Modeling hand clapping

Hand clapping is among the oldest and most fundamental human behaviors. The basic acoustics have long been known: Clapping cupped palms together, for example, produces a deeper pitch than clapping the fingers of one hand to the palm of the other. And the faster you clap, the louder the sound you produce.

But researchers have not devoted much study to understanding the physics of a round of applause. To investigate clapping acoustics, a team led by Yicong Fu and Sunghwan Jung of Cornell University used a microphone and a high-speed camera to capture footage of three common hand-clapping configurations—cupped, palm to palm, and finger to palm. The photo shown here is a still from one of the videos. To reproduce hand clapping in a controlled manner, the researchers digitally modeled the hand configurations and used a 3D printer to make replicas out of a silicone that resembles human skin. To help visualize the fluid motion of the air expelled from the palm cavity when the two hands collide, they dusted the replicas with baby powder.

Fu, Jung, and their team found that when hands clap together, the cavity they create operates like the one inside a Helmholtz resonator—a simple acoustic instrument essentially composed of a vessel with an outlet at the end of a neck. When pressurized air is forced out of the vessel, it resonates at a specific frequency. (Think of how blowing across the top of a soda bottle produces a distinct pitch.) The baby powder helped the team locate the resonator's neck and outlet, which were both determined to be at the opening between the thumb and the forefinger. The researchers also found that the soft tissue of human hands contributes to the short length of a clap because the tissue absorbs energy as it is deformed. They express the hope that architects and engineers will be able to use an accurate model of hand clapping to help in acoustic design. (Y. Fu et al., *Phys. Rev. Res.* **7**, 013259, 2025; photo courtesy of Yicong Fu.) —RD