, listening to a performance of piece on your primary instrument will elicit a greater physical response than a performance of a work on an instrument with which you

are not familiar. However, it is not always easy to anticipate how a performance will affect us, because there are far more factors that impact this than simply knowledge of instrumental topography.

As discussed earlier, habits can be learned and re-learned, and can also be forgotten. When I was younger, I had a very strong connection to both piano and flute technique, and could easily translate the feeling of playing things between the two instruments. I no longer play piano, so the strong habits formed with piano technique have faded. And yet, I can still access the memories. Therefore, when listening to piano recordings, my body can still hear the physicality of playing, as opposed to instruments that I have no experience with. For example, I can have a preferred interpretation of J. S. Bach's cello sonatas. However, because I do not play the cello, I will go through a process of additional steps to translate the cello sound into something that makes sense to me on the bass flute. Compare this with the experience of listening to recordings of the Bach flute sonatas, which immediately connect to my own embodied sensations of playing Bach on the flute, along with my memories of how I've played those works. Therefore, memory shapes our interpretation of works.

Different instruments organize pitch materials differently. Similar musical tasks might result in a different set of motions when works are transcribed between instruments. Differences in cognition between instruments have to do with the ways that pitch materials are organized, and not necessarily the mode of sound production. The physicality of an instrument has an effect on a player's perception of the pitches. Differences in cognition between playing instruments alters the interpretation of transcribed works.

## Instruments as Compositional Tools

Performers use technique to access music through their instruments. Composers also require instruments to access music. Through experience, composers become attuned to the affordances of the instruments they are writing for. Successful collaborations require an overlap between a composer's and performer's knowledge of an instrumental topography. Rigid interpretation of an instrument's topography can lead to notation that limits a performer's sense of agency.

### Instrumentation Enables Composition

A composer's experience with instruments informs the way they compose. A quote from C.P.E. Bach showed that while listening to a fugue, his father J.S. Bach could hear the possibilities or necessities for where it needed to go next. He was thereby attuned to contrapuntal affordances of the instruments that he was writing for (De Souza, 126).

Composition and instrumentation are entwined—one informs the other.

J. S. Bach's experience with multiple instruments also affected his fugal writing, evidenced by his ability to write highly idiomatic music for the violin. If transposed to a different key, these idiomatic models are often lost. This shows that his process of composition was directly tied to his knowledge of specific instrumental affordances.

The composer's instrument-specific habits and auditory-motor connections reveal certain possibilities, shaping the way that musical affordances show up. This goes beyond *instrumental composition*—that is, writing music that is playable or idiomatic. The violin here functions as a conceptual tool and a source of material; it becomes a *compositional instrument*. (De Souza, 133)

Knowledge of an instrument's affordances, its topography, and personal performance practice develop a composer's ability to generate musical materials. Compositional practice involves drawing on an instrument's external memory. Over time, a composer may create their own unique memory of an instrument.

Bach sometimes played his solo violin pieces on keyboard (David and Mendel 1945, 447, as cited in De Souza, 133). He also sometimes changed the instrumentation of his works, making alterations. The translation was not always literal, drawing on the differences between affordances of different instruments. Accessing the same musical materials on a different instrument highlights different aspects of the music.

In my own performance practice, I often play flute melodies on the piano, and vice-versa. When playing a melody on a different instrument, I become free of the particular affordances of one instrument, and re-map them to another. This allows my ears to listen to the music in a different way. Instrumental transcription provides a new lens through which someone can connect with music, similarly to how reading a book or a poem in a different language allows for a transformed connection.

### **Transform the Instrument, Transform the Composition**

Transforming the instrument used to compose with transforms the compositional process. As discussed earlier, cross-domain mapping allows for the translation of materials between mediums. Composers can intentionally map the affordances of one instrument onto another, sometimes resulting in the invention of brand-new instruments.

For example, Bach helped design a "lute harpsichord" (Lautenclavicymbel) which was built by Zacharias Hildebrandt. By combining the harpsichord's interface and basic

mechanism with the lute's strings, it links the harpsichord's playing techniques with the sonic textures of the lute (De Souza, 140). This allowed him to write keyboard pieces in lute style. The lute functions as a compositional instrument, even though it is not used to perform the piece. The affordances of one object can inform the way to interact with another object.

It is impossible to separate Bach's compositions from his experience as a keyboardist, transcriber, violinist, and instrument designer. Bach used cross-domain mapping as a compositional tool. Interpreting a musical score is an interactive system that supports multiple levels of meaning. Depending on the context, the relationship between object and action can be transformed (Dourish, 183). As Dourish points out, "how technology will be used in working practice cannot be predetermined by the designer, but instead will emerge from the specific, situated activity in which the technology is incorporated" (171).

Think about how many composers who are pianists compose at the piano, even though they are writing parts for other instruments. They are imagining the target instrument through a connection with a different one. Paul Hindemith's wind quintet is a standard work of the wind chamber music repertoire. I distinctly remember being told that Hindemith learned to play all of the woodwind instruments while composing his wind quintet. Whether or not this is true, it affected my perception of his flute writing. It made it make sense—surely a composer who has experience playing the flute would write in a way that is aware of the flute's topography. While working on a concert of works by Helmut Lachenmann at the Eastman School of Music, the conductor Brad Lubman pointed out how Lachenmann is able to demonstrate himself each of the extended techniques on the instruments that he writes for. This demonstrates a huge step



towards building a shared understanding of instrumental practice with the performers they write for.

Therefore, instrumentation is fundamental to composition. Instrumentation coordinates “tonal and performative patterns” (De Souza, 118). Instruments inform theoretical understanding. Notation distances music from its performance, allowing for many possible realizations. Therefore, I believe that transcribability is built into notation from the start.

## Transcription in Practice

The way that performances are framed change the quality of interaction between instrument and performer. Context defines the degree to which performers feel agency and ownership over their actions. The reasons for transcribing a work affects the process by which a performer develops interpretation. While all performances by definition occur in real-time, instrumental transcription emphasizes this even further, because the performer is translating a musical idea into a new medium. The way that instrumental transcription is framed alters the way that it is perceived.

### Space and Place

Presenting a musical transcription in performance settings creates a system of interactions, mediating the relationship between performer, instrument, score, and listener. When talking about systems, there is a distinction between *space* and *place*.

*Space* refers to a thing's physical properties, its configuration, and how they interact (Dourish, 89). When talking about instrumental transcription, space would refer to the instrument being played, the original instrumentation of the work, the way that the performer interacts with their instrument, and the way that the original instrument's affordances maps onto the translated instrument's affordances.

*Place* refers to the way that social understandings convey an "appropriate behavioral framing for an environment" (Dourish, 89). Place helps us fully understand the way context shapes our behavior. For example, the arrangement of artifacts in two settings can be very similar, and yet the interactions can have a very different meaning when they are framed within a different setting. The way that transcriptions are situated within a social environment

impacts the way that it is perceived, as well as influencing the decision-making process of the transcription itself.

The act of transcribing a work originally written for another instrument is a player's way of creating an experience that is compatible with their practice. Once a piece of music is written, the work enters the domain of the performer. As Dourish points out, practice emerges from the actions of its users, not from the designers of the system (91). Therefore, performance practice emerges from the actions of performers, not from the design of the musical score. The actions of the player (user) is what creates the experience. The composer understands that at this point, their work has entered the domain of the performer. The way a performer presents the transcription affects the environment in which it is presented.

### **Embedded Action**

Systems are embedded within social and cultural practices, which give them meaning, while at the same time constrain and transform them (Dourish, 97). Applied to the instrumental space, the relationship of player to instrument is part of a broader setting. The key to understanding how interpretation is formed is taking note of how the technology (the instrument and its affordances, the score and its abstractions) interacts with social action (the reasons for transcribing, and the way that it is presented to the audience). The combination of these processes is what creates meaning.

Listening is also embodied and conditioned by technology. And audience's prior knowledge of an object's external memory shapes the way they listen (De Souza, 146). Transcribing a work of music to another instrument alters this dynamic, transforming the way an audience interprets the same piece of music.

## Flight of the Tuba

Nikolai Rimsky-Korsakov's "Flight of the Bumblebee," while not necessarily a beginner-level piece, is still quite simple on the flute. It is a chromatic scale that goes up and down the range of the flute, something that is very idiomatic to the instrument. The chromatic scale is a basic building block for flute technique. The piece lies on the flute well, and is aware of the flute's topography.

"Flight of the Bumblebee" is often transcribed for other instruments because it is *perceived* as an impressive demonstration of technique. Depending on the instrument it is played on, the level of *perceived* and *actual* difficulty will be altered. What happens when this piece is transcribed for the tuba? It is objectively more difficult to play this piece on tuba than it is on the flute, simply because fast-moving chromatic scales are less idiomatic for the tuba than they are on the flute. Recall the earlier discussion of how works of music can be aware of an instrument's topography. In this example, the source is no longer mapped onto its target. Even though it is the same navigational goal (the chromatic scale), the way the tuba navigates it requires the manipulation of completely different tools, utilizing a different feedback system. Flute fingerings have been remapped to a combination of valves and partials, reorganizing instrumental space within entirely new dimensions.

Choosing to transcribe and perform this work on tuba demonstrates the performer's desire to tackle a significant challenge. In other works, the performer is pushing more strongly against the affordances and topography of the instrument. This requires a great deal of agency.

We are socially conditioned to expect fast chromatic passages from the flute, but not the tuba. Therefore, the perception of this performance has been transformed as well. In this

example, the purpose of transcribing the work is not necessarily a musical one, but an *olympic* one. It represents such a radical remapping between two instruments that it will make it difficult (or outright impossible) for the tuba's thingness to fully retreat from an audience's attention. Furthermore, an audience that has prior experience with the tuba draws them further into the physicality of the performance. Therefore, the technology never fully disappears from our perception, so the instrument remains present-at-hand.

The physicality of instruments constantly reappears in the experience of listening to music. Pierre Schaeffer refers to this as an "instrumental paradox" (1966, 43-46, as cited in De Souza, 146). Music can be an abstraction, but also remains concrete, and attached to instrumental possibilities. Whereas on the flute, the listener will naturally be focused more on the sonic features (musical listening), this particular example of transcription will make the listener focus more on the sources of the sounds, and how these sources correspond to the physicality/technical aspects of playing the piece.

### **Paganini and Affordances**

Because of the potentially vast differences in instrumental topographies, affordances do not always have exact equivalents. Therefore, transcription sometimes is not a matter of direct translation, but adaptation. Consider the fact that any work of literature has multiple translations, each emphasizing a different aspect of the original. Not only is each translation a remapping of the original, but there is also the translator's own spin on things. Therefore, translations allows for multiple interpretations of the same text. Transcribers are therefore designers, both in the act of performance, and prior to their performances as they make decisions about the transcription.

For example, in flute transcriptions of string pieces, the transcriber needs to decide what to do with the double-stops. A conventional solution would be to just play a fast arpeggio or octave slur, creating a blur of a double-stop. This is the standard way of re-mapping, used often in Baroque ornamentation. The standard transcriptions (Rampal, Piccinini, etc.) of Niccolò Paganini's *24 Caprices for Solo Violin* use this method for navigating double-stops.

Paganini's caprices were famously used by him as a demonstration of his mastery of the violin. But they also demonstrated novel ways of navigating the violin's topography, demonstrating techniques that have since then become standard on the instrument. In his practice, Paganini perhaps found new effectivities and affordances of the violin, discovering possibilities in the design that were not accounted for by the original designers. What happens if we apply this to flute transcription, pushing further into unconventional territory? This results in alternative transcriptions like Patrick Gallois's version, which applies contemporary flute techniques (e.g., singing and playing) to expand the re-mapping possibilities. The application of modern technique onto an older work transforms it further.

On one hand, solving the issue of double stops / polyphonic texture using extended techniques is not stylistically appropriate to Paganini. Meaning, in Paganini's time, flutists would not be playing in that way on the flute. But I personally find discussions of authenticity in this context to be problematic—going by that logic, why play the piece at all, if it was not intended to be played on the flute? The variety of interpretations of standard works of classical repertoire proves there is a range of potential ways of navigating instrumental space. Instrumental transcription adds even more potential possibilities.

## Conclusions

Performance practice exists within a complex web of interactions that involves the application of technique to instrument, the development and transformation of habits, the discovery and remapping of affordances, and the framing and context surrounding it all.

It is difficult to pinpoint exactly at what point an instrument's influence on us ends, and at what point our own performance practice begins. We exist at the confluence of many processes within and beyond our control that contribute to a rich web of memory and expectation.

Transcription disrupts the mapping between action and habit. This creates an unpredictable space in which performers act in a way outside of the plan intended by the composer. This re-contextualization creates an entirely new experience.

Transcription is a demonstration of a performer's agency. Perhaps the point of instrumental transcription is to emphasize the fact that works of music are never really fixed, even though we sometimes go through an intellectual process to make it seem like they are. Instrumental transcription is a radical way of saying that there is no such thing as ultimate authenticity.

Becoming more aware of how social conditioning, framing, and habits play a role in the decision-making process gives performers more awareness of who and what is shaping their musical interpretations, and how to communicate their intent to others. While I primarily explored how these concepts of human-instrument interaction apply to instrumental transcription, I am more interested in how it applies to interpretation more broadly. If we become more aware of the limitations imposed by conscious and unconscious processes, we can

increase feelings of intentionality for ourselves and our students, thereby transcending the technical and social constraints imposed on our musical creativity.



DMA Qualifying Exam Question 2  
For **Alexander Ishov**  
Submitted by  
Professor Amy Cimini

In this essay, present your research about how instruments impact musical organization and performers' embodiment with a focus on how an instrument-centered approach to music making might inform new approaches to collaboration and more nuanced understandings of creativity. Your practice and research has identified instrument alteration to be a critical tool within applied technique and pedagogy as well as valuable for broader reconsiderations about musicality that take into account the affordances and constraints of instruments and their histories. Discuss alteration practices that you have found to be especially generative. Analyze their impact on idiomatic technique and explain some musical and collaborative uses to which alteration might be put. Drawn on examples from relevant literature and music practice, but please also center your own experience and embodiment in this discussion. How might alteration suggest new collaborative working methods and how do these methods perhaps require a reconfiguration of divisions of creative work between composer and performer (if not creativity as such)?

Altered

## Introduction

As discussed in the previous paper of this series, “Translated,” instrumentalists develop deep connections between their bodies and their instruments. Habits enable tight motor-neural connections that enable the development of technique. These connections prime action, and generate creative and musical energy for performers. Instrumental affordances, in conjunction with experience, habit, and memory, influence a performer’s perception of the potential uses for their instrument. Effectivities are the process by which a performer discovers an instrument’s affordances. Instrumental topography determines the dimensions of the instrumental space. Changing the instrument a performer uses to access music transforms the musical experience, and alters the interpretation of a piece of music.

In the previous paper of this series, I explored how tools prime action and perception, and how changing the tools we use reveal an altered world. I applied these concepts to instrumental transcription, exploring the vectors that mediate the development of musical interpretation. I introduced mechanisms that alter a performer’s feeling of agency and ownership over their actions. I explored the ways that the context in which musical collaborations are framed affect the performer’s and audience’s perception of instrumental affordances.

There are some situations in which a performer intentionally breaks the habitual connections with their instrument, altering action-sound coupling. One way to do so is via instrumental alteration. In this paper, I explore what happens when the instrument itself is altered, either by the performer, the composer, or through a collaborative process. I apply the concepts introduced in “Translated” to several case studies in which alteration becomes the vector of communication. I am interested in exploring how altered instruments mediate

intrapersonal communication between a performer, their instrument, and their technique, as well as interpersonal communication that involves a performer, a musical score, and a collaborator. I seek to better understand what happens at these moments of communication, and how the intentional act of alteration transforms meaning, as well as our modes of listening.

My analysis draws on the work of Jonathan De Souza, a theorist working at the intersection of music theory, contemporary psychology, and phenomenology. His book, *Music at Hand: Instruments, Bodies and Cognition* is an exploration of the mechanisms involved in body-instrument interaction, and draws from a diverse array of musical case studies. A significant portion of his discussion centers on instrumental alteration, and he presents three methods for doing so: detuning, preparation, and invention. Instrument alteration may accomplish a practical need for a performer, for example, making a difficult technique or work more playable. Alteration can also be done for musical reasons, like developing a new technique or sound, or for ergonomic reasons, like making an instrument easier to hold.

In this paper, I primarily focus on another reason why an instrumentalist might alter their instrument: Alteration as a way to disrupt playing habits for creative purposes. One of De Souza's case studies for instrumental alteration involves jazz guitarist Kurt Rosenwinkel. In this situation, highly-developed technique and practice habits were actually limiting a performer's own feeling of creativity and expressive potential. I unpack De Souza's discussion of how Rosenwinkel broke free of his sensation of knowing his guitar "too well," and how detuning his guitar created space for new expressive potential. By changing the material conditions of their instrument, players transform the subjective experience of playing. I explore the way that performers navigate instrumental space, and how in player-instrument interactions performers

sometimes are listening *to* their instrument, while other times are listening *through* their instrument.

To support my discussion of Kurt Rosenwinkel's habit-breaking practice, I discuss the role that instability and control plays in instrumental practice. I examine the role that these concepts have played in my own instrumental practice. Control is tied to technique, and there are settings in which a lack of control is equated with poor technique. And yet, instrumental alteration often deliberately creates instability by breaking the habits performers rely on to exercise control over their technique. I explore how instability (intentional or not) affects feelings of ownership over musical materials, and unpack situations in which composers or performers utilize instability in their practices. In my own practice, I have encountered situations in which composers intentionally work with unstable musical materials. I evaluate how individual experience with instability alters the way I perceive works utilizing instability. I seek to better understand how differences in experience affect our perception of instability.

While this first example of alteration centers the dialogue between a player, their technique, and their perception of it, alteration can also serve as a mediator of performer-composer interactions. I apply Alfred Schütz's concept of *intersubjectivity* to understanding how performers and composers establish communication, and how the altruistic pursuit of common ground sometimes unintentionally denies ground to one or both parties. I challenge traditional models of performer-composer interactions that I believe lack the quality and richness of communication that I personally aspire to.

As a case study of what I consider to be a truly *collaborative* collaboration, I discuss a collaboration between guitarist Stefan Östersjö and composer Richard Karpen in which

instrumental alteration was the primary vector for communication. In *Listening to the Other*, Stefan Östersjö offers a rich overview of the philosophy of listening, challenging the ways that musicians traditionally listen to themselves, their instruments, and their collaborators. I seek to understand how instrumental alteration mediates collaboration, and how that mediation shapes the collaborative process. What mechanisms shape creative agency for composers and performers? Performers often go to great lengths to accommodate the composer's vision. The Östersjö example flips this around— through the process of collaborative instrumental alteration, the performer's embodied knowledge of the instrument drove the collaborative method. I am interested in the processes through which this collaboration is negotiated.

I am interested in exploring the following questions: Where does sound live? How does habit and technique generate the connection between a performer and a piece of music, via their instrument? Performers balance conscious and unconscious habits and reflexes when performing music. The degree to which a performer feels agency in their actions mediates decision-making when developing interpretations of notated music. How can the pursuit and negotiation of comfort become a musical, creative, or collaborative material?

The process of playing an instrument always involves a negotiation with what I want, what my body wants, what the instrument wants, and what the piece (and, by extension, the composer) wants. In *Improvisation*, Derek Bailey points how performers often refer to their instruments in a polarized way, either as a “best friend, collaborator,” or as a “liability, intruder.” To push against this dichotomy, Bailey suggests that “the instrument is not a tool but an ally. It is not only a means to an end, it is a source of material, and technique for the improviser is often an exploitation of the natural resources of the instrument” (1992, 99). De Souza interprets Bailey by

saying that the instrument is a “creative partner,” framing body-instrument interaction as a collaboration (De Souza, 101).

In non-improvisatory musical settings, instrumental alteration mediates the relationship between a performer and the score, because it transforms the way that habit and technique are mapped onto an instrument. The instrument is an ally for the performer because it involves two-way communication: the performer acts *through* the instrument, and the instrument provides feedback for the performer. This exchange of action and feedback is what creates meaning. Acting on the musical object by altering it affects feedback, revealing a transformed musical experience. By better understanding the mechanisms by which performers alter their instruments, and the ways that these alterations affect perception, I seek to make alteration a personal practice.

I use the topic of instrument alteration as a method for better understanding the dynamics involved in my collaborations. As a performer, I am continually seeking how to better understand the dynamics involved in my collaborations, how to navigate the dialogue between my technique, and the habits associated with my instrument. This paper demonstrates my work towards better understanding my instrument, my body’s relationship to it, and how my instrumental practice fits into the broader world of musical collaborations. I seek to better understand the collaborative process.

## Habits and Musical Creativity

In “Translated,” I discuss how the memory and experience affects the way we use objects, shape habits, and mediate the way we interact with our instruments. Unconscious habits enable fluid technique by allowing performers to not need to actively manage each individual aspect of performance. Instrumental idioms further enable performance, allowing performers to group action into larger, ready-made gestures. Performers access musical materials *through* their instruments. Habits, along with unconscious and automatic movements, mediate the degree to which performers feel bodily autonomy and ownership while performing.

Jazz guitarist Kurt Rosenwinkel is an example of a performer who believes that habits, when they are too strongly engrained, limit musical creativity. As he describes it, his instrumental practice is constantly going through a cycle of stability and instability, learning and unlearning. “You start off not knowing what you’re doing,” he says, “then you organize things so they become ordered. When that order becomes static, you have to break it up to create another state of instability, which, in turn, throws you back into chaos. That’s what continuing on to the next step is all about” (Rosenwinkel, 2007).

I would like to better understand what Rosenwinkel means by *chaos*, because it is not a term I would use to describe this process. I feel as though my instrumental practice is also constantly going through changes, but I do not associate this change with chaos. To me, chaos is the absence of a center, something that implies letting go entirely of all habitual practices, or the attempt to do so. Perhaps this can be explained by the vast difference between my instrumental practice and Rosenwinkel’s. I am a classically-trained flutist and primarily focus on notated contemporary music. Just like Rosenwinkel’s, my instrumental practice is influenced by the



music I play. However, because I am an interpreter of scores, my instrumental practice is mediated more strongly by external objects, and my self-judgement of the quality performances is often influenced in real-time by other people.

In addition to this, the vast range of sounds that contemporary music asks for means that it is impossible to always have access to all of them. Just how you take specific tools out of your toolbox needed to accomplish a specific task, I select sounds from my technique depending on what is on my music stand. The music I choose to perform alters what is most prominent in my technique, and over time this transforms the perception of my instrument. And yet, within this movement and change there is a central core to my practice that is stabilized by something deeper and more fundamental. While the content of what I perform changes, the quality of connection between my body and my instrument is stable. Stable does not imply static, but definitely is not *chaotic*. This is why I found Rosenwinkel's choice of "chaos" to be very interesting.

Perhaps once we get past the surface-level differences, my approach is not all that different from Kurt Rosenwinkel's. I find it interesting how the words we choose can change our perception of someone else's creative process. As I continue my journey as a professional flutist, I seek to promote a performance practice that allows for continual re-assessment of my playing habits, my perception of my own technique, and the way that I map my intent onto my technique. I seek to better understand how creativity is mediated via the ways we frame it within different models for interaction, and body-mind integration practices.

The following discussion explores how Kurt Rosenwinkel went through a process of instrumental alteration while working on his 2001 album, *The Next Step*, in which alternative

tunings was the mechanism by which he created new space for creativity. Rosenwinkel describes this album as “the culmination of many life phases for me....It represents the next step in my music and in my life” (Rosenwinkel, 2007). By understanding the process Rosenwinkel went through in *The Next Step*, I seek to find similar opportunities for growth in my own performance practice. By applying De Souza’s analysis of Rosenwinkel’s process, I highlight how the words others choose to describe someone else’s creative process often differ from the ones we choose ourselves. By analyzing and sharing this process of translation, I believe that we create opportunities to learn more about our own practice.

### **The Comfort Zone**

At a certain point in his playing career, Kurt Rosenwinkel began to feel dissatisfied with his playing. He began to feel as though his knowledge of the guitar was limiting him. Rosenwinkel described this as knowing too much about what he was doing, and not hearing the music directly enough (Rosenwinkel, 2007). As discussed in my first paper, “Translated,” performers develop strong habits in order to support their technique. These habits allow for a high degree of fluency when navigating musical passages. Eventually, some performers start to feel as though their instrument begins to play itself. Many performers strive for this, and yet this was a negative feeling for Rosenwinkel. What does Rosenwinkel mean by not hearing the music directly? Musicians develop the ability to audiate, allowing them to simulate internally the sounds that instruments make. Does he mean that his internal process of audiation was distracting him from listening to the actual sounds of the guitar, or is he referring to some other process? In my experience, sometimes musicians describe the sensation of listening *through* their instruments. If Rosenwinkel fingers are to some degree being controlled by unconscious habits,

does he mean that technique and habit is blocking him from listening to the guitar? To unpack this, we will explore Rosenwinkel's process of developing his technique.

Like other performers, Rosenwinkel developed his technique through years of practicing sequences, which formed musical idioms (De Souza, 77-78). Rosenwinkel specifically says that he feels as though his own habits were limiting his creative expression. Rosenwinkel developed tight auditory-motor connections over years of practicing, and now these same connections were working against him, causing him to no longer hear the music *directly*. His perception of his own technique was priming the way he interacted with it, which distanced him from a direct connection with the instrument. De Souza connects this to something said by another guitarist, Christian Rover, who says that "to have a certain collection of voicing for every harmony, and a sound you already internally hear before you actually play it, would eventually make it redundant to still play it" (Rover, 2006, as cited in De Souza, 88). I believe that Kurt Rosenwinkel was feeling his technique, strengthened by habit, taking away his feeling of agency over his musical materials.

Altering action-sound coupling in some way would break down the sequences Rosenwinkel accessed while improvising. The resulting instability would force him to be present with his instrument and technique in a new way, which perhaps would be perceived as hearing the music more directly. This would allow him to access a *beginner's mind*, while still retaining a highly refined ear that could actively listen and engage with the creativity generated within the instability. What Rosenwinkel wanted was the ability to change between different listening modes. As he was hearing his technique, it was altering his mode of listening. By altering his

instrument, he altered his body, which altered his hearing. De Souza describes the creative possibilities afforded by instrumental alteration, and the way that it transforms listening:

Whether retuned, prepared, or redesigned, altered instruments offer new possibilities in terms of harmony, timbre, texture, and so on. But at the same time, they play with habitual connections between action and sound, between performers' auditory and motor perception. They create new opportunities to relearn my instrument, moments when I become conscious of my bodily engagement with it, when I begin to listen to and think about and feel the sound differently. Changing the instrument, then, changes the player. Alteration illuminates everyday experiences of instruments, even as it disrupts them. (De Souza, 105)

If altered instruments break our pre-conceived notions of them, is an “everyday experience” of an instrument the way that it most naturally plays, before our habits are projected onto it?

Perhaps it is the mode in which we interact with objects in a playful way, free of memory and expectation. Going back to Christian Rover's quote, an everyday experience is one that isn't fully planned-out internally, and therefore less redundant. It is not *something*, it just *is*. And in that case, this experience is worth exploring because it is radically different from the way that highly-trained performers interact with their instruments in goal-oriented performance settings.

### **Breaking Habits**

As De Souza points out, habits can be unlearned and relearned. Unlike reflexes, habits are acquired, and influence the way we use objects (23). Objects are not neutral, and

“afford particular kinds of motor and perceptual habits; they reveal certain possibilities, while concealing others. Like the body, then, each of these things can be understood as a medium for having a world” (De Souza 23). Rosenwinkel altered his instrument to break free of his habits, and recognizes that he can re-learn his playing habits. The altered guitar changes the way that Rosenwinkel interacts with it. This makes me think about how the music I choose to play alters my practice habits, and how over time this transforms the way I listen to my own technique. For example, the last orchestral audition I took was in August 2019. Certain aspects of my technique were prioritized over others, due to the goal-oriented nature of my practice sessions. Over time, I was listening almost entirely to the sort of aspects of playing that I was conditioned to believe were desirable: exact rhythm and intonation, clear awareness of the excerpt’s context within the broader work and appropriate style, note tapers, etc. In a sense, I also was no longer listening to my playing *directly*, but was doing so through the context in which this playing would be situated in, which strengthened my playing and listening habits. I have not taken an orchestral audition since then, but have been in many performance contexts in which good musicianship is generally appreciated. And yet, practicing for a rehearsal of chamber music is a completely different process than practicing for an orchestral audition. De Souza would perhaps say that recognizing the ways that context alters the way I make and break practice habits allows me to regain more agency over my instrumental practice. Instead of agency, I propose using the term *intentionality*. Agency within instrumental practice is a matter of acting on your instrument with intentionality. I think intentionality also supports letting go of direct control over every element of performance. Letting go of conscious control does not imply a lack of agency.

In De Souza's analysis of Rosenwinkel's "Zhirgovo," he points out Rosenwinkel's focus on a "haptic engagement with the music" (96). After breaking free of habit, the physical shapes on the instrument take precedence over harmonic labels. In a 2010 masterclass, Rosenwinkel points out how he was able to play chords without an intellectual relationship with them. As he put it, this mode of playing was "pure sound and discovery." This analysis shows that motor habits and auditory expectations are formed more quickly than theoretical awareness. Altering instruments foregrounds its sensory, "aesthetic" qualities, rather than an intellectual perception of them (De Souza, 97).

Habitual actions integrate hand and tool, body and world. Fingerings are a sequence of *finger-key relationships*. Changing the fingering does not necessarily change the sound, but changing the keys does. As our actions become habitual, our playing starts to feel like a single flowing gesture. When that gesture is broken, playing demands conscious attention.<sup>3</sup> When something is difficult or unusual, we have to act *on* the fingerings, as opposed to acting *through* them (De Souza, 18-19). Retuning the guitar breaks the habits that allow playing to feel automatic, altering Rosenwinkel's mode of listening, generating new creative space.

Is it possible to hear music completely free of habit? De Souza discusses Heidegger's take on experiencing sound. Heidegger believes that it "requires a very artificial and complicated attitude in order to 'hear' a 'pure noise'" (2010, 153). Is Rosenwinkel trying to hear *pure technique*, or *pure sound*? Or is the instability he seeks takes away hearing technique?

Various body-mind integration practices seek to enable the individual to pick and choose what

---

3. In "Translated," I discuss Heidegger's distinction between *ready-to-hand* and *present-at-hand* interactions. While in *ready-to-hand* interactions, the focus is on an object's potential uses, *present-at-hand* directs action towards the object itself. In this example, the instrument becomes *present-at-hand* because it is being acted on.

stimuli to respond to. My experience with the Alexander Technique has shown me how to listen not only to the what I play on the flute, but to also listen to how my playing influences my body's reaction to listening. Perhaps it is not so much about listening to my playing directly, as much as it is listening to the feedback loops that influence the overall scope of my awareness. While Heidegger might describe this as "artificial and complicated," I believe that even something as complex as perception can be experienced in a simple way if one frames these processes within a broader, nuanced framework. Creativity and musicality in performance is not a matter of whether or not technique is controlled by habit, but rather whether or not there is an intentionality to action. Instrumental agency does not exist within a binary opposition of chaos and stability, but is instead a multidimensional process that is continually reshaping awareness and perception. Rosenwinkel's solution to a creative dilemma involved identifying a habit, intentionally intervening by altering the physical space of his instrument, and then observing how that altered his perception. I think that the daily life of a performer involves countless micro-versions of this process, and that the pathway to limitless creativity in performance involves embracing the fact that our instrumental practice is constantly undergoing change; recognizing the changes in our practice is a primary factor in the generation of new creative energy.

## Comfort and Instability

Music educators often use the word *control* to describe the development of a technical foundation in instrumental playing. In this model, stability enables the formation of habits, which then support the development of technique. Control over technique is what enables feelings of agency over musical materials. Situating this dynamic within the music conservatory setting affects the way that performances are judged. As discussed in “Translated,” *space* and *place* are two concepts that can be used to analyze the arrangement objects and interactions that they enable (space), and the context in which these interactions take place, as well as the implied social and behavioral understandings (place).

In my experience, pedagogical settings that primarily focus on technique-building often lead students to wait for *permission* to allow themselves to be *creative*, because achieving technical control is described as the point at which artistic freedom begins. Within a system that prioritizes control exists a promise of freedom. “Play it as if you’re improvising” is perhaps the most commonly-used phrase I have heard in masterclasses. While I acknowledge the importance of building technique and developing musicianship, I believe that music education settings (particularly at the advanced level) should allow for more space to unpack the dissonance created when control and freedom are used as a mediator of performer-instrument interaction.

Controlling a technique is often described as a way of making it *comfortable*. Comfort is tied to good technique. If an unfamiliar performance technique is uncomfortable because it is not able to be controlled, how does this condition a musician’s perception of the music? The opposition between comfort and discomfort, stability and instability creates a hierarchical structure that will invariably condition what a performer considers to be desirable and undesirable aspects of



playing. When this dichotomy is situated within a *place* (for example, the music conservatory), entire categories of music are at risk of being excluded from a student's musical exploration because they exhibit characteristics that are perceived as undesirable.

I am personally invested in this subject because I see enormous potential within traditional music education settings for widening the scope of the what is considered to be an *appropriate* way to develop your technique. I have been conditioned to seek stability in my playing. Through this discussion, I seek to translate this self-discipline into a force for creative energy. As a graduate of a music school with very high performance standards, I wonder what kinds of possibilities for action can be unlocked if these environments enable students to embrace instability as an intentional act, and not only as a sign of poor technique or even worse—lack of artistic merit. Exploring how and why performers intentionally create instability helps understand the deeper mechanics involved in generating creative energy.

### **In(stability) is a Feature, not a Bug**

As a flutist, I am used playing an instrument that has a great deal of stability built into its design. My technique relies on my instrument's invariance. Assuming that my flute does not have a leaky key or sticky mechanism, I am conditioned to perceive something going *wrong* as user-error. As discussed in "Translated," performers rely on two-way feedback to guide their technique. Altering an instrument alters feedback, which then alters the perception of technique. A poorly-maintained instrument will, over time, warp a performer's perception of their playing. Therefore, instruments with a high degree of stability and invariance rely on regular maintenance. In my own experience, it is especially important to make sure that the instruments with which I have less developed habits are well-maintained. For example, after years of using

borrowed instruments, I recently purchased a bass flute. I now can start building habits that will be mapped onto a stable, invariable object. However, many of my well-developed habits on the other flutes have not been fully mapped onto the bass flute. When I first got the instrument, I did not understand why one particular gesture was going wrong in my playing. What I did not realize was that one of the keys was not fully sealing. I only realized this when I actually looked at the key and saw the leak. Therefore, our perception of instability is affected by our embodied understanding of habit, technique, and feedback. Memory and expectation enables performers to navigate spaces of stability and instability.

The context in which technique is situated affects the way we judge our own performances, which influences the way we approach solving issues in musical performance. For example, the way professional orchestras rehearse is influenced by structural reasons like limited rehearsal time and a high volume of repertoire. The musical expectations of the orchestral space also influences the habits of musicians. Because music programmed by orchestras prioritizes a very particular performance aesthetic, it shapes the way orchestral players approach their instruments. In this repertoire, stable tone and intonation, as well as extremely accurate rhythm are therefore prerequisites to musicality. While professional musicians can rely on years-worth of habits to enable this sort of stability, students at earlier stages in their technical development need to focus much more on these basic technical elements. Therefore, the ability to control your instrument takes up a significant amount of a student's focus at any given moment within a rehearsal environment. Within this environment, instability carries an exclusively negative connotation, because it directly impacts performance. Therefore, the *workplace performance metrics* of the professional orchestra have greatly impacted the way that orchestral instruments are

taught in conservatory environments. Many point out the fact that music conservatories are, in essence, trade schools which focus on a narrow band of performance applications. While this has begun to change in recent years, in my experience any significant deviation from the standard model of performer-instrument interaction is done on the student's own time, after completing the standard requirements imposed by the institution. In my opinion, this limits the amount of hours a conservatory instrumental student has to explore their instrument in a way that develops intentionality and creativity.

### **(Dis)comfort Zones**

As a performer of contemporary music, I am sometimes asked by the music to perform techniques with which I have limited experience. A composer's understanding of the flute's affordances may be unique enough to require re-mapping my own habits associated with a particular sound. I become aware of how a new technique intersects with my existing technique. This awareness enables new techniques to become *comfortable*. As comfort increases, so do feelings of control. There is a paradox here, because the more you learn idiomatic playing, the less *in control* performers sometimes feel.

For a fleeting moment, it may feel as though my body or the instrument or the music itself is in charge. Examining this paradox, the philosopher Eddy Nahmias argues that musicians and athletes do not make detailed, self-conscious decisions in the course of play. This kind of overthinking, in fact, would hinder performance. Instead, Nahmias suggests, the player has "a general intention or plan to play well" and then lets the details unfold (2005, 774). I monitor my

playing as if from a distance, watching in wonder my own fingers move. (De Souza, 80)

Perhaps this sort of “overthinking” is what was limiting Kurt Rosenwinkel’s creativity, since he specifically noted that retuning the guitar allowed him to distance himself from intellectually analyzing what he was playing. Getting to the point of comfort often requires a period of overcoming tension. Mid-body integration practices teach us to have a certain *softness* to our technique, allowing movement to occur within control. Comfort is equated with a sense of “ease,” allowing movement within practices that otherwise feel fixed and predetermined. Control becomes an intentional process, instead of something that’s strived towards blindly. This is what Nahimias suggests with monitoring playing from a distance.

For some, control is used to create a sense of comfort. Some players actively seek out a sense of comfort in their playing, making the instrument an extension of the body. Comfort is seen as the ultimate goal of developing instrumental technique. Trumpeter Jens Lindemann, on comfort: “It’s a lifelong pursuit trying to get to that point of comfort,” he says, “but when you do arrive there you realize that you’re just taking a piece of metal and you’re blowing through it. It’s that simple and that complicated at the same time.” (Lindemann, as cited in De Souza, 48). Instead of seeking a universal definition of what comfort means for instrumentalists, comfort can be seen as a dynamic process that involves balancing of habit, technique, and control. Mihaly Csikszentmihalyi would describe this as achieving *flow*.

### **Flow vs. Complacency**

When there is an optimal balance between skill and challenge, performers can enter a state of *flow*. Flow allows us to combine increased feelings of control with a decrease in

self-consciousness, allowing our technique to tackle challenges before we realize what we did (Csikszentmihalyi 1990, 52-66). Flow enables comfort, stability, and heightened states of awareness. Comfort can manifest in different ways. Physical comfort is required for flow. For example, in my practice I sometimes experience feelings of physical discomfort. Physical discomfort takes me out of flow. And yet, I have found that by first establishing flow, it is much easier to let go of the habits that I have identified as the source of physical discomfort. This is another example of how body-instrument interaction is a feedback loop. The way I set up an interaction affects the quality of it; the quality of that interaction affects my perception; my changed perception mediates the degree to which I sense flow.

There is also musical comfort, which is distinct from physical comfort. For others, musical comfort creates a sense of complacency. In Kurt Rosenwinkel's case, highly-developed instrumental technique hindered creative spontaneity. Stability and comfort limited creativity. Rosenwinkel altered his instrument to break free of his playing habits, thereby altering the mapping between his technique and his instrument, his perception of his technique, and his perception of his instrument. This created room for a new quality of flow.

When we are in a flow state, we do not notice the tools we use to do the work. Changing the feedback of an instrument via alteration can take a performer out of their flow state by focusing attention on the tool itself. On the other hand, habits sometimes *prevent* us from entering flow states. Therefore, instrumental alteration works both ways, moving in both directions from *ready-to-hand* and *present-at-hand* interactions.<sup>4</sup> Acting *through* the instrument in a flow state is an example of a ready-to-hand interaction. In this state, we are focused on the

---

4. See the section "Objects Create Interaction" in "Translated" for a further discussion of *ready-to-hand* versus *present-at-hand* interactions.

music. When we become distracted by an object's *thingness*, we act *on* the instrument, entering a state of present-at-hand. Examples of *presence-to-hand* include a sticky key, a broken string, or a tuning problem. Some musicians purposely enter this state by altering their instruments. The instrument might “surprise, resist, or provoke its player.” Instrumental alteration affects the players' perceptual experience (De Souza, 82-84).

Learning to play a new technique on an instrument involves a degree of discomfort or instability. As the technique becomes part of your embodied practice, it becomes more comfortable and stable. However, certain musical materials or techniques are inherently unstable (e.g., multiphonics, whistle-tones, or subtle microtunings). In this case, instability is a built-in affordance of the technique.<sup>5</sup> Composers sometimes intentionally seek out this instability, inviting the performer to explore what happens within these unstable environments. In this example, the performer's comfort is not directly tied to stability. Meaning, one can be comfortable within an unstable environment.

Instrumental alteration disrupts and alters players' habits, helping understand the nuances of their auditory-motor integration, and “complicating the connections between instrument, action, intention, and sound” (De Souza, 82). Instrumental alteration can allow an individual musician to break out of a tool's *external memory*, by obfuscating the connection between instrumental idioms, instrumental topography, and the embodied expectations of that instrument.

---

5. For more discussion on *affordances*, see “Instrumental Affordances” in “Translated.”

## Alteration as a Mediator

So far, we have discussed how instrumental alteration is used as a habit-breaking device for generating creative energy, the role that comfort and instability play in instrumental practice, and the ways alteration can take us out of (or put us into) flow states. The discussion has focused on the dialogue between a performer's actions and their internal perception of them. What happens when alteration exists as part of a dialogue between collaborators? How do two individuals with different expectation and memory of an instrument navigate differences in perception? What mechanisms can a performer and composer use to reach a shared understanding of an instrument's potential musical uses?

Recall the earlier discussion of acting *on* versus *through* objects. When a composer gives me a score to interpret, the path of dialogue between me and the composer is *through* the score. I use technique to communicate between my instrument and the score. Am I acting *on* the score, or am I communicating *through* the score? The answer to this question depends on the context in which the communication is situated. I often find myself in situations where my interactions are framed within a standard approach to performer-composer interactions: I receive the score as a fixed object, and I am expected to realize the composer's vision through my instrument. Interacting *through my instrument* affects the score, but I often feel like collaborations within institutionalized settings are not designed in a way to support this sort of two-way interactivity. In this section, I will explore alternative modes of communication, presenting a pathway to creating an alternative method for performer-composer interactions.

In *Listening to the Other*,<sup>27</sup> Stefan Östersjö describes a collaboration with composer Richard Karpen in which detuning the guitar became an important structural element

of the piece. Östersjö and Karpen established a shared creative practice by unpacking the differences in perception of the guitar's affordances. In this example, the alteration of musical instruments became a space of dialogue. In other words, the instrument allows for communication, and alteration (as well as the perception of it) is itself the communicative process. When instrumental alteration is built-into the collaborative process, alteration itself becomes the mediator of communication. Before we analyze this collaboration, I will introduce several mechanisms by which collaborators establish communicative pathways.

### **Intersubjectivity and Common Ground**

Composer-performer interactions are mediated by musical tools. These tools alter the collaborative dynamic by defining the topography in which collaborations are situated. Our perception of instruments is mediated by our individual experiences, habits, and embodied practices. Instruments translate meaning between people who sometimes have radically different embodied knowledge of those instruments. These differences in perception alter the meaning of musical ideas. Therefore, two parties cannot have an identical embodied understanding of the same musical object. I believe that successful collaborations that are *truly collaborative* require an acknowledgement of perceptual differences, as well as a high degree of trust. In order to establish communication, two individuals must first find common ground.

Alfred Schütz's work on the phenomenology of the social world can be used to address this problem, specifically his concept of *intersubjectivity*. It seeks to answer the following: how can two people share an understanding of the world without having immediate access to each other's mental states (Dourish, 110-11)? Schütz believed that the meaningfulness of social action emerges within the context of the actor's own experience of the world. The



source of Schütz's concept of intersubjectivity is Husserl's *lebenswelt*, or "life-world".

Lebenswelt incorporates our social understandings, and includes how our actions look to others and how others' look to us. Schütz was reacting against the views of Max Weber, who believed that "society and stability of social facts are a given, existing independently of their application or interpretation by social actors" (Dourish, 111).

Applied to my earlier example of being given a musical score within a socially rigid environment, I think that Weber would say that the performer-composer interaction has a built-in structure in which objects imply action, and this defines the communicative process. The composer creates, the performer performs. Schütz would focus more attention on the way I (as the performer) respond to the score, and frames interaction within a richer web that includes my prior experience, as well as the specific context in which this interaction is situated. Performers often say that we are *interpreters*. I would take this a step further by saying that performers the *creators of meaning*, because the act of interacting with the score is what creates meaning. In the next paper of this series, "Designed," I discuss Paul Dourish's design philosophy, as expressed in *Where the Action Is*. Dourish believes interface designers pass on the creation of meaning to the users of their design because the act of using an interface is what creates meaning. If musical collaborations are a communicative process that also involves interacting with designs, then meaning is created once a performer's actions are mapped onto a score. This does not mean a composer's work has no meaning prior to performance, but instead that composers should anticipate the additional layer of meaning performers will create through the process of interaction. Musical notation captures gestures, and lays them out temporally. A musical score is not an actual performance—it is a guide for a potential pathway through musical space.

Various notational practices have different degrees of specificity when mapping out actions on-page. For example, *La Chute D'Icare* by Brian Ferneyhough is extraordinarily specific when it comes to rhythm, dynamics, expression, and phrasing, whereas J. S. Bach's *Sarabande* from the *Partita in A Minor* leaves a lot of space for a performer to create their own ornamentation, and relies on stylistic knowledge that goes beyond what is coded within the notation. While these two examples are very different when it comes to their notational aesthetic, they are similar because neither can fully anticipate how a performer will navigate the instrumental space. While on a surface level Ferneyhough's music looks planned-out and rigid, I have found that the actual act of performing his music feels incredibly open. The music demands many hours of practice that focuses on learning each individual shape, but to actually perform it I have to choreograph broader musical gestures. Compare this to the *Sarabande*, where comparatively simple notation gains its richness when I add my own pacing and ornamentation, which is informed by my experience of the style. Both notational practices have encoded within them the potential future actions of a performer; neither of them try to fully anticipate the sonic result. This connects with what Dourish says about interfaces, in which "users are less predictable than planned-out systems. Users have different goals, and different ways of using the system" (83). From this approach, good notational practices communicate a composer's intentionality, while leaving space for performers to create their own goals for working within the system, and sometimes even alter the system itself. While in my own performance practice I find an enormous richness in the sort of communication I get from interpreting scores, I find that the social dynamics of traditional music environments often imply that meaning exists on a binary plane where giving a performer space is at the expense of the

composer's vision. In my opinion, this assumption says less about the true potential of composer-performer interactions, and more about the flaws and one-dimensionality of this specific collaborative environment. When a composer is actually present in the rehearsal space, the additional social dynamics that this creates are not always fully understood or acknowledged. I believe that performers and composers within educational environments need more opportunities to actually discuss the communicative process of collaboration. Otherwise, people will just default to whatever behavior feels most efficient, or simply least awkward. In my opinion, this temporary solution hugely limits the richness of musical collaborations.

## **Rationality**

Schütz's intersubjectivity assumes that the actions of others are *reasonable*, and that both parties share a common reality within which *rational* behavior is universal. Rationality is considered to be the starting point for developing understanding (Dourish, 112). What does it mean to have reasonable actions within performer-composer interactions? Who defines what is rational within a collaborative process, particularly when it is presented within an institutional setting? How do student-teacher power dynamics influence *who* gets to define what is reasonable and rational? One person's search for common ground, even with the best intentions, can easily deny space for others. As discussed in "Translated," the environment in which action is situated defines what is considered to be reasonable. Therefore, performers and composers need to keep in mind the specific environment in which the collaboration is situated, and how it frames their collaboration. Performers and composers should question the design of their interactions, *especially* when the purpose is to have an optimal educational experience. I believe that students

within academic environments should be part of the conversation about how their collaboration is designed, why it is designed that way, and how the design of this process shapes the resulting experience. This is easier said than done, because very rarely do student participants have any input in designing the collaborative experience. My hope is that increasing awareness of these processes can empower individuals to question the design of their interactions. This bottom-up approach to change needs to be paired with a top-down awareness of these issues, and therefore it is critical for educators who are in a position of power in institutions to also reconsider the models they use to teach. Assuming everyone shares an understanding of a collaboration's expected design at best leads to a sub-optimal educational experience, and at worst perpetuates bad practices that greatly limit the potential benefit of the collaboration, and leave participants wary of future emotional and intellectual commitments.

I have encountered situations in which composers and performers have vastly different understandings of what giving space to each other means; to an instrument, to a collaborator, to their score. In many educational and professional settings I encounter, the structure of the interaction is already predetermined. Therefore, definitions for what is reasonable and rational is out of the control of the participants, *especially* if one (or all) parties are a student within a rigid student-teacher power structure. Different approaches to composition means there is no universal understanding of where the balance lies in the power dynamic performer, the instrument, the score, and the composer. Assuming meaning is built into scores without a performer's actions is like imagining a MIDI representation of that instrument that can robotically filter out the physicality of interacting with the score. For example, writing for the piccolo, being surprised when the piccolo's natural affordances interact in an unexpected way

within a specific musical context. At a certain point, this begs the question of why that instrument (with a human player) was being written for in the first place.

On the other hand, if you recall the earlier discussion of affordances and resistance, the clash between an instrument's affordances and musical materials can create a space for the performer to express a high degree of creativity and imagination. Therefore, it is important for the composer to establish a direct line of communication with the performer to create this common ground. Settings in which there is a lack of flexibility severely limits the degree to which intersubjectivity can be attained. Pre-determined musical collaborations are not automatically bad, unhealthy, or unproductive collaborations. However, these settings require special care to allow collaborators to navigate with grace and nuance in a way that generates shared, collective meaning. One collaboration that I believe lives up to this standard is Stefan Östersjö and Richard Karpen's work on *Strandlines*, a work for guitar and electronics.

### **Instrumental Form Creates Communicative Function**

In his collaboration with Richard Karpen in *Strandlines*, Stefan Östersjö wanted to tackle the issues of intersubjectivity and common ground from the get-go. Östersjö goes through an extensive documentation process of their collaboration in order to analyze their collaborative process. I feel as though Östersjö did this not only to better understand this particular collaboration, but also to extract lessons about the experience that can be shared with others. Presenting the dynamics of his collaboration with openness and vulnerability, Stefan Östersjö's emphasis is not on specific logistics and technicalities of his collaboration with Richard Karpen, but on the quality of the communicative process that emerged as a result of their intentionality.

Östersjö seeks to break the traditional design of performer-composer interactions, one that accounts for the differences in perception between composer and performer. I see a parallel between Östersjö's approach to design, and Paul Dourish's principles of Embodied Interaction, as described in his book, "Where the Action Is." Dourish discusses the designer's role in creating an interaction with a user. Dourish believes that while a design may reflect a particular set of ontological commitments on the part of the designer, it cannot provide an ontology for a user (Pg.13). Therefore, a composer cannot provide an ontology for a performer. This is compatible with Karpen and Östersjö's approach to collaboration. They both understand they each have a unique ontological approach to the guitar. They accept the differences of their embodied knowledge of the instrument, and intentionally lean into these differences to establish a dialogue.

For Dourish, users and designers come to the material from a different perspective. Therefore, it would be impossible for them to have the same "ontological model." Different modes of interaction and sets of practices will result in different ways of understanding the domain (Dourish 130-131). Östersjö points out that in order to create a collaborative model which acknowledges these differences, they first needed to develop a great deal of trust, creating an "ecology of musical collaboration" (Östersjö 12). The methods that emerged from this collaboration involved listening "through" the guitar (57). Therefore, Östersjö and Karpen's collaboration was *designed* from the outset to enable a form of collaboration that was truly collaborative, taking into account the uniqueness of their two approaches, and accounting for their ontological differences as part of the creative process.

Östersjö and Karpen work with the instrument's affordances to establish their collaborative process. The instrument is the mediator of their connection, and enables the dialogue between composer and performer. Östersjö uses James J. Gibson's term *resonance* to describe the coupling between action and perception. Resonance, (also described as *tuning*) describes how objects are seen in terms of their affordances, and perceived as things that can be used (Gibson 1979, 134, as cited in De Souza, 13). To me, this shows that Östersjö wants Karpen to not only focus on the guitar's abstractions, but on the way that he as the performer is *tuned* to the guitar (interestingly, detuning becomes an important structural element of *Strandlines*, and so tuning here is used both in a musical and a perceptual sense.).

Just as the 'resonance' between an instrument and the musician's body mirrors the touching hands, the affordances of a musical material are also experienced by the composer as a resonant subject in the ongoing musical dialogue, emerging from the particular interaction between analytic thinking and perception, which is the basis for the flow of musical intuition. (Coessens and Östersjö 2014b, 3316 as cited in Östersjö, 2020, 69-70 )

The dialogue between composer and performer is a web of multi-modal interactions in which perception and analysis are inexorably linked to feedback and action. What excites me about this model for collaboration is how it allows for spontaneous and unexpected creative ideas when one person's web reacts to another's. Identifying the moments in which there is potential for creative flow and then engaging with those moments is how truly collaborative work is created.

In *Strandlines*, the *tuning* of action and perception is altered by the *tuning* of the guitar. While in Rosenwinkel's case, retuning was used primarily as a way to break free of

instrumental habits, in *Strandlines* discovering the affordances of each tuning is what informs the form of the piece, and mediates the communication between composer and performer. The process of discovering affordances is mediated by *effectivities*, which are the qualities of an object that allow us to perceive of its potential affordances (Neumann 1966, 78, as cited in Östersjö, 18). The compositional structure of *Strandlines* is informed by the physicality and limitations of the guitar, its idiomatic qualities, the mechanisms of alteration, and the perception of them by both performer and composer.

Developing *Strandlines* without a score further enabled this approach to collaboration. Östersjö describes *Strandlines* as a “work not so much for guitar as for guitarist, the merging of person and instrument” (11). The stated intent was to create a piece through verbal and musical dialogue, and not via strict notation.

Instead of a polite discussion about how we might go about getting the piece finished and premiered, we both dived into a verbal and musical interaction that eventually involved retuning my guitar. We found a scordatura on the instrument that we liked, but we also discussed a radical approach to musical composition, deciding to create a piece that would not use notation but would instead explore musical materials that were “hard or impossible to notate.” (Östersjö 2008, 32)

I find it interesting that this method of collaboration is described as *radical*. Perhaps it is uncommon within classically-trained Western contemporary music practice, but working through materials without strict notation and relying on verbal interaction is an extremely common within



the broader world of music. In this sense, the *place* that collaboration is situated within makes the *space* feel radical, even though in a different place it would be commonplace.<sup>6</sup>

### **Tension as a Generative Process**

As discussed earlier, the crucial step in this creative type of process involves navigating moments of tension. Östersjö and Karpen have established their ideal collaborative model, one that involves unpacking each other's perception of instrumental affordances. Moments of tension that would be uncomfortable in a different context are re-framed to be generative.

At one point early in their collaboration, Östersjö suggests exploring scordatura tunings for the guitar as a source of musical materials. However, Karpen is not interested. To him, it makes the guitar sound unlike a guitar, and he does not want to hide what he perceives as the guitar's important idiomatic qualities (60-61). But for Östersjö, the detuning process is part of his embodied practice. The mismatch between their perception of the guitar creates an opportunity for learning, where two musicians get to experience what happens when their viewpoints come together. The process of listening and unpacking their differences in perception affects their mode of listening. "...this musical listening is filtered through a particular listening through the scordatura of the guitar, and our dialogue is fueled by the novelty of the sonorities heard through the new tuning system" (71). Östersjö sees alteration as a tool for generating musical material, where "invention became a vehicle for creating novel sonorities, through instrumental techniques that were sometimes rather unconventional in themselves" (81).

---

6. *Space* refers to the physical configuration of objects, and the interaction between them. In this example, *Place* refers to the way that social understandings provide a behavioral framing for our environment (Dourish, 89). For further discussion, see the section "Transcription in Practice" in "Translated."

What stood out to me in this this description is how thoughtfully and intentionally Östersjö presents unfamiliar materials to Karpen. He goes through a process of retuning his guitar, and then demonstrating sounds to Karpen that he feels are musically relevant. This activates Karpen's *musical listening*. Östersjö notices how the change in Karpen's listening mode changes him—opening up to hearing things from a different perspective changes the quality of their interaction. As opposed to earlier in the collaboration where Karpen was not interested in exploring scordatura because of its “foreignness,” Karpen is now asking questions that engage with what Östersjö is presenting. Pierre Schaeffer calls this *musicianly* (as opposed to *musical*) listening. Karpen overcomes his doubts about scordatura, and even finds his own voice in this sound world (60-62). At a certain point, Karpen begins offering his own suggestions for things to try. Östersjö describes this specific moment:

...I am convinced that he is hearing something entirely different with his inner ear. The sounding guitar is certainly provoking this inner hearing, but Richard's radical proposal results less from what I am doing and more from Richard's internal listening. Similarly, when I hesitate and look at the instrument, *my* musical imagination has been activated by my inner hearing. But, in both cases, this imagination is immediately further sparked by the concrete listening that follows. (Östersjö, 62)

What really appeals to me here is how direct the connection between creativity and imagination is to critical listening. To me, Östersjö is creating an environment in which both he and Karpen can listen and engage with the materials in a rich and multi-modal way. Materials that at first felt foreign and unwanted by the composer have now become part of a shared language. Eventually,

Karpen is not only convinced that Östersjö's suggestions fit into his idea of the piece, but Karpen himself feels as though he's able to contribute to the development of the guitar tunings. As Östersjö states, this is what enables dialogue between a composer and performer: "It seems fair to conclude that the development of a compositional practice through immediate engagement with a performer's voice has also provided an impetus to contribute to a dialogue with musicians through performance" (83). Developing a shared practice of instrumental alteration allows composer and performer to both feel equal ownership over the musical materials.

### **True Collaboration is a Unique Experience**

Imagine if this collaboration was framed within a rigid context, and their exploration ended at the point when Karpen felt like Östersjö's idea of using alternative tunings did not fit into the piece. Would it be a good experience? Using De Souza's distinction of agency and ownership, would the performer feel as though they were part of that experience? This example demonstrates that collaborations do not need to adhere to strict roles; in fact, what makes *Strandlines* interesting is the way in which both parties pushed against traditional collaborative roles. This example demonstrates that translation of musical meaning sometimes has to take place outside of pure listening, and involve a discourse that translates the musical meaning and affect of sound between two individuals with very different internalized languages that they use to understand the instrument.

Stefan Östersjö ends his analysis of *Strandlines* by pointing out the uniqueness and un-replicability of each individual collaboration between performer and composer. *Strandlines* is not just a work for guitar, but a work that has the voice of the specific performer built-in to the composition. *Strandlines* relies on the "specific relations between a specific

performer and instrument. And because a performer's voice typically will transform over time, the identity of compositions like *Strandlines* will also shift. Its materials may expand or become more precisely defined" (82). The continual evolution of the work is built into its structure.

*Strandlines* situates interactions in the compositional process within embodied and social processes. This creates music that "merges the voices of composer and performer into a single, discursive voice" Gorton and Östersjö 2019, as cited in Östersjö 2020, 84).

I acknowledge that the potential richness of the collaborative discourse in *Strandlines* may be difficult to attain within rigid, institutionalized settings. Furthermore, I understand that the approach outlined here might not appeal to all performers and composers. And yet, I believe critically analyzing the design of the collaborative process can be adapted to nearly any scenario. Increasing awareness of the processes that mediate communication creates more creative space for all parties involved, and increases intentionality within collaborations. This makes collaboration a richer, more satisfying process that is healthier, and simply more fun.

## Electroacoustic Mediation

In the previous section, my analysis focused on how the acoustical elements of *Strandlines* mediated Östersjö and Karpen's communication. I discussed how creating a shared listening practice of the guitar's affordances developed intersubjectivity. Because *Strandlines* is a work for guitar *and* electronics, I will now focus on how the computer music component is an added mediator of communication. I am interested in exploring the following: What happens when electronics are part of the alteration process? How does live processing affect a performer's perception of their instrument? How does the temporal separation of performance and alteration affect the way a performer perceives their own playing? How does electronic manipulation alter a performer's way of listening?

*Strandlines* was not envisioned as an electroacoustic piece at the beginning of the collaboration. Instead, the electronics in *Strandlines* were added to the work to solve a structural issue that arose during the collaboration. Because of the fact that *Strandlines* is a single-movement work that involves multiple tunings, Östersjö needed to retune the guitar in the middle of the performance. Karpen wanted Östersjö's act of tuning to be "theatrical and intentional," so that they are not taken to be mere tuning (71). One of re-tunings was particularly challenging that required the performer to disengage from the act of performing, and so Karpen and Östersjö came up with the idea of creating an electronics part that would hide the act of retuning. The electronics became a structural element of the composition. Karpen proposed having the computer record the performance up to that point, and then use those materials to create a cadenza for the electronics. In the meantime, Östersjö could retune his instrument without

distraction (§4.3). Adding the electronics creates an another layer of listening. Karpen frames Östersjö's tuning as acting *on the instrument*, but wants it to be done in a way that hides it.

What I find most interesting about the electronics component of *Strandlines* is not necessarily the way it sounds, but the way it made Östersjö feel about his own playing. Unpacking Östersjö's words on how electronics affect the collaborative process has clarified some of my own thoughts about electroacoustic collaborations. The way that he describes hearing his processed sounds reminds me a lot of my own feelings in one of my ongoing collaborations with composer Theocharis Papatrechas.

### **Developing Electroacoustic Intersubjectivity**

I am drawn to working with electronics because it allows me to disengage with having full control over my sound in real-time. Without electronics, producing a tone on the flute requires a continuous airstream. As soon as I let go of my airstream, the tone ends. I do not have strings that will continue resonating after I release the bow, nor do I have a sustain pedal that allows my sound to ring after I strike a key. Therefore, acoustic flute playing emphasizes the real-time nature of performance. Electronics temporally distance me from the act of playing, creating more space for me to listen to my own act of listening. Experimenting with flute and electronics feels similar to what I feel when I play chamber music, in the sense that the responsibility of creating sound is no longer fully on me. I agree with Stefan Östersjö's assessment that the addition of electronics into collaborations potentially speeds up the development of common ground, because it creates more listening space for a performer and composer to coinhabit.

One collaborator with whom I feel a strong degree of intersubjectivity is composer Theocharis Papatrechas. Our first collaboration was a 3D audio installation work called *Pythmenas* (from Greek: “bottom of the ocean) that featured improvisations of the performers (Dimitris Paganos Koukakis, Ilana Waniuk, Rebecca Lloyd-Jones, and myself), which were then processed and spatialized by Theocharis. The final product was then presented at the Spatialization Lab of the Qualcomm Instituted at UC San Diego. *Pythmenas* was created in collaboration with Joshua Jones, a Staff Research Associate at Scripps Institute of Oceanography (SIO), who provided us with acoustical data collections of marine mammals, as well as sea ice formations. The goal of the project was to explore these sounds as a source for creative inspiration. Each player in this project chose a set of sounds from the collections, and used them to develop a sonic palette of extended techniques that were in dialogue with the source material. Theocharis then recorded the improvisation session, and used these materials to create a 3-dimensional soundscape. From the program notes:

Three distinct worlds interact to create a musical experience. The ocean sets the primary component of the triadic entity, inspiring the entirety of the artistic work. The sonic profiles from recordings of several of its living organisms (i.e. whales, dolphins, seals) are being interpreted by members (instrumentalists) of the overwater universe, who carry out a discussion following a line of instructions for improvisatory action. Technology, the last constituent, intervenes, capturing and processing the activity of the performers as well as manipulating the original recorded media.

The final outcome is the audio registration and fusion of the totality of layers projected and spatialized through an infrastructure of 28 spherically configured loudspeakers laid out in 4 levels; ground level - center (ring of 4), ear level - perimeter (ring of 12), 2 meters above ear level - perimeter (ring of 8), ceiling - center (ring of 4).

The work is influenced by the recording process of underwater sounds, in which the participation of the three worlds (i.e. ocean species, humans, technology) is necessitated.”

The goal of this project was not necessarily to imitate the sounds of undersea mammals and sea ice formations, but to use them to spark a creative exploration of the instrument. In the previous paper of this series, “Translated,” I discuss how an instrument’s *effectivities* are the vector by which a performer discovers instrumental affordances. *Efectivities* focus on the exploration and learning processes of performer-instrument interaction. From that perspective, the sample library we used for inspiration guided the exploration of our instruments. The recordings we listened to shaped the way we listened to our own instruments, which relates to the concepts of *grip* and *reach* I discuss in “Translated.” A major difference between *Strandlines* and *Pythmenas* is that Östersjö and Karpen did not start with pre-recorded sound materials. However, I believe even while the process by which these projects generated source material was different, the effect was similar. In both projects, going through a shared exploratory process created a collective listening practice. Even before our first improvisation session, we had already established common ground.



The bottlenose dolphin and bowhead whale recordings inspired me to translate the way I perceived the physicality of those sounds into how I perceive the physicality of my flute technique. By translating source to target and externalizing my perception of sonic materials, my collaborators can hear the original sound, as well as my interpretation of it. This is a sonic solution to the visual perception paradox “is your green the same as my green?” Recall the earlier discussion of Alfred Schütz and intersubjectivity. Schütz’s core question was: How can two people share an understanding of the world without having immediate access to each other’s mental states? Externalizing my internal perception of the source material provides a potential solution.

When Theocharis then takes recordings of the improvisations and processes them, I experience what his interpretation of my playing is, and how he relates it to the source material. This feedback loop of performance, alteration, and listening is similar to Östersjö and Karpen’s back and forth discussions about the guitar’s affordances. This is the process by which Theocharis and I develop intersubjectivity. Similar to how Östersjö’s playing in *Strandlines* was then processed to create the electronics part, Theocharis took the recorded improvisations in *Pythmenas* and transformed them, presenting them in an altered medium. Listening to my transformed playing in the Spatialization Lab gave me the experience of simultaneously recognizing my own playing, but also being detached from it. Listening to a recording made weeks earlier already temporally distanced me from the act of playing. Electronic alteration and spatialization further distanced me by physically rearranging the instrumental space. This actually made me feel more connected to to my own playing, because this radical

decontextualization allowed me to listen to myself in a way that I normally cannot. Östersjö shares a similar perspective:

...the more elaborate electronics made me feel the process was even more interactive: by further developing the computer part....the sense of interactions among equals was strengthened. The essential outcome, though, was that the design of the interactive electronics now had become an integral component in the performative identity of the composition. (80)

What is interesting to me is how Karpen and Östersjö did not start with this sort of collaborative model. Early in their collaboration, Karpen had a more standard approach to the electronics. “In the first phase Richard assumed a more traditional, composerly role; but the structural ideas that he advanced were further developed through interaction with the agencies of performer, instrument, computer programmer, and electronics” (77). Recall how in the previous section I discussed how Östersjö and Karpen developed trust in their collaboration over time. I believe that as their trust developed, so did their idea of how to approach the electronics. As they got comfortable listening to the guitar together, the electronics also became a pathway through which Karpen and Östersjö could listen to the guitar together. Eventually, this changed the process by which they developed their electronics.

Both have become instruments for listening, for perceiving the world through sound. Or rather, when the processing had been fine-tuned, we were listening through an extended instrument, which afforded particular sonic characteristic for different registers, thereby enabling Richard’s initial compositional idea. (79)

While in *Strandlines* the collaboration began with a collaboration that fit into the standard model of performer-composer interactions, from the start *Pythmenas* had already discarded any obligations to adhere to traditional compositional ideas.

Another parallel between *Strandlines* and *Pythmenas* is that both projects were developed without a score. As Östersjö says, the goal of *Strandlines* was to collaborate by interacting with the music directly, rather than through the abstraction of a written score. Similar to this, Theocharis and I have agreed that if we do eventually use notation in our collaborations, the notational practice should emerge from an already established collaborative process. While notation is often extremely useful in kickstarting the collaborative process, it can also be used as a substitute for developing intersubjectivity. A lack of notation does not mean that the work is just an aimless improvisation, but it does mean that meetings between a composer and performer are not classified strictly as rehearsals, and are more like a guided exploration of the instrument.

Östersjö noticed how when his explorations on the instrument were less intentional, the composer's role became that of approving or rejecting specific improvised material. The composer would create a "filter," framing materials and deciding whether or not they fit the structure (pg.68). I find it refreshing that in my work with Theocharis the focus is on first unpacking my perception of my own improvised materials, and then building from there. That way, the composer's input is already tied to a statement made by the performer. This contrasts with traditional performer-composer interactions in which a performer plays something and then asks the composer "is that what you want?" I am not arguing one model is better than the other, but feel as though highlighting this distinction creates the possibility for more dynamic collaborations. Östersjö points out an additional effect of this:

I would argue that an essential quality in this process—as well as in all music creating using the same methods—is how the materials selected for the composition are instantaneously embodied by the performer. This in turn seems to generate a quality in performance that is similar to the particular experience of performing music that has been rehearsed to the extent that it becomes second nature to produce it. (69)

This is a good reminder that there is no reason to wait for permission to make a piece of music my own, and that it is possible to have my creativity and curiosity built-into the collaborative process from the start.

### **Next Steps**

My next project further develops the collaborative process of *Pythmenas*, and applies the lessons learned from my analysis of *Strandlines*, as well as the concepts discussed in the first two papers of this series, “Translated, and “Altered.”

*Morphēs* for flute and electronics is an ongoing collaboration with Theocharis that explores the themes of transformation and translation, demonstrated sonically, visually, and spatially. Each member of this duo assumes the role of artistic co-creator, blurring the distinction between composer and performer. In *Morphēs*, the four flutes (Piccolo, C Flute, Alto Flute, and Bass Flute) represent four characters, which go through processes of transformation and translation. We explore how the differences in our embodied experience with the flute shapes the way we describe action-to-sound coupling, and how through improvisation we can develop intersubjectivity. Throughout the work, these characters go through processes of transformation

and translation. Through this, the work seeks to highlight the distinct characteristics of each instrument, while simultaneously blurring the boundary between an object and its affordances.

All sounds in this work will originate from the performer's interaction with the four flutes. There will be several sound sources in this work: live, live-processed, and pre-recorded. The piece will shift between textures that highlight this distinction and those that intentionally obfuscate it. In doing so, the focus of the piece is on the transformation between different modalities, and how this transformation alters musical meaning. The perception of an instrument's affordances are altered by microphone placement. Amplification and signal-processing affect a performer's connection to their instrument. In the development stage of the project, we will be experimenting with unique microphone placements that capture how the body of the instrument reacts to different playing techniques. We are interested in amplifying subtle and intimate sounds that are not perceptible without extremely close micing techniques. Zooming into small sounds, and then framing them within a spatialized environment, makes subtle changes in playing result in larger perceptible effects.

There are two distinct phases to the work: the "stable" phase, and the "shifting" phase. In the "stable" phase, the playing distinctly represents one character, occupying the area of one cardinal point in space. The "shifting" phase highlights the transformation between characters and the activity meanders spatially, blurring the boundaries of the protagonists. The dramaturgy of the work becomes apparent through the overlap, fusing, and merging of all elements and the acoustic space being fully encompassed in sound.

Focus on characters as opposed to strict notation converges our conceptual practices. Each member feels equal co-ownership over the musical materials. Our collaboration

seeks to answer the following questions: Does an object's affordances shape character development, or do we shape the object to express our ideas? How do composers and performers navigate a space in which they have different embodied knowledge of instruments? What are strategies for developing intersubjectivity in artistic collaboration?

Overall, the catalyst for our research stems from the desire to co-create musical characters with composer and performer as equal collaborators. We seek to understand how instrumental characters are developed, and how they are informed by the particularities of an instrument's affordances, amplified by microphone placement. We are interested in the effects of using audio spatialization and processing to morph instruments. We seek to recreate acoustical environments that are unfamiliar to us and the listener (i.e. the inner world of an instrument) - this unknown territory fuels the creative process.

While recorded versions of the performance will be released, there will not be a "definitive" version of it. Different versions will have different degrees of modularity and freedom: versions where the composer makes decisions, where the player makes decisions live, and versions where the listener makes the choices.

In the live performance version of the work, each character will have a "station" in the performance hall. Moving between stations is a visual representation of the transformation between characters. The movement will occur visually (the flutist will move between stations), and will be augmented with spatialization. The closer to the station, the more strongly that character will be expressed in the musical materials (live and pre-recorded). The performer is thereby "playing" with their movement.

At each station, there will be a choice of which direct to “shift.” In the live version, we envision the player controlling this via a foot switch. In another scenario, the electronics part could select where the shift occurs, and the player will have to respond to this shift as it becomes apparent. In this scenario, there’s a degree of interactivity between the player and the electronics part (which could be automated, or controlled by a human).

The online version of this project allows for more viewer/user interactivity, in which the viewer/user could select which character to “shift” to. This could be represented by recording each character and its transitions as a module, and each “stable” could be a distinct scene. This could be hosted within a standalone Unity app that would bring in a visual component, or in a simple 2D interface that gives the user basic on-screen cues to control the transitions.

The project will be developed in Spring and Summer 2022, with a scheduled premiere in late 2022/early 2023.

## Conclusions

I began this paper with an exploration of how breaking habits creates space for dialogue between a performer, their instrument, their technique, and their perception of their own actions. I explored how instrumental alteration affects a performer's sense of comfort and stability, and the ways context frames the way we perceive our instrumental technique. I then applied these concepts to the interpersonal domain, applying Alfred Schütz's concept of intersubjectivity to the way that performers and composers develop common ground. My analysis of Stefan Östersjö and Richard Karpen's *Strandlines* demonstrated one potential collaborative model. Connecting this to my work with Theocharis Papatrechas in *Pythmenas* clarified principles I aspire to in my own collaborations. I explored the role that electronics play in further mediating communication, and how *Morphēs* is my next step in developing my electroacoustic practice.

In this paper, I push against the classical model of collaboration in which there is an all-or-nothing approach to agency, and the flawed perception that increasing one person's creative agency is at the expense of another. I push against the idea of agency as a finite resource within a collaboration. Situating agency within a dialogue that involves the performer, their instrument, the composer, as well the social context surrounding the collaboration empowers individuals to question the design of their collaborations, increasing the intentionality of their work. Increasing agency is not necessarily the goal, but is part of the process in generating creativity and activating imagination within collaborations.

In the introduction to this paper, I cited Derek Bailey's idea that performers often refer to their instruments in polarized ways, either as best friends and collaborators, or as liabilities and intruders. My paper demonstrates that the behavioral expectations present in many of the



contexts in which we perform music can lead us to feel a similar way about our collaborators: composers and performers are either best friends, or liabilities. Bailey's solution is that the instrument is not a tool but an ally; Jonathan De Souza develops this further by saying that instruments are creative partners for performers.

I suggest that healthy collaborations are a matter of creating space for freedom within structures. Learning collaborative methods which open me up to things outside of me creates space for creativity. Externalizing my internal perception of external processes allows me to share my imagination with my collaborators. This feedback loop creates more joy in collaborations, and in a way actually decreases feelings of agency in the traditional sense. The less collaborations are polarized *me vs them*, the more they are truly collaborative. I hope that the discourse presented here gives others a potential model for making the design of collaborations more intentional, more creative, and less dictated by predetermined models that do not serve the development of the project.

DMA Qualifying Exam Question 3  
For **Alexander Ishov**  
Submitted by  
Professor Miller Puckette

Among all your studies of musical instruments, their design and their affordances, you included a deep dive into the possibilities of electronics and computing. What are the implications of electronic hardware, software, and interface design on musical performance? What ideas can be gleaned from these?

Designed

## Introduction

The design of interfaces shapes the way we interact with data. The design choices made by designers shapes the way we interact with interfaces. In this paper, I focus not on design as the object of attention, but the way that design mediates human interactivity. I am interested in the way that human-interface interactions enable communication.

As a performer and music educator, I believe that exploring the mechanisms by which design mediates communication and aids the development of my performance and pedagogical craft. Awareness of design helps me become a better performer, by unlocking new pathways for exploring the communicative function of scores; a better collaborator, by better understanding the design of collaborations; and a better educator, by opening my eyes up to more possibilities for engaging with my students. I explore how the use of electronics and interactive technologies affect our perception of ourselves, our work, and our collaborators.

In “Translated,” I discussed how the affordances of objects influence the way we interact with the world. I explored how habit enables technique, how the objects we use to connect with music influence our perception. I demonstrated how the perception of music is mediated by the tools we choose to perceive it with, and applied this to understanding the process of instrumental transcription.

In “Altered,” I looked at how instrumental alteration can serve as a mediator of communication, between performer and instrument, and also between performer and composer. I sought to answer the following: What happens when the act of alteration becomes the communicative process? How do collaborators navigate space in which they have a different

understanding of an instrument's affordances? What practices enable good communication within collaborative spaces?

In "Designed," I am interested in exploring the communicative function of design, specifically when design is used to enable communication between individuals. What happens when artists create interfaces that serve as communicators of meaning? What is the designer's role in enabling communication, and what are best practices for doing so? I am interested in exploring the communicative function of design.

In 2020, I wanted to deepen my understanding of microtonality, and sought out resources for microtonal ear training. I became curious about microtonal ear training. After learning some of the theory involved, I began searching for interactive tools to help my learning process. As a flutist, I wanted to find something that could integrate well into my practice. I did a broad survey of iPhone/iPad apps that allow for microtonal tunings. I could not find the tool I was looking for, so I began learning Pd in hopes of creating my own. While I made a great deal of progress in learning the principles of electronic music, I experienced a great deal of frustration because my know-how of electronic music programming was too far from my vision of what I wanted to create. After spending a while experimenting with creating my own patches, I decided to step away from the hardware in order to better understand general design principles. This paper chronicles my journey towards better understanding the communicative role of design.

In *Where the Action Is: The Foundations of Embodied Interaction*, Paul Dourish outlines an approach to design that is influenced by embodied interaction. Embodied Interaction is a set of principles that a designer can utilize in their design process. These principles emphasize the fact that it is the user who creates meaning in design through the act of interacting with it, and

question whether or not designs have built-in meaning. Dourish describes how designers often make decisions for users that negatively impact the degree of freedom a user has when navigating interfaces. I cited Dourish's work in the previous papers of this series. In this paper, I use Dourish to establish a foundational language I use to analyze design, and apply it to exploring the role of design within the music studio.

Ge Wang's *Artful Design: Technology in Search of the Sublime* connects Dourish's foundational text to the modern world. While Dourish's text was written in 2001, Wang's book is from 2018. I connect Dourish's philosophical principles to Wang's practical design suggestions. I explore the role of gamification in music design, and use Wang to present an approach to design that highlights the humanity in human-computer interactions.

I apply Dourish and Wang to analyzing two creators of interactive digital music interfaces: Khyam Allami and Jace Clayton. Allami and Clayton both use interfaces to connect musical communities. Their work seeks to create tools for musicians traditionally underrepresented in electronic music.

I have been exploring the use of software and hardware solutions for improving the experience of remote music collaborations. Instead of seeking to replace the in-person experience, I have been interested in exploring the unique affordances of remote musical environments. In a space that limits the amount of data my students and collaborators see, every design decision has a much greater impact on the overall experience. My experience has shown me that the way that information is presented is of equal, if not greater importance than the content being delivered. As we return to in-person teaching and performance, I seek to extract lessons that can be applied from my experience working in the virtual music studio.

## Design Foundations

In the second paper from my series, “Altered,” I introduced the concept of *intersubjectivity*, using it to analyze performer-composer collaborations. Alfred Schütz’s intersubjectivity addresses the question of how two people can share an understanding of the world without having access to each other’s mental states (Dourish, 110-11). In “Altered,” I discuss how musical collaborations develop *common ground* in order to create a shared understanding of instrumental affordances.

In “Translated” and “Altered,” I applied Paul Dourish’s approach to design to analyze body-instrument interaction, and explored how the design of musical instruments affects perception. In this paper, I will use Dourish to establish a foundation for analyzing interactive musical interfaces. I am interested in exploring the following: What are the processes by which a designer enables communication? What are best practices for approaching design when they are meant to serve a communicative role for their users?

Dourish believes that in order to establish intersubjective understandings in interactive technology, there needs to be a communication between a designer and user. The designer communicates a set of constraints and expectations about using the design. These intentions are communicated through the form of the interactive system itself, and its *usability*. Usability is the process by which a system reveals its purpose to a user. The user then develops an understanding of the meaning of objects and the consequences of actions within the system (132-133). To me, Dourish’s approach can be applied to developing an interpretation of the score. The intention of a composer is communicated via the form of the score. As discussed in my first paper, “Translated,” composers learn over time how to map notation onto instrumental

idioms. While there is potential for meaning within design, it is only unlocked after a user interacts with it.

Throughout the book, Dourish emphasizes the fact that users create meaning by communicating *between* each other, *through* the system. Communities of users develop and communicate shared ways of using interfaces by *appropriating* systems to fit their needs. In this context, appropriation is the process by which technology becomes situated within a specific context, taking into consideration a community's needs. By focusing on what decisions people make and what expectations they have when using an interactive system, the focus is not just on what a system *can* do, but what it *really does do* for the people who actually use it (133). This principle will guide my analysis throughout this paper.

By what process does a community appropriate a system to fit their needs?

### **Design in the Music Studio**

Consider the fact that in the music conservatory environment, much of teaching time is spent on sharing tips and tricks for getting through difficult passages in repertoire. For example, an orchestral studio class helps students share special fingerings to get through a difficult passage. Such an intense focus on the craft of music-making can make these environments feel as though learning how to “get through the piece” has become the primary focus of the learning environment. This hypothetical orchestral studio class is focused on the goal of winning an orchestral job. Therefore, overcoming the technical challenges created by the design (the score) becomes tied with feelings of self-worth. As discussed in “Translated,” Dourish's terms of *space* and *place* help emphasize how the setting in which a design is used



greatly affects the perception of its meaning. Therefore, when analyzing design, it is important to keep in mind the various contexts in which it might be used.

Educators are also designing, both in real-time and prior to their teaching. I believe that it is crucial for the music professional to consider the communicative functions of design, both within their performance practice, and in their approach to pedagogy. The pandemic has made it clear that the way that information is presented to a student is equally important to the content of the materials presented. Virtual telecommunications limited the modes of interaction between a student and educator. In this space, music pedagogy loses many dimensions that it relies on. Therefore, each design decision that goes into presenting materials carries much more weight.

For example, teaching over Zoom meant that I no longer could hear my student playing within a live acoustical space, and I also lost the ability to see my students from multiple angles. This greatly limited the degree to which I could analyze their body language while playing, as well as my ability to judge how my students react, both to my comments, and to their own playing. In this constrained information space, language became an even more important communicator of information. The degree of clarity which my words express action now had a greater impact on the student's experience. The words my students used to describe their perception of their playing became an even more important vector of communication between us.

The pandemic underscored the importance of considering design as a crucial component of the music studio. What elements of pedagogy are geared towards *efficiency* and *performance*? What is the role of *user experience* within pedagogy? What are the similarities

between how a pedagogue teaches a student to analyze a score, with how a designer guides a user through their interface?

Consider the earlier example of the orchestral excerpt class. A group of flutists stand in a circle, taking turns playing an orchestral excerpt, with no commentary between each rendition. After finishing the round, there is a discussion about the technical and musical elements of the excerpt. Tips are shared for successfully overcoming the challenges of the music. Is this the most effective system for accomplishing this task? Is there musical merit to this method, or is it simply a way to increase *efficiency* and *performance* within the context of orchestral auditions? What does a *successful* performance mean here? In this example, musical success is tied to objective performance metrics.

If I am not mindful of the intent behind my teaching, perhaps at the end of a long day, I start feeling like a technician working on making a machine run better. Social conditioning in the music conservatory means that it is important not to revert to my “backup” mode of teaching. While I acknowledge that developing discipline with technique is part of the process of learning an instrument, it is crucial to do it in a way that becomes personally meaningful for the student. I believe that unpacking the communicative function of pedagogy in design is a step in that direction.

As I consider my teaching practice, here are some questions that I now consider: What elements of user-experience design go into shaping the way I teach? Which of the models I use are traditional and based on my own experience, and which are responding *against* my experience? Were my own teachers focused on user experience?

One of Dourish's main points is that designers create *artifacts* within their designs that lead users through the process of working with the interface.

...designers can create artifacts that lead users through the process of using them, with each stage leading naturally to the next through the ways in which the physical configuration at each moment suggests the appropriate action to take.

The relationship between physical form and possible action can give designers some purchase on the problems of unbounded parallel action. (52)

As discussed in "Translated," learning an instrument is a matter of familiarizing yourself with its topography. Teachers leading a student through a difficult piece are in a way taking on the role of the designer. The main difference is that with notated music, you already have a completed design to work with. Another way to approach it is thinking about a piece of music as an obstacle course. The interface is the way we train our students to connect visual processing to physical actions. While the basic appearance of the score remains the same, adding layers of meaning (e.g., by marking the score) helps organize materials in a way that makes sense to the student.

### **Flexibility in Design**

Another important principle in Dourish's approach to design that I have alluded to in my previous papers is that designs must support flexibility. Dourish points out that when designers create interfaces, they sometimes rely on formalized work processes to get an idea of what actually goes on in the practice they are designing for. This approach leads to software systems that don't account for the flexibility with which they will be put into practice (64). This forces the user to either change their practice to fit the model the program has prescribed, or stop using the interface entirely because it does not seem to be useful. Another solution is to attempt to *hack*

the interface to get it to do something that it was not designed for. I will explore this later in the paper in my analysis of Khyam Allami and Jace Clayton's approach to interface design.

Inflexibility in designs, combined with a lack of firsthand knowledge of a practice reinforces the belief, shared by many classical musicians, that interactive interfaces do not play a role in their musical practice, because the interfaces do not fit their needs. In my own performance practice, I have searched for apps to help me work on microtonal tuning. However, I have found this to be frustrating, because the apps that I found often assume that I want to use them in a way that does not actually fit my practice.

An example of this is *Droneo*, a drone generator that allows a user to build a drone with up to 8 voices over a given fundamental. There is one fundamental, with 8 reeds that can be individually tuned. The fundamental's waveform can be static (sine, triangle, saw, etc), shift between multiple waveforms, or combine them. Each reed can be tuned using Hz, cents, or a tuning ratio. In theory, this app allows me to create any kind of drone to then practice with. However, in practice, there are elements of the interface that are frustrating. For example, when selecting a pitch for one of the reeds, it brings up the full iPad keyboard, even though I am simply typing in a frequency (440), a tuning ratio (5/4), or a note name (A4). While it is possible that the designer of the app was working with technical limits that prevented them from adding a custom interface here, or maybe they did not see a need for it. For me, this small detail diminishes the enjoyment I get from working with this interface, and limits the amount of time I want to actually be using it. Later in the paper, I will explore the concept of *satisfying design* in my analysis of Ge Wang's "Artful Design." In my opinion, Wang's approach to gamification,

coupled with Dourish's philosophy of flexibility in design, would greatly benefit the design language of an app like *Droneo*.

What happens when I want to use an app differently from how it's designed? Do I invent a new app? Do I search for a different one? Do I adapt my own practice to the limitations (or prescribed workflow) of this app? Software should be informed by the practice. Allowing software to shape the practice diminishes the benefit of bringing software into an otherwise analog practice. As Dourish points out, "Users are less predictable than planned-out systems. Users have different goals, and different ways of using the system" (Pg.83). Systems of interaction that prescribe a way for users to interact with the system cannot do so without also seriously impacting the flow and embodiment of the materials. When designing an embodied system, designers must give up the need to control the way that users interact.

### **Mismatched Ontologies**

*Ontology* deals with the existence of objects and entities. How can we individuate the world, or distinguish between one and another object? Ontology provides structure from which meaning can be constructed. From the very onset, software design involves making decisions about entities, their relationships, and how they *line up* (129). When software designers discuss ontology, they are mostly focusing on how the system will treat objects, and how those objects will be mapped onto features. Ontology in software design can also refer to a conceptual model, either the user's or the system's (130).

What happens when a design does not fit the user's ontology? What design practices enable a user to create their own ontological model? In the previous paper of this series, "Altered," I pointed out how the pursuit of *common ground* in a collaboration has the potential of

actually denying someone their ground. In “Translated,” I discuss how previous experience with an instrument shapes the way we perceive of its affordances, and potential uses. Consider how when a composer chooses an instrument to write for, they are making decisions about how their ideas map onto an interface. Depending on whether or not they have a personal connection to the instrument, this will change their approach. I am not saying that composers should only write for instruments that they play, because it is clearly possible to have a connection with an instrument without playing it. However, as discussed in “Altered,” composers should be in dialogue with performers of that instrument, if their goal is to write something that can become a personal experience for the performer. In “Translated,” I explored the intersection between the ontological model that the composer uses to create the score, and how the performer uses their instrumental technique to interpret it. I explored how transcription alters that relationship.

Dourish points out that in philosophy, ontology is a participatory process, and is something that is not fully formed. However, designers often think of ontology of something that is designed. While a design may reflect a particular set of ontological commitments on the part of the designers, it cannot provide an ontology for a user (13). User and designers approach the interface from a different perspective. Therefore, it is impossible for them to have the same ontological model. Different modes of interactions result in different ways of understanding the domain (130-31). In interactive design, there are several specific issues that arise from static ontologies. First, there is a mismatch between the assumptions of the system and the expectations of users. Next, it creates rigid procedures for accomplishing tasks, disregarding the fact that different people work in different ways. And finally, it creates brittleness in adapting new systems as practices develop and change.

I am always approaching challenges from the perspective of my students, trying to remember back to the time when that particular aspect of music was challenging. However, this approach has its limitations. There are certain things that came more easily to me than my students. Therefore, a good teacher learns how to simulate a beginner's mind when solving a particular need that the student has. Good pedagogy is a matter of constantly learning new ontological models that allow teachers to become not just more effective and empathetic, but also adaptable and perceptive. In my experience, students appreciate when their teacher seems to understand when something is difficult, and demonstrate an attempt to approach the issue from the student's perspective. Students do not like it when a teacher makes it seem like their issue is an *easy fix*, or even worse, when their teacher denies that it is even happening.

### **Abstractions in Music**

The final concept from Dourish that I would like to apply to the music studio is the idea of *abstraction* and *implementation*. Abstractions allow us to make complex behaviors into a simple, higher-level object. An abstraction uses a single object to capture a range of potential uses and needs. Abstractions isolate one component from another so they can be managed and maintained separately (82). Abstractions hide implementation. Meaning, by isolating one piece from the rest, they represent a modular approach to design.

Abstractions manifest in music education and performance in many ways. For example, expression, articulations, and tempo markings are forms of abstractions. The relationship between two markings in music is also a form of abstraction. An *accelerando* is an abstraction. In "Translated," I discuss how instrumental transcription re-maps action and habit. Abstractions manifest differently on different instruments. On one instrument, an *accelerando* leads fingers to

move faster, while on the other articulation speed will increase. When reading notated music, an *accelerando* increases the speed that you scan music. Therefore, the *accelerando* abstraction has a series of behaviors coded into it. The idea of being able to isolate one component from another is also very familiar to anyone who has worked on a difficult piece of music. Pitches can be isolated from rhythms, or vice-versa. Dynamics can be isolated from articulation. This is all done to make learning a complex piece easier.

The singular event of performing a work of music is broken down into a series of modules, which are themselves comprised of abstractions. Instrumentalists often practice articulation separately from intonation, technique separately from dynamics, etc. At a certain point in practicing, it becomes important to learn how to do everything all at once. Many teachers summarize this as “play musically.” Playing musically is therefore a matter combining these modular abstractions into a single, flowing entity. Students learn their own abstractions for processing music. Imagine a music lesson where a student is having difficulty with a technical passage. A teacher will help the student invent a new abstraction to interact with this difficulty in a new way. It could be by directly interacting with the sheet music (marking up music so that rhythms can be read more clearly), playing a game where you play the written notes, but invent the rhythms, or by filling in gaps between articulations by subdividing each note. Breaking down difficult music into a series of manageable abstractions is the process by which students can match difficulty with skill-level, increasing a sense of flow while performing.<sup>7</sup>

Dourish discusses how abstraction hides implementation. By isolating one piece from the rest, the broad structure is no longer clear. Therefore, it is important to balance focus on the

---

7. For further discussion, see “Translated, section “Habits Enable Performance.”



micro-level shapes in music with macro-level structures and gestures. *Chunking* is a classic example of this, which is the practice of breaking down a piece of music into tiny chunks, and then combining each of those chunks into bigger pieces until you can play the piece bar by bar, phrase by phrase, and section by section. Teaching students how to look at music from a wide range of “zoom levels” is one of the most important lessons in music. It is important to also account for the fact that different people will navigate the challenges of music differently. While on paper (in the score) it might seem like there is some objectivity, the models that people internalize are vastly different. That is why it is useful to take lessons with different teachers, because they will often have a completely different model of thinking about something. It really opens up perception to new ways of thinking. Even a single lesson with a new teacher can completely revolutionize and revitalize playing.

## Artful Design

Paul Dourish's *Where the Action Is* established the philosophical foundation of my design approach. Written in 2001, his book anticipated and influenced the development many interactive interfaces that we take for granted over 20 years later. Ge Wang's *Artful Design* bridges the philosophical foundation in Dourish, with a modern approach to interactive design that includes the developments of the last 20 years. This book that has transformed my views on interactivity, visual design, and gamification. Ge Wang is a designer/engineer/artist, and professor at Stanford University. In *Artful Design*, Wang unpacks his approach to designing interactive music tools. By combining principles of human-computer interaction, game design, and know-how of music software, Wang presents a unique design philosophy he calls "Artful Design."

Ge Wang's work gained public fame with his design of the *Ocarina*, one of the first musical instruments designed for the iPhone. This was also one of the first smartphone apps I ever encountered, having gotten my first iPhone (also my first phone) in 2008. Ge Wang entered the burgeoning world of touchscreen-enabled interactive music software, developing numerous groundbreaking interactive music apps.

I became seriously interested in software design in 2020 for two reasons. First, the sudden shift to remote teaching meant I needed to find a way to transfer my entire flute and music theory practice into the virtual space. Second, my performance practice began to expand into electronic music. What I discovered was an immense world of software and hardware, and a seemingly limitless supply of iOS music production and teaching apps. And yet, even within that abundance of variety, I often found myself frustrated with interfaces that could not quite do what

I wanted them to, or did things in a way that was incompatible with my own performance practice.

I decided to invest time into building my own skills in basic programming, and began learning the basics of Pd, as well as iOS coding. I faced the issue of having a huge gap between my technical know-how, and my ideas for what I wanted to design. What I realized was that in my exploration of software, hardware, and programming, I lacked a clear design philosophy. Ge Wang's book, *Artful Design*, unlocked a world of ideas for me that really kickstarted my exploration of design.

### **Humanity within Design**

One of the elements of Ge Wang's approach to design that really spoke to me was his desire to reclaim the humanity within digital interface, rejecting the coldness of so many interfaces. Later in the paper, I will analyze how Jace Clayton's software design in *Sufi Plug-Ins* has parallels with Wang's. From Wang's intro to Chapter 1:

In our age of rapidly evolving technology and unyielding human restlessness and discord, design ought to be more than simply functional; it should be expressive, socially meaningful, and humanistic. Design should transcend the purely technological, encompass the human, and strive for the sublime.

What does it mean to strive for the sublime? What are the mechanisms that balance function and expressivity within interfaces? I love the way Wang describes it:

Sublime design presents itself, first and last, as a useful thing, but nestled within that window of interaction lies the novel articulation of a thought, an idea, a reflection — an invisible truth that speaks to us, intimate yet universal, purposeful

without necessity of purpose, that leaves us playful, understood, elevated. It is a transformation so sublime that it escapes our conscious grasp but that once experienced — like music — we would never want to be without again. Design should be artful.

Ge Wang acknowledges the importance of design as a mediator between a user and a piece of technology. He focuses on the interaction as the source of meaning, similar to Paul Dourish's approach in *Where the Action Is*. Thinking about the aesthetics of a design does not limit its functionality, instead, one informs the other. Wang believes that aesthetics go beyond a thing's function. And yet, the aesthetics of a design are linked to its functionality. Artful Design can be described as "design with fundamental emphasis on aesthetics." Wang believes that anything worth designing is worth designing beautifully. Combining problem solving and creative design becomes Artful Design. The aesthetics of Artful Design is a multidimensional approach to design that incorporates material, structural, interactive, emotional/psychological, social, and moral-ethical considerations. The focus is on where the human meets technology, and how that technology demonstrates both its own purpose, but also is aware of how it situates the users purpose. Wang believes that design needs to have a humanist dimension, an ethos, a conscience. The social dimension of music-making is what appeals to me most in my practice. Therefore, this approach to design, one that focuses on the human using technology, is one that greatly appeals to me.

To me, Wang's focus on the space in which humans meet technology is an expansion of Dourish's concepts of *space* and *place*, which I discuss in "Translated." While *space* is the physical configuration of objects and their relationships, *place* is the social

environment in which they are framed. Throughout *Where the Action Is*, Dourish emphasizes the idea that meaning created during the act of actually using the design. This is compatible with Wang's approach: "Design is never complete until it accounts for the person experiencing it. The choices we make in design can compel a user to take action or influence the user's thinking. It is the art of making useful things that also make us feel, and feel human" (46).

The form of *Artful Design* is itself a demonstration of Ge Wang's design philosophy. While it is technically a design textbook, it is in graphic novel format, with bright pictures and charts. At the end of every chapter, Wang gives a set of etudes that allow the reader to put his ideas into practice. One of the etudes from Chapter 1 stood out to me: "Add aesthetics to something that doesn't seem to need it." For Wang, there is no excuse not to think about design aesthetics.

An important concept in Wang's approach to design is the concept of *Inside-Out Design*. design works outward from available technological ingredients, taking into account their possibilities and constraints. I see a parallel between Wang's possibilities and constraints with Dourish's *artifacts*, De Souza's discussion of *affordances*, and Östersjö's description of *effectivities* (the process of discovering affordances). Wang's *Inside-Out Design* rejects *blunt transfer*, which is the direct *porting* from one domain to another. *Porting* would be akin to a literal translation between two languages, or an instrumental transcription that does not take into account the nuance involved in changing domains. Wang's approach to design embraces the medium that you are designing in. Similar to Dourish, Wang also describes this process as *appropriating* technology, which then "imbues a sense of play and delight." Wang embraces the approach of form inspiring function when transforming physical into the virtual.

In *Where the Action Is*, Paul Dourish discusses how designers need to think about their designs on multiple levels, and how users must be able to disengage and reengage in different ways. In Chapter 3, Ge Wang shares a similar thought:

The artful designer is a planner and builder with aesthetic sense, able to shape technology with the understanding that we are multi-sensory, multi-modal creatures who experience the world through sight, sound, and interaction. We are aware of this “multi-ness,” make use of it, appeal to it, and ultimately fashion entirely new things out of it.

The multi-ness that Wang describes also enables the development of flexible designs that account for different use cases. Wang believes that every part of the design’s form and how the components function contributes to the design’s personality and nuance. To me, this shows that Wang sees design as a communicative process.

### **Feedback and Constraints**

In “Translated,” I discussed how performers rely on feedback to play their instruments. In *Artful Design*, Ge Wang describes how feedback is the mechanism by which someone learns about the personality of an interface. Feedback is what creates a feeling of satisfaction within design. I think what he means is that when action, feedback, and controls are properly coordinated, using a digital design actually feels satisfying. Consider how successful video games are often described as having “satisfying controls.” Here, Ge Wang points out the importance of designing with the intent to create this satisfaction.

Because there is a lack of tactile feedback on the flat touchscreen, the visual language of design becomes a very important element (§3.1). This connects with my discussion

in “Translated” of how different instruments manage feedback differently, therefore transcription relies on re-mapping how feedback feels on different instruments. For Wang, the visual language of a design is what creates the expressive connection to the user (§3.2). Wang suggests designers think using expressive verbs. To me, this highlights that Wang is focused on the actual act of interaction (§3.3). Visuals can enhance physical interactions by providing meaningful feedback for users (§3.6). For Wang, good design prompts users to experience substance, and not the technology itself. Good design uses the medium to highlight a narrative, while hiding the medium itself (§3.7). This is very similar to Dourish’s distinction between *ready-to-hand* and *present-at-hand* interactions which I discuss in “Translated.” For Dourish, when we act *through* an object, the technology disappears from our immediate concerns (Dourish, 109). Wang’s approach here is similar.

Ge Wang believes that visualization yields understanding. Design that visualizes a process, an algorithm, or a system that helps one to comprehend its inner workings, and also forces the designer to understand their own work (§3.10). Elements should be arranged in a way to allow the user to understand their purpose and relationship (§3.11). This is connected to the human-instrument interactions I unpack in “Translated” and “Altered.”

Designs should invent artificial constraints. Constraints are the underlying rules that define how a system works, give it shape, and ultimately specify how a user engages with it. Like rules in a game, constraints make a system useful, safe, fun, and interesting. They provide the basis for creative agency. (§3.13). This connects with the concept of *resistances* I discuss in “Translated.” Resistances are the conceptual constraints placed on an instrument by its affordances and social conditioning (De Souza, 72). Dourish also talks about how designs have

built-in constraints that guide users. Wang believes that creating constraints actually gives a user creative agency. I think what Wang means here is that constraints give a user the ability to actually work through a design. In “Translated,” I discuss De Souza’s analysis of how habit and technique allow a performer to exercise their agency, so it is interesting to see Wang bring up the role of agency in interactive interfaces.

In my other papers, I unpack De Souza’s discussion of the importance of feedback loops, specifically how they guide performance. Wang suggests that designers should “savor strange design loops” (§3.14). “Strange design loops encode and enact notions of self-reference, self-reflexivity, feedback, recursion, paradox....[strange design loops] arise as uncanny connections between form and function, where elements in concept and elements in actuality are in conversation. Feedback loops in design are a dynamic process. We are constantly evaluating the results of our actions (§5.1). For me, this is a connection between Wang’s ideas, and what I talk about in “Altered.” Dourish discusses how designers should simultaneously think on multiple levels, and De Souza talks about the binary between technology determining action, vs action being projected onto technology. Wang points out that designers should “blur the distinction between medium and message, using some intrinsic property of the design.” As demonstrated here, there are deep connections between Ge Wang’s *Artful Design*, Paul Dourish’s design approach in *Where the Action Is*, and Jonathan De Souza’s ideas of human-instrument interactions in *Music at Hand*.

### **Design Enables Interaction**

Wang believes that computers should be used to create experiences that are not possible without them (§4.5). As discussed earlier, Wang embraces the medium. He believes that



the ability to design something does not automatically make it worth designing (§4.10). Ge Wang sees the interfaces as “the membrane of interaction between human and technology.” Interfaces enable interactions between human and technology. Design should understand the specific ways that the human is meant to meet the technology. This shows that Wang is aware of the communicative function of design.

“The Artful designer must be cognizant of situations in which it is essential to design the human into the loop. Interfaces ought to extend us, make us feel a sense of embodiment in their us, giving us new hands to interact with the world around us.”

I start off “Translated” with a discussion of how objects create interaction, enabling us to experience the world. When virtual objects are created in interactive designs, it becomes even more important to be aware of the way they mediate our communication. Wang offers designers several prompts to ask themselves as they make design decisions: Does the end product justify the technology? Does it do at least one thing that can be achieved by no other means? Does the design use the medium to support the right interplay between technology and humans (§5.18)?

What I appreciate about this design philosophy is that Ge Wang is focused on that way that design impacts humans.

Another design lesson from Wang that has impacted me is his discussion of gamification in design. Wang believes that play is essential design, because it is an integral part of human life.

Play is an essential aspect of artful design, because it is an integral part of human life, having everything to do with purpose and a deep commitment to activities

that have no extrinsic purpose. Play is about engaging in an activity for its sheer intrinsic value — its design entails the crafting of such internally meaningful experiences. It is psychology in motion — how we set the conditions to motivate specific behaviors and induce certain mindsets in the player. We design play into pure games and toys, and can incorporate game-like elements into practical contexts.

Recall how Dourish believes that designers must give up control to their users. Here, Wang emphasizes the fact that games require interaction and active participation. The designer “must relinquish significant curatorial control to the player.” Games cede control to the player, just like instruments (§6.7), which is very similar to what Dourish was saying about designers giving up control to users. Incorporating gamification in education can be used to identify, develop, and overcome habits (§6.13). Wang brings up the example of playing something and then raising the metronome speed. Recall the imaginary piano exercise I discuss in “Translated,” where I asked my student to imagine her hand playing an imaginary piano, while signing the pitches on note names. I used this exercise to allow my student to access the habits she had with the piano, because of the difficulties she was having with flute fingerings. But on a more fundamental level, what I was doing was introducing an element of gamification that increased my student’s enjoyment of playing. As Wang points out, gamification can lead to what he describes as a *pure play* state, which he links to being *in the zone*, also known as a *flow state*. Gamification in design allows users to balance goals and challenges with rewards, provide a sense of satisfaction, and set the conditions for flow (§6.17). Crucially, Wang also believes that fun does not have to come at the expense of expressiveness (§6.18).

Wang discussed the social power of design, emphasizing the importances of how designs connect people. He believes that designers should strive for creating human connection (§7.1). Wang would likely agree then that design allows for the development of intersubjectivity, evidenced by: “From one’s self outward to the sum of humanity, there is a continuum of familiarity in how we relate to another person” (§7.2); and: “It is not technology that determines the quality and meaning of those social interactions...it is entirely up to the people in them.” Wang believes that “technology should strive to get out of the way of human interaction” (§7.2), similar to how Dourish believes that designers should not define interaction for the user. Designers should ask themselves whether or not their designs enrich the activity they are designing for, and whether or not they elevate their users. Designers should be aware of how “heavy” the touch of their designs are. A heavier touch means that the designer has more impact on the result (§7.4). Therefore, designers should be mindful of the way that their work impacts users. As I discussed in “Translated” and “Altered,” the use of objects alters the user. Here, Wang connects it to the use of interactive designs:

There are implications beyond the utility and surface novelty of technology. These affect us beyond their intended purpose, leaving us touched and altered.

Deliberate or not, the result of an encounter with technology is always an aesthetic, but its meaning lies not in the names, or the objects, but in their significance to us, like the experience of music or poetry. To design beautifully is to seek a kind of truth — of technology, and also of ourselves. To design artfully is to imbue a certain authenticity and poetry into our creations — about who we are, and who we want to be. (§8.1)

Later in the paper I will apply Dourish and Wang’s design philosophy to understanding two computer music designers: Jace Clayton and Khyam Allami. Both Clayton and Allami believe that their designs have an educational component. Wang’s words on the educational impact of design is important to highlight:

In order for us to truly move forward, the narrative of our educational and technological institutions must evolve — from a primarily need-driven and problem-solving narrative to a value-based, self-defining (and still problem-solving) ethos. As an engineer myself, I obviously champion problem solving, but a core issue with the solution-centric narrative is that much of the humanities and arts (and life itself) is not about solving problems (e.g., music, philosophy, history aren’t ‘problems to be solved’). Rather, they are about ever more fully understanding and expressive ourselves as human beings. At the same time, I, for one, believe engineering is capable of more than ‘simply’ solving problems. Through how we shape the world, we can speak authentically to who we are (not unlike art and the humanities). The ethos of the humanist engineer ties this together! (§8.15)

Wang emphasizes the humanity of design. For Wang, aesthetics “provides the human context and impetus to learn subjects requiring advanced logic and reason, in a way that is not anchored solely in the calculus of need, but with an artfulness that can only be human. To value things for their intrinsic worth, beyond pure function, may well be to appreciate a core condition of being human.” Wang believes that designing without aesthetics is no longer a viable path for the

designer. For Wang, the designer must “evolve into a synthesis of a technological artist, a moral-ethical inventor, and a compassionate system designer.” Why design artfully?

...we design to make life interesting, authentic, and meaningful. Ultimately we strive to design useful things that are intrinsically beautiful — that bring the world into alignment with our idea of the good, the authentic, and then just — as an end in itself. Design should express our humanity, acknowledging that we value play, find beauty in authenticity, seek to connect with one another, and desire to be free.

We can design for the sublime no more than we can design for beauty, for these are not features of products but consequences of experience, manifested through the gridwork of sense and cognition. Yet, when we design with intention, as we do in art, we can create things that invoke the sublime, that bring into focus a truth and a beauty despite our limitations and chaos. Design cannot forsake the practical needs of humanity, but it — no less than art — can transcend them, seeking beauty in the authenticity of things, reaching for something more than we are, while speaking to precisely what we are. Sublime design is design that understands us.”

Finally, here are Ge Wang’s “Laws of Artful Design” to keep in mind as I move into Jace Clayton and Khyam Allami’s work with music interface designs:

*The Laws of Artful Design*

*Design is the artful shaping of our world into something useful and human. Anything worth designing is worth designing beautifully.*

*Design is an act of alignment with our notions of the purposeful and the good.*

*Design is the radical synthesis of means and ends.*

*Design not only from needs — but from the values behind them.*

*Design is the embodied conscience of technology.*

*Design should understand us.*

*What we make, makes us.*

## Jace Clayton

Jace Clayton is an artist and writer based in Manhattan, also known for his work as DJ/rupture. I am interested in Clayton's work because he explores the ways that software is used to enable communication within and between communities. In his book, *Uproot: Travels in 21st Century Music and Digital Culture*, Clayton describes his vision of applying software design to communities outside of those who traditionally get attention from software engineers. I am interested in Jace Clayton's approach to software design, particularly his idea of "software-as-art." I see parallels between Clayton's approach in *Uproot* and Ge Wang's *Artful Design*.

As I analyze Clayton's work, here are some notes to consider: What happens when software considers the communities that use it? What if by design, the software accommodates the culture and lifestyle of its users? How does decolonization manifest in computer music software design? Clayton, on bringing design outside of the tech bubble:

We live in a world where it is almost unthinkable that a tech product with global uptake could emerge from Africa. The farther one lives from tech hubs such as Silicon Valley or Redmond, Washington, the less likely that any gear or app will be made with your specific needs in mind. I wanted to flip that dynamic (on a shoestring budget): to encode digital tools for my small group of Berber friends in Casablanca and myself, then make those tools available to a global audience."

(Clayton, 188-89)

### Auto-Tune and Communication

As discussed in "Translated" and "Altered," instruments mediate communication between performers and their instruments, performers and composers, and performers and their

audiences. What happens when a piece of software mediates communication? As discussed in “Translated,” performers rely on feedback to guide their instrumental technique. How does the digital alteration of feedback affect performance?

Jace Clayton discusses the impact of Auto-Tune on music production. As he describes it, “the most important piece of musical equipment of the last twenty years is not an instrument or a physical object. It’s a specialized piece of computer software called Auto-Tune and is now used on a staggering 90 percent of all pop songs” (Clayton, 26). In “Translated,” I discuss the role that feedback plays in mediating a performer’s perception of their instrument. In “Altered,” I discuss how instrumental alteration can mediate communication. What happens when human voice and software mix together? What happens when the human voice is altered by software? How does this affect the perception of the voice?

While earlier software effects were applied evenly over source material, Auto-Tune actively responds to what it “hears.” While in-tune notes will pass through unaltered, others might be radically different after processing. Corrective auto-tune often goes unnoticed by the artists themselves, other than the signature lack of vibrato on auto-tuned notes (Clayton, 29). When Auto-Tune is applied to music, there is a conversation between different sources. The interaction gains another layer of meaning. In “Altered,” I explored what happens when the act of instrumental alteration becomes the process of interaction between a composer and a performer. With Auto-Tune, the interaction itself creates an instrument. The dialogue between human and computer creates an entirely new object. Auto-Tune created something that did not have a physical equivalent, creating a new dimension of interaction with sound (Clayton, 30). This means that the invention of Auto-Tune passes Ge Wang’s test of whether or not a piece of



software creates something that does not exist in the physical domain. Consider my earlier discussions of De Souza’s musical dimensions, and Dourish’s levels of interaction. Here Clayton argues that Auto-Tune has expanded the plane of interaction with music.

Clayton mentions how some artists do not record an untreated version of their vocals, for example the rapper Lil Wayne. Clayton describes this as the “cyborg embrace” (29).

This interplay between singer, software, and song becomes complex. Vocal runs that would sound bizarre without Auto-Tune have become necessary to create some now-common effects. Far from novelty, Auto-Tune is a contemporary strategy for intimacy with the digital. All this vocal negotiation is neither a fight with technology nor an embrace of it; it’s more like glossy coexistence, a strange new dance of give-and-take. Quite literally, this is the sound of voice and machine intermodulating. (Clayton, 30)

Auto-Tune has become a piece of technology that combines the creativity, skill, and artistry of a human musician with technology. It’s interesting to note that some artists choose to hide the use of this technology, while others embrace it as a part of the process. It is a difference between a traditional approach (using technology to create a “better” version of a traditional product), versus exploring the unique possibilities that the use of technology provides.

### **Design Cannot be Neutral**

In *Where the Action Is*, Dourish emphasizes the fact that design cannot be neutral because designers make decisions on behalf of their users. In *Uproot*, Clayton focuses on how the cultural background of a software designer is another factor that prevents neutrality, pointing out the fact that most software designers come from a similar environment.

Virtually all music software is made in the United States or Europe. These programs all tend to do the same thing, in varying amounts, and that thing defaults to a narrow concept of what music can or should be. It matters because more and more music is being made using this tiny number of systems. Software tools are never neutral. They reinforce their builders' blind spots and biases and, once widely distributed, play an active role in maintaining those assumptions. (Clayton, 178)

While Dourish focuses on how designers sometimes make incorrect assumptions about how a user will use their design, Clayton emphasizes the fact that designs impose the designer's biases onto the user. Auto-Tune is inherently biased. For example, Clayton describes how difficult it is for it to interpret *melismas* (singing multiple notes over one syllable), which is a core technique of many non-Western musical practices.

What does the computer think of this weightless technique of vocal gymnastics whose touch of the divine spans religions? Auto-Tune hates it. For all its algorithmic fineries, Auto-Tune cannot distinguish between world-class melismatic pitch control and off-key drunken shouting. To fix the problem of 'out-of-tune vocals,' Dr. Hildebrand had to encode into the software his beliefs about what constituted appropriate singing. (Clayton, 45)

There is a parallel here with Paul Dourish's comments on the issues that arise when a designer creates an ontology for a user. To create the software, Dr. Hildebrand had to define the boundaries for the user. Auto-Tune assumes a set of appropriate behaviors. The role of the

designers of Auto-Tune parallels what I discuss in “Altered,” where performance contexts often define a series of expectations for performers.

In my previous papers, I discussed the ways that habits enable instrumental playing, and how performers sometimes modify their instruments to break free of habits for creative purposes. Dourish focuses on the mechanisms by which a designer alters a user’s experience, and Wang suggests a design language that creates an optimal experience for a user. Clayton turns the attention to the social and cultural dynamics that influence the way users experience design. Clayton discusses the benefit of having software design occur far away from the traditional design hubs.

“Sure, Ableton is flexible, and on the one hand you can say these great producers from Kenya are using German software to make the funkier music imaginable,” Clayton says. “But wouldn’t it be nice if we could extend the same creativity we have making music into how we make our tools? We might even end up with Germans having to fight against African software to make their metronomic techno.” (Faber, 2021)

Throughout *Uproot*, Clayton emphasizes the creative potential that can be unlocked by expanding access to design to new communities. What happens when the use of an electronic music tool occurs outside of the usual environments?

### **High Tech / Low Tech**

Clayton explores the use of Auto-Tune among Berber folk musicians in North Africa. He points out that these musicians began actively using Auto-Tune before T-Pain, who gained fame in the West for his use of it. Clayton is curious what happens when high-tech

software is used in low-tech music environments. In his overview of the development of electronic music software, Clayton points out how the democratization of software allowed music production to occur in new places. A DJ whose musical practice is primarily with electronic music, Clayton's own practice and experience leads him to define music environments based on their relative technological complexity. For example, notice how Clayton describes an occasion where he saw Auto-Tune being used in a studio in Morocco: "The transformation of twenty-first-century music production from expensive hardware studios to a haphazardly democratic scatter of home computers has made it possible for bare-bones studios such as Moulouk to exist" (Clayton, 41). For me, this is interesting to notice, because the vast majority of my own music experience is in acoustic performance settings in which there is little/no technology involved. In another section, Clayton describe the Al-Maarif Studioa studio in Morocco. I find it interesting the way that Clayton describes the use of Auto-Tune within this environment.

The banjo...sets the reference note, the rest of the band tunes to the banjo, and the singer, days later, adjusts her intonation to fit the band. Auto-Tune then gets tuned—or rather, detuned—to whatever results. I say *detuned* because in studios across Morocco, I watched time and again as the people who used Auto-Tune the most relied the least upon its interface. The software offers many ways to customize its effects, including settings called Arabic and Pentatonic—registers that wouldn't be hard to tailor-fit to Berber songs. Nobody bothers with any of that. Instead, people click a single knob—Pitch—and twist. Ait Bouzid and others simply listen

to the vocals and adjust the software on the fly, using broad, impressionistic settings until things start to sound the right kind of wrong. (Clayton, 48-49)

The designers of Auto-Tune include settings like “Arabic” and “Pentatonic,” but musicians from this community do not see a use for those settings. What does it even mean to have an “Arabic” knob? The cultural assumptions made by the designers of Auto-Tune does not align with the actual users of Auto-Tune who work within those cultures. This makes me wonder who the “Arabic” and “Pentatonic” settings were intended for: were they meant for musicians at the Al-Maarif Studio, or for someone in Berlin or New York City who wants to evoke a North African aesthetic? In the next part of this paper, I will discuss Khyam Allami’s views on how designers often perpetuate the exoticism or “otherness” of non-Western musical practices.

Dourish and Wang both use the term *appropriate* in the sense that communities of users *appropriate* a design to fit their community’s needs. There is a distinction between appropriating design, and cultural appropriation. Here, the cultural appropriation built-into Auto-Tune with the “Arabic” and “Pentatonic” settings is ignored, while the musicians appropriate the design by using the single pitch knob. To use Dourish’s words, the way that the designer planned out the use of the interface does not necessarily align with the way that a community will use the design. Furthermore, it is incorrect to assume that every community will use a design the same way. Later in *Uproot*, Clayton points out a similar situation with Souljah Boy’s use of FL Studio, in which an entire song was made using default software presets. This demonstrates that some users do not always require a high degree of modification built-into the software that they use. That means that the decisions that designers make in creating those software presets has an even greater effect on the end result.

## Auto-Tune and Gender

What happens when the interpretation of software intersects with gender norms? Clayton discusses how in these North African studios, Auto-Tune is not applied evenly across genders. “Cultural distinctness, female purity, unblemished nature, and Auto-Tune. Women may not always be directly responsible for applying the effect, yet their voices consistently receive the most extreme auto-tuning in Berber pop. Even in male-female duets, the lady always has her voice more altered, often beyond legibility” (Clayton, 54). How intentional is this uneven application of Auto-Tune across gender lines? Is there a parallel here with my discussion in “Translated” of how unconscious habits condition the way we use tools? Meaning, does cultural conditioning impact the way a sound engineer uses Auto-Tune? Clayton discusses this further, emphasizing the nuance created when the use of technology intersects with culture:

Auto-Tune activates deep-seated and conservative ideals of Berber womanhood by making those high-pitched voices cut even more keenly. The software amplifies old ideas of the rural and the feminine. Music made with it enjoys widespread, lasting popularity. Shockingly contemporary sonic radicalism grafts onto long-standing ideas about gender.

The processed female voices in Berber pop are unavoidably spectacular, yet their pleasures are not precisely of the flesh. With the software, one can simultaneously flaunt that rough-and-pure womanhood while preserving its modesty via a synthetic veil. The cyborg sheen makes bodies less carnal. This hiding and showing at the same time is part of how Amazigh Auto-Tune functions culturally and sonically. It parallels the main Koranic arguments for the veil: “so

that they may know who you are” and “to hide your charms from their eyes.”

(Clayton, 54-55)

The cultural and musical practices that exist in a community away from software impacts the way that it is used. In “Translated,” I discuss the role context and framing affects the way we develop musical interpretations. What I am curious about is to what degree Clayton believes the unequal use of Auto-Tune across gender is an intentional musical act, or if social and cultural conditioning overcomes musical considerations. What Clayton is emphasizing is how software can be used as a cultural filter. Auto-Tune gains meaning when it is used by a community; different communities situate this technology within a unique *place*. This transforms the meaning of the technology. The tension between a technology’s imposition of cultural assumptions and a community’s interpretation of an interface is the space that Clayton is most focused on.

In pushing the American software to the limits with such dedication and flair, the Amazigh have elevated the struggle between human and machine into artistic expression, with all the history of how he’d it is to be a woman, here or anywhere, embedded in it at unsettling angles. Auto-Tune sound-tracks the twenty-first-century Amazigh condition, that of a bucolic nation made real only in its digital diaspora. Villagers subsisting with a minimum of state infrastructure (tax inspectors yes, phone lines and garbage pickup no, in many cases) suddenly enjoy smartphones linked to satellite Internet. Ancestral ties strengthen—on Facebook. Auto-Tune is a compelling call-and-response between pastoralist and robot, although nobody’s steady enough to point out who is who (Clayton, 56).

Is this a romanticized take on technology, or is this an accurate analysis of what happens when an interface is transported to a new environment? I am not sure. However, what is clear is that Clayton would wholeheartedly agree with Dourish's assessment that a piece of software gains meaning when it is actually used by a community, and that designers cannot predict all of the possible ways that their tools will be used. The tools by which we transfer meaning alter the meaning itself. The way the community uses the tool can fundamentally alter its initially-envisioned effect. I will now explore Clayton's own journey with music software design.

### **Frustration with Existing Designs**

What happens when software does not accommodate something a potential user would like to do? Clayton describes a jam session with Abdelhak Rahal, a violinist from Fez, Morocco. Jace realizes that Abdelhak's rhythm seems "off" compared to his computer-steady, 95 bpm, 4/4-time FruityLoops beat. "...my beat was suffocatingly, unbelievably square to Abdel, steeped as he was in the robust rhythmic diversity of Maghrebi music. We may have thought similarly, yet our 'default settings' were so far apart as to be almost incompatible" (Clayton, 185). There is a mismatch between Rahal's playing and Clayton's ontological model. Clayton and Rahal were trying to establish common ground, but the software was getting in the way. Clayton points out how when a design does not accommodate your desired actions, you begin to fight with it.

I didn't use software, I fought with it. I got a pretty good idea of what values the good programmers in Berlin and Silicon Valley believe are important. Their assumptions became my roadblocks. I kept a running wish list of what I wanted in my musical tools. I began to wonder about other musicians from traditions not



represented in software. What concepts would they be most excited to bring into the digital? (Clayton, 186)

Here, Clayton is discussing the same exact issue that Paul Dourish says designers have when they try to define an ontological model for their users. Clayton feels as though the designers are making decisions for users without knowing how a community might want to use the software.

Jace realizes that he needs customized music software, allowing him to work without any work-arounds and reconfigurations. “I didn’t want more choices. I wanted fewer, better choices. I wanted the entire experience of using my software to give what musicians call a vibe. I could do that by incorporating different defaults, different assumptions, different blind spots. Virtually every software update claims new features. Rather than focus on making new things possible, I wanted to rethink ‘old’ things” (187.)

### **Cultural Invisibility in Designs**

What happens when software is blind to potential uses? Jace Clayton discusses the issue of trying to fit polyrhythms into a Western-oriented software system. How do artists of different cultures fit into the boxes that software presets create?

[Polyrhythms] occur when two or more irreducibly distinct rhythmic points of view (points of hear?) coexist within a single song. That’s how I’d describe the phenomenon — others might use a totally different framework to explain polyrhythms, and this plurality of understandings is part of what makes them so stubbornly human, and so resistant to digital encoding. Which is precisely the magic. Computers can’t handle paradox or ambiguity, and polyrhythms are built from the stuff. Their notoriously subjective take on time and pattern exists smack

in the middle of one of music software's many blind spots. Polyrhythms spring from an understanding of music, if not life itself, as shifting relationships of patterns, each with its own internal logic and timing. (Clayton, 181)

Some music software solves the issue by measuring out and dividing the beats mathematically. But what happens when the people playing those polyrhythms do not think about rhythm that way? What happens when the method by which computation is done is different from the way humans think about it? At what point does the translation of human thought into computation alter meaning to the point it excludes the original human voice? Clayton, on this dilemma:

So we're faced with a structure that forms the backbone to so much delightful music, especially in sub-Saharan Africa, that is illegible to the machinery. The closest thing to polyrhythmic compatibility in music software is the notoriously unfunky technical work-arounds that aggressively measure out the beats, which may be fine for math majors, but not for people like me, since it's not at all how folks from those traditions conceive of it. (Clayton, 181)

The software does not take into account the way the actual people creating the music conceive of the musical context. In *Where the Action Is*, Paul Dourish discusses how designs should accommodate multiple levels, allowing users to engage and reengage with the software. What happens when electronic music software does not accommodate a musical culture, and what happens when designs are blind to musical practices? What happens when a musical practice does not have space within the world of digital musicmaking? Jace Clayton describes attending a *zar*, a musical ritual from Nubia. He describes the complex interlocking rhythms of the performance:

[As] I watched three women pound out interleaved patterns on a variety of frame drums, I understood how it is said to chase out malevolent spirits. Their drumming pivoted between complexity and simplicity, never quite resting in either end. The room's energy crystallized. When I focused on the drum line any individual woman played, I found it easy to follow, yet the sum total of interlocking parts left me wondrously confused: I couldn't count it out. (Clayton, 181)

I am not sure how much Clayton's own electronic music practice involves polyrhythms, so I am not sure how familiar he is with the various ways musicians internalize them. Clayton's comments that "from the software's point of view, *zar* is invisible. If the *zar* tradition can't make the leap into digital, it may simply vanish" (Clayton, 182). He emphasizes the importance of digital compatibility of musical cultures. What would the role of software be in the *zar*? What communicative function would it enable?

Of course, software could never replace *zar*'s subtleties; it's as much a culture as a musical genre. What software could do is spark a connection between what these woman create and what a younger, more wired generation could make of it. Software functions as an archive of what we want to be possible at any moment; wouldn't it be nice to see what happens when we try to get stuff like *zar* in there? (Clayton, 182)

What I think is interesting here is the fact that Clayton is not trying to replace a tradition with a digital format, but instead wonders what happens if those sort of interactions have a space within the digital realm. Jace wonders about "Zar. 2.0," a hypothetical future in which the perfect piece

of software is created that will link this culture to electronics. He points out how often the most talented software programmers go into more lucrative fields, so there remains a lot of untapped creative projects in these alternative spaces.

...this is why we need programmers from far-flung corners of the globe making digital instruments to share. To strike up intergenerational conversations. To think about what a digital environment that respects the wisdom bound up in *zar* would do differently. To give some of the incredibly varied methods people use to make music a fighting chance in our electrified present. To keep things culturally polyrhythmic. (Clayton, 182)

In this quote, I think it's interesting that Clayton says about a "fighting chance" for music. So he's acknowledging that we need to accept the reality of technology, while carving out space for human culture's subtleties. Clayton wants to see the *zar* translate to the digital "so that other people can wield those tools incorrectly and blow our minds. More forks in the road, more left-handed turns. Give me new ways to be wrong." (Clayton, 183)

### **Sufi Plug-Ins**

*Sufi Plug-ins* are Clayton's answer to his frustrations with software. They are a set of plugins for Ableton Live that work with North African quartertone maqam scales. They are what Clayton describes as "software-as-art." Equal parts art object and musical tool, Clayton describes the plug-ins as somewhere between "art provocation and instrument" (Clayton, 187). "Riddle and tool, provocation and dream. Why shouldn't software be able to be all these things at once?" The plug-ins support a multiplicity of meanings and potential uses.

Clayton has created what Dourish describes as *artifacts* in the design, built-in limitations that the user pushes against. While “you can adjust the settings to sculpt an enormous range of sounds,” the tuning of the keyboard synthesizers “is hardwired to North African quarter-tone scales. You can play all sorts of amazing music on these scales, from Umm Kulthum classics to Emirati pop, but you can’t use them to perform Beethoven or Rihanna” (Clayton, 187).

The design of the plug-ins are a reaction to the “grimly efficient” and “macho visual environment” that comprises the majority of software plug ins (Clayton, 187). This connects with Ge Wang’s approach to design, which emphasizes the need to reclaim humanity within designs. Another parallel with Wang is that Clayton emphasizes *play* within design. Instead of presenting things clearly, Clayton was interested in creating an intentionally frustrating (in a playful way) experience of the interface, pushing back against the desire to make everything user-friendly. As he puts it, he engages the user’s creativity by slightly frustrating them, encouraging them to “explore the software’s sound guided by their ears, with less focus on the numbers of language (music software loves numbers)” (187). In “Altered,” I discuss how Kurt Rosenwinkel’s detuning allowed him to separate himself from an intellectual analysis of his playing, and I think there is a similar effect here. Clayton’s hope is that within this intentionally unclear space, the visual language of the plug-ins would make sense to someone familiar with synthesizers.

Instead of labeling knobs with clear terminology, he labels the functions of the plug-ins using the Tifinagh script of the Moroccan Berber Language. When a user hovers over a knob, “instead of saying something literal such as ‘volume’ or ‘pitch,’ a fragment of Sufi poetry

from twelfth-century Persia to today will appear, such as this one: ‘Here eloquence can find no jewel but one, / That silence when the longed-for goal is won’ (Clayton, 188).

Who is this software for? Are the *Sufi Plug-Ins* created for use within this musical culture, or is it Clayton’s way to connect with it? Recall the frustration Clayton experienced when jamming with the Abdelhak Rahal, the violinist from Morocco. Do the *Sufi Plug-Ins* solve the issue Clayton had with not being able to fully connect with him via his electronic instruments, or are the plug-ins intended for Rahal to use? To me, this is not entirely clear.

In the next section of the paper, I will explore the software approach of Khyam Allami, whose explicit goal in software design is to create something for his own musical community. While Jace Clayton faces the issue of traveling to another musical community and not having the right tools to communicate, Khyam Allami uses software to express his own musical practice that is not accommodated by software.

## Khyam Allami

Khyam Allami is another example of an artist who uses software design as a communicative tool. Allami is a UK-based musician and musicologist of Iraqi descent who is a performer of classical and contemporary works for oud, an Arabic string instrument similar to the lute. Allami created *Leimma* and *Apotome*, two browser-based tools for allowing musicians to work with tuning systems other than 12-tone equal temperament. While *Leimma* is primarily a utility for outputting tuning systems to the software/hardware of your choice, *Apotome* is a generative music synthesizer that supports tunings made in *Leimma*. In my opinion, Allami's design language uses a lighter hand than Clayton's (to borrow Wang's terminology). Clayton himself points out that *Sufi Plug-Ins* are "software-as-art," and in my opinion there is an explicit emphasis on the *art* of the design. However, Allami instead focuses on creating tools with clear aesthetic, in which the clarity of the design is what makes it satisfying to use. While Clayton and Allami both designed interfaces that are a mix of a utility and instrument, they have a different approach to visual design language. They are both interested in exploring the ways electronic music software can be decolonized. Just like Dourish, Allami does not claim his designs are neutral. While his goal with *Leimma* and *Apotome* was to "create transcultural digital music making tools that are free of as much bias as possible," he acknowledges that designers cannot account for all bias.

I seek to better understand how Allami's vision of decolonizing electronic music software intersects with Paul Dourish's ideas of software design. I will explore the similarities and differences of Allami's and Clayton's approach to design.

## “Decolonizing Electronic Music Starts with Its Software”

Khyam Allami describes fighting against electronic music software, similar to what Jace Clayton describes in “Uproot.” An article in Pitchfork titled “Decolonizing Electronic Music Starts with Its Software” describes Allami’s journey into design.

In 2004, Khyam Allami was ready to give up on electronic music. No matter how hard he tried, he couldn’t write melodies that sounded like the music in his head. “It felt like the software was leading me somewhere that wasn’t my intention, and I couldn’t understand why that was,” he recalls. Born in Syria to Iraqi parents, Allami had grown up in London playing guitar and drums in punk bands. He was exploring Arabic music for the first time—or at least trying to, but the music’s distinctive quarter-tones were proving difficult to emulate. The software simply wasn’t made for him. (Faber, 2021)

Allami felt frustrated by the way that electronic music software excluded the performance practice of musicians working outside of the tuning systems of European classical music. He describes the feeling of “fighting” against software, relying on complex workarounds. Jace Clayton also describes this, talking about “hacking” tech to fit musical needs. Because he could not find software that did what he wanted to musically, Allami decides to start working on developing his own software. The result was *Leimma* and *Apotome*, two browser-based music plugins. Khyam Allami is an example of an artist who, from Clayton’s perspective, creates music software outside of the environments in which it is normally done.

The main issue Allami has with electronic music software is that it does not easily accommodate non-Western tuning. While the possibility of microtonality has been built into the



design of MIDI from the start, the vast majority of software and hardware tools default to 12TET tuning.

Allami expresses a keen sense of injustice about the young global musicians struggling to make digital sounds that feel authentically local. “It’s not that the music they make will sound ‘more Western,’ but it is forced into an unnatural rigidity,” Allami says. “The music stops being in tune with itself. A lot of the culture will be gone. It’s like cooking without your local spices, or speaking without your local accent. For me, that’s a remnant of a colonial, supremacist paradigm. The music is colonized in some way.” (Faber, 2021)

In the electronic music software that Khyam feels is limiting him, the software assumes a certain approach to intonation. Paul Dourish would say that the designer has forced their ontology onto the user, and De Souza would comment on how the place-to-pitch mapping of this software is rigid. Paul Dourish believes software design cannot be neutral, a viewpoint that is supported by Tom Faber, the author of this article on Allami. Faber points out how “if a musician opens a new composition and they are given a 4/4 beat and equal tempered tuning by default, it is implied that other musical systems do not exist, or at least that they are of less value.”

### **Approaching Design**

In his article, “Microtonality and the Struggle for Fretlessness in the Digital Age,” Khyam Allami describes the challenges of going against the standard approach of software. “Persistence is a powerful word. It implies a sense of arduous effort – taken to go against the tide. To be insistent, to go on resolutely in spite of opposition. It is markedly different from the

idea of perseverance, which implies a sense of focus and determination in one's continuation but doesn't really communicate the effort involved.”

Jace Clayton and Khyam Allami both comment how many of the inadequacies in software faced by players of non-western music are compounded by the lack of programming resources devoted to those markets. Allami describes how he wanted a “well-known piece of music notation software” to allow playback in non-12TET tuning. Something that feels simple to a user is impossible because the software designer assumes it is not a feature needed by its users. Eventually Allami contacts the company's senior product manager to get some answers.

The product manager knew the software inside and out and was able to show us reasonably straightforward workarounds to the majority of our needs – although playback tuning was unmodifiable. But when I asked him why, if these musicological needs were easy to accommodate through workarounds, they weren't made explicitly possible in the programming of the software, his answer was straight to the point: there was no market, and therefore resources weren't assigned to develop this kind of functionality at a time when the market was demanding other kinds of developments. And so I persisted with my research.

(Allami, 2019)

Even though the software could technically support non-12TET playback (MIDI allows for microtonality), market forces dictated the priority list for the design of this notation software. Allami is left to either accept the limitations of the software (which, as he describes it, would lead to these musical practices eventually dying out), or invest a significant amount of time to create his own software. This example highlights an inequity in software development—because

a “default” or “standard” mode is so highly engrained, anything outside of what is considered to be “normal” therefore becomes an rare/or highly specialized setting, even though for many potential users of the software these “special” settings would be very common. The design is blind to users with potentially different ontologies.

### **MIDI as a Creative Filter**

The development of MIDI in the early 1980s forced the music industry to make decisions about software and hardware that would greatly impact the way musicians would interact with electronic music. Allami describes how the MIDI Tuning Standard (MTS) was created.

Developed together with composers Robert Rich and Carter Scholz, MTS allows the use of both octave-repeating and non-octave-repeating tunings to a resolution of 0.0061 of a cent, which essentially divides the octave into 196,608 equal parts. It also allows the changing of the tuning of one or more notes in real-time, and even gives the user the choice of changing all currently sounding notes, or only the new notes that follow the tuning change message. This is a phenomenal level of detail that covers all the melodic needs of all musics from across the world, past, present, and future.

The issue was that while MTS could accommodate an enormous amount of tuning flexibility, most hardware manufacturers did not fully implement MTS into their designs. This meant that hardware and software was in essence blind to a huge number of musical practices that would utilize this flexibility in tuning. Further complicating matters was the fact that hardware and software manufacturers did not include a way for MTS to actually communicate with DAWs.

Secondly, MTS messages are part of a MIDI data group called SysEx messages (System Exclusive). Most Digital Audio Workstations (DAWs) do not allow for SysEx data to be generated within them or pass through them, nor to go from them and out to hardware. The same applies for the majority of software instruments and samplers.

Because of this, a musician would have no way of using a unified tuning data system for all of their gear. Even though the MIDI language could accommodate this, the user lacks a pathway to communicate. Because of this, “tunings need to be set on an instrument-by-instrument basis in accordance with its manufacturers’ implementation, and very often on a preset-by-preset basis. This is totally counterintuitive and creatively inhibitive” (Allami, 2019). A partial solution to this issue was invented by Manuel Op de Coul, who created the digital tuning file format called Scala. However, this did not solve the issue of sending data to instruments in real-time (Allami, 2019). Individual software manufacturers have created tools for users to set tuning parameters within their projects, but even then the tuning only applies to that specific program.

Further complicating matters is the fact that even when software/hardware supports microtonality, it does not provide any documentation to give users contexts as to the meaning of this microtonality.

The pre-loaded tuning files are often generous and include many historical, modern, and non-Western tunings. Unfortunately, though, when any such tuning is loaded up, it is impossible to know how it is supposed to be used. There is often no documentation on what these tunings are, what their values are, which note on

the keyboard they start on... nothing. The maximum we can find is a little bit of a blurb about each tuning in the manuals, but even this is usually trivial.

The software also implies the use of a 12-tone piano keyboard, regardless of how they are mapped in practice. This reinforces the *otherness* of these “non-standard” tuning systems. Allami points out that giving users access to tunings does not immediately make them usable. This connects to how Jace Clayton pointed out that musicians using Auto-Tune in the Moroccan studio were not using the “Arabic” and “Pentatonic” presets, because they were not actually usable for their practice. This also connects to how Dourish discusses how “usability isn’t just about making the system ‘work,’ but that the system reveals its purposes to the user in a ‘useful’ way” (122-123). Allami points out that this sort of approach to software potentially causes more harm than good.

That the inclusion of such capabilities is so tokenistic and counterintuitive is really a shame. Rather than allowing users to discover such wonderful worlds and experiment with them, tunings are treated like stocking-fillers, used to make the main gift seem bigger and more exciting, knowing they will be thrown aside within minutes of opening. More importantly, this “othering,” whether innocent or intentional, is detrimental on many levels.

Allami believes that the tokenization of microtonality perpetuates the approach to looking at non-Western music as “ethnic” and “exotic.” This perpetuates the “cultural asymmetry in the tools for cultural production, understanding, and engagement” (Allami, 2019).

In “Translated,” I discuss how the instruments we use alter our perception of the world. Allami emphasizes that software design actually alters the way musicians hear.

When looking at non-Western music, the disaster of ET is even more painful. Not only have microtonal tuning systems been bastardised, but listeners' and musicians' ears have also been compromised. In the Arab world today, I don't know a single musician that doesn't use a tuner – set to the default ET – to tune their instrument. This means that the fundamental tuning of their open strings is set to ET and that their intonation is therefore manipulated.

The Arab world is suffering even more because of a misconception that the Arabic musical system is based on quarter tones, i.e. an octave divided into 24 equal parts. This is a grave misunderstanding and has led to the norm of musicians using electronic instruments to tune their “quarter tones” to -50 cents, which is not only incorrect but also sounds horrendous.

The solution for the hardware and software to “see” maqams is very different from the way actual musicians of the practice conceptualize it, similar to how Clayton discussed the way software calculates polyrhythms. The way issues in computation are solved must be compatible with the way humans engage with these materials, a sentiment echoed by Ge Wang in *Artful Design*.

### **Breaking free of 12TET**

Allami's first project towards solving these issues was Comma, a Max4Live device allowing for real-time tuning and real-time changing of tuning presets. Allami believes having a piece of software that allows for this kind of flexibility unlocked a new level of connection with the maqam scales he studied. They were now “unlocked in unlimited timbres, colours and shades, allowing me to explore [them] in compositional and sonic ways I could only

have dreamed of.” Allami believes that tuning in music software should “be about the celebration of difference – of cultures, ideas, methods, opinions, and tastes. It should also be about the celebration of choice, the choice of individuals to sound however they please.”

*Leimma* and *Apotome* are browser-based and free, designed to be maximally accessible. This is similar to Clayton’s approach. *Sufi Plug-Ins* also began as Max4Live devices, which were then ported to the VST format. Allami goes further by choosing to create software run entirely through web browsers. Allami specifically points out the educational potential for his software.

For too long, the world’s tuning systems have been presented as an academic concern—something to be studied rather than heard. *Leimma* offers an intuitive, tactile introduction for anyone. Even if you know nothing about the musical systems of Indonesia, Japan, or Iran, you can jump in and hear the differences immediately.

The educational effect extended to both artists and producers. Here is Tunisian producer Deena Abdelwahed on how *Leimma* and *Apotome* have influenced their work:

“Before this project, I didn’t know major and minor scales were Western,” says the Tunisian producer. “I thought they were simply ‘melodies’ and I didn’t realize there was an alternative.” The programs allowed her to musically access something within herself, to address an absence she had long felt but never been able to articulate. “I had always felt oppressed by my melodic phrases in Ableton. I don’t want to say my brain is wired to Arabic scales because I’m an Arab, but I found it much more logical to go from one note to another in *Leimma* and

Apotome. They brought me close to something familiar, closer to what I truly want to express. (Faber, 2021)

This shows that software influences your perception of the world, even if you are not conscious of the specific mechanisms by which it does. *Leimma* and *Apotome* are designed to allow users to un-train their habits influenced by other software design. This connects with De Souza's ideas on the ways habits can be learned and unlearned, which I discuss in "Translated" and "Altered." *Apotome* is designed for exploration and experimentation, to help us "unlearn" and "untrain our ears away from equal temperament and away from traditional rules of music making associated with different musical cultures."<sup>8</sup>

### **Digital Intent**

In the introduction to the user guide for *Leimma* and *Apotome*, Khyam describes the intent behind the project. The tools are "attempts to create transcultural, digital music making tools that can facilitate the exploration of melodic possibilities from musical cultures long repressed by Western music theory, modern music technology and the hegemony of 12-tone equal temperament."<sup>9</sup> Allami points out how the standard tuning system has affected all of music:

It is obviously non-Anglo-European cultures that have been mostly affected and disfigured by 12-tone equal temperament, but it is not exclusive to them. Anglo-European cultures have been affected too, as have the efforts of 20th century experimental Anglo-European composers. Tuning affects all music, and although

---

8. <https://calls.ars.electronica.art/prix/asset/379020/>

9. <https://docs.google.com/document/d/1vxLZaL8jeXQcj3m7q6qF42ZWAaG-2HIRkQZiGacRUXI/edit?usp=sharing>



the difference in comparison to 12-tone equal temperament is sometimes subtle, it is precisely these subtleties that make a difference. In this sense, “transcultural” could be a good word to describe the nature of these tools.

The design of Leimma and Apotome accommodates a wide range of hardware setups. Allami describes how he intentionally designed it so that it could be “integrated into any music-making or music-learning environment.” In “Where the Action Is,” Paul Dourish describes how users should be able to engage and disengage with software on multiple levels, and how designers should keep in mind the wide range of potential use cases for the software. Allami’s approach is similar, he intends for these tools to be used in a way that suits the user’s individual process.

What is interesting to me is that Allami specifically points out how he wants these tools used by educators, in-person or for online teaching. “Being browser based they are easy to access, and having clear, intuitive interfaces helps make them inviting for those new to the subject. All the while they’re also capable of satisfying the advanced user.” In my own exploration of non-12TET tuning, I have found a lack of tools that allow a user to bridge the gap between surface-level introductions, and more advanced topics.

Tuning is a complex subject and has occupied countless hours of some of the entire world’s greatest minds for millennia - but the tools to aid us in teaching, learning and exploring it, need not be. Think of the bamboo pipes of ancient China, or even the monochord used by Euclid - simple tools, behind which lie incredible philosophical, technical, scientific, practical and musical ideas.

In my own experience with Western contemporary music, I have often found it challenging to approach “non-standard” tuning. While breaking free of 12TET playing does require a technical and intellectual commitment, I have found that most materials available for teaching feel almost intentionally challenging to understand, making an already challenging subject entirely unintelligible. I greatly appreciate the openness with which Allami approaches software design.

Allami’s approach to design was informed by his own performance practice. He identified a gap in existing software, and created a series of tools that directly responded to a need in his practice. The development of a software design philosophy affects an artist’s perception of music. Allami presents a compelling case study of a performer who used software design to not only broaden their own awareness of their musical practice, but empowered others to go through the same process. As I consider the gaps I see myself in music education software, Khyam Allami will serve as an inspiration to me.

## Conclusions

I began this paper by exploring how a design-focused approach can influence the way music educators organize their teaching space. By connecting design texts to my own musical practice, I demonstrated how learning about a new subject is a matter of re-contextualizing it within practices that we are personally familiar with. Once that process is complete, we can then apply those lessons beyond the narrow application we began with.

Because there are potentially limitless ways to manage the technical and visual space of interface design, it is important for the designer to develop a philosophy that guides their approach to interaction. In this paper, I focused on the communicative function of design, and the processes by which we make technology personally meaningful to us. In a world in which technological progress is influenced by market forces, it becomes crucial for the designer to consider the human element of their designs.

Designers should consider the following questions: Who is my design for, and how does it impact my potential users? Does my design enable, obfuscate, or change the communicative process? Does my design leave space for users and communities to repurpose it for their needs? What is my design philosophy blind to?

Design is all around us, and there is no excuse not to consider the impact of design in everything that we do. Intentional design is impactful. Intentional design can be transformative, both for its users, and its designers. Design enables interaction with the world, interaction with those around us. Good design can create new space for artistic and intellectual exploration. We should strive for intentionality in our design choices. But first, we must go through a process of critically analyzing how design manifests in our own practice.

## Works Cited

- Allami, Khyam. "Microtonality and the Struggle for Fretlessness in the Digital Age." 2019,
- Bailey, Derek. *Improvisation*. Da Capo Press, 1993.
- Bangert, M, & Altenmüller, EO. "Mapping perception to action in piano practice: a longitudinal DC-EEG study." *BMC Neurosci*, vol. 4, 2003, pp. 26.
- Chen, J et al. "Stochastic aspects of motor behavior and their dependence on auditory feedback in experienced cellists." *Front Hum Neurosci*, vol. 7, 2013, pp. 419.
- Clayton, Jace. *Uproot*. Macmillan, 2016.
- Coessens, Kathleen, and Stefan Östersjö. "Kairos in the Flow of Musical Intuition." *Artistic Experimentation in Music*, Leuven University Press, 2014, pp. 416.
- Csikszentmihalyi, Mihaly. *Flow*. Harpercollins, 1990.
- David, Hans T., and Arthur Mendel. *The Bach Reader: A Life of Johann Sebastian Bach in Letters and Documents*. W. W. Norton, 1945.
- Dourish, Paul. *Where the Action is*. MIT Press, 2004.

Drost, Ulrich C et al. "Instrument specificity in experienced musicians." *Q J Exp Psychol*

(*Hove*), vol. 60, no. 4, 2007, pp. 527-33.

Faber, Tom. "Decolonizing Electronic Music Starts with its Software." Pitchfork, 2021, [https://](https://pitchfork.com/thepitch/decolonizing-electronic-music-starts-with-its-software/)

[pitchfork.com/thepitch/decolonizing-electronic-music-starts-with-its-software/](https://pitchfork.com/thepitch/decolonizing-electronic-music-starts-with-its-software/).

Heidegger, Martin. *Being and Time*. SUNY Press, 2010.

Hutchins, Edwin. *Cognition in the Wild*. MIT Press, 1995.

Ihde, Don. *Technology and the Lifeworld: From Garden to Earth*. Indiana University Press,

1990.

Jeannerod, Marc. *The Cognitive Neuroscience of Action*. Fundamentals of Cognitive

Neuroscience 1. Blackwell, 1997.

Kirsh, David. "Embodied cognition and the magical future of interaction design." *ACM Trans.*

*Comput.-Hum. Interact.*, vol. 20, no. 1, 2013, pp. 1-30.

Mcluhan, Marshall. *Understanding Media*. MIT Press, 1994.

Merleau-Ponty, Maurice. *Phenomenology of Perception*. 2013.

Meyer, Leonard B. *Emotion and Meaning in Music*. University of Chicago Press, 1956.

———. “On the Nature and Limits of Critical Analysis.” *Explaining Music: Essays and Explorations*. University of California Press, 1973.

Moore, GP, & Chen, J. “Timings and interactions of skilled musicians.” *Biol Cybern*, vol. 103, no. 5, 2010, pp. 401-14.

Nahmias, E. “Agency, authorship, and illusion.” *Conscious Cogn*, vol. 14, no. 4, 2005, pp. 771-85.

Östersjö, Stefan. “Shut Up ’n’ Play! Negotiating the Musical Work.” Dissertation, Lund University, 2008.

Östersjö, Stefan. *Listening to the Other*. Leuven University Press, 2020.

Palmer, C, & Meyer, RK. “Conceptual and motor learning in music performance.” *Psychol Sci*, vol. 11, no. 1, 2000, pp. 63-68.

Palmer, Caroline, Erik Koopmans, Janeen D. Loehr, and Christine Carter. "Movement-Related Feedback and Temporal Accuracy in Clarinet Performance." *Music Perception*, vol 26, 2009, pp. 439–49.

Rosenwinkel, Kurt. "The Next Step—2001." 2007, [http:// www.kurtrosenwinkel.com/archives/144](http://www.kurtrosenwinkel.com/archives/144).

Souza, Jonathan De. *Music At Hand*. Oxford University Press, 2017.

Stiegler, Bernard. *Technics and Time: The Fault of Epimetheus*. Meridian: Crossing Aesthetics, 1998.

Taylor, Timothy. *Strange Sounds: Music, Technology, and Culture*. Routledge, 2001.

Tucker, M, & Ellis, R. "On the relations between seen objects and components of potential actions." *J Exp Psychol Hum Percept Perform*, vol. 24, no. 3, 1998, pp. 830-46.

Tucker, M, & Ellis, R. "Action priming by briefly presented objects." *Acta Psychol (Amst)*, vol. 116, no. 2, 2004, pp. 185-203.

Tucker, Mike, & Ellis, Rob. "The potentiation of grasp types during visual object categorization." *Visual Cognition*, vol. 8, no. 6, 2001, pp. 769-800.

Tullberg, Markus. *Timber and Timbre*. 2018.

von Neumann, John. *Theory of Self-Reproducing Automata*. University of Illinois Press, 1966.

Wang, Ge. *Artful Design*. 2018.

Whitehead, Bruce A. "James J. Gibson: The ecological approach to visual perception. Boston: Houghton Mifflin, 1979, 332 pp." *Syst. Res.*, vol. 26, no. 3, 1981, pp. 308-9.

Windsor, W Luke, & de Bézenac, Christophe. "Music and affordances." *Musicae Scientiae*, vol. 16, no. 1, 2012, pp. 102-20.

Zbikowski, Lawrence Michael. *Conceptualizing Music*. Oxford University Press on Demand, 2002.