

## Composed Research FACULTY PROFILE: ELAINE CHEW



**As her fingers flew back and forth** across the keys of a grand piano interpreting the intricate bi-tonal composition “Doubles” during a December concert in Los Angeles, Elaine Chew was also getting in a little practice for her day job.

“My technical training is in operations research, the science of decision making,” explains the assistant professor of the Daniel J. Epstein Department of Industrial and Systems Engineering. “A concert performance is the result of a series of decisions, conscious or unconscious. A musician plots a course through a complex network of choices using his or her experience, analysis, and instinct.”

Chew is also a senior investigator at the Integrated Media Systems Center (IMSC), a teacher, an accomplished international concert pianist, and an avid proponent of new music.

### Crossing Cultures & Disciplines

Born in Buffalo, New York, she spent most of her childhood in Singapore before returning to America to study music, mathematics, and engineering. She majored in music and computational mathematics as an undergraduate at Stanford, and received her master’s and PhD in operations research from MIT.

In her PhD dissertation, Chew began to explore tonality in music by using mathematical models. She has since created computer models that mimic human capabilities in finding keys. “Most people have the ability to determine the key of a musical passage intuitively, though they may not realize it,”

she says. “When you hear the music, you can pick out the most stable pitch, which is ‘doh,’ and you have found the key.”

Chew believes music is an ideal domain in which to study communication, creativity, human perception, and cognition. By building computer models that can probe more deeply into the structure of music, and by relating this

structure to performance decisions, she hopes to gain a deeper understanding of human creativity and communication.

“Music, mathematics, and engineering are all human attempts to describe and understand the logic and patterns in the world in which we live,” she explains. “Using the language of one to describe the other, and understanding the commonalities among seemingly disparate fields, reveals as much about ourselves as it does the world around us.”

### Research Through Composition

Peter Child, an MIT professor of music, composed Chew’s concert piece, “Doubles.” It stemmed from several Chinese and Malay melodies and folk songs from her childhood. The MIT professor reworked the melodies into a series of complex pieces for piano. “I am not a composer,” she says, “but I do like to work closely with composers on their creations.”

In Child’s bi-tonal composition, the pianist’s left and right hands each play in different keys and often in widely varying rhythms. It can be a challenge for pianists and audiences alike. Yet “Doubles” was easily the most melodic part of the evening’s program, and many of the images from the words of the original folk songs were apparent to the mind’s eye. This was surprising because Chew gave Child the melodies to the folk songs, but not the lyrics.

Chew says that as a child, she and her siblings competed to see who could sing “Spring Song” the fastest. The song is about an old man lamenting over his spent youth

symbolized by birds flying away. Child presents that melody in a rush of fleeting notes, the fastest tempo heard in “Doubles.” The “Cockatoo” is characterized by a series of playful and staccato notes that sound like a bird hopping. Two other Malay melody-based pieces, “Riversong” and “Sampan Variations,” culminate in a burst of ragtime, an American musical genre from the Mississippi Delta. The music has made cross-cultural connections about rivers and water.

In a discussion that preceded the concert, Child said that composers who put poems to music must carefully match the rhythm and tone of their music so that it reflects what the poet’s words convey. Why then, did Child’s “Doubles” capture so many of the images and feelings expressed in lyrics he had not seen?

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“It must have something to do with the piece’s original composition,” Child says, and Chew adds that “folk songs are some of the oldest music in existence.” Many of the songs Chew sent to Child were songs that children have been singing for countless generations, perhaps for thousands of years. The words and the music have combined on a very fundamental level.

“I’m not surprised,” Chew says, “that a New England composer can evoke the same emotions from audiences that I felt as a child in Singapore, because music transcends cultures.”

Some artists maintain that it is not possible to explain a concept such as melody. Chew clearly disagrees. She uses modern engineering tools to investigate music. “Understand music and you begin to understand how the human mind works.”