

Curricular reform in medical education has encouraged the use of both explicit and implicit methods to teach the humanistic skills of medicine. An example of an explicit method is the standardized patient program: students interact with actors portraying patients with predefined illnesses and backgrounds. As well as testing accurate history taking, directed interviewing and diagnostic abilities, these encounters are used to evaluate interpersonal skills, for instance, empathetic listening and the art of breaking bad news. Adequate performance of specific tasks, such as introducing oneself and allowing time for the patient to answer questions, has become a criterion by which students are judged as they seek to pass their national medical board exams.¹

Less uniformly applied are more implicit methods of teaching humanism in medicine: approaches that require students to make connections between situations encountered in the realm of human experience and their own activities in medicine. Because of the necessary limitations of one's own life experiences², these more implicit approaches often rely on the arts as a means of illustrating the range and complexity of the human condition.³ Most straightforward are approaches using literature, drama or other sources of narrative.⁴ Drawing from fictional and non-fictional sources, narratives of illness and loss can be used to develop empathy in a young practitioner who might thus better understand the struggles of an ill, conflicted, or grieving patient. Allegory and imagery can teach a young doctor to think laterally, be insightful, appreciate ambiguity, and challenge the algorithmic thinking on which applied medicine is often based. More recently the visual arts have been promoted to improve observational skills by careful, guided consideration of paintings and sculpture.^{5, 6}

Of all the arts, however, music may be viewed as the least obviously related to the practice of medicine, and hence it offers the challenge of relevance to medical education.

Nonetheless, the overlap of music and medicine is broad and has been the focus of various investigations. In this article, we will briefly review some of the diverse intersections between music and medicine. These intersections include the relationships between musicians and doctors and artists and illness, music as therapy, and the neuroscience of music. We then describe a curricular innovation, *The Art of Listening*, that we undertook at our medical school to examine connections among music, musical performance and medicine. The program explored music as a metaphor for communication in medicine and medicine as a performance art. We argue that emphasis on the skills of listening demanded by full appreciation of music provides a novel and fertile ground for relating music to the practice of medicine and provides a point of departure for the use of music in medical education. Finally, we outline some limitations and concerns regarding the incorporation of music into the medical curriculum.

Musicians and Physicians

Research into the historical and current relationship between musicians and doctors includes biographical literature about composers who were also physicians, such as Alexander Borodin,⁷ as well as literature documenting the relationships between physicians and composers. For example, the friendship between the renowned Viennese surgical pioneer, Theodor Billroth, and the great romantic composer, Johannes Brahms, has been well documented via their extensive correspondence.^{8,9} Literature on musicians and doctors also explores the role of musical performance as an avocation in doctors' lives, the tradition of doctor and health care worker orchestras,^{10,11} and speculations on the potential benefit of prior musical training on physician skills.¹² Thus, this literature broadly covers musical talent from the amateur to the world famous.

Artists and Illness

A second wide-ranging category of literature describes the impact of illness on the lives and work of the great composers and performers. Ludwig van Beethoven is archetypal: analyses focus on his gastrointestinal disease, his psychological health, the etiology of his storied deafness, and the impact of this deafness upon his compositional life.^{13, 14} Some of his most sublime composition relates directly to his experience of illness, notably the slow movement of the Op. 132 quartet, subtitled the “Heiliger Dankgesang eines Genesenen,” or “A Convalescent’s Holy Song of Thanks,” written upon his recovery from a near fatal episode of intestinal inflammation in the winter of 1825. Numerous other composers have incorporated images of illness or bodily anxiety into their music, from the first irregular heartbeat rhythms at the opening of Mahler’s epic 9th symphony (written with full late-romantic self-consciousness that a ninth symphony might be one’s last), to the labile musical moods of Robert Schumann’s work, thought by many to reflect Schumann’s own struggles with bipolar affective disorder^{15, 16}. Contemporary composition has also been used to illustrate medical illness, such as composer Brent Michael David’s “Tinnitus Quartet” which uses a high drone tone played throughout a sixteen minute composition to reveal to an audience the sensation of life with this persistent auditory dysfunction.¹⁷ Furthermore, in response to the impact of performance and practice on musicians themselves, the cross-disciplinary field of performance medicine has evolved to address the medical and mental health concerns of contemporary musicians and other performing artists.^{18, 19}

Music as Therapy

Numerous studies have assessed the impact music has on illness and have measured its effect on somatic and psychic symptoms in settings from ICU to psychiatric ward to nursing facility to operating room. This extensive literature includes the evaluation of music therapy and other musical interventions on pain, anxiety, cognitive development and patient satisfaction.²⁰⁻²² Recent studies have also investigated the benefit of live music performance versus recorded as a therapeutic tool, concluding that there is a special quality to live performance that conveys benefit to the listener.^{23, 24} Though music has mostly been studied as it impacts the well-being of patients, its effects on the art of practitioners is also under investigation. For example, not only has music been studied as an agent promoting patient comfort in the operating room,^{25, 26} music's effect on the activities and performance of surgical and support staff has also been subject to scrutiny.^{27, 28} Finally, this extensive category also includes the use of music as an outlet for expression, reflection and the building of community in the medical setting. For example, programs commemorating cadaveric donors to anatomy classes can include music to provide a sense of respect, closure, rite of passage and gratitude.²⁹

The Neuroscience of Music

The neurosciences provide a further area of interconnection between music and medicine. Understanding the perception of musical stimuli offers a myriad of possibilities for comprehending the structure and function of the nervous system, as music offers a window into neural processing from the level of sensory perception in the inner ear to the interaction of emotive, memory, and analytic functions of the brain's higher cortices.³⁰ Variants of musical perception offer fascinating insights into sensory processing and

memory, as seen through phenomena such as synesthesia³¹ and absolute pitch perception.³² Pathological entities including Tourette's disorder,³³ autistic spectrum disorders³⁴ and Williams syndrome³⁵ have also been described to interact, often positively, with musical ability. Musical precocity, as famously demonstrated by composers such as Mozart and Mendelssohn, further offers an approach to understanding creativity and human development.³⁶

Music As A Metaphor For Communication In Medicine

The above topics represent in broad strokes much of the voluminous literature on music and medicine. Our goal in this perspective, however, is to advance another means for interrelation of music and medicine, one that we explored in a session for first year medical students, and then again in a session open to the general public, in the winter of 2005. This session was led by Robert Kapilow, a composer, conductor, music commentator and educator from New York City, along with the Saint Lawrence String Quartet (SLSQ), an internationally renowned string quartet in residence at Stanford University. The title of the session was "Music and Medicine: The Art of Listening." An outline for the session was written in advance by Robert Kapilow and was informed by preparation, including both a site visit by Kapilow and the SLSQ to a medical student psychiatry lecture on patient interviewing and an evening meeting among Kapilow, the SLSQ, the medical school course director, the faculty director of the Arts, Humanities and Medicine program at Stanford, and a small number of interested medical students. The session thus conceived follows the format of programs Kapilow has frequently performed with the SLSQ and other artists. This format involves taking a movement of a classical composition (in our sessions, quartet movements by Franz Joseph Haydn and

Antonin Dvorak), and breaking the music down into its component themes, accompaniments, phrases, transitions, and individual parts, which are demonstrated to the audience by individual and grouped members of the quartet. Indeed, the audience is often asked to clap, sing and memorize these elements in an attempt to engage and demonstrate the complexity and intricacy with which even a short moment of quartet music is composed. The goal is to engage the listener in listening, and in doing so, to demonstrate that such listening takes active attention and focus, as well as the knowledge, emotions, memories and expectations that any individual brings to such an encounter. After working a piece through in this manner, the audience is given a full performance of the movement during which they can “test-drive” their new listening skills and understanding.

As readers may suppose, description of such a session in text omits the brilliance brought to the encounter by a seasoned performer and educator such as Kapilow, with his unique gift for structuring and delivering such programs and his ability to identify and elaborate through discussion with the audience the myriad themes that emerge from consideration of the musical experience in all its facets, from perspectives of composer, performer, historian and listener. Similarly, this description omits the rare and crucial gift of vitality given to the performance by the players of the Saint Lawrence String Quartet. Nonetheless, we present here many of the topics identified during this session in the hope that they might be explored independently in other formats and in future efforts to incorporate the musical arts into teaching of the medical humanities.

Innovative programs using music in the education of medical students and residents have been described previously.^{37, 38} These programs appear to have relied heavily on contemporary music and the interpretation of popular songs, as songs provide

both a means to connect with trainees and a powerful source of emotional narrative that can be used to illustrate diverse psychological and cultural issues. Another program has used opera similarly for its synthesis of narrative and powerfully expressed emotion.³⁹

While these courses do emphasize listening skills as a goal of medical humanities education, our session, using the classical quartet as a model, focuses more on the process of listening over interpretation of any particular narrative or emotional content of the works heard. The interface between music and medicine conceives the doctor patient-interaction as a dialogue with opportunity for listening and performance. In this sense, our approach is most closely aligned with that advocated by Woolliscroft and Philips,⁴⁰ who argue for medical education reform by considering medicine as a performance art, and extend an analogy between string instrument training and clinical education.

The Art of Listening

The ground explored in our sessions can perhaps be best described by elaborating two viewpoints: one of the practitioner as audience, and the second of the practitioner as performer. From the first perspective, conceptualizing the medical practitioner as a listener, or audience member, the primary goal of our program was to reinforce the value of involvement and engagement in listening. Indeed, Kapilow describes committed listening as a “full-contact activity.” By demonstrating the subtlety and invention in even a single phrase of quartet-writing, we are reminded of the depth of cues and complexity of elements that may come from a patient as she or he relates a history of present illness. By encouraging listeners to consider pitch, rhythm, attack, voicing, repetition, color, and direction in music, we are encouraged to consider these qualities in voice and affect of our patients. Music, both harmonic and discordant, reflects the interplay of multiple

voices, and much of the value of Kapilow and the SLSQ's demonstration comes from isolating instrumental voices individually, then showing the way in which these voices interact and complement each other. Understanding this, we are encouraged to listen and attend broadly to the multiple streams of information that may come from our patients: for example a patient's words, behavior, appearance, medical history, and interactions with family all convey relevant and actionable information to an astute practitioner. Kapilow and the quartet encourage breadth and simultaneity of attention, understanding which voices are concordant and which voices conflict, color or alter the meaning of what may otherwise appear as a primary melody. With a gift for contextualization, Kapilow encourages us to consider the diversity of themes in our own lives as physicians. What themes in our own lives give meaning? With demonstration from Haydn, he points out that interest often comes not from the dominant Violin I melody, but sometimes from the subtle colors and unexpected rhythms of a Viola / Violin II accompaniment. As he points out, small efforts, volunteer side projects and incidental kindnesses may have a greater role in shaping our identities as practitioners of the medical arts than those activities we consider our primary occupation.

One further topic of great relevance in considering the practitioner as listener is the role of expectation in listening to music. A long-standing series of Kapilow's at New York's Lincoln Center is entitled "What Makes It Great?" and uses a similar format of breaking down and reassembling music via interaction with audience and guest performers. These sessions aim at illustrating what makes a famous piece of music great, by revealing the compositional choices that gifted composers make, thus setting their work apart. Quite often, great composers' choices challenge listener expectations of what is to come, by inverting melodies, quoting unexpected themes, making small alterations

of rhythmic patterns, masking downbeats, generating false cadences— in effect creating all the surprising twists and turns of genius and invention that separate the work of great composers from the merely good. By demonstrating for us how great music is made by challenging our expectations, by showing that art exists at the edges and interstices of familiar patterns, the apposition of music and medicine here challenges our own highly-valued approach to medicine, the pattern recognition upon which so much of medical diagnosis is based. While recognizing established patterns of signs and symptoms will always be fundamental to the teaching and practice of medicine, appreciation of music suggests the value to be obtained in recognizing deviations from those expected patterns, the elements that reinforce the individuality and uniqueness of each patient and presentation. In this sense, it could be argued that understanding music helps us listen past the illness to the patient.

Medicine as a Performance Art

The second perspective using music as a metaphor for doctor-patient interaction casts the practitioner as performer. This should be familiar to students of medicine in particular, as a history and physical is a performance of sorts, and as students we rehearse lines of questioning and exam techniques for delivery with appropriate timing, style and sequence. During the clinical portion of student training, great emphasis is placed on the effective verbal communication of medical information to an audience of peers and supervising physicians. Similarly— although we risk pointing out the obvious— the medical profession, particularly in procedural specialties, is rich in practiced skills, performed by teams in learned, protocol-driven sequences. Considering this, the parallels between quartet performance, for example, and a surgical team are evident in that both

require individuals to perform highly practiced, learned roles that are interdependent and require cooperation, mutual attentiveness, and clear communication. Even while conceptualizing the practitioner as a performer, however, the key skill emphasized by Kapilow and the SLSQ in our session remains *listening*. This lesson comes across most strongly in the consideration of how things go wrong under conditions of stress or performance anxiety. Having a music educator lead such discussion is valuable, in that understanding and coping with stage fright is necessarily an aspect of training in musical performance. What happens to an inexperienced musician in a situation of great stress? As Kapilow explains, such players stop listening and concentrate instead on their highly practiced and memorized role, repeating from rote their trained behaviors. Without listening, however, rhythms and tempos become unstable, intonation is off, coordination with fellow players suffers, and the spontaneity of performance is lost. How do doctors fail in stressful situations? In the same way: we fail when we miss important medical cues, when we neglect to heed our colleagues, and, most basically, when we cease to listen to our patients with full patience and attention, and thus lose the sense of connection and empathy that only such listening can achieve.

Above all, music rewards the ability, both as player and as listener, to be “in the moment.” Good music absorbs as much attention as can be given, and rewards this attention with increasing depth of immersion and experience. Our program for medical students set out to demonstrate what music can offer to an active listener and to suggest that medical encounters demand and reward similar skills of active listening.

Conclusions

We present the topics described above as worthy for exploration, but, due to their limited exposure thus far in the medical curriculum, we acknowledge that conclusions about their use are necessarily restricted. One might reasonably argue that music from the 18th and 19th century is not the most culturally relevant means for connecting to current medical students or the general public. While we would not contend that all music is created equal, certainly approaches considering more contemporary styles of music could be equally valuable, provided the music and its performance similarly reward active listening and analysis. Regardless of the musical format chosen, a central difficulty in reproducing a program such as the one we describe is the challenge of identifying collaborators such as the SLSQ and Kapilow who can perform with the presence, insight, and technical and artistic skill necessary to challenge and engage listeners. Indeed, for music, as with all the arts in teaching medical humanism, it is the process of discussion and exploration in a setting of engaged attention, rather than any didactic presentation of preconceived conclusions, that yields pedagogic value. The reflection fostered by such events is an end in itself, and such reflection has been characterized as a professional responsibility for those in medicine.^{4, 41} The act of exploring the rich thematic material that music and the performance of music presents ultimately yields both illumination and beauty. In this sense, music as a tool for teaching the medical humanities reflects the nature of the art itself: an exploration into the human condition via the mutual dialogue of performer and listener.

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