Hendrickson's perception of theory of transfer and multi-sensory processes in developing violin skills and likewise promoting speech in non-verbal autistic children

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Abstract

South Australian, Lyndall Hendrickson AM (1917-2017) led a lifetime of achievements as a prodigy, concert violinist, polio survivor, violin instructor and teacher of language and music to non-verbal autistic students. Her career halted when she contracted poliomyelitis at the age of 34. To regain motor skill, Hendrickson researched theories of human performance and followed developments of cognitive neuroscience. In the 1970s, she experimented with violin teaching and learning through multi-sensory channels of information. Whilst Hendrickson was not the only teacher who wrote drills, used large notation, colour, stories and focused on the actions of technique, she formulated her own series of exercises designed to map an order of finger movements, that would normally not be employed in beginner lessons. Hendrickson used theories of transfer and perception in explaining violin exercises. At the age of 73, she followed new career paths in working with non-verbal autistic children and developed a multi-sensory based program aimed to encourage speech.

Keywords: violin, somatosensory, autism, synaesthesia, pedagogy

Introduction

As a child, Hendrickson noted that she visualized the colour brown and smelt earth in hearing the note C (439hz). Hendrickson reflected that her mind was constantly active with these parallels whenever she was in the bush, desert, or was hearing sounds in traffic. She stated "if I hear a sound, I see a colour, and if I see a colour, I hear a sound" (Hendrickson, c. March 2008, p. 1). Professor John Bradshaw from Monash University, noted that the binding of sensory information known as synaesthesia, is possibly related to persons with more brain connections than most (Giles, 2000). This synaesthesia possibly guided Hendrickson's ability in the application of sensory connections in her method.

Hendrickson started violin study at the age of three, trying her father's instrument and experimenting with playing. Her first teacher Louise Hakendorf was a pupil of Gerald Walenn. In childhood, Hendrickson studied Dalcroze Eurhythmics, and describes her teacher Heather Gell, as giving her freedom of movement and a consciousness of being 'loose' which she then transferred to performing on the violin (Cox, Holmes, & Pope, 1995). In 1936, Hendrickson studied violin with Ludwig Schwab, a student of famous pedagogue Otakar Ševčík. By 1939 she was performing as a soloist under the baton of Sir Thomas Beecham, Sir Malcolm Sargent and many other conductors.

In 1951, Hendrickson suffered paralysis after polio (Polio-Australia, 2019). Exercises designed by

her husband, Dr Graeme Robson, led to a recovery period of around eight years. Whilst bed ridden, she read books on psychology, attention theory, pedagogy, and taught herself to write with the right-hand. Reflecting on her recovery, Hendrickson wrote to American music critic Henry Roth, that she regained her former motor skills and gained further flexibility, when she applied elements of her husband's rehabilitation exercises to her violin practice (Hendrickson, 22 April 1993).

Over the past 60 years, numerous teachers including Hendrickson, have developed their own style of pedagogy, focusing on developing the mechanics of string playing (Gerle, 1983; Givens, 1981; Nelson, 1973; Rolland & Mutschler, 1974; Szilvay, 1980). What sets Hendrickson's pedagogy apart, is the development of her multi-sensory approach to processing music, the belief in allowing the student to explore all parts of the fingerboard from the start, the hierarchy of written drills, and her translation of learning theories. Her aim was to encourage students to realise a sense of freedom of motion in both arms and reduce the amount of study time taken to develop advanced technique. Hendrickson appeared to have achieved this with several students who, after a few years of study, performed virtuoso works and won competitions. The new experimental styles of teaching were not understood or readily accepted. Reporter Randall Ashbourne noted discrimination for being a different thinker in *The Advertiser*. In the article, *The pain and the prodigy,* he wrote, "They call her a crackpot, an eccentric, a prodigy propagator" (Ashbourne, 1981).

This case study of Hendrickson's teaching explores processes such as the use of the theory of transfer and multi-sensory learning. In 2017, her student files, collection of notes and audio tapes have been handed down from her estate specifically for this research (Mikajlo, 2017).

Identical elements

A principle that sparked connections for Hendrickson, was the theory of transfer by Edward Thorndike and Robert Woodworth, describing transfer of learning arising when identical elements are present (Thorndike & Woodworth, 1901). In 2008, Peter Frensch and Hilde Haider researched historical understandings of transfer, explaining that transfer is positive when a learnt skill in one task can also be applied to improve in another task, and transfer is negative when performing the original task is obstructive or inferior in the succeeding task (Frensch & Haider, 2008).

Hendrickson analysed identical components of advanced violin techniques missing in elementary instruction. She used her understanding of transfer theory to include advanced elements of skill in beginner lessons. Hendrickson identified common motions in left-hand execution of thirds, sixths, octaves, vibrato and shifting. She found that oscillations in vibrato and wider slide motions had common movements differing in execution of size and speed. Hendrickson identified two fingertip tensions as negative transfer in their relation to each other. One is where the fingers stop the strings, whilst the other is where fingers are required to produce oscillating movements. The finger pad pressing on the fingerboard requires a certain level of muscular tension. When the fingers remain firmly on the strings, increased fingertip pressure can result. The fingertip releases some pressure to perform oscillations movements as vibrato. The tasks of stopped and oscillating finger pads do not share identical elements. Existing elements of the stopped finger action may delay or hinder the learning of a released oscillatory movement (Hendrickson, 2008b; Mikajlo, 2009).

In the 1970s, Hendrickson used applications of lanolin, termed 'grease on the fingerboard', to impress on the learner the amount of finger pressure needed in larger gross-scaled slide movements, that could be reduced to tiny micro-scaled oscillations in the performance of vibrato (Mikajlo, 2009). In preparing her talk for the AUSTA 2009 Conference in Perth, Hendrickson prepared the following figure to show her representation of negative or positive transfer.

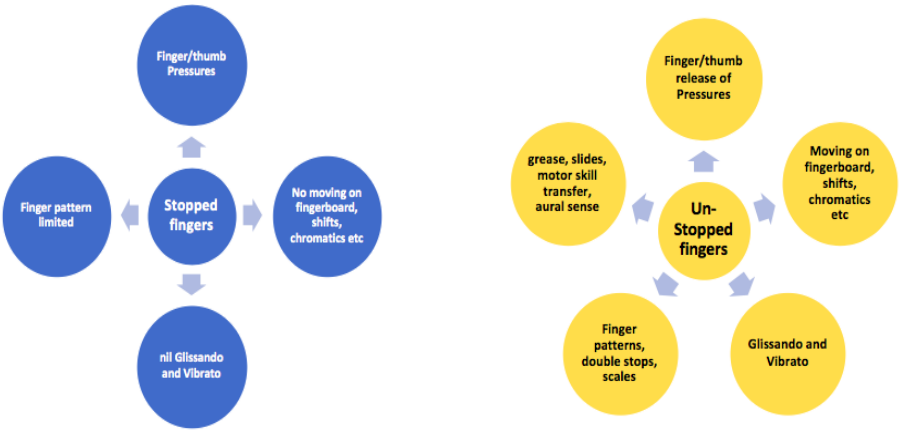

Figure 1: Negative and Positive Transfer.

Somatosensory processing

Pascual-Leone (2001) examined the causal effect simple keyboard practice had on the plastic reorganization of neural hand representations. He refers to functional and structural changes that include "rapid unmasking of existing connections and the establishment of new ones" (Pascual-Leone, 2001, p. 315). This increased representation of networks in the motor cortex is likely to act differentially in violinists, as left-hand motions are quite distinctive from right hand tasks. In right-hand bow manoeuvres, forefinger and hand pressures, directions of bowing, the sounding point of bow on strings, are adjusted to cope with left-hand finger activity and alternating tension of the strings. Ottó Szende and Mihály Nemessuri analysed the physics of the bow as, "The mean weight of the bow when used at the nut is 270g, whilst at the point is only c.17g" (Szende & Nemessuri, 1971, p. 18). Further adjustments in right arm bowing are adapted to pressures of different left-hand finger depressions of the strings, as well as different forces and pressures from the right arm movements to control the curved spring in the bow and playing surface of horse hair.

As for the left hand, an immense variation in groupings of notes and fingers are possible on the violin. In 1983, Robert Gerle measured these, finding that "not only can the 54 semitones be played in 100 or more different places but most of the notes can be played with any of the four fingers. If you add groups of notes or whole passages, chords, double stops as well, the sum total of all these variations and combinations is truly staggering" (Gerle, 1983, pp. 25-26). Amongst other physical considerations, Gerle noted that each and every note is slightly different from any other note performed on the violin, because the fingerboard span is wider toward the higher positions. The distance between similar intervals is also reduced in higher positions and the height and tension of the strings is increased closer to the bridge (Gerle, 1983).

In approximately 300 published elementary manuals from 1650, beginners have been instructed to master the spatial widths of fingers from the first position (Mikajlo, 1994). Whilst establishing security of intonation in one position may be considered positive, it also may have a negative effect repeated over many months. This is due to a delay in learning to adjust finger pressures and intervals in higher

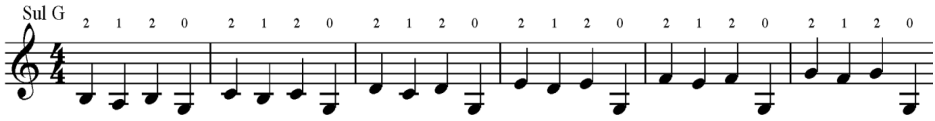

Figure 2: [sample exercise from Hendrickson files].

positions. The Manby Violin was introduced to Australia in the early 1900s with incised fingerboard marks measured in semitones. These markings on the Manby fingerboard did not take into account differences in finger pad measurements and as a result these violins were soon fitted with standard fingerboards (Lewis, 1998).

Hendrickson utilised knowledge of identical elements to experiment transferring advanced concepts to the start of violin lessons. In one of her first exercises, she instructs the student to sing the exercise first to identify pitch, before proceeding with a drill that transfers a simple finger pattern along the G string. The student is encouraged to self-identify spatial widths, finger pressures and observe the shape of their own hand and finger operations in ascending the string. Early drills usually included open strings, so the learner would be encouraged to practise releasing the thumb and finger pressures. Of the following exercise Hendrickson wrote, "This is introduced in the fifth lesson and intonation is monitored by the learner's ear and not by reading the notes followed by the initial sequence" (Hendrickson, c.1980).

Hendrickson reasoned that connections of pitch along with finger motions are linked to a memory store of melody and song learnt in beginner lessons. Hendrickson used nursery rhymes and singing as part of early lessons, not only to assist the learner in the memory of intervals, but to construct a memory of aurally guided note recognition measurements as the fingers adjust to smaller interval changes ascending the strings (Hendrickson, c.1990) .

Transfers in Bowing

Hendrickson applied her understanding of the transfer of identical elements to bowing. She illustrated ricochet bowing concepts to one of Mikajlo's students in 2006. The first instruction was to show the student two empty plastic drink bottles. Hendrickson playfully bounced them together to illustrate tension and release. After demonstrating and feeling the bounced motion with the bottles, the student was encouraged to play around with the idea of letting the bow find its own bounce against the strings. The learning of the ricochet motion of the bow on the violin strings became a very easy task to master as pressure and release elements were present in both tasks. Hendrickson also introduced the right arm 'crash bow landing' or 'putting a hole in the runway' movement on the strings. The student is shown where weight transfers down the arm and allowed to make a scratchy, heavy sound. An accompanying story, like 'too many passengers on the plane', was added. The opposite type of 'landing', taking all arm weight pressure off the fingers and bow, was named 'coming in for a smooth landing' (Hendrickson, 2008b). These opposites can inform early learners of the differences in weights and pressures in bowing and the effect on tone. Hendrickson encouraged this learning with self-discovery, and, from a teaching point of view, it required no verbal explanation.

Skin Receptors

Skin receptor cells detect pressure on the fingertips as well as vibration, temperature, position and pain (Dougherty, 1997-Present). In reference to this, Hendrickson stated "If you had a small bit of grit under your fingertip, it would depress sufficiently not only to cause pain and send a message to the brain which is very rapid. Some of the pressures are not deep enough to excite receptor cells for the brain to regard it as

important information" (Hendrickson, 2008b, p. 3). Hendrickson reflected that skin receptors might respond by their 'location', their 'quality' of pressure / temperature, the 'quantity' in the amount of pressure and 'duration' of contact. Hendrickson felt some teachers trained to teach piano, violin, cello, guitar or even tennis, may disregard receptors and sensory learning measures. Hendrickson followed Wilder Penfield's research (McGill.CA, 2019) and other studies of the somatosensory system, and her interest in this may have been triggered by her post-polio rehabilitation program that began with exercises to activate nerves of her left toe and thumb (Hendrickson, 2009). Hendrickson posed the question, "Do violinists train the receptors to accumulate in the hand from what is naturally there?" (Hendrickson, 2008a, p. 3).

Sensory links to Autism

In 1986, a doctor visited a display of Hendrickson's teaching materials at the AUSTA 150 Workshop held at the University of Adelaide, and requested Hendrickson to teach their autistic child. Autism Spectrum Disorder (Autism) is a neuro-developmental condition that may impact on a child's development through their communication, contact with others and forms of repetitive behaviour. It is associated with sensory sensitivities and sensory processing complications (Autism, 2019). Following several requests from the parent, Hendrickson trialled the autistic child on her violin program. After some time, Hendrickson noted this student had all the appropriate finger weighted actions for playing the piano. Rather than persevering with violin, she co-taught their continued piano lessons and paired this student in a duo with a violinist for a successful performance in 1989 (Bryant, 1993). At this concert, the Director of the South Australian Autism Association, asked Hendrickson if her input could support students who were non-verbal and brain impaired. Not knowing if she could assist, Hendrickson agreed to this request and, over the next few years, developed individualised experimental programs to encourage the communication of speech (Hendrickson, c. March 2008).

In the 1990s, Hendrickson speculated that receptors may accumulate differently in autistic individuals and questioned if unknown events or attentions affected the concentration of sensory sensitivity and pressure receptors (Hendrickson, 1996). Noting her own perceptions in recovery from polio, she reflected on location of receptors in areas of the body, and why some autistic students were able to sense more information from their fingertips, by producing incredible works in sculptures or perform with so much detail on the piano without even looking at their fingers (Hendrickson, 2008a; Mikajlo, 2009).

Hendrickson aimed to establish identical elements between words, music, rhythms by tonal means. In other programs, she noted the emphasis stressed on speech and its connection with sound as frequencies, instead of using 'music' in developing speech (Hendrickson, 1993). Some words Hendrickson first established, were part of babbling vocabulary a…a…ee-ol, layered with microtones to transform them into 'apple' and 'milk'. In the early 1990s, the students listening to Hendrickson's experimental night tapes were exposed to musical songs, patterns, pitches and an overlay of words. Hendrickson reported that parents involved in her program, heard their child vocalise sounds for the first time after listening to her tapes (Mikajlo, 2009).

Conclusion

Hendrickson accumulated a vast collection of lesson recordings and research papers in her lifetime and these may be of interest in other studies. Obvious restrains are privacy and family protection issues that will be treated with due diligence and sensitivity. Further research and adaptations of some key functions of her violin method may be transferable to other instruments aside from exercises designed for stringed fretless instruments with bowing. Cross-sensory artistic creative ideas for teaching in schools are currently being investigated by

many researchers such as Paul Collard (Collard, 2011) and Borbála Szirányi, (Szirányi, 3rd October 2018). Hendrickson's understanding of sensory loadings may pose other questions such as 'can elements used in Hendrickson's night tapes extend the auditory range of nerves in the inner ear to capture elements of recognisable speech?' Hendrickson's archives promises to yield additional understanding of learning theories, perceptions and sensory processing.

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