

Strength through connection: Multisensory stimulation as communication

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Abstract

Without our senses there would be no human development, no learning, and no communication. Our senses are the engine that drives neuroplasticity. Our brains change in response to experience and all human experience depends on the senses. What is more, because we are multisensory beings we function best when our senses are used in combination. When things go wrong with the senses we are at risk of sensory deprivation. Prolonged severe sensory deprivation causes profound disturbances across the entire human condition. It even threatens survival. Because of this our society, and particularly our education system, has a moral responsibility to minimise sensory deprivation, by ensuring that all children, regardless of disability severity or type, have ample opportunities to maximise their sensory processing potential. Furthermore multisensory stimulation provides the tools to more effectively communicate with children with sensory and learning disabilities, even those without speech or language. The key to unlocking debilitating sensory deprivation is a triad of three equally important parts - of engendering wellbeing in the child, skill interventions by a caring practitioner and appropriate environmental manipulation. This paper details how this triad is put into practice.

Introduction

The title of my paper is 'Strength through connection: Multisensory stimulation as communication'. I chose this title to fit in with the conference theme of: 'Weaving the mat: Strength through connection'.

It was fascinating for me arriving at Auckland International Airport, and the first thing I saw when I came out of the plane was the airport carpet. It had a 'weaving the mat' theme. The message I was being given as I set foot in NZ was how fundamentally important weaving is to this country's sense of identity. I suddenly wanted to find out much more about the SPEVI conference theme and what weaving actually means to Maori people.

I found out that in the Maori creation story the origins of weaving are deeply connected with the origins of the universe, the world and humankind. Weaving is part of the creation story. Hine-te-iwaiwa, is the spiritual guardian of weaving, childbirth, and the cycles of the moon. The important point for me is how weaving symbolises the process of creation. Weaving is a poignant symbol for creation. It has great depth. For example if we think of procreation – how human beings are created.

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of the creation story. Hine-te-I-wai-wa, is the spiritual guardian of weaving, childbirth, and the cycles of the moon. The important point for me is how weaving symbolises the process of creation. Weaving is a poignant symbol for creation. It has great depth. For example if we think of procreation – how human beings are created. Consisting of 23 pairs of chromosomes. Each pair comprises one chromosome from the father's sperm and one chromosome from the mother's egg. Both were woven together to create a single cell. Then the cell subdivides to form two cells, then four, eight and nine months later ... a child is born. As we grow we become the weavers ourselves. We employ our senses to weave information from inside and outside our bodies to tell us about our relationship with the world. This weaving of the senses through the use of multisensory stimulation provides the foundation of communication.

For most of us, the process of learning to use our senses to weave this multisensory stimulation into information we can make sense of, is spontaneous and innate. It happens so seamlessly and automatically that we tend to just take it all for granted. We don't even notice that it is happening. That is unless our senses don't develop in a spontaneous way. Then we have a problem. The child needs help. In this paper I want to go back to the beginning and talk about how we learn to use our senses – what's involved and then to use this information to give us ideas about how we might better teach children with multiple sensory disabilities to more effectively use the senses they do have.

Yesterday after the Powhiri – the Maori welcome - I went over to the three elders to thank them. I also asked them about what they thought of the conference theme – weaving the mat. They told me they thought it was an excellent theme because “with weaving, when a strand is disentangled, in Maori culture the aim is to weave it back into the mat so it becomes a stronger part of the whole”. So when children have a disability which disconnects them from the group we need to help to weave them back into the group so they are more included. It's all about inclusion – and the key to inclusion is being able to communicate. Communication is an important part of weaving.

I want to start by getting you to chat to your neighbour. Tell your neighbour: 'what's your favourite sense? and then discuss 'what'd life be like without it?

Apart from today's discussion have you ever stopped to imagine what it would be like if you didn't have a particular sense? For example what would your life be like if you couldn't see, or hear, or taste, or smell, or feel? What about if you didn't have any senses at all? What would your life be like then? The simple answer to that question is, if we didn't have any senses we wouldn't be alive. This is because our senses are the only way we can engage with the world. Our senses are essential for our survival.

Even though our senses are crucial to our survival, we tend to take them for granted, focusing more on what information our senses are providing rather than taking time out to consider how critical the senses are or the possible ramifications on development and learning. It's only when our senses start to fail that their importance comes into sharper focus. This is when we realize that our senses play a vital role in helping to define who we are, who we will become and how we maintain our

relationship with the world. Our senses are everything! Without them there would be no human development, no learning, and certainly no wellbeing.

The senses and sensory deprivation

So what is a sense? Put simply a sense is any ability that enables us to access stimuli from either outside or inside our body. We access these sensory stimuli through our nervous system. The sensory stimulation, if powerful enough, travels from the sense organ through the nervous system to the brain, where it is collected, organized, interpreted and acted upon. This very process of the brain engaging with these sensory stimuli causes the brain to change. The idea that the brain changes in response to the sensory stimulation it processes is called neuroplasticity or cortical re-mapping (Doidge, 2007). Our senses are the engine that drives neuroplasticity. Our brain changes in response to experience and all human experience depends upon the senses. If a sensory pathway is used often and in different ways it strengthens and develops, whereas if it is not used or the sensory stimulation lacks variety it weakens and fades.

Our sense organs comprise different sensory receptors, which convert energy in our bodies or in the external environment to electrical activity in the nerves. These sensory receptors combine to inform us where the self ends and where the environment begins. The senses that allow us to access stimuli from inside the body are called the senses of interoception and the senses that enable us to access stimuli from outside the body are called the senses of exteroception. Interoception encompasses proprioception (muscle spindles and Golgi tendon organs) and the vestibular sense whereas the senses of exteroception include taste, smell, touch, hearing and vision.

Throughout history humans we have tended to regard the senses as isolated abilities and even thought they were in competition with each other, for example vision being regarded as superior to hearing (Jütte, 2005). Furthermore many school curricula still describe the senses as discrete abilities. However as Calvert et al. (2004, p. xi) point out in their seminal work *The Handbook of Multisensory Processes* this way of thinking about the senses is inaccurate and problematic. They conclude:

There can be no doubt that our senses are designed to function in concert and that our brains are organized to use the information they derive from their various sensory channels cooperatively in order to enhance the probability that objects will be detected rapidly, identified correctly, and responded to appropriately.

We are multisensory beings and we function best when our senses are used in combination.

The opposite is also the accurate. When our senses are used in isolation they are less effective and efficient. Furthermore when things go wrong with the senses we are at risk of sensory deprivation. *The Dictionary of Medicine, Nursing, and Allied Health* (2003) defines sensory deprivation as:

a condition in which an individual receives less than normal sensory input. It can be caused by physiological, motor, or environmental disruptions. Effects

include boredom, irritability, difficulty in concentrating, confusion, and inaccurate perception of sensory stimuli. Auditory and visual hallucinations and disorientation in time and place indicate perceptual distortions due to sensory deprivation. Symptoms can be produced by solitary confinement, loss of sight or hearing [or other senses], paralysis, and even by ordinary hospital bed rest.

A multitude of scientific research now catalogues how prolonged severe sensory deprivation causes profound disturbances across the entire human condition, even threatening survival. For example Joseph (1999, p. 193) sums up this research by stating: "Children who survive an infancy spent in institutions where mothering and contact comfort were minimized, display low intelligence, extreme passivity, apathy, severe attentional deficits, pathological shyness, and exceedingly bizarre social behavior". Additional stark evidence comes from Perry and Pollard (1997) who published a brain scan of a three-year-old infant subjected to extreme sensory deprivation, which showed significant cortical atrophy.

Much of the research reporting sensory deprivation in children focuses on neglect, nevertheless it is also important to recognize that there are other causes of sensory deprivation, particularly sensory learning disabilities. When children have sensory learning disabilities their natural ability to access sensory stimulation is greatly reduced, and this reduction, if appropriate early intervention is not provided, results in the child's sensory pathways weakening and fading. When this happens the child withdraws and even reaches a stage where (s)he fervently protests when any stimulation is offered. Without active and intelligent intervention the child's sensory world continues to shrink.

Because of the child with sensory learning disabilities' vulnerability to sensory deprivation our society, and particularly our education system, has a moral responsibility to minimise sensory deprivation, by ensuring all children, regardless of disability severity or type, have ample opportunities to maximise their sensory processing potential. However, providing such opportunities is easier said than done.

Most of us take the senses for granted, assuming that a child will automatically access all the sensory stimulation (s)he will need, and in the vast majority of cases this is an accurate assessment. However some children have sensory learning difficulties that preclude them from being able to automatically access sufficient sensory stimulation. These children require expert assistance to help them overcome their sensory learning disabilities.

One of the most serious consequences of sensory deprivation in the young child is that of communication. The ability to be able to access adequate sensory stimulation is a prerequisite of the child being able to develop communication. Furthermore multisensory stimulation provides the tools for the practitioner to be able to more effectively communicate with children with sensory and learning disabilities, even those without speech or language.

The key to unlocking debilitating sensory deprivation is a triad of three equally important parts - of engendering wellbeing in the child, skill interventions by a caring

practitioner and appropriate environmental manipulation. Given the time constraints of this paper it will only be possible to touch briefly on the first two parts of the triad.

Engendering wellbeing in the child

Earlier I remarked that for sensory stimulation to be effective it must be 'powerful enough' to trigger in the nerve receptor a cascade of neural electrical impulses able to travel all the way to the brain. For this cascade to reach the brain the sensory stimulation must pass through a series of three sensory thresholds.

The first threshold is the detection threshold. The detection threshold refers to the minimum level of sensory stimulation necessary for the person to be able to detect the sensory stimulation. Initially the detection threshold might be quite high, however with ongoing use, the detection threshold will lower, thereby making it easier for the person to be able to detect the stimulation.

As the pool of experience accumulates in the brain, over time the sensory stimulation passes over a new sensory threshold, the recognition threshold. Now the person is not only able to detect the sensory stimulation, the person can also recognize it as being familiar in some way.

With even more experience the pool continues to grow and eventually the person is able to add a new level of processing the sensory stimulation, that of making differentiations. This third threshold, the differential threshold provides the foundation for the development of all forms of communication, including speech and language. We must be able to decipher whether a sound is different to another sound before we can add those sounds together to form a word.

This pool of experience enables the person to become better at anticipating detail (Clark, 2008). According to Clark (2011) the brain is "an engine of prediction" and it is this very process of expectancy that enables the person to guide their own perception, thoughts and actions, instead of it all being solely reactive as was previously believed. Predictive coding is different to earlier theories of perceptual processing, such as the bottom-up theory (Gibson, 1966), which assumes perception results from the stimulation flowing from the sense organ to the brain, or Gregory's (1970) top-down theory, which assumes the pool of past experiences stored in the brain enable the processing to occur in response to sensory stimulation received, a matching of past experience with the most recent experience.

With predictive coding however the assumption is that, in addition to the bottom-up and top-down perception strategies, the human brain becomes a "perception expert", which enables it to anticipate the sensory stimulation, thereby processing it before it actually happens (Clark, 2011). This means that the person's emotional response to the anticipation is much more important than had previously been acknowledged. This is because if a person dislikes an anticipated sensory experience then it is highly likely that the person will block the experience in order to prevent it from happening. Predictive coding therefore helps to explain why some children with sensory learning disabilities, such as those with autism, steadfastly refuse to engage in sensory experiences that they do not like or do not recognise. As Pagliano (2012, pp. 37-38) writes:

If the baby's environment is harsh – perhaps a result of trauma, illness, neglect, abuse, sense impairment or learning disability – then withdrawal from a sense experience may become a regular reaction to all future novel experiences. This is because the baby has already started to predict that new experiences are going to be overwhelming, unpleasant and/or lack meaning.

Pagliano (2012) goes on to argue that in the design of sensory intervention for children with sensory learning disabilities it is important to consider the child's emotional response to the sensory experience. The practitioner only begins the intervention once (s)he is convinced the participant will find the sensory experience pleasurable. The practitioner therefore needs to prime the child to anticipate that a novel sensory experience is going to be pleasurable. Practitioner does this through the use of care theory.

Skill interventions by a caring practitioner

Noddings (1984) proposed care theory as way of providing ethical guidelines for practitioner practice when working with participants who require care. She argued that caring is bidirectional. It is not sufficient for the practitioner to simply say (s)he cares. The engagement must occur at a much deeper level. According to Noddings an essential component of a caring relationship is recognition on the part of the cared for that an act of caring is taking place. The caring practitioner employs engrossment to become fully absorbed in what the participant is trying to communicate, and it is this engrossment that informs the participant that the practitioner is engaging in a caring relationship.

Communication is based on our ability to make associations. We learn to communicate by making associations between one thing and another. This ability to make associations starts with sensory processing, first with detection of a sensory experience, then being able to recognise it, and finally being able to differentiate it from other sensory experiences. This ability to make differentiations provides the foundation for us to become aware of our own experiences and to share this information with others. Multisensory stimulation therefore provides the infant with his/her very first introduction to meaning and it is through multisensory stimulation that we acquire more sophisticated forms of communication. It also provides a key to designing sensory intervention.

The caring practitioner is anyone who is interested in the wellbeing of the child. For Pagliano (2012) the idea of wellbeing relates to a person's ability to derive enjoyment from a sensory experience. He identifies three types of pleasure, namely: ease, consummatory pleasure and anticipatory pleasure. Ease describes an unconscious state of comfort, a contentment that derives from having ones essential needs met. Consummatory pleasure refers to a more conscious in-the-moment experience, which arises from being actively engaged in the sense activity. Anticipatory pleasure comes from a desire to re-engage in a sensory experience that was enjoyed in the past. Anticipatory pleasure therefore links in nicely with predictive coding.

According to Noddings (1984) care starts at home where the child learns to care-about through the experience of being cared-for and this care relationship continues

into education, where the teacher becomes the caring practitioner. Care is both an essential need and a deep-seated want making it both a pre-condition for education and a key ingredient in education. Caring educators therefore work closely with families to promote high quality home care throughout the student's education. This is especially the case when working with children with profound sensory learning disabilities who show evidence of sensory deprivation.

In care theory Noddings describes four key components of a caring education. These are: modelling, dialogue, practice and confirmation. Once the child is able to detect a sense experience and can demonstrate detection ability then the caring practitioner is able to use this ability to begin the communication process, to have a multisensory conversation. This multisensory conversation at first merely consists of the caring practitioner becoming aware of the child's level of engagement with the sensory experience and identifying ways to extend this engagement in rewarding ways, moving through the three forms of pleasure described earlier.

A model is an example, a behaviour the learner can copy. The caring practitioner introduces a novel experience to the participant as a model, an example of a new activity to try. Modelling provides a powerful opportunity for the child to learn through imitation. However when designing novel activities the caring practitioner must deeply consider the child's ability and preparedness to engage in the experience. For example modelling for a student who is blind must be non-visual. For an activity to be an effective model it must be within the realms of possibility for the child to replicate. In care theory the social interaction provides a powerful means of transition from one stage to another.

Noddings talks about the child being a caring apprentice. In Vygotsky's (1978) words the caring practitioner becomes the more knowledgeable other (MKO) who ensures that the novel sense experience being modelled is within the child's zone of proximal development (ZPD). The caring practitioner therefore manipulates the multisensory environment to construct a suitable scaffold for future sense development and learning.

Through engrossment the caring practitioner begins to identify the child's sensory vocabulary. This sensory vocabulary provides an opportunity for the caring practitioner to begin a sensory conversation with the child. Noddings uses the word dialogue to highlight equality between the practitioner and the participant and the way exchange of information forces change. The child is placed in a situation where the modeling, a passive activity for the child, now becomes an action. Once this change occurs the next task for the caring practitioner is to encourage the child to repeat the activity, to begin to practice it. As with modelling for dialogue to be successful it must be informed by the child's ability to communicate, and practice requires active student participation.

A caring educator builds a caring relationship with the child by paying sympathetic attention to accurately read the student. Reflection on this information makes it possible for the caring educator to respond in helpful and hopeful ways that encourage the student to discern a better self. In this way the caring educator matches student intention with confirmation.

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