Dinosaur Choir and the Insect Orchestra

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1 Program Notes

Dinosaur Choir & the Insect Orchestra is a work for hadrosaur skull instrument, soprano, and audience participation. The dinosaur skull instrument, part of the Dinosaur Choir project, recreates the sound of an extinct hadrosaur, the Corythosaurus, a duck-billed dinosaur with a large cranial crest that scientists hypothesize functioned as an acoustic resonator.

Fig. 1. Performance of Dinosaur Choir & the Insect Orchestra, 2026.

The skull instrument is 3D printed from fossil scans and built at approximately the scale of the original specimens. It functions similarly to a wind instrument, incorporating a computational syrinx (avian vocal organ), whose parameters are derived from avian biological research and adjusted using Corythosaurus fossil measurements. In performance, the musician's breath, captured via throat microphone, drives the modeled vocal system. Optical motion capture of the mouth modulates vocal muscle tension in the digital syrinx. Additional parameters are informed by comparative anatomy from birds, alligators, humans, and Corythosaurus inner ear fossils.

While science is one way of knowing dinosaurs, this work explores how musical instrument design and performance can also generate knowledge.

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Like many recent audience-interactive works that blur the boundary between stage and listener, Dinosaur Choir & the Insect Orchestra invites the audience into the act of sounding itself. The audience becomes part of this act of reconstruction. Using a QR code, listeners join the piece via a web app and perform eight movements through smartphone-based instruments. These instruments, including cricket, frog, cicada, and dinosaur voices, are created using physically-based modeling synthesis. Many are activated through motion capture and gesture; for example, the cricket instrument is played by running one's finger across the thumb, mimicking stridulation. (Alternative versions are provided for devices without motion capture.) Together, the audience forms a distributed paleoacoustic soundscape surrounding the hadrosaur instrument and soprano, at times joining the stage performers directly in shared chorus.

Fig. 2. Closeup of Performance of Dinosaur Choir & the Insect Orchestra, 2026. A second dinosaur skull instrument (Rawr!) is visible in the photo as part of the larger concert program but is not part of the submitted work.

My work on dinosaur vocalization has increasingly moved toward embodied and collective practice. As a social Argentine tango dancer, I am deeply interested in how synchronized movement and shared rhythm create profound forms of connection. Tango offers a model of social musicality, strangers entering temporary synchrony through attention and breath.

In this project, I extend that social musicality into the concert hall, a space not traditionally structured for participation. By activating the audience as sonic collaborators, I explore how deep time might be encountered collectively, not as distant prehistory, but as a shared, living vibration.

2 Project Description

Dinosaur Choir & the Insect Orchestra is a musical work that emerged in part from solo rehearsal and improvisation with the hadrosaur skull musical instrument, and in part from the development of four motion-capture instruments designed for

smartphone interaction. The submitted video documentation is 6 minutes long, but the proposed duration is approximately 8 minutes.

The musical instrument (*Dinosaur Choir: Adult Corythosaurus*) is part of a larger research project recreating dinosaur vocalizations using CT scans of fossil skulls as well as paleontological and bioacoustical research [5][4]. The *Dinosaur Choir: Adult Corythosaurus* voice box is based on the bird syrinx (bird vocal box) because recent research suggests that dinosaurs had syringes instead of larynges (like mammals and crocodiles) [16]. Older research implied that dinosaur vocal boxes were more likely to be larynges, and it remains an open research question [6].

The computational model for the *Dinosaur Choir: Adult Corythosaurus* employed in *Dinosaur Choir & the Insect Orchestra* is based on a bioacoustic model of the dove syrinx [8] [18]. Parameters such as trachea length and vocal membrane circumference have been altered to reflect Corythosaurus skull and skeletal measurements. The actual organ length and placement are not known, so these measurements provide a range of possibilities rather than definitive conclusions. Other parameters, including vocal cord tension ranges and input air pressure ranges, have been adjusted to produce stable sound within the altered anatomical constraints. All estimated parameters for unpreserved soft tissue are informed by comparative data from birds, alligators, and humans and therefore function as both best estimates and creative interpretations of missing biological data.

The *Dinosaur Choir: Adult Corythosaurus* musical instrument uses a throat microphone [1] to capture breath input. The Google MediaPipe face landmark detection model[2] is employed to detect mouth shape. Mouth-tracking control has a rich history within NIME, including applications to bioacoustical models [7]. The computational model is implemented in the browser. Microphone audio is translated into dinosaur air sac pressure in real time, and mouth shape determines vocal tension. The wider the mouth horizontally, the greater the tension, and generally the higher the pitch. The overall two-dimensional mouth area modulates vocal tension at finer granularity, with more open and wider mouth shapes creating greater vocal tension and more closed mouth shapes reducing it. The computational vocal model is written in JavaScript using the Web Audio API [3] and implemented as a ToneJS plug-in[4]. While exhibition versions of *Dinosaur Choir* use an iPad Air [5], in this work I run the software on my laptop and connect to the instrument for sound output.

The audience interface runs on smartphones in a web browser and consists of four musical instruments and panels for receiving instructions from a server, referred to as the conductor. The use of audience smartphone interaction is inspired by recent related works such as [10]. The four instruments were created for motion capture and smartphone interaction and implemented for web deployment. They are implemented in JavaScript using Google MediaPipe, the Web Audio API, and ToneJS. Visual web design was created using Figma[6]. The conductor site and server are implemented using WebSockets and Node.js.

The first audience instrument uses the *Dinosaur Choir* computational model and mouth tracking to create dinosaur vocalizations. Instead of using microphone audio to drive air pressure in the syrinx model, this version uses vertical mouth openness to drive air pressure and horizontal mouth openness to drive tension changes. This modification allows easier use on a phone, since blowing into a microphone often requires tilting the camera away from the face. If the participant does not have access to motion capture, they can activate a fallback interface and drag a black circle to control the sound. In this case, greater vertical position corresponds to higher air pressure, and movement toward the left corresponds to higher vocal tension.

The second instrument is the cricket, developed from cricket bioacoustical research [3] [9], and based on a previous implementation originally for microcomputers [1] [2], with further refinements such as an envelope follower allowing smooth overlapping strikes (i.e., syllables) and other minor adjustments to increase realism. This instrument uses hand tracking and allows participants to generate cricket sounds by rubbing their fingers against their thumb, mimicking cricket stridulation. Each rubbing gesture creates excitation impulses analogous to the tooth strikes produced when crickets rub their wings together. The vertical location of the participant's hand on the screen determines the resonant frequency of the wing model. If motion capture is unavailable, participants can drag a black circle on the screen to generate excitation impulses, and the vertical position of the circle determines the resonant frequency.

The third instrument is the cicada, based on cicada bioacoustics [17] and informed by the Smyth & Smith [12] [11] implementation. The code was simplified to improve performance in the web audio context. As with the cricket, hand tracking is used, and finger bending and movement drive rib excitation corresponding to the tymbal mechanism of the

[1] https://iasus-concepts.com/product/nt5-throat-mic/
[2] https://developers.google.com/mediapipe
[3] https://developer.mozilla.org/en-US/docs/Web/API/Web_Audio_API
[4] https://tonejs.github.io/
[5] https://www.apple.com/ipad-air/
[6] https://www.figma.com/

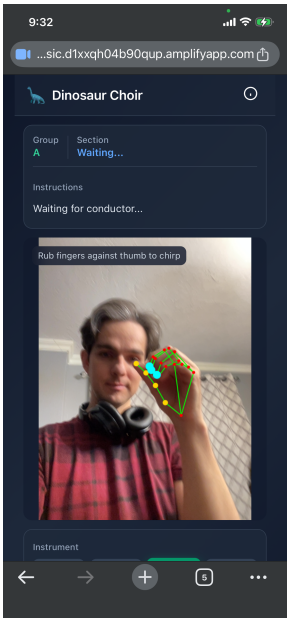

Fig. 3. Participant using the Cricket instrument, 2026.

cicada. Faster movements produce more complex sounds. If motion capture is unavailable, participants can tap the screen to generate tymbal excitations.

Finally, participants can embody a frog using a smartphone instrument. The frog model is based on mechanistic models of anuran phonation [13][14]. Following general models of self-oscillating laryngeal valves, it was implemented as a nonlinear lumped mass–spring valve [15] coupled to simplified acoustic resonators representing laryngeal and vocal sac cavities. Like the dinosaur instrument, the frog uses mouth tracking. Vertical mouth openness drives lung pressure and vocal stiffness, producing a more croaking quality when the mouth is more open. Mouth openness also inversely affects oscillation damping so that perceptually a more open mouth produces a louder and more voice-like call. Participants can adjust call frequency using a slider to approximate different frog species.

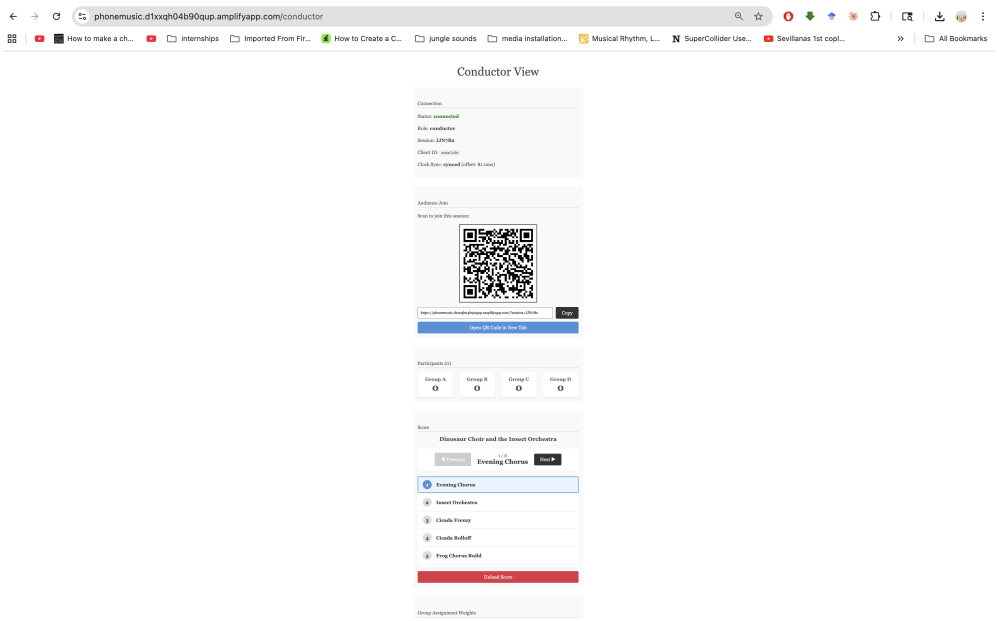

Fig. 4. Conductor view for the Interactive Score of Dinosaur Choir & the Insect Orchestra, 2026.

The conductor server provides instructions specifying when and how much to play, delivered to each audience member through the phone interface. A conductor page generates a custom QR code for each performance, and audience members access the work through the provided link. Upon joining, participants are assigned to groups and receive different instructions and instrument availability depending on their group. During performance, the performer advances through sections of the score, each of which specifies distinct instructions and instrument configurations for each group.

3 Technical Notes

Dinosaur Choir & the Insect Orchestra requires at least 3ft X 3ft of space to be performed. The work requires proximity to an electrical outlet or another source of external power. WiFi access is required.

3.1 Equipment Artists Provide:

- 1 *Dinosaur Choir: Adult Corythosaurus* musical instrument (includes speaker, amp, microphone, webcam)
- laptop
- audio interface

3.2 Equipment Required from Venue:

- Tables: 2 tables 24 inches X 24 inches X 48 inches (or some combination of tables that provide that area). I can also perform at normal seat-height tables.
- 2 microphones, dynamic microphones preferred with a tighter pickup pattern
- 2 microphone boom stands
- 3 audio outs to PA/speakers
- Access to electrical outlets/power
- Access to WiFi preferred
- Projector or large screen to show the QR code to the audience

4 Media Links

Documentation:

- Musical Performance video: https://vimeo.com/1164134260?share=copy&fl=sv&fe=ci
- Audience Interactive App Demo Video: https://vimeo.com/1164577315
- Audience Interactive Web App: https://phonemusic.d1xxqh04b90qup.amplifyapp.com/
  The instruments in the above application are completely playable without a conductor or score. The instructions say "Waiting for conductor..." and "Waiting..." but this is irrelevant unless you are playing as part of a musical work. By default, it will allow all the instruments to be played. Audio is calibrated for phone speakers and may sound distorted when played through larger or external sound systems.

5 Ethical Standards

Dinosaur Choir has been made accessible to the public as an interactive installation displayed at public museums, talks open to the public, and used in several public musical performances. The dinosaur vocalization code will be released open-source and the interactive dinosaur sound can be experienced remotely (without the physical skull) via an interactive website. I also have plans to release open-source 3D models.

No empirical user studies have been performed with the instrument, so issues of inclusion in that context are not relevant to this work.

Dinosaur Choir is fabricated using PLA plastic, and does not require replaceable parts, unlike previous versions, and thus is more sustainable.

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