Physical contact in violin teaching

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'There are certain professions (eg medicine, hairdressing, ballet) where the doctor, hairdresser, balletmaster or other practitioner must touch the patient, client or student. The work of a violin teacher in teaching the first years of violin playing is unquestionably one of these professions. Mere verbal explanations, illustrations or showing by example are not sufficient when, eg, establishing the hold of the violin and bow.' (Szilvay, 2005)

At a time when professionals in many disciplines are increasingly wary of physical contact with children, the issue of physical contact between string teachers and their students is controversial. Many teachers, not just violin teachers, are uncomfortable with the idea of touching their students (Stamatis and Kontakos, 2008), and many jurisdictions have imposed guidelines designed to discourage physical contact between teachers and students.

Naturally, the physical and sexual abuse of children is abhorrent, and those to whom the education of children is entrusted should do everything in their power to ensure that children are protected from abuse. However, most string teachers acknowledge that physical contact with their students is unavoidable if they are to do their job well, and some argue that successful string teaching demands skillful, purposeful physical contact on a regular basis.

It is not the aim of this article to defend or justify the use of touch in violin teaching – used well and appropriately, touch is simply part and parcel of good string pedagogy. Rather, this paper will examine the role of physical contact and propose some explanations as to why touch is effective.

Many fine teachers have incorporated physical contact into their teaching. Paul Rolland is known to have used physical assistance (Foster, 1996), and Mimi Zweig (Indiana University) may be seen using physical assistance in some aspects of her teaching on her online video guide for violin teachers (Zweig, 2011). Tor Fromyhr (Canberra School of Music) has described the use of touch in the teaching practice of Jan Sedivka, and, in turn, uses touch frequently in his own teaching (Fromyhr, 2011).

A superb model of physical contact in violin teaching may be seen in the work of Géza Szilvay, founder of the Kodály-based Colourstrings approach to string teaching developed with his colleagues at the East Helsinki Music Institute. In Szilvay's teaching, physical assistance of the young violinist is regarded as a necessity, and he describes physical assistance as the norm for Hungarian teachers in the 1950's and 60's (Szilvay, 2011). Szilvay compares violin teaching with other professions in which physical contact is normal, for example medicine and physiotherapy (Szilvay, 2005). In his studio, students are skillfully assisted and moulded from the very first lesson. Left and right hand shape and technique are shaped and guided, posture is optimized, and even the musical pulse is communicated through physical contact.

The quality of Szilvay's students is well known. Not only have hundreds of his students become professional players, but also, perhaps even more compelling, very few of the students that begin with him give up the violin. A crucial part of this success, in Szilvay's own opinion, is the physical assistance he offers to his students.

It is common sense that physical contact is necessary in many professions. For doctors, touch (during a physical examination) is usually necessary in the process of making a diagnosis. Beyond this, there is evidence that touching a patient enhances their compliance in taking medication (Guégen and Vion, 2009). Touch is fundamental to the practice of physiotherapy, where its uses include diagnosis, therapy, patient assistance, expressing care, and conveying information (Roger *et al*, 2002). Dance instructors use touch in a variety of ways, and oversee physical contact between students (Collen, 2002).

There is a paucity of research relating to touch in violin teaching. Indeed, touch is a relatively neglected area of research in general (Hertenstein *et al*, 2006). However, there is a growing body of evidence in medical research, as well as in the experience of medical practice to suggest mechanisms behind the effectiveness of physical contact in violin teaching. Some of this evidence relates to the nature and consequences of touch, and to new insights into the neurology of learning. In practice, valuble experience may be found in the work of Paediatric Occupational Therapists, where touch is necessary to model, mould and modify motor activity.

This article offers a brief overview of violin technique in relation to the nervous system, before examining the role of touch in violin teaching.

A brief overview of the nervous system and the learning process.
Understanding the mechanisms by which touch may be useful in violin teaching requires a basic understanding of the structure and function of the nervous system. Learning the violin is a complex and multifaceted task, involving many different neurological processes and many different parts of the nervous system. The *motor cortex*, comprising a major collection of nerve cells in the brain mantle, is responsible for conscious muscle activity. Messages initiated in the motor cortex reach muscles via several co-operating nerve pathways, causing them either to contract or to relax.[1] Muscles operate on joints, and it is the movement of joints that produces *function*.[2]

The *sensory cortex* receives information from an enormous variety of nerves. Such information provides pleasure, warning and feedback, and includes information crucial to monitoring the success of motor tasks. Using violin playing as an example, the sensory cortex processes such information as sound, sight, muscle tension and pain. A vital aspect of this process is *joint position sense*, to be discussed in more detail below.

Memory and learning are intimately related. The process of *memory formation* is different for sensory information and motor activity. New sensory information is 'parked' in the *hippocampus*, however sensory memories (ie long-term memories) are ultimately stored in whichever part of the cortex initially received the information (eg memory for sound is stored in the auditory cortex, for sight in the visual cortex, etc). The strength of sensory memories may be enhanced by factors including frequent experience of a given stimulus, or the association of a stimulus with strong emotion. Of particular importance to this paper, it has been shown in infants that touch enhances the brain's capacity to lay down sensory memory (Rossi, 2002).

Motor memory works in a different way. Whereas memory for sensory information may be laid down as discrete units (eg the colour green, the precise location of pain etc), motor activity is stored as programmed *sequences* of movement. In developing such memories, a given movement is said to become *automatic*. Many repetitions of a given movement are required to establish *automaticity*. Motor memory is stored in a variety of locations, including the *cerebellum*, whose other functions include balance, and the refinement of motor activity from jerky to smooth movements.

The *corpus callosum* is a structure that lies centrally in the brain, running from the front to the back, and transmits information from one side of the brain to the other. Without the corpus callosum, the right hand 'knows not what the left hand is doing'.

Joint position sense is the subconscious knowledge of how our joints relate to each other in space. The importance of joint position sense may be appreciated by considering any motor activity performed with closed eyes. Clapping with closed eyes, for example, requires a subconscious knowledge of the spatial relationship of the upper limbs. This is even more important in new tasks – try closing your eyes, then touching your nose with your right index finger. For most people this is a novel task, and only possible with a sophisticated joint position sense.[3]

The brain as a map.
The brain of a newborn is an extraordinary mixture of ability and incompetence. Newborn babies are neurologically ready to feed, cry, breathe and sleep, but not yet ready to speak, walk, or feed

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[1] Muscles act in groups, with *opposing* groups of muscles on *opposite* sides of most joints. Flexion (bending) of the elbow, for example, requires simultaneous *contraction* of muscles on the front of the arm (the *flexor muscles*) and *relaxation* of muscles on the back of the arm (the *extensor muscles*).
[2] Each muscle is attached to the bones on each side of a given joint. A muscle that is detached from its so-called bony *insertion* (eg through trauma or inappropriate use) will still contract, but cause no action on the joint.
[3] Joint position sense may be lost through disease or intoxication, and the finger nose test is used in some jurisdictions as a roadside assessment of driver intoxication.

themselves. These abilities develop over time, partly as a matter of course, but largely due to the development of a series of 'brain maps'. The brain's sensory map, for example, allows us to recognize the location of pain, while the visual map allows us to locate objects in space.

It is in the development of such maps that the 'incompetence' of the newborn proves to be not incompetence at all. Rather, the brain of a newborn is a blank canvas waiting to be encoded according our individual needs and experiences (Clandinin & Feldheim, 2009; Haupt & Huber, 2008; Leary & McLaughlin, 2005). Thus, for example, we create a map for pitch - initially a fuzzy map that distinguishes just 'high' sounds and 'low' sounds, but with appropriate experience a map that may ultimately identify tiny nuances in musical intonation. Similarly, we create a map of joint position. Early signs of this evolving joint position map include the ability to point at a face or an object. Later development allows us to walk and feed ourselves. Going beyond such biological imperatives, a much more sophisticated joint position map is required for tasks such as playing the violin.

The neurology of violin playing.

Learning the violin involves many different neurological processes, but foremost amongst these various processes include:

1. the development of a highly sophisticated joint position sense;
2. the refinement and correlation of various sensory maps, particularly those relating to sound;
3. acquiring musical literacy – relating its aural to its graphic form;
4. the automatisation of many and varied motor sequences.

Ultimately, all of these processes must work together in a myriad of ways, informing and responding to each other. To give just two examples, joint position sense and pitch perception co-operate to inform left hand function (joint position sense and sensory mapping), while the visual representation of rhythm becomes intimately associated with various automatised motor sequences of the bow arm (literacy and motor memory). In turn, all of these processes have a dynamic relationship with the emotional aspects of violin playing. An excellent reader identifies written music not just with pitch and rhythm, but also with emotion, and makes appropriate adjustments to sound, rhythm and vibrato even when playing *prima vista*.

The emotional aspects of violin playing are not limited to the individual's reaction to the music. Anxiety associated with performance pressure may interfere with other neurological processes, even if those processes are highly developed. Anxiety may influence the learning process (for better or for worse), as may positive emotions associated with encouragement, enjoyment, collegiality and success.

Physical contact in violin teaching.

The teaching practice of Géza Szilvay provides an excellent model for the value of physical contact in teaching the violin. From the first lesson students are moulded more than instructed, ensuring that optimal posture and function are experienced right from the beginning.

Right arm technique will serve as an example – a well-known challenge for violin teachers, and one that has provoked a substantial volume of literature in journals, textbooks and curricula. Both Rolland and Suzuki tacitly acknowledged the difficulty of introducing the bow in their practice of modifying the beginner bow-hold (Sprunger, 2009).

Using *teacher-assisted bowing*, the learning process begins for the student with a *passive* experience of the bow stroke, as the teacher moulds the right hand and directs the stroke, simultaneously stabilizing the right elbow and shoulder if necessary. In time the student is encouraged to take more and more responsibility for bowing, until independent bowing is achieved. Even at this stage, physical assistance returns whenever significant errors creep into the bow stroke, and whenever a new bow technique is introduced. Similarly, when problematic passages for the *left hand* are encountered, assisted bowing is used to help the child through the problem. Figure 1 shows techniques for assisted bowing, using both the right hand and the left hand of the teacher. In each case the 'spare hand' is available to assist in other aspects of the child's technique.

Figure 1 - Assisted bowing using both the right and left hand. In each case the 'spare hand' is available to assist another aspect of the child's technique.

In light of the observations of the neurology of violin playing outlined above, a number of benefits may be observed. First, assisted bowing undoubtedly contributes to the evolving joint position map. The teacher's assistance establishes limits in the joint position map with respect to bowing. Optimal habits may be developed with respect to the relationship of the shoulder, the elbow, the wrist and the fingers.

Secondly, assisted bowing begins the long process of establishing the bow stroke as an automatic, subconscious motor process.[4] It is only when bowing has become a *subconscious* activity that it can be used effortlessly to serve the music.[5] Teacher-assisted bowing models not just contraction of appropriate muscle groups, but, perhaps even more importantly for the young violinist, relaxation of opposing muscle groups, thus minimizing tension from the beginning and avoiding the need for unwelcome remediation later on.

'Practice doesn't make perfect; practice makes permanent.' This advice, given by an Occupational Therapist, alludes to the fact that the motor cortex does not discriminate between good technique and bad. *Habits established on the violin are simply those motor sequences that have been practiced most often*. As the responsibility for the bow stroke is gradually passed from teacher to student, future bad habits can be minimized by ensuring that optimal technique is the norm.

Thirdly, assisted bowing provides the student with optimal sensory experiences in various aspects of violin playing. The arbiter of 'good and evil' in violin playing will ultimately be the ear, and with the teacher's assistance, students hear themselves producing good sound *on their own violin*. As the student takes more responsibility for the sound, connections are established between sound production, joint position sense and motor programming. By contrast, if left to themselves from the beginning, many students never establish such connections, not only producing an ugly, tense sound, but accepting such sounds as reasonable.

Fourthly, assisted bowing may be profoundly wedded to the acquisition of reading skills. By assisting the musical reproduction of what is on the printed page, the student 'hears what she sees and sees what she hears'. If this process is applied to a curriculum that has a suitably methodical and comprehensive sequence of notation, reading fluency develops, to a certain extent, by osmosis. Within the limits of the teacher's own interpretative abilities, subtleties of tempo, dynamics, rubato and expression are subconsciously (and later consciously) associated with reading, preparing the way for a future violinist who can play not just accurately, but expressively, when sight-reading.

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[4] Szilvay describes this stage of teaching as '*unconscious teaching*'; the activity is brought to a *conscious* level at a later stage when aspects of technique are explained in words. The process is completed when the technique becomes *subconscious*.

[5] It will remain important that, when necessary, bowing technique can be brought back, by the student, to the conscious level.

Finally, the corpus callosum, connecting the right and left hemispheres of the brain, is of great importance in violin playing. However, in the beginner violinist, where tension is always a potential problem, the corpus callosum may be more hindrance than help, by transmitting unwanted muscle tension from one side of the body to the other. However, when the teacher assists the student, the corpus callosum becomes an ally, allowing assistance rendered to the right arm to be of service also to the left arm. For example, rhythmic accuracy created in the bow arm will assist the rhythmic accuracy of the left hand. Of special importance, *the release of tension in the bow arm* will allow the *left arm* to function with less tension.[6]

Space does not permit a similar analysis of teacher-assistance of the left arm; suffice to say that the function of the left arm and hand is equally enhanced by teacher assistance. Best of all, both right and left arms may be simultaneously assisted, contextualizing optimal function and posture of each side with respect to the other.

Feedback for the teacher.

In addition to the assistance provided to the student, physical contact allows the teacher to identify points of tension that may not be obvious simply through observation. With practice, the teacher's ability to predict points of tension is greatly enhanced, and, by listening as well as feeling, the teacher's ability to 'hear' tension and to pinpoint its origin is developed.

Medical models for assisted motor activity.

Of the many disciplines within the realm of medical science, the discipline perhaps most closely allied to the profession of violin teaching is Occupational Therapy.[7] Irrespective of the emotional and sensory aspects of violin playing, conveying the music to the audience is, finally, a motor activity. Like violin teachers, Occupational Therapists have specific motor activities as their goals. However, the techniques used by OT's are not limited to motor activities, but also involve the sensory cortex to a great extent.

Some pertinent aspects of Occupational Therapy

Motor Learning Theory is one of many important principles of Occupational Therapy. Over several decades an understanding of motor learning has evolved, and important principles of motor learning have been established. For the purpose of this paper, a useful aspect of this research is the sequence of stages of motor learning proposed by Fitts and Pusner (1967). Three stages are described – *cognitive*, *associative* and *autonomous*. In the *cognitive stage*, the individual begins the learning process. The individual may understand the aim (eg writing with a pencil), but may not know how to do it. In this stage, performance is highly prone to error, requiring a great deal of input from the therapist. Functional MRI scans (ie brain scans taken during the performance of a task) have shown that many areas of the brain are activated during this stage. During the *associative stage*, the performance is refined, fewer errors are made, and less guidance is required from the therapist. The aim during this stage is independence, and the therapist allows errors to be made, so that the individual can learn to recover from errors. (Learning from error is thought to be important in transferring skills to new contexts.) Finally, during the *autonomous phase*, the activity becomes *automatic*. Functional MRI scans have demonstrated that less brain activation is required once automaticity has been achieved (ie the brain now functions more efficiently with respect to the task), and 'proof' of automaticity is that the activity can be performed at the same time as another activity (eg walking and talking, singing and playing the piano) (Zwicker and Harris, 2009). Achieving automaticity may be regarded as akin to writing a computer program – the programmed brain has the ability to produce the activity at will (though, like any computer program, there is still the possibility of malfunctions for various reasons).

Touch is an integral part of OT practice. Touch is used to stabilize posture, and to mould, model and modify motor activity. In the OT literature, touch often comes under the umbrella description of *extrinsic feedback*. While the notion of touch as feedback would imply that touch is used to *correct*

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[6] The most burdensome left arm tension is caused by contraction of flexor rather than extensor muscles, and the flexor muscles dominate left arm function on the violin. In contrast to the left arm, the function of the right arm alternates between flexor contraction of the elbow and wrist (up bow), and extensor contraction (down bow). It is perhaps for this reason and the role of the corpus callosum that left hand tension is often more noticeable during the up bow than during the down bow.

[7] Physiotherapists also rely heavily on physical contact. While there is much overlap between the work of physiotherapists and occupational therapists, physiotherapists are principally concerned with improving *movement*, while occupational therapists are concerned with the improvement of *activity* (ie function). In this respect, occupational therapy comes closer to violin teaching than does physiotherapy.

during practice rather than to mould the initial attempts at a new motor activity, in reality therapists use touch from the start when a new motor activity is being learned. Informally known as 'hand-over-hand' therapy, such physical contact is particularly useful in paediatric practice.

An important debate in the OT literature regards the value of error-free practice in developing motor skills. Recent research seems to point to the need for a balance between error-free practice and trial-and-error practice (Zwicker and Harris, 2009).

The OT literature highlights some of the advantages and disadvantages of touch in relationship to acquiring motor skills. So-called *neurodevelopmental therapy*, an especially hands-on approach to paediatric OT, has been criticized for its difficulty of delivery, the time demands it places on OT's, and its demands on the health budget (Brown and Burns, 2001). These criticisms, however, say nothing against its effectiveness, particularly in the paediatric setting, and are criticisms familiar to violin teachers attempting to set up effective programs where, for example, expensive one-to-one teaching should take precedence over less costly group teaching.

Implications for violin teaching

Experience suggests that touch in the process of teaching a young violinist follows its own sequence. In Szilvay's teaching practice, physical assistance initiates the process of motor learning for most aspects of technique. Szilvay stresses that, for any given skill, this stage *precedes* the cognitive stage, describing the initial teacher assistance as *subconscious* learning. By the time the cognitive stage is reached ('bringing the activity to the conscious level' (Szilvay, 2010)), the student has repeatedly experienced the activity passively and performed the activity with the teacher's assistance. Thus, the cognitive stage does not introduce a completely new concept, but begins with an explanation to the student of an activity that has been experienced and performed many times. An example of this may be found in Colourstrings, Book A, when bow technique is brought to the conscious level for the first time. By this time, the child has already experienced teacher-assisted bowing for a number of lessons.

The therapist's associative stage corresponds to the transfer of responsibility from violin teacher to student. Physical assistance continues to play a role in refining and correcting, though the student is now expected to perform the task independently. During this stage the role of physical assistance as *extrinsic feedback* becomes clear. At this point, teacher assistance alternates with an *expectation* of independence, and abundant opportunity is given to practice error correction.

In light of the debate over the value of errorless vs trial-and-error practice, it may seem at first glance that physical assistance in violin teaching has errorless practice as its aim. Perhaps a key to the success of Géza Szilvay's teaching is a fine balance between error-free learning (eg assisted bowing) and opportunities to practice recovering from error. Examples of the latter include Szilvay's early shifting exercises, where students must search with the left hand to play harmonics accurately – the searching is as important as the finding, as it prepares the hand for the horizontal movements on the finger board that will later be necessary for correcting intonation. A further example is the transposition of simple melodies to exploit various finger patterns. While Szilvay provides any necessary postural assistance of the left wrist, hand and elbow, and assists the bow arm if needs be, he often pointedly avoids directing the left hand *fingers* to their correct positions, so that the student must make their own adjustments and build connections between pitch discrimination and left hand shape.

Touch and neurogenesis

The arguments proposed thus far in support of touch have related specifically to *purposeful* touch – touch designed directly to assist violin playing. However, beyond this, there is evidence that touch *per se* enhances learning in infants, suggesting the possibility that the same may be true later in life.

Over thirty years ago a story appeared in the Reader's Digest of twins born prematurely. One of the twins was healthy, while the second twin had many heath problems, including respiratory and cardiac difficulties. It was decided after some time to place the twins in the same crib. Unexpectedly, the healthy twin threw an arm out over the weaker twin, embracing her sibling. Quite rapidly the heart rate, blood pressure and respiration of the weaker twin improved. The weaker twin gradually developed good health, and both were subsequently discharged from hospital as healthy babies (Rossi, 2002).

While one must be cautious about reading too much into one-off reports such as this, many similar experiences have led clinicians and researchers to take a closer look at the role of touch in human health and behaviour. There is now abundant evidence that touch in infancy has a plethora of positive effects on development and psychological well-being. In older children it has been found that so-called 'therapeutic touch' reduces stress in oncology patients (Kemper *et al*, 2009) and improves the conscious state of children in a coma (Karma and Rawat, 2006).

In a summary of current understanding of sensory learning and memory, Ernest Rossi identifies learning with *neurogenesis* – the formation of new neurones and new *synapses* (connections) between neurones. In infancy, a profound relationship between touch and neurogenesis has been shown - the withdrawal of touch has been shown to be associated with a range of devastating sequelae, including depression, failure to gain weight, and the *inhibition* of neurogenesis. These effects are quickly reversed when touch is reintroduced (Rossi, 2002).

Such research is difficult to reproduce in older children – it is acceptable to perform blood tests in babies in the intensive care nursery whose blood is already being frequently tested anyway, but it harder to convince healthy seven year-olds to have a needle for the sake of medical knowledge! While it is reasonable to suggest that such a profound neurological response to touch is most important in infancy and may attenuate over subsequent years, there is no reason to believe that it is ever lost completely.

Without for a minute suggesting that teachers should touch their students for the sake of touching, perhaps touch itself, providing that it is welcome, appropriate, and not unpleasant, is beneficial to the learning process. This is clearly true for infants, and further research is necessary to elucidate the situation in primary school children – the commonest age group for beginner violinists.

A challenge for teachers.

A legitimate concern of violin teachers and teacher trainees is the technical difficulty of using touch in a purposeful way. It is true that such an approach will only be as good as the teacher's own technique – the teacher will transmit their *own* sound to the child, whether good or otherwise. Those who observe Géza Szilvay are often struck and a little overwhelmed by what could be described as 'virtuoso' teaching – his facility in assisting students is extremely sophisticated.

However, these skills can be readily learned, and with practice, become a normal part of the teaching process. Peer-peer teaching in pedagogy courses offers an excellent chance to learn such skills. In teaching teachers to use these methods, physical contact is again useful – the lecturer may assist the trainee as the trainee assists the 'student'. Perhaps this could be described as 'hand over hand over hand' lecturing. Similarly, motivated parents of young students may be taught these techniques, enabling the parents to provide valuable assistance at home.

The value of acquiring such skills is not limited to students – colleagues and trainees who have been taught and use such skills frequently describe an improvement in their *own* playing.

Conclusion.

Playing the violin requires the acquisition and integration of a wide range of skills. Extrapolating from principles and practice in neuroscience and Occupational Therapy, physical assistance facilitates simultaneous acquisition of skills, and allows the student to experience and develop optimal violin technique from the start. There is great scope for future research in this area – the neurology of violin playing remains largely unexplored in formal literature, leaving violin teachers to rely on anecdotal evidence for the value of most aspects of their work, including the use of physical contact. (Touch, in general, is relatively poorly researched and understood.) In the future, more detailed analysis of the practice of teachers such as Géza Szilvay may offer valuable insight into the best techniques for the physical assistance of our students. The inclusion of teacher-assisted playing in undergraduate and postgraduate violin pedagogy courses will improve the skills and allay the fears of young teachers, whose use of touch will benefit students, as well as develop their own understanding of the process of playing the violin.

Acknowledgments
I am indebted to two individuals whose skills and knowledge have greatly assisted in the preparation of this paper:

Dr Robert Smith
Paediatric Neurologist, John Hunter Children's Hospital
Senior Lecturer, Newcastle University Faculty of Health
Newcastle, Australia;

Rachael Fallon
Paediatric Occupational Therapist, John Hunter Children's Hospital,
Newcastle, Australia.

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