T-Shaped Music Tech Curriculums: Preparing Music Technology Students for the 21st-century Creative and Technology Workforce

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Abstract
This paper documents and communicates efforts to cultivate T-shaped professionals within music technology curriculums in higher education. In addition to teaching the requisite music and music technology competencies that are necessary for a successful career in music technology fields, music technology programs are also poised, without too much additional overhead, to teach transdisciplinary competencies within the music tech curriculum. This allows students to branch out and find employment in information technology fields, in addition to music technology fields. For more than a decade, the University of Nebraska at Omaha has deployed a music technology curriculum that graduates T-shaped professionals. Graduates from the program find employment in diverse fields ranging from music to information technology. This paper and presentation outlines aspects of the curriculum that prepare students to be T-shaped professionals.

Keywords
interdisciplinary , information, technology

Aims
Dr. Phil Gardner from Michigan State's Collegiate Employment Research Institute, points to work and writings from Jim Spohrer from IBM Labs and serial tech entrepreneur Judy Estrin regarding the orientation of professionals in the current information technology workforce who are not only surviving but who are also thriving. Spohrer identifies these techno-

logy professionals as T-shaped professionals. T-shaped professionals possess deep skills and knowledge in one discipline and one system, but also have broad skills and knowledge in many related pertinent disciplines and systems. More importantly, the T-shaped professional possesses transdisciplinary competencies, such as programming, communication, problem solving, analytical thinking, Agile/Scrum, and creativity/ideation, which allow them to cogently integrate their deep skill/knowledge sets with other disciplines, in the pursuit of solving complex problems. Curiously, the concept of a T-professional is not new. Daniel Pink described similar traits as part of six metaphoric senses in the early 21st century and the work of experimental technology-mediated Intermedia artists of the 1970s are also echoed in the T-shaped model. In addition, a handful of academic programs in American higher education had long-established programs that, although named differently, recognized the value of musically T-shaped professionals, especially musically-oriented technology professionals, and educated their students as such. These institutions include Indiana University Purdue University at Indianapolis and University of Nebraska at Omaha, which will be the case study described in this paper. These institutions instill deep knowledge and skill in core music technology disciplines and systems, broad skill and knowledge in a variety of disciplines and systems, and the transdisciplinary competencies to cogently connect a variety of disciplines and systems.

Methods

The curriculums that instill deep competencies in music technology are well-developed and long established, although much work does still need to be pioneered in terms of pedagogy, diversity, and sustainability. Programs such as the music technology program at the University of Nebraska at Omaha, not only train students to achieve a high level in the music technology field, the program also instills transdisciplinary competencies in pursuit of graduating T-shaped professionals. Several of these transdisciplinary competencies are covered in this section.

Programming terminology and concepts: Max/MSP (and in some cases, Pd), is one of the primary technology platforms used in the music technology programs at the University of Nebraska at Omaha. In addition to deep learning Max, electronic composition, acoustics, and digital audio,

students also learn, through Max, several information technology basic concepts including object-oriented programming principles (such as encapsulation and abstraction), program logic, conditional statements, control flow,, data structures, retrieval, networking, software development lifecycles, and human-computer interaction.

Creativity: Creative processes for composing electronic music (fixed media, interactive, and multimedia) are also the same creative processes that are taught to information technology students. Many creative processes are employed by the technology start-up entrepreneurial communities as well as larger companies who are invested in intrapreneurship. These creative processes are documented in detail in Michael Michalko's Thinkertoys, which is a handbook of creative thinking techniques. One of the more widespread creativity techniques used in information technology is a lateral thinking approach called S.C.A.M.P.E.R. and it has many parallels with a theme-and-variation creative process in music. Although it is a lateral technique, S.C.A.M.P.E.R. also has provisions for free association ideation and synthesis techniques (not in the computer music community's use of the word synthesis, but rather in the creative community's use of the word).

Emotional Resonance: One of the most important aspects of new product design and development is the incorporation of emotional resonance in design. Emotional resonance is nothing new, as we have had the FCB grid since the 1980s, laddering techniques since the 1960s, and Design Thinking and new ethnographic approaches to informing the design process have incorporated elements of recognizing and leveraging emotional resonance. This area is where musicians, especially technology-mediated musicians, can organically excel, as musicians make emotional communication (independent of implementation) the primary driver of their *raison d'être*. As obvious as it may be, information technology emotional design and musical emotional messaging have very similar aims, and tapping into those similarities allows a music technologist to provide valuable insight into the development of new products and services in the information technology areas, although it is acknowledged that artists draw their sources for emotional resonance independently of requisite qualitative research that would normally be applied by their information technology counterparts.

Systems Thinking: One of the most important transdisciplinary competencies in information science is the ability to view and work with large systems. This includes the ability to understand a system's inner workings and details and how they combine to serve the purposes of the larger system. This is important in both the design of a new product or service and in the analysis of a system, product, or service when it has to be refined, updated, and upgraded. Students learn this sensibility when studying Max, if instructors point out the parallels.

Outcome(s)

Although many students from the University of Nebraska win traditional jobs in the music technology field, others from the UNO program also go into information technology fields working for companies like TPG Telemedia, ConAgra, Guild Media, 3-D Robotics, Inc., Mutual of Omaha, SkyVue, Northrup Grumnan, and Boys Town Medical Center.

Rationale

No one in the field of music would ever concede the importance of the intrinsic value of music, and make that importance secondary or even subservient to another discipline. However, no one should discount the value of a musician/music technologist as a T-shaped professional and the value that they can provide to other disciplines. With the UNO program as a proven case study, in a music technology curriculum, T-shaped professionals can be easily cultivated, and thereby adding more value to the music curriculum as well as the other disciplines to which music technology can connect.

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