# The Distaff: A Physical Interface to Facilitate Interdisciplinary Collaborative Performance

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## ABSTRACT
This paper presents an interface designed for an interdisciplinary collaboration between a visual artist (known within this paper as a "visualist") and electronic musician. With the specific goal of enabling expressive real-time visual performance in conjunction with live electronic music, the interface draws from methodologies and design practices informing interaction design, HCI, and experimental music practices [7, 16, 20]. The affordances and general design techniques of the interface are described, and an initial reflection on the performative experience is presented, considering both the visualist's and musician's perspectives. What begins to emerge from this design experience is a core set of issues and values for performers working with media technology; the Distaff suggests ways we might approach such issues with expressivity, collaboration, and physical engagement in mind.

### Author Keywords
Audiovisuals; digital media; performance; collaboration; expression.

### ACM Classification Keywords
J.5. Computer Applications---Arts and Humanities---Performing arts, H.5.1 Information Systems---Multimedia Information Systems---Video, H.5.5 Information Interfaces and Presentation ---Sound and Music Computing

## INTRODUCTION
Performances involving multiple disciplines are often facilitated and enhanced through the use of technology [4], particularly in the domain of experimental music. The combination of dance, visuals, and music is increasingly becoming commonplace, partially due to the rising affordances computers provide in both hardware and software. In order to connect distinct elements of performance thematically, formally, or aesthetically, mapping procedures often play a crucial role, sometimes making it difficult for collaborators to discern how discrete agents are acting and interacting [5, 11, 13]. The inclusion of iPads and other tablet technology on the stage, automation of soundboards and lights, and projection of video are just a few indicators of the trajectory toward increasingly integrated multimedia performance practices. However, the novelty of these experiences present unique challenges to collaborating performers, as we attempt to accept—or reject—technology as a collaborator sharing our stage space.


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## INTERFACES AND THE BODY
The sense of physically being and interacting in the world is complicated in an age of virtual identities, second selves, and digital communications. Researchers and practitioners from disciplines ranging from HCI to gender studies observe that our physical bodies are both a barrier we wish to overcome [2] as well as an undeniable factor in our understandings of how we communicate with each other and act in the world [9, 14]. On the stage, we are engaged in a constant communicative feedback loop between our selves as actors and creators, and our inner interpretations of our own and others' actions [12]. We are simultaneously adapting to and interfacing with others around us at all times, in both perceptible and imperceptible ways. Though much of this interaction may seem immaterial, our bodies enable an understanding of the information being produced and interpreted that is unique. There is a tacit dialogue with the world that we can touch [2], and that physicality plays a large part in our notions of immersion and active engagement [3, 6, 15].

New interfaces can offer ways to transmit data across different disciplines that didn't previously exist. They can also complicate notions of what is immersive and what is distracting. The movement away from physical instruments toward digital ones can create less intimate, less expressive performance experiences [4, 19]. Bahn et al. discuss this development in great depth, positing that by creating purely or mostly digital instruments, we reduce or eliminate physicality, feedback, and gesture from our interactions on the stage [1]. The ability to "read" collaborators throughout the course of a performance, the physical dialogue between actuating an instrument and hearing the resulting output, and even being able to distinguish the exact location of a performer's contribution are all under threat when we de-prioritize the performers' bodies.

As it exists in current form, the computer as a performance tool is often perched awkwardly in an intra- or extra-diegetic space, sometimes vacillating unpredictably between the two. Performers take instruction from a networked iPad held at arms-length, musicians glance distractingly at the Max patch cueing them as to their next interaction—it is unclear whether these devices are meant to be props, instruments, or necessary evils. This paper considers three specific issues as particularly obvious byproducts of performance technology: *attention*, *mapping*, and *obfuscation*.

### Attention

Issues of attention present through technology which physically comes between the performer and the audience (or other collaborators on stage), in a way which disconnects the parties from each other and the larger work [18]. An example of this might be a laptop sitting on a table in front of a performer, giving occasional or constant direction or otherwise interfacing with the performance. The technology in such circumstances sometimes requires a level of attention which, for all intents and purposes, is observationally disproportionate to its role in the performance dynamic; it contributes systematically to the mechanics of the work, but appears to lend little or no creative input.

### Mapping

Mapping, though fundamentally important to the process of digitally enhanced performances [5], is a Pandora's Box of sorts. Performance technology in most cases carries out simple or complex mappings, connecting distinct parameters at a level ranging from autonomous to synchronous. On one end of the spectrum is one-to-one mapping, for example controlling the brightness of a video through the amplitude of sound being produced. On the other end is one-to-many or many-to-one mapping, in which many parameters are controlled or manipulated by simple or complex streams of information, for example an EKG monitor funneling data to a computational system which transposes that data into sound [17]. This particular issue is difficult to address, as "meaningful" is a subjective term. However, one can say that at its worst, mapping can render the connective threads of a piece meaningless, trivial, or unknowable to the audience.

### Obfuscation

Obfuscated performances are often referred to through the well-known "checking email" adage: who really knows what that laptop performer is doing on stage [18]? At the heart of such performances are often technologies which physically come between the performer and audience/collaborators and remove potential corporeal communication and expression from the performance, concealing information which would otherwise be conveyed through physical actions [1] (Figure 1).

One might argue that live coding, as a practice, provides evidence to the contrary. Within this discipline there is very little physical gesturing, and the instrumentation is enclosed entirely within a laptop, and yet there is little question that live coding can and does produce expressive, engaging content. In fact, live coding is an excellent illustrator of the importance of transparency, as the vast majority of live coders share their screens with the audience during performance. By "opening of the box," the performer exposes and reinforces the connection between their input and the system's output—the gesture is encoded in the text on the screen, and each change to that text is a performative action. For the live coder, the code itself is the instrument, and revealing as much to the audience provides an important level of transparency.

**Figure 1. Issues of attention and obfuscation in performance**

## DISTAFF

Named for the spiked spindle upon which fiber materials are spun, the Distaff is an instrument designed for the real-time generation and manipulation of visual content in conjunction with a musical collaborator. The system was designed as an exercise in incorporating technology in a way which facilitates communication and expressivity for the performer, maps input parameters thoughtfully into performance output, and conveys that information to the audience and other stage members, all while demanding no more attention than a traditional acoustic instrument would.

### Hardware

The Distaff interface (Figure 2) was born out of a series of prototypes focused on the importance of the human body in technologically-aided performances [1, 8]. Through several previous design experiments it became clear that color, movement, and space could constitute a core set of parameters for the live visualist, similar to how pitch, duration, and amplitude might be considered the basic toolset of the musician.

Using these principles to develop an instrument, the Distaff's hardware is almost entirely stripped from a Technics SL B2 record player, including the strobe light (used for calibration), variable speed fader, and motor (Figure 2). When switched on, the strobe light powers on and the motor engages. By sliding the fader up (away from

performer) or down (toward performer), the speed can be switched between 33 and 45 revolutions per minute (RPM), with a small amount of variable control between full speed and resting state.

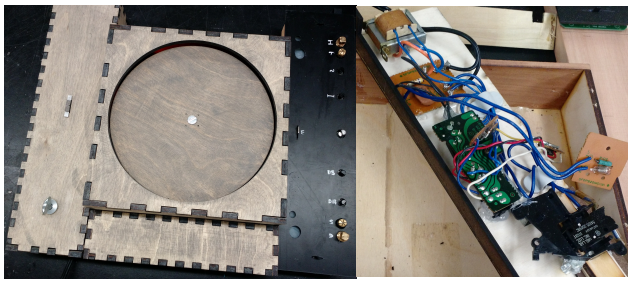

**Figure 2. Distaff (left) and turntable electronics (right)**

The main visual content comes from light-emitting diodes (LEDs), which can be quickly plugged into metal sockets embedded in the surface of the platter, connecting them to batteries mounted on the underside of the surface (Figure 3). A flexible borescopic camera captures, in real-time, the manipulation of the Distaff (Figure 4). The colors of the LEDs, the speed of the spinning platter, and the distance from the camera to the interface are the three main parameters that the artist can control.

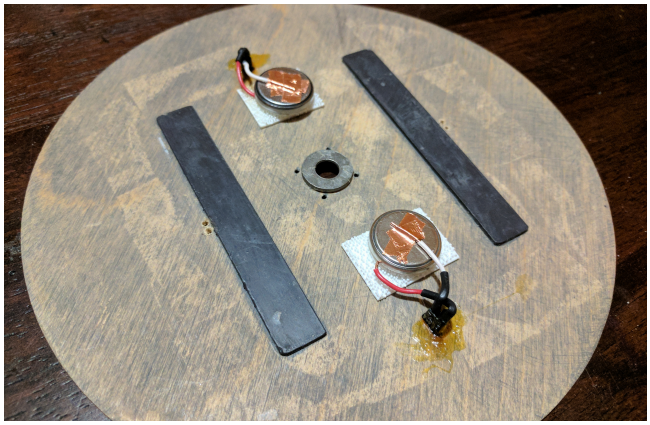

**Figure 3. Batteries mounted to the underside of the platter**

### Software

Jitter (Cycling74.com) is a programming language that allows for visual generation and processing. It is used by many live visualists to produce real-time graphics, much as it's sonic counterpart, Max, is used by musicians to produce electronic sound. For the purposes of this project, Jitter was used relatively sparingly, in order to preserve and highlight the focus on the hardware.

## PERFORMANCE PERSPECTIVES

Within the practice of live visuals, issues of collaborative communication and meaningful expression are crucial [18]. The majority of practitioners utilize custom software to accomplish their goals, with the rare MIDI controller making an appearance. This is a flawed approach, due to simple issues of sensory bandwidth. When performing with musicians, all senses are engaged: the visualist's eyes see the movements of cellist's fingers, her ears hear the resulting sound. With her fingers at the keyboard/trackpad, clicking number boxes one at a time, scrambling to respond in rhythm, looking at the screen, looking to the projection surface—is the output what she wanted? What box did she just click? Did she miss the dancer's signal while looking between these two glowing screens?

The visualist's eyes are demanded in too many places at once, and it is a fair bet that when looking in one place, another element of the performance is being neglected. There are simply too many sensory demands to attend to, and in most cases the suffering party is the collaborator. When they look to the visualist for information and all that she can provide is a preoccupied glance, she is failing as a partner and as a performer.

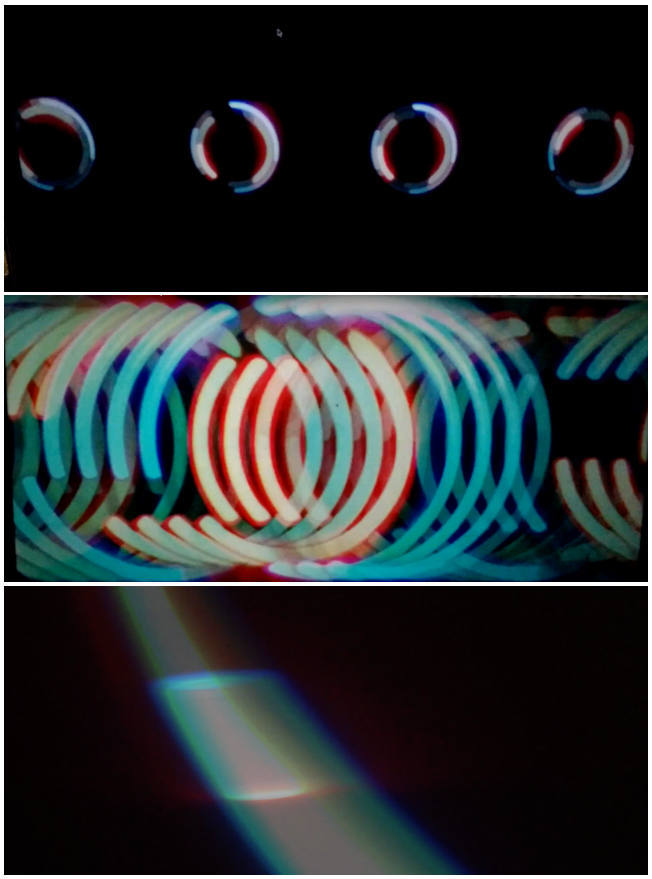

**Figure 4. Examples of The Distaff's performance output**

### Inter-Facing the Music

The Distaff interface has its faults and flaws, as any instrument, new or old. It is hard to learn, and harder to master, and the speed at which a performer can switch between material leaves much to be desired. However, what it does enable is worth reflection:

- Eye-contact: The hands of the visualist can manipulate the interface, maintain ongoing activity, and even change material in some cases, all without the need for visual attendance. This allows the performer to watch the

musician and communicate non-verbally with them throughout the performance at a significantly higher level than with a computer-only interface.

- Tacit Presence: The physicality of the Distaff itself provides a more engaging, immersive experience for the performer. The feel of the wood spinning under the fingers, the pressure applied to slow or quicken that motion, even simply pushing a button and turning a knob at the same time all contributes to a performance in which the visualist may feel actively *present*.
- Physical Expression: Physically engaging with the interface enables the expression of intentions both to the audience and the musical collaborator. Leaning in, backing away, timing gestures—all of these actions are possible on a laptop, but they are not expected behaviors in the same way as with traditional or acoustic instrumentation.

The freedom to cue collaborators on the stage, engage with the interface physically, and express intent visually are powerful capabilities [10], ones which are at risk of falling by the wayside when situated behind a computer screen. The Distaff, while still in early development, enables a more effective and productive performance experience.

## CONCLUSION

This paper presents a new interface for cross-disciplinary collaboration, and identifies three particularly salient issues facing multimedia performers today: mapping, attention, and obfuscation. The Distaff is designed to specifically enable expression and thoughtful collaboration on the stage, but more than that it provides an opportunity to critically reflect on how we might enact and evaluate such qualities. By focusing on the increased eye-contact, tacit presence, and physical expression enabled by the instrument itself, a framework begins to emerge within which visual performers can approach ideas of color, movement, and space with collaborative and performative objectives.

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