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Music, neurology, and psychology in the nineteenth century

2

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Abstract

This chapter examines connections between research in music, neurology, and psychology during the late-nineteenth century. Researchers in all three disciplines investigated how music is processed by the brain. Psychologists and comparative musicologists, such as Carl Stumpf, thought in terms of multiple levels of sensory processing and mental representation. Early thinking about music processing can be linked to the start of Gestalt psychology. Neurologists such as August Knoblauch also discussed multiple levels of music processing, basing speculation on ideas about language processing. Knoblauch and others attempted to localize music function in the brain. Other neurologists, such as John Hughlings Jackson, discussed a dissociation between music as an emotional system and language as an intellectual system. Richard Wallaschek seems to have been the only one from the late-nineteenth century to synthesize ideas from musicology, psychology, and neurology. He used ideas from psychology to explain music processing and audience reactions and also used case studies from neurology to support arguments about the nature of music. Understanding the history of this research sheds light on the development of all three disciplines—musicology, neurology, and psychology.

Keywords

mental representation, Tonvorstellung, Stumpf (Carl), Gestalt psychology, aphasia, amusia, Knoblauch (August), origins of music, music and emotion, Jackson (John Hughlings), Wallaschek (Richard)

1 INTRODUCTION

The relationship between music and brain has emerged as a central issue in the twenty-first century in the field of music cognition, as well as a topic of investigation in the field of neuroscience. How and why did music come to be one of the domains

of brain research? This question takes us back to the late-nineteenth century, when investigations of music and brain became a shared element in the newly emerging fields of psychology, musicology, and neurology. Researchers in these three disciplines, primarily located in Germany, France, and England, were interested in various aspects of music and how the brain processes music. Because these academic disciplines were new, domains of knowledge for each were fluid and overlapped with other disciplines. Psychologists and musicologists shared concepts and discussions, and thought in terms of multiple levels of sensory processing and mental representation. While neurologists discussed similar concepts, they pursued a completely separate research path focused on localization of music function within the brain, including a dissociation between music as an emotional system and language as an intellectual system.

2 BRAIN PROCESSING OF MUSIC

2.1 MUSIC PERCEPTION AND COGNITION

The modern study of music perception and cognition is often traced to the work of Hermann von Helmholtz (1821–1894), a German physicist, physician, and physiologist (see the chapter “Franz Joseph Gall and Music: The Faculty and the Bump” by Eling et al., as well as [Graziano and Johnson, 2013](#), for discussion of earlier roots of the study of music perception). Helmholtz took the scientific study of music from acoustics to perception, from the physical to the physiological—he “. . . shifted the focus of inquiry from exterior to interior aspects of the perceptual process” ([Green and Butler, 2002](#)). [Helmholtz \(1863\)](#) believed the physical aspects of music (acoustical properties) had been addressed by his time but the physiological and psychological aspects of music still needed investigation. He stated:

Now whilst the physical side of the theory of hearing has been already frequently attacked, the results obtained for its physiological [sic] and psychological [sic] sections are few, imperfect, and accidental. Yet it is precisely the physiological part in especial—the theory of the sensations of hearing—to which the theory of music has to look for the foundation of its structure.

[von Helmholtz \(1877/1954, p. 4\)](#)

Helmholtz explored the anatomy and physiological processes of the ear, which led him to describe three levels of music perception: (1) acoustical properties of sound that lead to (2) physiological processes in the ear resulting in sensations (*Empfindungen*) that lead to (3) mental images (*Vorstellungen*), which are perceptions (*Wahrnehmungen*). He was particularly interested in the development and role of sensations.

Helmholtz’s work led to the study of *Tonpsychologie* (tone psychology), focused on the physical and physiological aspects of sound, as well as on sensations produced by individual musical elements. This line of research was pursued in Germany

among psychologists and some musicologists (who overlapped with psychology). The musicologists involved were practitioners of comparative musicology, later known as ethnomusicology. During the second half of the nineteenth century, the study of *Tonpsychologie* expanded. Some researchers considered how a combination of individual musical elements formed entire musical compositions. This emphasis on higher-level music led to investigations of higher-order cognitive processes, the study of *Musikpsychologie* (music psychology). The practitioners of *Musikpsychologie* focused on mental representations or conceptions (*Vorstellungen*) for music (see Gjerdingen, 2002, for detailed discussion of *Musikpsychologie*).

Carl Stumpf (1848–1936), a German psychologist and comparative musicologist, was one of those who discussed mental representation for music, emphasizing the psychological rather than the physiological. Stumpf's work can be seen as a precursor to *Musikpsychologie*. Like Helmholtz, Stumpf (1883) discussed different levels of music perception: sensations (*Empfindungen*) result from hearing or remembering a sound; sensations become mental representations (*Vorstellungen*), which are then analyzed (*Urteil*); the analysis of mental representations leads to understanding or knowledge (*Erkenntnis*). He explored several musical elements, such as musical consonance. Stumpf (1883, 1890, 1911) detailed how the perception of consonance is psychological rather than physiological. The sensation of an interval (two simultaneous tones) leads to a mental representation, the analysis of which results in an understanding of the sound as a whole rather than as two separate tones. The two tones fuse into a sound of consonance. This was Stumpf's theory of tonal fusion (*Verschmelzung*) (Ash, 1995; Green and Butler, 2002). The perceptual process of fusion leads to an understanding that intervals are transposable—for example, the same perception of consonance results for all fifths, regardless of the specific pitches involved.

Stumpf speculated that tonal fusion developed in “primitive cultures” when adults and children called out to each other in different vocal ranges, creating different combinations of tones. He stated:

Of all the combinations, only one has the virtue of pitch simultaneity that is similar to the point of confusion with the impression of a single note: the octave [sic]. . . In psycho-acoustics [sic] we know this characteristic by the name fusion, and even Greek music theorists found the essence of ‘consonance’ in it. This unity of simultaneous pitches in the octave did not arise initially through music itself. It is not the result of a musical development, rather a phenomenon that is necessarily conditioned by the nature of tones or the brain processes on which they are based.

Stumpf (1911/2012, p. 46)

Stumpf (1911) stated that intervals other than the octave exhibited the same characteristic of fusion, especially the fifth and the fourth.

Theodore Lipps (1851–1910) was another psychologist who described a series of perceptual events from the physical to the psychological, resulting in a mental representation for music (Lipps, 1905/1926). Both Stumpf and Lipps emphasized the psychological aspects of perception, while concentrating on individual musical elements removed from musical context.

An interest in mental representation for music was also seen in early Gestalt psychologists, such as Christian von Ehrenfels (1859–1932). Ehrenfels (1890) described Gestalt qualities (*Gestaltqualitäten*) as patterns that operate in space and through time and are holistic—they go beyond the separate elements found within them. These patterns, or qualities, are mental representations created from sensations—Ehrenfels used the term “*Tonvorstellung*” to refer to a Gestalt quality or pattern. Ehrenfels’s example was that of a melody: a transposition of a melody is perceived as identical to the original, regardless of the fact that they have different pitches. The perception is of the interval relationships between the notes, which remain the same in the transposition. A melody, Ehrenfels argued, is a Gestalt quality since the perception of that melody as a whole is different from the perception of its individual elements (pitches) (Ash, 1995; Gjerdingen, 2002). Ernst Mach (1838–1916) also described similar ideas a few years earlier (1886).

Stumpf’s theory of tonal fusion (*Verschmelzung*), first discussed before Ehrenfels’s or Mach’s publications (Stumpf, 1883), is noticeably Gestalt-like in nature. The sound of two tones is perceived as a whole—a particular type of consonance—rather than as two separate elements. In fact, several of Stumpf’s students became important Gestalt psychologists in the early twentieth century [Max Wertheimer (1880–1943), Wolfgang Köhler (1887–1967), and Kurt Koffka (1886–1941)].

2.2 TONVORSTELLUNG

The term *Vorstellung* has a complex history in philosophy literature and can be translated in multiple ways, including idea, representation, conception, and imagination (Wason and Marvin, 1992). Helmholtz and Stumpf both used the term to indicate a mental image or representation resulting from sensations. In particular, *Tonvorstellung* was used to indicate a mental representation of music. Ehrenfels used *Tonvorstellung* to indicate a mental representation of a Gestalt pattern for music. For all, *Vorstellung* indicated a mental, or cognitive, process rather than a physiological process. At the same time as psychologists were discussing *Vorstellung*, neurologists were also exploring mental representation for music, but in different ways.

2.3 LOCALIZATION OF MUSIC FUNCTION AND LISTENING TYPES

During the first half of the nineteenth century, those in medicine interested in the brain often focused on studying aphasia and how brain damage could affect language abilities. Investigators often looked at singing abilities in the context of aphasia, since singing involves language (see the chapter “Some Early Cases of Aphasia and the Capacity to Sing” by Johnson and Graziano for discussion about aphasia and singing). By the 1870s, neurologists were looking at impairments in areas of music other than singing (e.g., rhythmic performance, music reading, music writing), and some looked at how music abilities could be preserved in the context of aphasia

(e.g., [Finkelnburg, 1870](#)). By the late 1880s, Hermann Oppenheim (1858–1919) discussed how the assessment of music skills should be a necessary part of investigating aphasia ([Graziano et al., 2012](#); [Oppenheim, 1888](#)).

Listening Types: Looking at music abilities in the context of language impairment led to broader speculation about how the brain processes music. Some neurologists classified language processing into three categories, three types of mental representation for language: auditory, motor, and visual. This classification was influenced by French psychologist, Théodule Ribot (1839–1916), who discussed three ways to mentally represent ideas. Ribot was a colleague of neurologist Jean-Martin Charcot (1825–1893) in Paris and likely influenced Charcot’s thinking about mental representation ([Ribot, 1881, 1891](#)). Charcot (as cited in [Miliotti, 1885](#)) discussed three listening types for language and added a fourth type, a person who used all three together (auditory, motor, and visual). Charcot did not describe listening types for music, but he did imply that parallel modes of mental representation existed for music.

Richard Wallaschek (1860–1917) speculated that different individuals represent music in different ways. He stated:

... in thinking of a tone, one associates it with the written note or the key-board [sic], the other with the motion necessary to play it on an instrument, the third is satisfied with sound alone.

(1894a, p. 259)

Wallaschek discussed three listening types for music ([1894b](#)), citing and comparing his ideas to Ribot’s. The auditory type associates hearing music with the sound itself. The motor type associates music with physical movements, for example, movements required to play an instrument. The visual type associates music with visual images, for example, written music notation or images of landscapes. [Wallaschek \(1894b, p. 9\)](#) described a woman who listened to Saint-Saens’ *Danse Macabre* and visualized “an ocean beach illuminated by moonlight with fishermen sitting ashore, lighting a campfire.”

Localization of function: In addition to speculating about listening types, neurologists speculated about the underlying neural circuitry for music processing. This way of thinking began at the end of the eighteenth century with Franz Joseph Gall, who thought he identified a locus for tone perception and music above and toward the lateral side of each eye, an idea he published in 1810 and maintained in later works (see the chapter “Franz Joseph Gall and Music: The Faculty and the Bump” by Eling et al.). By the second half of the nineteenth century, some neurologists based their thinking about music processing on diagrammatic models for language processing, such as those by [Wernicke \(1874\)](#) and [Lichtheim \(1885\)](#). These models were based on observations of patients and also speculation about the patterns of deficits and preserved abilities to illustrate the effects of brain damage on cognitive functions. In 1877, Adolf Kussmaul (1822–1902), who wrote one of the first monographs on disorders of language, proposed a language model. Kussmaul’s model diagrammed the flow of information processing, including processing centers, pathways connecting the centers, and sensory input to the model (see [Fig. 1](#)). [Kussmaul’s \(1877\)](#) model

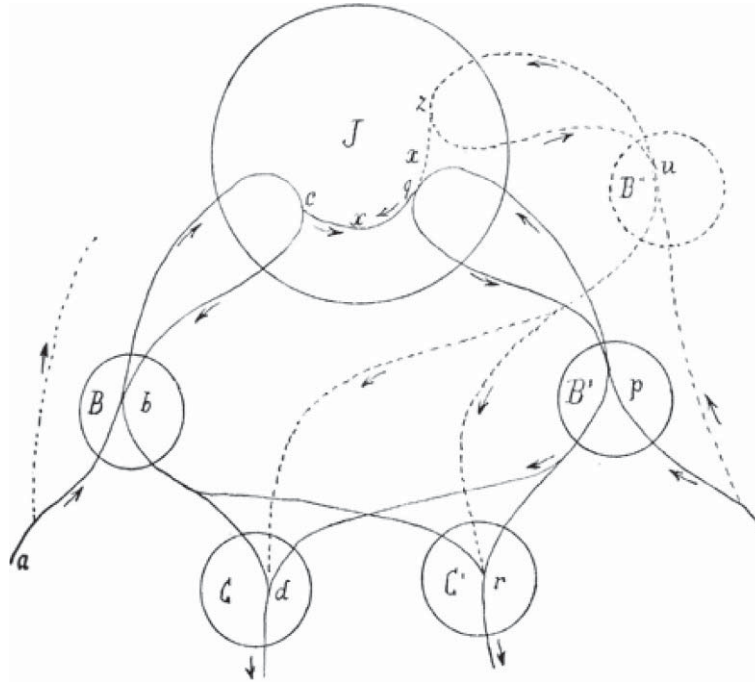


FIGURE 1

Adolf Kussmaul's 1877 diagrammatic model of language.

Reproduced from Kussmaul (1877, p. 779).

included the acoustic nerve (“a,” starting on the bottom left of diagram) and a pathway for language perception between “a” and “image-centers” as well as the conceptual center. He also proposed a separate pathway for music perception (dashed line from acoustic nerve “a”) but did not connect the music pathway with any other part of the model (Johnson and Graziano, 2003).

Charcot (as cited in Miliotti, 1885) also proposed a diagrammatic language model. He did not diagram music as a separate system, or even indicate a single music pathway, as Kussmaul had. However, he did describe how music is processed in a similar way to that shown in his language model (see Fig. 2).

In 1888, August Knoblauch (1836–1919) proposed the first “cognitive” model for music, which diagrammed centers, and pathways connecting centers, specifically for music (Johnson & Graziano, 2003; Knoblauch, 1888). Knoblauch’s music model was based on Lichtheim’s (1885) language model (see Fig. 3).

Diagrammatic models led to speculation about brain localization of music, where different centers in the model represent different music cognitive functions (e.g., processing of melodies, writing or reading music). Based on patient observations and speculation about how other music functions might break down using his model, Knoblauch discussed how a lesion to one area of the brain would result in a certain

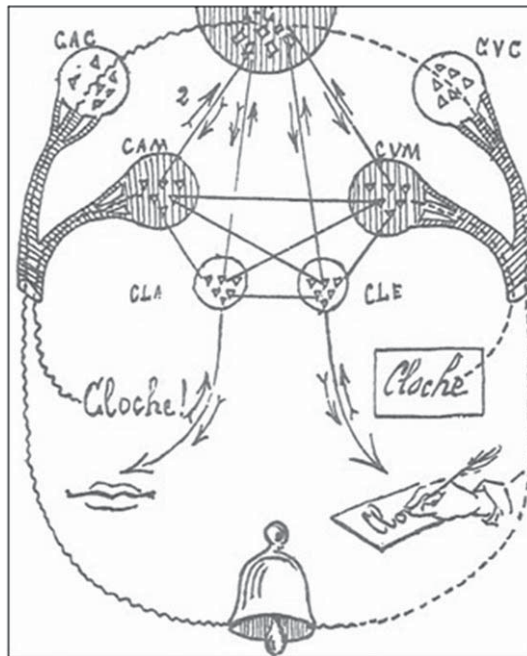


FIGURE 2

Jean-Martin Charcot's "Bell" diagram of language processing. Diagram indicates auditory memory for words (CAM), visual memory for words (CVM), written language (CVC), articulated language (CPM), and Idea Center (IC).

Reproduced from Miliotti (1885, p. 153).

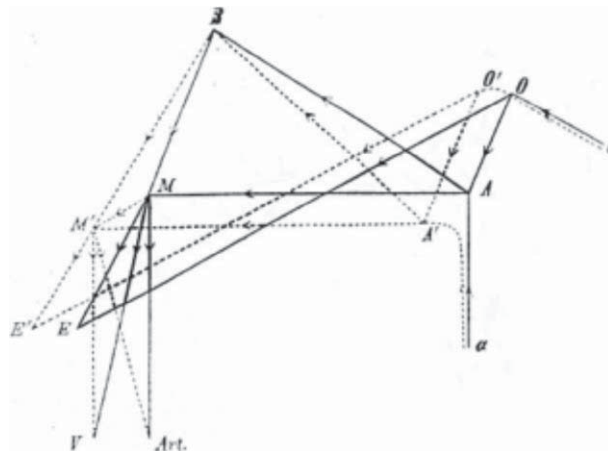


FIGURE 3

August Knoblauch's 1888 diagrammatic model of music. Dashed lines represent pathways between music centers and solid lines represent pathways between language centers. Knoblauch took the language modal from Lichtheim (1885). Letters A, O, M, etc., indicate language centers, while A', O', M', etc., indicate music processing centers.

Reproduced from Knoblauch (1888, p. 342).

type of music impairment, while a lesion to a different area would result in a different type of impairment. Knoblauch coined the term “amusia” to refer to a specific type of motor impairment resulting from a lesion to the motor center for tones (M' , see Fig. 1; Knoblauch, 1888). Although he did not give specific details of localization of music function, Knoblauch speculated that music is a left hemisphere function with the main auditory center for tones located near the superior temporal lobe, and the motor center for tones located near Broca’s area (in Knoblauch’s model, the motor center is necessary for movements involved in producing music). Others followed Knoblauch’s lead, but used the term “amusia” to refer to all types of music impairment, and classified different types of amusias that could affect different music functions (Blocq, 1893; Brazier, 1892; Wallaschek, 1891b). For example, Brazier states that Knoblauch:

...assumes, in addition to lesions in the centers of music, the existence of lesions in the fibers that connect the centers to one another, and based on that comes up with nine forms of amusia analogous to the aphasias described by Lichtheim.

Brazier (1892, p. 344, translated by Rebeca Heidbreder)

Similar to Helmholtz and Stumpf, physicians like Knoblauch were thinking of music as a cognitive system processed in a multilevel flow of information where sensations entering the network lead to higher-level processing. The psychologists described this higher level in terms of mental representation (*Vorstellung*), whereas neurologists attempted to link the higher-level functions to localized areas of the brain, sometimes using diagrammatic models to explain this concept. In Knoblauch’s model, music shared the highest conceptual center with language processing (Idea Center—B in his diagram, see Fig. 3), suggesting that he considered music to be processed on a high conceptual level, similar to language.

3 MUSIC AS AN EXPRESSION OF EMOTION

Another topic that crossed lines between psychology, musicology, and neurology was the idea of music as an expression of emotions. This idea was discussed by musicologists and philosophers (Bujčić, 1988) and often tied to speculation about the origins of music, in large part through the writings of three British scholars: philosopher Herbert Spencer (1820–1903), naturalist Charles Darwin (1809–1882), and psychologist Edmund Gurney (1847–1888). Spencer (1857, 1890, 1891) argued that music evolved from speech, specifically from emotional speech. Darwin (1871) proposed that music evolved from emotional language used to attract the opposite sex, and Gurney (1876, 1880) thought music developed from prosodic exaggerations of emotional speech (see the chapter “Darwin and Spencer on the Origin of Music: Is Music the Food of Love?” by Kleinman for discussion on Darwin and Spencer).

Like Spencer, Darwin, and Gurney, neurologists in England also discussed the connection between language and music and the emotional nature of music.

Specifically, neurologists discussed songs, since they combined music and text. John Hughlings Jackson (1835–1911) differentiated between propositional, or intellectual, language that expressed ideas and emotional language that used automatic gestures without propositional value (see the chapter “Singing by Speechless (Aphasic) Children: Victorian Medical Observations” by Greenblatt and Lorch for further discussion of Jackson’s ideas). Jackson (1866, 1878, 1879) drew a parallel between aphasic patients who had limited propositional speech but could verbalize “automatic speech” (such as “oh my goodness”) and could sing a song with lyrics. He argued that automatic speech is generated from emotions, since single words and short phrases do not have propositional value. He described language in the context of song as similarly emotional without propositional value. He used examples from case studies of patients who could sing text but could not speak to support the idea that emotional and propositional language are processed separately. Jackson referred to Spencer’s writings several times (see the chapter “Singing by Speechless (Aphasic) Children: Victorian Medical Observations” by Greenblatt and Lorch, as well as chapter “Some Early Cases of Aphasia and the Capacity to Sing” by Johnson and Graziano) indicating a link between philosophers and neurologists in England.

Other neurologists also differentiated between emotional and intellectual language. In Britain, William Gowers (1845–1915) held ideas similar to Jackson’s (Gowers, 1887, 1888). In Germany, Kussmaul also argued that music was an expression of emotions, independent of speech (Kussmaul, 1877, and see the chapter “Some Early Cases of Aphasia and the Capacity to Sing” by Johnson and Graziano for details). He was aware of and referred to Darwin’s ideas about the development of language and music. Kussmaul argued, based on Darwin and others, that music expression develops before speech, and therefore that music and speech must be separate processes, which explains why singing of text could be preserved in the context of aphasia.

Like Kussmaul, German psychologist and comparative musicologist Stumpf (1911) discussed the development and origins of music. He was aware of ideas about music psychology put forth by British scholars (e.g., Stumpf, 1885), and he referred to Darwin and Spencer’s ideas that music evolved from language. Stumpf (1911) disagreed with Darwin and Spencer and proposed the following: in “primitive” societies, men, boys, and women called out or signaled simultaneously in different vocal ranges, creating octaves, perfect fifths, and perfect fourths. This led to the perception of “fusion,” the immediate perception of the consonance of a fifth, a fourth, or other consonant interval as a holistic, unique sound, and the understanding that these intervals are transposable—Stumpf’s concept of *Verschmelzung*, see above. Stumpf believed it was the process of fusion that led to singing in parallel intervals and combining intervals in different ways. He argued that the development of music began when humans achieved fusion and understood transposition.

Although Stumpf specifically argued that music did not evolve from language and did not refer to neurologists like Jackson, it is possible to see a connection between Stumpf’s ideas and those who discussed music’s link to emotional language. Stumpf described people calling out or signaling to each other as the origin of

consonant intervals in music. This is similar to Jackson's and Gower's descriptions of automatic speech, generated from emotions and without propositional value. Stumpf did not categorize these vocalizations as language, but did propose that music developed from them. Jackson and Gowers referred to such vocalizations as emotional language without intellectual content, and linked them to music, specifically song texts. Thus, philosophers, psychologists, comparative musicologists, and neurologists discussed fairly similar ideas about music, language, and emotion. However, there appeared to be only limited cross talk between the different disciplines (with the exception Spencer, who influenced several disciplines).

4 RICHARD WALLASCHEK—SYNTHESIS OF MUSIC, NEUROLOGY AND PSYCHOLOGY

Richard Wallaschek (1860–1917) wrote extensively about the origins of music, music esthetics, and music psychology, as well as being an active music critic in Vienna. Today, he is known primarily for his contributions to comparative musicology, but during his life he was known and referred to by psychologists and neurologists as well as musicologists (Graziano and Johnson, 2006). Wallaschek studied in Germany, and then in London from 1890 to 1895. He returned to Austria and the University of Vienna in 1896, where, after a habilitation with Ernst Mach, he taught esthetics and psychology of music for the remainder of his career (Fig. 4).

Wallaschek described two levels of mental processing for music. Like Helmholtz, Stumpf, and Ehrenfels, Wallaschek used the term “*Tonvorstellung*” in German (1894b) and in an English paper (1894a). His English translations of “*Tonvorstellung*” include: “mental tone representation,” “music representation,” and “ideas of tones.” As such, his use of the term indicates he was thinking about higher-order cognition, and thus his thinking belongs to the practice of *Tonpsychologie* (see above). For Wallaschek, “mental tone representation” is the processing of individual musical elements (e.g., pitch, intervals, chords). This is consistent with Helmholtz and Stumpf's use of “*Tonvorstellung*.” However, Wallaschek went one step farther. He argued that there is a higher level of mental processing, which he called “*Musikvorstellung*” (“music representation” or “ideas of music”). According to Wallaschek, “music representation” is the processing of complex musical structure created by combinations of individual musical elements. He argued that listeners use both levels of processing—*Tonvorstellung* to listen to details and *Musikvorstellung* to comprehend a piece of music as a whole, i.e., without paying attention to individual pitches, intervals, chords, or other details. However, he believed that one level of processing generally dominates (either tone or music representation). In the early twentieth century, musicologists Hugo Riemann (1849–1919) and Ernst Kurth (1886–1946) also discussed music within musical context, rather than as individual elements, and focused on mental representation (Gjerdingen, 2002; Rothfarb, 1989).

Like Charcot, Wallaschek (1894b, 1930) adopted Ribot's three listening types—suggesting that people process music in an auditory, motor, or visual way.

**FIGURE 4**

Richard Wallaschek.

Reproduced from Mathews (1899, p. 457).

Wallaschek applied his two levels of conceptual processing to these three listening types. For example, the visual type associates music with visual images. When the process of *Tonvorstellung* is engaged, listeners might imagine the written music notation. In contrast, when the *Musikvorstellung* process is engaged, listeners might imagine landscapes or scenes, something more global in nature.

Wallaschek (1895) also described rhythmic perception as a mental process of “time sense.” He argued that beats (the metric pulse of a piece of music) are perceived in groups and not as individual beats. This perception is immediate—the listener hears the grouping pattern (of two or three or four, etc., beats in a group) rather than each beat individually. For Wallaschek, “time sense” is a cognitive process, not a sensory one. He stated:

The rhythm is in the object, while the time-division is only the form in which our mind perceives the rhythm. . .this time-sense of the observer, his ability to arrange regular sensations into periods, to perceive them not as single beats but as groups of beats, is an immediate (intuitive) perception, i.e. the observer. . .immediately perceives the group as such without the medium of counting.

Wallaschek (1895, p. 28).

Like Stumpf, Wallaschek's ideas have Gestalt-like qualities—the notion of “time sense,” the holistic understanding of metrical groupings, and the idea of *Musikvorstellung*, which allows for the understanding of a piece of music as a unified whole. Unlike Stumpf, Wallaschek tied these ideas to the brain, in particular, time sense, which he stated, “took place not in the senses themselves but in the cortex” (Wallaschek, 1895, p. 29). Also unlike Stumpf and other psychologists and comparative musicologists, Wallaschek referred to the ideas of neurologists and used those ideas in his arguments about the origins of music and the relationship between music and language.

Wallaschek argued that music and language involve separate brain processes. He debated with Spencer in a series of articles in the British journal *Mind* (Spencer, 1890, 1891; Wallaschek, 1891a, 1892) and discussed music as an expression of emotion in a separate paper in a German journal (1891b). He also published a monograph on the origins of music (Wallaschek, 1893). Wallaschek disagreed with Spencer, Darwin, and Gurney that music evolved from language. Instead, he argued that music developed from rhythm. He drew from the ideas of Jackson and other neurologists, proposing that music is an expression of emotion, and that text in the context of song does not convey intellectual meaning, only emotional meaning. In addition, he argued that speech in the context of song develops in children later than speech used in conversation; although children imitate songs, they do not invent them until after they acquire spoken language, suggesting a separation between singing text and speaking text (this is different from Kussmaul's assertion, that music expression and the ability to sing develop earlier in children than the ability to speak). Wallaschek also described case studies of patients with aphasia who could sing text but could not produce conversational speech. He believed that for all these reasons—song texts do not contain meaning, music develops later than language, and language in the context of song is dissociable from language in conversational speech—music and language are independent brain processes. For these same reasons, he felt that music could not have developed from language. He described two separate processes, one for emotion that results in automatic speech and in music, and one for intellectual thought that results in conversational speech.

Wallaschek (1891b) used Knoblauch's term “amusia,” and was the only scholar with a background in psychology and musicology to contribute to the discussion among neurologists about classifications of different amusia syndromes. This unique perspective among psychologists and musicologists led to unique speculation about mental representation for music. Case studies suggested that a particular type of amusia could impair one music ability yet leave other abilities intact, and these studies suggested different ways of processing music. This perspective may have led Wallaschek to his division of music mental representation into the two processes of *Tonvorstellung* and *Musikvorstellung*.

Wallaschek-linked ideas from neurology with ideas from psychology, comparative musicology, and music criticism to speculate on the perception of large-scale musical works. He did this in three ways: in a discussion about mental representation and “modern” music (Wallaschek, 1894a,b), in a discussion of time sense and

perception of meter (Wallaschek, 1895), and in a discussion of the validity of program music (Wallaschek, 1897).

Music mental representation and “modern” music: Wallaschek proposed that individual listeners use *Tonvorstellung* and *Musikvorstellung* to varying degrees; some rely more on one than the other. The *Musikvorstellung* process allows for the perception of holistic, higher-level musical structure, created by a combination of tones, intervals, chords, rhythms, etc. The global structure is perceived even if mistakes in individual elements are made. Wallaschek argued that “modern” Romantic music of the nineteenth century relies on listeners using the *Musikvorstellung* process. Composers of “modern” music, like Richard Wagner, were less concerned with accuracy of a performance (getting all the individual elements correct) than they were with communicating the larger, general effect (Wallaschek, 1894a). Listeners who relied on the *Tonvorstellung* process would not be able to understand a modern piece as a whole, and would find such music incomprehensible. The *Tonvorstellung* process, Wallaschek argued, would allow for understanding of the music of previous styles, such as the Classical style (ca. 1750–1820, the era of Mozart), because these styles rely more on individual tones, intervals, chords, etc., being accurately performed. Wallaschek used his ideas about music perception and cognition to explain audience resistance to modern music. Those audience members who rely on the *Tonvorstellung* process would be resistant to modern pieces that require an understanding of the global structure of the piece.

Time sense: In his discussion of rhythm, Wallaschek (1895) argued that perception of metrical groupings of beats is an immediate, holistic perception. He maintained that listeners do not perceive individual beats. He argued that time sense is a mental process, taking place “in the cortex” rather than on the sensory level. Since it is a mental process, such metrical groupings do not exist in the music *per se*. Despite the notated time signature (which describes the metrical grouping), different listeners could perceive the same time signature as different groupings of beats (for example, groups of 2, 3, or 6 beats). For Wallaschek, this explained disagreements about meter among listeners.

Program music: Wallaschek applied his ideas about music as emotional expression to Romantic program music. In his music criticism articles in the journal *Die Zeit*, Wallaschek was a critic of program music (instrumental music that portrays nonmusical meaning without the inclusion of a text, such as Tchaikovsky’s concert overture *Romeo and Juliet*, or Berlioz’s program symphony *Symphonie fantastique*, or Smetana’s tone poem *The Moldau*). Wallaschek argued that a program (the non-musical content) is an expression of intellectual thought with propositional meaning. Composers try to communicate that intellectual thought through music, which is an expression of emotion and has no propositional value. In fact, Wallaschek argued, the processes for emotional expression and for intellectual thought are separate neurologic processes in the brain. He stated that “intellectual expression is different from emotional expression. . . it starts from other parts of the brain or nerve pathways” and that “the intellectual side of our mental lives. . . is actually physiologically separated from the emotional side” (Wallaschek, 1897, pp. 202–203). It is therefore impossible

to perceive both program and music at the same time. Thus, he justified his criticism of program music by using arguments drawn from neurologists.

In a similar fashion, [Wallaschek \(1897\)](#) argued that the art song, which is supposed to be a union of music and poetry, can only express emotion and cannot express the intellectual meaning of the poetry. Other musicologists and critics of the time grouped the art song with program music—a descriptive genre meant to express a narrative (in the case of the art song, a poetic narrative). But Wallaschek grouped the art song with absolute music (instrumental music that has no nonmusical meaning, such as a Brahms symphony). Wallaschek again argued that emotional and intellectual expression are two separate brain processes, and that song texts are processed as emotional expression, and are unable to express conceptual thoughts. However, he thought that when music is combined with text in the context of drama, it constitutes intellectual language, which has propositional meaning. Thus, opera—a genre combining music and language in a dramatic context—does express intellectual thought. For Wallaschek, songs and opera are psychologically different because they depend on different brain structures.

5 SUMMARY

Late-nineteenth-century researchers in music, neurology, and psychology shared certain topics of investigation but did not commonly interact with each other. Stumpf, who contributed to both psychology and comparative musicology, integrated thinking from these two disciplines. German psychologists and neurologists shared an interest in investigating the multilevel processing of music, from sensory to complex cognitive levels. British neurologist Jackson was influenced by Spencer's thinking, which held that music is an expression of emotion. In Germany, Stumpf had some similar ideas to both Spencer's and Jackson's. Wallaschek was the only one to synthesize musicology, psychology, and neurology, using case studies from neurology to support his arguments about the nature of music, and ideas from psychology to explain musical processing.

Except for Wallaschek, the lines of research produced by psychologists and musicologists, on the one hand, and by neurologists, on the other, remained disconnected through much of the twentieth century. It was not until the 1980s and 1990s that research from different fields coalesced into an academic discipline (music cognition/music psychology) that had a unified set of issues and methods ([Graziano, 2009](#)). Relationships between music and brain have emerged as a central issue in the twenty-first century in the field of music cognition, as well as a topic of investigation in neuroscience. In particular, issues that were explored in the late-nineteenth century have become focal points for research today: hierarchical levels of perceptual and cognitive processing; localization of music function and music impairments (amusia), and what they tell us about perceptual and cognitive mechanisms; and the relationship between music and emotion.

Interest in the history of music and brain studies is a relatively recent trend (Graziano, 2009; Graziano and Johnson, 2013). Understanding the history of this research sheds light on the development of all three disciplines—musicology, neurology, and psychology. Recent interest in the history of music and brain research indicates that music has taken its place as part of the history of psychology and of neuroscience. Since mature disciplines generally include a specialization in the historiography of the field (history of psychology, history of neuroscience, historical musicology), the interest in historical underpinnings also indicates that the relatively new field of music cognition/psychology has reached a certain level of maturity as an academic discipline.

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