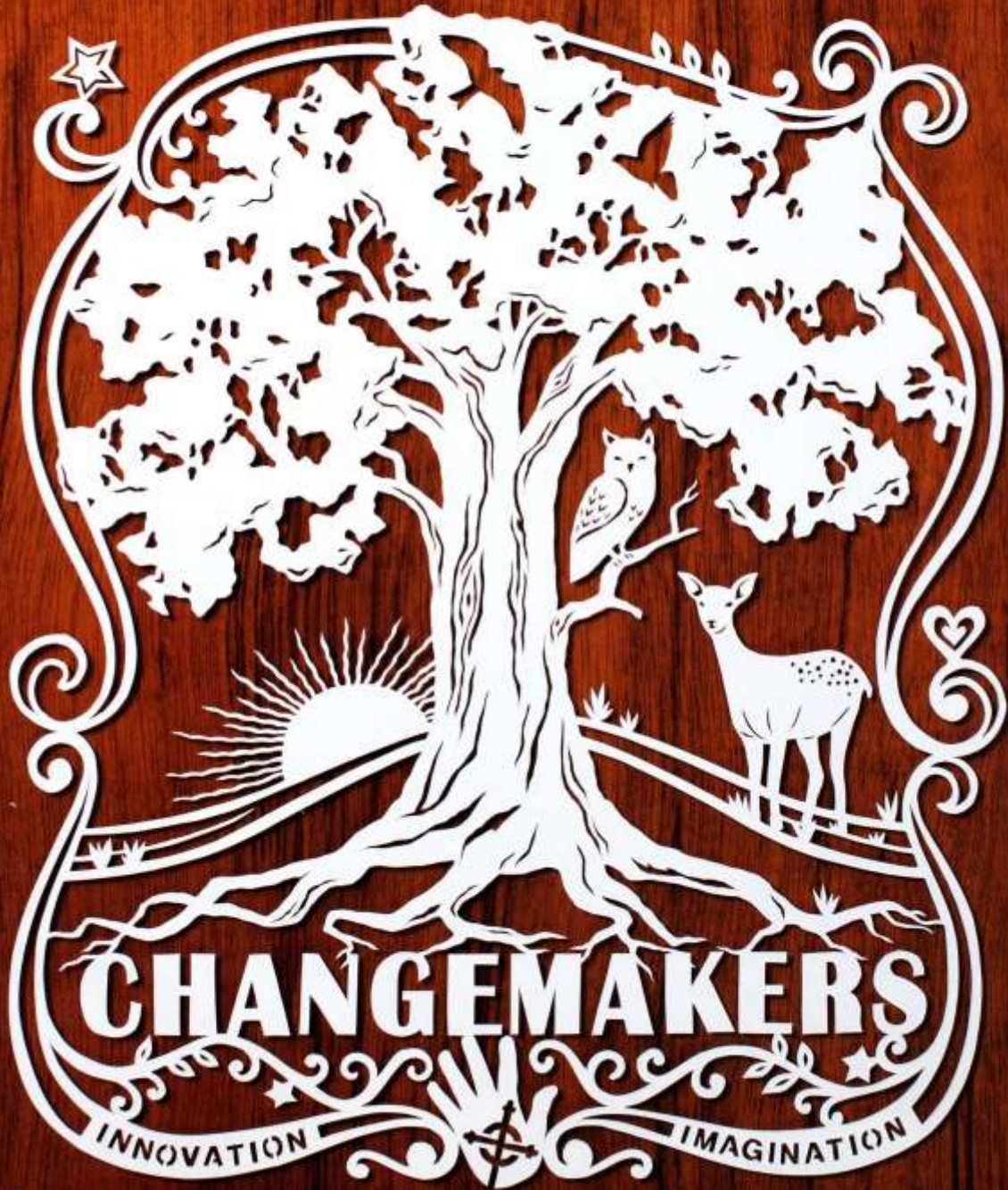


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USD Electrical Engineering Professor Tom Schubert points out that music has long been of great importance to the intellectual life.

[convergence]

WHEN MUSIC MET SCIENCE

Professor helps marry two disparate disciplines

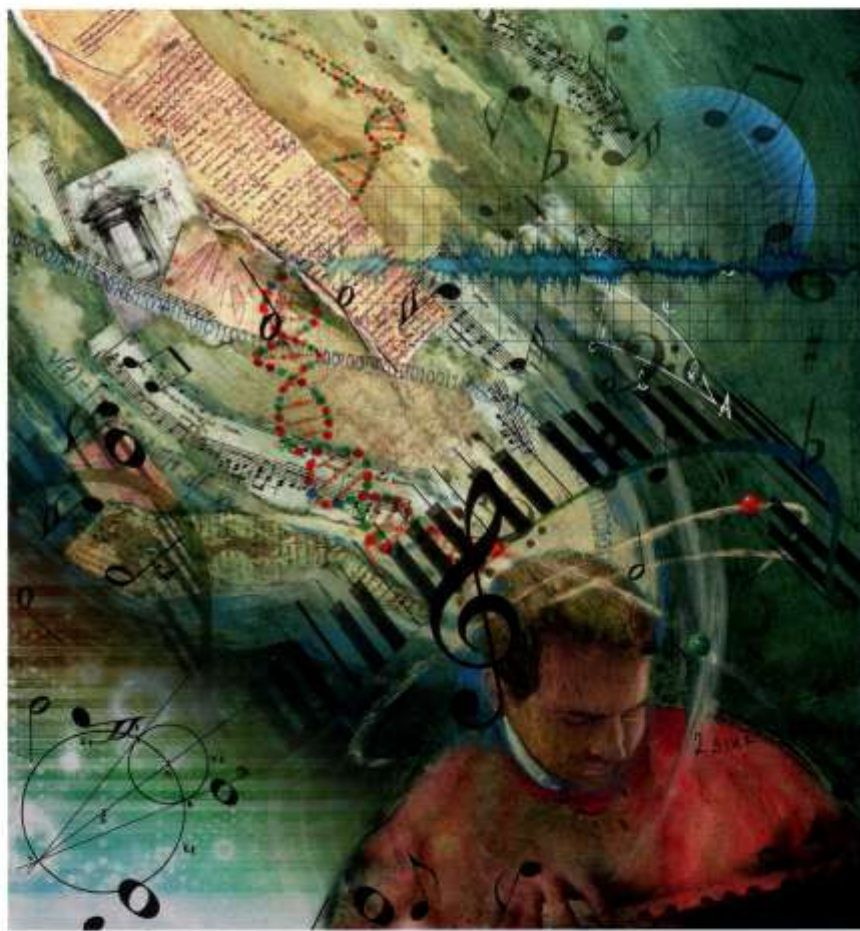
by Steven A. Murray

There was something missing, and Tom Schubert knew exactly what it was. Music. When the USD professor of electrical engineering pointed out that a 2010 conference symposium on science and the arts “was mostly sculpture and painting,” he was promptly given the job of setting up a 2011 session that filled the gap.

It was a logical assignment for Schubert, who’s not only an avid musician, but also principal bassoon for the La Jolla Symphony.

With the help of three USD faculty members, Schubert arranged a session that included scientists with diverse perspectives, anchored by a common love of music and its connection to their professional lives. The result was “Music and the Sciences: Synergies Among Musical Arts, Math, Science, and Engineering,” a symposium given as part of the American Association for the Advancement of Science — Pacific Division 92nd meeting, which was held on campus last June.

Music has long been important to intellectual life: Pythagoras studied harmonics and vibration, Leonardo da Vinci designed musical instruments and Albert Einstein played the violin. “The relationship between science and music isn’t a new concept,” Schubert explains. “Throughout much of Western history, science and



art were considered as forms of philosophy. This symposium was an opportunity for people separated by their respective scientific disciplines to re-

explore common ground.”

Schubert worked with Associate Professor of Mathematics Ani Velo to organize presentations. A violin and piano play-

er in childhood, Velo volunteered because “both my favorite subjects, math and music, were involved.” Together, they assembled a slate of

speakers from around the country representing physical science, cognitive science, engineering, history and music practice.

Shubert established a general pattern for the symposium with his talk about the physics of music. He discussed the basics of how notes are generated and how scales are built for both stringed and wind instruments, and linked physical characteristics such as string length and hole stops to the mathematics of Fourier analysis.

Like Schubert, David Malicky is both an engineer and a musician. The assistant professor of mechanical engineering plays the piano and occasionally sits in with San Diego Contra Dance Community Band. Malicky's professional interest in music came through his classroom work. "I needed a woodworking project for my engineering students," he recalls. "So, I had them build their own guitars." His interest in the guitar as a construction project soon extended to the guitar as a research problem. "But to make sure that the project would give good results to the students, I needed to know more about guitar acoustics."

Malicky brought an array of guitar components to accompany his talk of engineering experiments. "I was fascinated by how luthiers — the craftsmen who make stringed instruments — get very successful results based on experience and judgment. Clearly, what they're doing works, but is every step of their process necessary to the result?" His research testing involves materials, construction methods and resulting tonal qualities which, when finished, could place the craft of guitar building on a more scientific foundation.

Ron Shaheen, adjunct assistant professor of music, is looking into technology to make

his singing classes more effective. His view is that good teaching requires good feedback, especially when it comes to providing clear information about a student's performance and showing them the most efficient path to improvement. Shaheen is now experimenting with a commercial product that provides such support through a spectroscopic analysis of the singer's voice. Software like this can allow students to quickly assess and adjust their own vocal patterns, reducing their learning time.

Wearing a headset and microphone, Shaheen described some of the essential characteristics of classical singing, such as vowel formants and the singer's formant, and explained their importance to musical performance. He then demonstrated a range of these characteristics using his own voice and showed the impact of using the software. "I've been using it primarily on myself, and occasionally I'll use it with one or two of the singers in my private studio," he explained. "I'm hoping to begin to use it at USD this fall but, when I do, it will most likely be with the more advanced singers."

Other presentations from extramural speakers augmented the symposium with discussions of music as information theory, the mathematics of novel scale progressions and the cognitive processes underlying musical pattern recognition.

Energized by the music interests of his USD colleagues, and enthused with the possibilities of cross-disciplinary collaboration, Schubert is already thinking about a future symposium to include talks by neuroscientists, practicing musicians and makers of exotic instruments.

He's got at least one colleague convinced already. Velo is an enthusiastic proponent: "It was very eclectic," she says. "And a lot of fun." 🎵