As the Luthiers Do: Designing with a Living, Growing, Changing Body-Material

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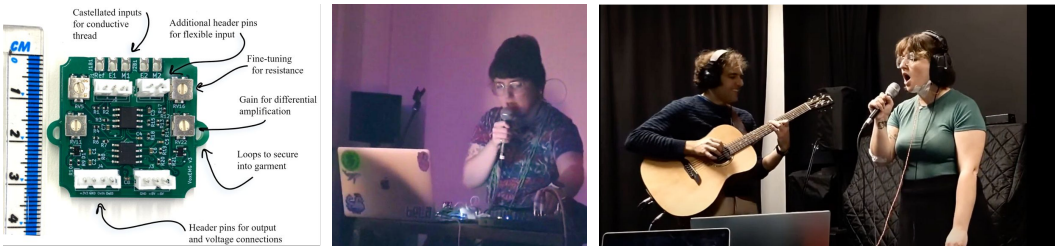

Fig. 1. Working with the materiality of the voice: noisy, unconscious, and unexpected muscle movements captured through vocal surface electromyography using the VoxEMG (left) [11]. Aspects of the body's materiality is incorporated into elements of a performance (middle, right) through sonification.

Through soma-centric research, we see the different interaction roles of our bodies: they are the locus of our experience, a conduit for our expression and engagement, a sensor of feedback in the world, and a collaborator in our interaction with it. More "traditional" examinations of the body might look at control over it; for instance, in my research around vocal embodiment, I see many teachers and practitioners alike talking about how we can maintain control over the body. However, bodies are living, inconsistent, and typically *weird*. In reality, we do not have as much control over them as we would like or think we do. In this position paper, I will touch on my research around vocal physiology and sonified and vibrotactile feedback as I frame our role in a new light — designers as Body Luthiers, who must address the body as a material with inconsistencies, flaws, and variability, and work with it as a partner, embracing its uniqueness and changeability.

CCS Concepts: • **Human-centered computing** → **Interaction design theory, concepts and paradigms**; *User centered design*; • **Applied computing** → *Arts and humanities.*

Additional Key Words and Phrases: materiality, surface electromyography, control dynamics, lutherie and craftwork, somaesthetics

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1 INTRODUCTION

Luthiers — referring to musical instrument designers, and specifically those who create string instruments like violins — work with wood, a material that is living, ever-changing, and unique. As with other woodworkers, the quality or uniqueness of that material often influences what it becomes or how the luthier works with it. This relationship with the material comes from deeply

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knowing and understanding the material itself, as an agent with its own role in the design process [3, 8]. Although specific tree types may be grown in very specific conditions, there are many uncontrollable aspects of their growth which ultimately influence the wood. The environment, especially with increasing impacts of climate change, location, age, weather, and so on ultimately make up the material; only some of these (age) or portions of these (perhaps hydration and sunlight aspects of weather) can be managed. The other influences must be managed by the luthier in the creation of the instrument; in woodworking, like other crafts, the material often dictates the design. This has also been the case for "digital lutherie," wherein aspects of a digital instrument such as programming environment and language and available parameter controls also influence the digital sounds created [6, 12], as well as in the dynamics of agency in fabrication [2]

My interest in this Workshop comes from an interest in treating the body the same; we would like to have complete control over our bodies, but we do not and cannot possibly achieve this. This is even more true (rightly so) for the bodies of others. Much like trees and other living beings, we are made up of our environments, locations, age, backgrounds, genetics, cultures, contexts, and physiology. Many of those things cannot be controlled; there are many background process in the body we do not understand in current science, and *many* which are autonomous and operate even in our conscious absence. I am interested in the idea of material influence in lutherie particularly because of its musical context. In my research field in vocal embodiment and connections to the vocal apparatus in singing, we can see human expectations of control over the body in contention with unconscious movement, daily variability, and other background factors [7, 10].

I would like to further explore how we can work as *Body Luthiers*, by approaching bodies as materials themselves, with interesting quirks, unique features, and ever-changing and growing qualities, both physically and experientially. For this Workshop, I bring this proposition in reference to the body variability and controllability in my voice research. As well, I provide extensive experience in working with unconscious body movement and "noise" in the physiology through my work with surface electromyography (sEMG), as well as other biodata sources I am currently exploring.

2 PERSPECTIVES

To briefly summarise my research: I examine the vocalist-voice relationship and how singers understand complex, multi-modal feedback within their body and through external audio feedback. This understanding allows vocalists to perform highly refined, technically-demanding tasks, even without a visible or tactile interface. Relationships and knowledge of living in the body drive this connection — even for non-singers, many of us can understand this vocal connection with respect to speech. What does it feel like to talk? Are we aware of the sensorimotor mechanics that allow us refined speech control? Mostly, no; through lived experience we understand our bodies and action-result cases, and through tacit knowledge of our bodies we can even imagine making sounds we have never made before.

My research explores the internal sensory experiences in singing, particularly in muscular movments of the laryngeal muscles, through auditory biofeedback. Using surface electromyography (sEMG), we are able to measure internal muscular movements involved in singing and create external auditory feedback, giving presence to the physical voice outside of the body [9]. This has provided rich experiences body from my own autoethnographic standpoint [7] and from the perspectives of other vocalists [10]. A component of these interactions I find most notable are elements of control; for both singing and speech vocalisations; this relationship is *not* one of control. I myself worked with many unconscious behaviours in my vocal technique; in places I felt my muscles should be more active, they were not, and often I would be convinced I was not moving, yet I was

unconsciously. Such unconscious or non-deliberate movements are useful in musical performance, where the body's role is that of a collaborator and provides a source of inspirational material [4, 7].

There are many moments where things go very wrong: The sensation of fighting against the body or not having our expectations honored by our action can cause a feeling of disconnect [10]. Sometimes these things are within our control: perhaps we pushed ourselves too much the previous day by staying up all night to write a thesis and now are in a battle of will with our drooping eyelids. At other times, changes to our bodies happen without our consent: hormones, hydration, illness, and other physiological factors can impact our day-to-day relationship with our bodies and our activity. For singers, these factors can make or break a performance (I have twice heard of singers who purposefully scheduled their concerts around their menstrual cycles to ensure their laryngeal muscosal lining would be unaffected by hormones). Some days the body just does not cooperate with what we want, and this can lead to not only disconnect from ourselves but also feelings of guilt, frustration, and anxiety. However, with time, patience, and deeper knowledge, many singers know their bodies well enough to work *with* them, acknowledging and adapting to their body's living qualities and their day-to-day variability.

In this sense, the idea of Body Luthierie is a helpful concept to approaching the body as a material; recognising we cannot control everything but embracing uniqueness and variability and, indeed, messiness [5, 13]. This can in fact offer insight into new designs and interactions; for instance, as with the vocal sEMG collaboration. As well, technology can also go wrong or act outside of our direct intentions [1]. In the end, this can lead to deeper connection and appreciation of the body itself. Especially following my autoethnographic work, the way I understand my body is not the same way I understand a person — we do not have a direct, spoken communication, but I know and trust that we understand each other. Through acknowledgement of the things we cannot change, we learn to listen to what is there and grow, adapt, and create with it.

3 METHOD: SEMG INTERACTION

For this workshop, I will provide a source of ambiguous data about our body through sEMG. sEMG's noisiness, ambiguity, and direct connection to internal movements inside can provide a sense of this body materiality. For instance, different bodies produce unique data streams; muscle positons are different and fidelity can be impacted by other body processes and body composition. The use of sEMG in interaction design helps depict the unique body (even uniqueness on a day-to-day basis) and view it in a novel, dynamic light.

I am able to bring materials for working with sEMG — my development in this area is also open-source, so other Workshop participants can further engage with it. In addition, I am now working with heart (electrocardiogram, aka ECG) and respiration measurements as depictions of the living body. I am also able to provide some information and materials to explore these bodily material aspects.

4 DISCUSSION POINTS

In conclusion, I would like to provide two specific discussion points I bring to this workshop:

(1) **How can we do as the luthiers do?**: As other designers work with materials, how can we develop processes which work with the body as a material; e.g., as a luthier allows the material to dictate the design, how can we create individual, even artistic pieces, as we work with individual bodies?
(2) **How can we focus on the *why* in our design?**: Perhaps, rather than prioritising fidelity, ubiquity, and effectiveness, how might we focus on individual, living bodies and embrace

their noiseness/messiness, impossible-to-generalise uniqueness, and playfulness. How might this shift benefit us in remembering *why* we do our design, research, and practice?

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