



FEATURE ARTICLE

# Optimizing arousal to manage aggression: A pilot study of sensory modulation

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**ABSTRACT:** *The dominant model that informs clinical training for preventing violence and managing aggression posits arousal as mediated downwards from higher cortical structures. This view results in an often-misplaced reliance on verbal and cognitive techniques for de-escalation. The emergence of sensory modulation, via the Six Core Strategies, is an alternative or complementary approach that is associated with reduced rates of seclusion and restraint. Sensory-based interventions are thought to promote adaptive regulation of arousal and emotion, but this connection has had limited theoretical and empirical development. This paper presents results of a pilot trial of sensory-based interventions in four inpatient mental health units in New Zealand. Narrative analysis of interview and focus group data suggest that modifications to the environment and the use of soothing stimuli moderate or optimize arousal and promote an ability to adaptively regulate emotion. Findings are discussed in light of recent advances in the neurophysiology of emotional regulation and the General Aggression Model that posits arousal and maladaptive emotional regulation as precursors to aggression.*

**KEY WORDS:** *aggression, arousal, behaviour mechanism, coercion, inpatients.*

## INTRODUCTION

The training for nurses in managing violent situations has progressed significantly over the past 20 years. Practice is now guided by theory, and discrete skill modules such as de-escalation have replaced intuitive judgement about handling volatile situations (Paterson *et al.* 1997). The language of ‘control and restraint’ has been explicitly rejected in favour of ‘calming and restraint’ or other formulations that do not evoke the language of correctional services (Paterson 2009). Despite these improvements, clinicians still ‘believe in’ seclusion as a useful tool (van Doesselaar *et al.* 2008; p. 97), and manual restraint of inpatients is increasing (Bowers *et al.* 2012). These

features indicate that nursing practice remains at odds with both nursing values and the evidence base for clinical practice (Sailas & Fenton 2000). This dilemma arises, in part, from limitations in our understanding of arousal and consequential gaps in our management of mediators and precursors of aggression.

Chief among these precursors is autonomic arousal, which is known to influence affect and emotion (Schachter & Singer 1962), and can lead to aggressive behaviour (Berkowitz 2001). While arousal is mediated along afferent and efferent neurological pathways, clinical training for de-escalating aroused states has a distinct bias toward a ‘top-down’ efferent model. This ‘top-down’ model describes the modulation of emotional response from cortical brain structures that elaborate the emotions and regulate affective behaviour (Beauchaine 2001; Panksepp 1982). The dominance of this model is manifested in Selye’s (1936) general adaptation syndrome where the fight/flight response flows along the hypothalamus–pituitary–adrenal axis. This approach is also typified in clinical training to manage aggression through a process

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that employs social learning theory of aggression that posits aggression as a cognitive process, enacted through schema that have been learned across the lifespan. This view is reflected in clinical training which describes an escalation axis from anxious, to agitated, to verbally or posturally threatening, to potentially lethal behaviours, followed by stages of crisis resolution. This pathway preference does not allow for an arousal process that could be recursive, and capable of self-regulation (Richter 2006). Thus, when the clinical responses of validation, negotiation, and warning fail, as they sometimes do, practices such as restraint or seclusion are often the only options remaining (Perkins *et al.* 2012).

With the launch of the Six Core Strategies to reduce seclusion and restraint (Huckshorn 2006), sensory modulation (Champagne 2011) emerged as a suite of sensory-based interventions that provide an alternative, afferent or 'bottom-up', response to arousal or aggression. As a tool for reducing coercive events, sensory interventions seem to de-escalate aroused states and eliminate the risk of restrictive responses by clinical staff (Champagne & Stromberg 2004; Cummings *et al.* 2010; Lee *et al.* 2010). Deliberate use of selected sensory inputs have been shown to moderate arousal (Miller *et al.* 2007), thus allowing individuals to become aware of emotions as well as equipping the person with a strategy and tools for adaptive emotional regulation (Ogden *et al.* 2006). A recent review of contemporary research into the role of emotional regulation in aggression found clear evidence that maladaptive emotional regulation can cause aggressive behaviour (Robertson *et al.* 2012).

Under-regulation of emotions, particularly anger, usually becomes aggression as a way to terminate difficult emotional situations, while over-regulation contributes to aggression by increasing physiological arousal and raising the likelihood of activating suppressed emotional triggers. In the face of a difficult situation, the deliberate use of emotion regulation strategies could enable individuals to 'contain the emotion experience sufficiently to engage in goal directed behaviours while allowing the emotion experience to run its course' (Robertson *et al.* 2012; p. 74). The problem seems to be that alternatives that promote this outcome remain virtually unknown. A recent review of practice found that nurses engage in restraint, in part, because they are not aware of alternatives to taking an aggressive person to a horizontal position (Perkins *et al.* 2012). There is a need to develop a suite of strategies to help nurses and other clinicians promote optimal arousal to assist the person to self-regulate emotion.

It is likely that sensory interventions perform the function of allowing emotional experiences to be contained so

that adaptive behaviours can be engaged. Such a de-escalation pathway could provide a set of practical tools for preventing distress moving to aggression. However, the relationship between sensory input and emotional regulation has not been fully established in mental health-care practice. Therefore, this paper will evaluate this connection through the lens of the arousal and regulatory experience of people who engaged in this intervention. The qualitative findings of a trial of sensory modulation in four inpatient mental health units in New Zealand will be presented. These findings will be discussed in light of recent advances in the neurophysiology of emotional regulation (Porges 2001) and the General Aggression Model (GAM) (Anderson & Bushman 2002). The purpose of this paper is to examine the potential of using sensory-based approaches to develop the theory and practice of preventing, minimizing, and managing aggression in mental health settings.

### The General Aggression Model

The GAM is a framework through which the study findings and the application of sensory modulation practices can be conceptualized. Aggression has been seen traditionally as either an impulsive and hostile act usually driven by anger, or a premeditated goal-oriented behaviour. This dichotomy limits clinical responses to inpatient aggression by locating the source of aggression in the individual (Duxbury 2002). However, this view has been explicitly rejected in recent research and guidance on managing clinical aggression (Oud 2006; Paterson *et al.* 2010; Richter 2006). The GAM integrates multiple theories to present a framework for understanding aggression. This framework is specific to aggression that has an immediate intent to cause harm (i.e. not accidental) and that includes both non-violent and violent behaviour.

According to the model, aggression arises out of a complex interaction of inputs (personal attributes and situation), mediating pathways (learned cognitive scripts, affective repertoire, autonomic arousal), and outcomes (decisions and actions). Emotional regulation can be influenced by the ongoing interaction between a person and their environment. To illustrate this dynamic, Figure 1, adapted and modified from Anderson and Bushman (2002) and Robertson *et al.* (2012), depicts a sequence in a hypothetical emerging behavioural crisis when a request to lower the room temperature is denied. An individual with a dominant or hostile interpersonal style may become aggressive (Cookson *et al.* 2012) and depending on the strength of existing scripts (e.g. retaliatory or hostile), the affective route may activate rapidly, spurred by a heightened state of autonomic arousal that

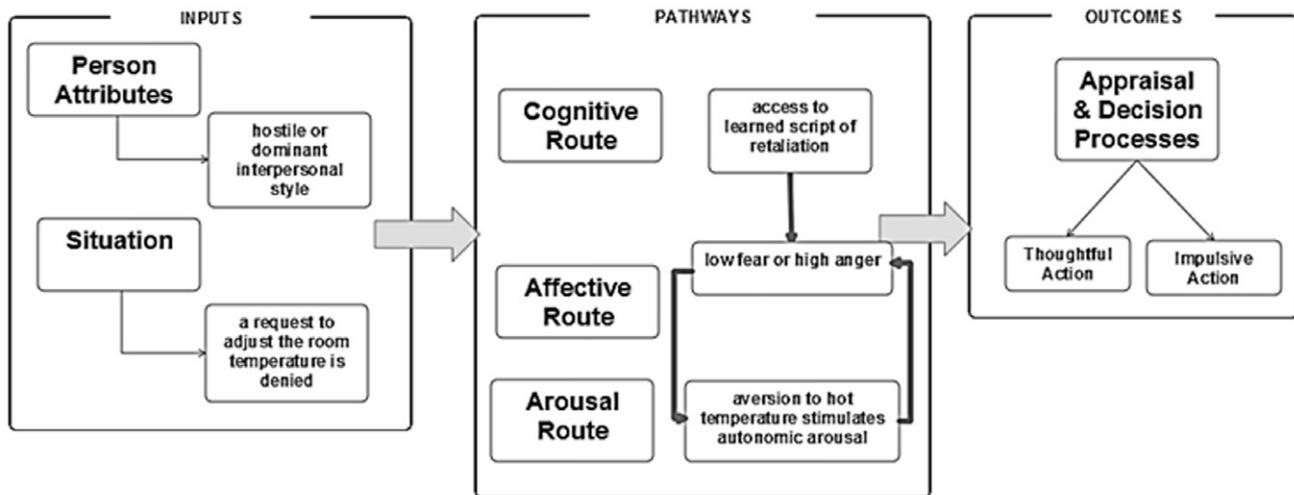


FIG. 1: General Aggression Model with behavioural example.

could be expected from someone with a sensory aversion to hot temperatures (Anderson *et al.* 2000; Berkowitz 1993). The interaction of both individual and environmental variables can generate a process that supports impulsive, aggressive behaviour, triggered by cognitive scripts in memory.

The GAM asserts the primacy of cognitive triggers for aggression, to the neglect of neurological and other biological factors as well as environmental stresses that could cause distress and lead to aggression. A recent critique of the model cites the ‘squishiness’ of data that support the assumptions that aggression is either learned or cognitive, and also the inadequacy of the linearity and mechanistic properties of the model (Ferguson & Dyck 2012). For our purposes, however, the GAM remains a useful schema for conceptualizing how a ‘bottom-up’ sensory approach may work with cognitive approaches to prevent aggressive behaviour in mental health settings. While learned scripts in memory may play a larger role at the outcomes stage of the process where decisions are made, the model highlights the problem of using a purely cognitive or verbal approach to de-escalating aroused, agitated, or aggressive situations where personality and situation combine with cognitive scripts in memory. Without an intervention that optimizes arousal or moderates affect, cognitive scripts may not even be accessible to negotiation or change. This feature of the model will be discussed along with recent advances in the neurophysiology of emotional regulation as a way to understand the findings of the pilot study using sensory interventions to minimize the risk of aggression.

## PILOT STUDY

In 2009, a pilot sensory modulation intervention was introduced into four mental health inpatient units in New Zealand (three adult units, one youth unit), in the form of a designated space (a ‘sensory room’) equipped with a range of items for various sensory inputs. Staff from multiple disciplines had initial training in the theory and principles of sensory modulation and an introduction to the sensory tools, as well as scheduled brief ‘refreshers’ to discuss issues that arose in using the approach. Service users were oriented to the room as part of the admission process where the purpose of the room was explained. Subsequently, when experiencing an increase in levels of distress, a service user could access the sensory room accompanied by a member of clinical staff. Apart from responding to an occasional request by a service user to use the sensory room, staff would offer the intervention as early in an escalation process as possible. When prompted by early signs of agitation, staff would reflect the behaviour back to the person and invite them to use the resource. Once in the sensory room, staff helped the person select from a range of equipment to facilitate being comfortable in that environment. This range of objects included a massage chair, rocking chair, beanbag, faux-fur blankets, weighted blankets, weighted soft toys, ‘stress’ balls, portable audio and DVD players with relaxing sounds and visual scenes, aromatic oils and diffusers, scented hand creams, and adjustable coloured ambient lighting.

**TABLE 1:** *Number and characteristics of interviewed sample*

Interview sample	Total	Female (%)	Male (%)	Nursing (%)	Allied health or other (%)
Clinical staff	40	90	10	72.5	27.5
Service users	20	90	10		

## Method and sample

An inductive, qualitative study using focus groups and interviews was conducted in two phases to evaluate the acceptability, implementation, and impact of the intervention. Clinical staff and discharged service users who had used the sensory room were invited to participate in interviews and focus groups to discuss their experience of the intervention. Unit managers and senior staff on the units acted as intermediaries to recruit staff from the units. Community key workers or consumer advisors approached former service users to participate in the study. A semistructured interview schedule was developed for the staff and service user interviews. Service users were interviewed either in their home or in a private room in a clinical agency according to their preference. Informed consent was obtained from all participants. The research was approved by the New Zealand Multi-region Ethics Committee, New Zealand Ministry of Health.

The first phase of the research occurred in late 2009 and focused on initial experiences of the implementation of the sensory modulation rooms. The second phase occurred in 2011 and focused on how the intervention had evolved in the four units. In both phases, participants described their experiences using the intervention. All interviews and focus groups were conducted by a member of the research team who was not employed by the mental health service. All interviews and focus groups were audio-recorded and transcribed. A description of the sample is shown in Table 1.

## Analysis

An inductive approach was used to generate themes from the transcribed focus group and interview data (Graneheim & Lundman 2003; Thomas 2006). Analysis was guided by the study objectives and involved detailed, repeated readings of the raw data in order to develop key themes from manifest content and underlying meanings (Graneheim & Lundman 2003). The organization, coding, and analysis of data was conducted using nVIVO software (QSR International, Melbourne, Victoria, Australia). The first round of raw data was categorized according to broad themes which emerged from participant responses. Further thematic analysis took place to

develop subthemes within each of the above categories. A coding structure was developed and applied to the second round of interviews and further themes were identified. Three members of the research team cross-checked the themes and data to ensure consistency of the final themes and subthemes. These themes capture the perceptions of service users and staff in relation to their experience of using the sensory modulation rooms, and in particular the impact of the intervention on managing distress and agitation.

## FINDINGS

Three main themes emerged from the analysis: (i) facilitating a calm state; (ii) enhancing interpersonal connection; and (iii) supporting self-management. Each aspect was an important element of sensory modulation which contributed to the management of distress and agitation.

### (i) Facilitating a calm state

There was agreement amongst the participants that the sensory intervention reduced arousal and induced a calm state in the majority of the people who used it. Within this broad theme, several subthemes highlighted the mechanisms which enabled the de-escalation of distress or agitation. The first of these relates to the 'soothing and grounding effect' that the sensory intervention had. For many participants, the sensory room provided a space to withdraw to, where the room and sensory equipment were experienced as relaxing. As one staff member reported, 'I think the environment just allows people to soothe . . .' (staff member (SM)9, site 4). The soothing effect appeared to relate to the easing and comforting of both mind and body as reflected in service user reports:

It's positive, calming, soothing, slowing down of racing thoughts . . . (service user (SU)12, site 4)

I remember being really, really emotional and going in there and sort of calming down. Just looking at the colourful walls in there with the lights off and that, it made your mind feel at ease. (SU5, site 4)

The accounts indicated that soothing involves a movement from mental and physical harshness and speed, to a softness and slower, rhythmic pace, characteristic of the body's physiological state when relaxed. This alignment of external input with internal processes such as brain waves, heart rate, and breathing is known as entrainment (Rider, 1985), and appeared to be a key mechanism in the sensory intervention.

In addition to aligning internal processes with external stimuli, some modalities had a stabilizing effect by

drawing attention to the service users' somatic or bodily senses. Many participants used terms such as 'grounded', 'anchored', 'centred', and 'collected' when describing this type of experience. The grounding effect of somatic sensation was one of the strongest subthemes in the participant accounts.

I really liked that feeling of being in the [massage] chair, so I got into there and it had that focus of actually centring me . . . I actually found, that sort of made me feel a lot calmer, but . . . you know, alive and not unconnected . . . shutting off senses that were too activated and not helpful. (SU11, site 4)

I stopped being racy for even just five minutes. I was actually still, you know, and centred and focused. Whereas usually, I'm not like that at all, and when I get unwell, it just magnifies twenty million times, so I'm never resting, you know, and I don't sleep. So, to even be centred for five minutes is a really big deal. (SU14, site 4)

Sustained feedback through internal and musculoskeletal sensation helped service users to ground themselves in their body and to be attuned to the present. Participants who had experienced psychosis, elevated mood, dissociation, and overwhelming anxiety all reported that this aspect of the intervention was a significant factor in assisting their de-escalation, helping them to feel secure and oriented in space and time:

It was good for dealing with situations where I was starting to feel somewhat distant . . . it was really good at helping ground me. It would get me back to the present . . . (SU2, site 4)

Being brought back to the present supported participants to engage with the immediate context more constructively ' . . . it's sort of like focusing on the here and now, and what's most helpful' (SU14, site 4).

The 'shifting of attention and affect' was another key subtheme in the findings. By drawing attention to the bodily sensation or the immediate environment, the sensory intervention provided distraction from anxious thoughts, urges to self-harm, delusional ideas, and overwhelming auditory hallucinations. For example, participants stated:

I get voices in my head, so when I was in the room I could kind of, not switch them off, but concentrate on something else, and [it] kind of relieves the tension. (SU1, site 3)

. . . then you were in a room and you've got things distracting you . . . usually for me, eventually [the agitation] passes, it can just take time . . . (SU3, site 4)

You know, with paranoia with the music that's really quite good, as it takes them right away. (SM2, site 2)

Distraction through strong sensory input was a significant factor in reducing agitation, if it allowed enough time for individuals' physiological and emotional arousal to subside. A further aspect of shifting attention and affect was the experience of being transported away from the present to another time or place:

I wanted the sound of the beach, of the waves, so I had that. And the smell of the hand cream reminded me of sort of sun block . . . and so I was taken back in time to good childhood memories, felt like I was at the beach, tension was relieved and [I was] at peace. (SU11, site 4)

This positive association involved a direct emotional response to specific sensory input; shifting focus away from stressful situations or thoughts towards affective states connected with memories of other times and places.

Participants also commented on the importance of experiencing a 'sense of safety and control' for inducing a calm state. Having a dedicated safe space was identified as an important aspect of the intervention and the sensory room was perceived as being less clinical and not so prone to interruption as other spaces on the ward, including individuals' bedrooms. For many participants, using a weighted blanket, or sitting in a beanbag, added to the sense of safe containment:

For me, the most helpful was that opportunity the sensory room gave me to have a quiet, relaxing space on the ward . . . it's a safe space . . . The weighted blanket just gave me a sense of protection and safety. (SU13, site 4)

The service user accounts suggested that having the opportunity to remove oneself from potential threats and intrusions and to provide one's body with a strong indication that it is secure was important for inducing calm. Staff also saw the development of a safe space as key to the implementation of the sensory intervention. One staff member emphasized the importance of preserving both time and the space for the sensory experience:

Well I just think having that time . . . and having that sort of space really respected and recognized as a space that you don't invade . . . (SM5, site 1)

Another significant subtheme was the increased sense of control created through the use of the sensory tools. Service users found that through the soothing and stabilizing effect of the sensory intervention they were able to think more clearly, regulate their emotions, influence their immediate environment, as well as control destructive behaviours:

... to be mentally in a better space, you know? And the control that comes with that ... I had control over what I wanted to feel. I knew that was going to make me feel good and relaxed. (SU14, site 4)

I found it really good sort of to be in control of the environment. Like, the sound ... the lighting, it was just being in control of things around you, kind of helps to calm you down. (SU11, site 4)

It should absolutely be something that's available, because I think that it helped me get the behaviours under control as much as anything and had I not ... it could have been a lot worse. (SU2, site 4)

The participants' accounts suggested that institutional restrictions and distressing symptoms resulted in a loss of control over their bodies, minds, and environment, and the sensory intervention supported service users to regain agency over these factors.

The last subtheme related to the facilitation of a calm state was the experience of 'expression and release' through the sensory interventions. The opportunity to release tension and express emotion within the safe confines of the room was cathartic for some participants:

It kind of calms you down enough to allow your feelings to come out instead of holding them all in ... (SU6, site 4)

It was just somewhere where you could go and exert energy and not be judged for it ... to go and sit in a room and jiggle and squeeze a ball and throw a ball in the air is like, that was okay, but pacing the corridors at 4 am wasn't. (SU1, site 4)

Staff found that the relaxed and safe space led to service users 'opening up' and expressing issues or releasing pent up energy. The grounding effect of being in a rocking or massage chair, or squeezing a stress ball, appeared to allow the safe discharge of energy which was not always possible in other parts of the ward due to perceived lack of privacy and safety.

Participants suggested that the impact was not long term, but long enough to enable engagement in something more restful, constructive, or therapeutic. Service users reported being able to get some sleep or engage in meaningful activity after using the sensory room, while staff found that following the use of sensory tools they could facilitate the use of other verbal and cognitively based strategies:

[It] calmed her down so that she could focus; you know: we could talk about what happened logically. (SM1, site 3)

This finding was particularly significant as it suggested that the intervention acted as a precursor to subsequent

cognitive and interpersonal engagement. This effect is reflected in the second major theme related to the enhancement of relationship through the sensory interventions.

## (ii) Enhancing interpersonal engagement

As well as having a calming effect, sensory modulation was perceived as a tool for developing meaningful connection between staff and service users. Social relationships are a significant factor in managing aggression and the findings suggested that the sensory room and equipment enhanced interpersonal interaction by facilitating the rapid building of rapport and trust. Having someone present in a soothing or stabilizing manner was often as important to service users as the room and equipment. Service users valued the uninterrupted one to one time and appreciated the sense of interpersonal engagement that resulted from time in the sensory room.

I found it good for a connection with staff, 'cause when they're busy on the wards, they don't have time to talk to you, and at least in the sensory room ... you actually got that one-on-one time for 15 minutes or so with that nurse. (SU13, site 4)

In addition to having a staff member present and attuned to their experience, service users also suggested that having someone to talk to was important in creating connection:

For me, it's been a place, at times, where I've been able to talk openly and freely to nurses about what's going on in my head. (SU1, site 4)

A number of staff participants also described how the application of sensory modulation created an opportunity for developing trust and relationship. Trialling and accessing the sensory approach and tools with service users was perceived as a means to rapidly build rapport and share meaningful experiences, even in the absence of verbal communication:

That rapport building as well ... you're not communicating verbally with them, but you've still built up a rapport ... they trust you ... talking and building up communication and building up that rapport, it's kind of just come instantly with that person. (SM10, site 4)

Comments such as this indicated that sensory modulation not only induced a relaxed atmosphere, but also allowed staff members to get alongside to work in close proximity with service users. The approach encouraged staff to 'tune into' and talk with service users about their sensory and emotional experiences, while engaging in simple and practical strategies for managing their own

arousal. This aspect of self-management was the final major theme in the participant accounts.

### (iii) Supporting self-management

While the initial focus of the study was on implementing sensory modulation as an inpatient de-escalation tool, both staff and service users recognized the potential for using the approach to increase self-awareness and self-management. By supporting service users to recognize their own sensory sensitivities and triggers and to develop their own strategies, sensory modulation broadened the focus of de-escalation practices and encouraged shared responsibility.

Staff members suggested that the practical nature of the approach enabled service users to be proactive in calming themselves:

It did take longer than giving people medication but it gave people a real strategy of how to help themselves next time. So instead of just sticking a plaster on it, on the problem, which is kind of what PRN does . . . you're actually giving somebody a really concrete way of dealing with their problems. (SM6, site 3)

Staff participants also commented on the need to take sensory modulation beyond the sensory room and into the wider service and home environment. One commented: ' . . . there's the tools in that room that they can figure out what helps, and then hopefully, they can think about how to take that home in some form' (SM9, site 4). Service users were able to describe how they integrated sensory modulation strategies into their everyday lives: 'I utilize the stress ball I've got at home and the deep breathing all the time which I have learnt from there, so yeah, find that really helpful to get through tough situations I'm faced with' (SU16, site 4). Accounts such as these suggested that in addition to being an effective approach for calming and increasing interpersonal connection, the sensory modulation approach also enhanced service user self-awareness and capacity for self-management. By supporting individuals to develop their own practical sensory strategies, sensory modulation had the potential to broaden the focus of de-escalation practices and better support recovery.

## DISCUSSION

This paper maps the subjective responses to deliberate sensory inputs against a cognitive model of aggression (GAM), and examines this with recent theoretical advances in the neurophysiology of emotional regulation (polyvagal theory). The study findings align with other

recent research which found that sensory interventions had a calming effect in people experiencing acute distress (Chalmers *et al.* 2012; Novak *et al.* 2012). The participants' accounts provide important insights into how a sensory approach can promote the reduction of agitated states of arousal. It is important to note here that the intervention focussed on factors known to promote aggression, and that the behaviours that warranted the intervention were not necessarily aggressive. Through reducing aversive stimuli and shifting the affective state of an agitated person the intervention sought to direct a cognitive script that led to a thoughtful outcome rather than an impulsive one. The study findings will be discussed with a focus on the mechanism and utility of reducing aversive stimuli, communicating safety, and shifting the affective state of a distressed person.

### Reducing aversive stimuli and communicating safety

General discomfort and aversive conditions, such as hot temperatures, loud noise, or unpleasant odours, increases the risk of aggressive behaviour by escalating negative affect and physiological arousal (Anderson *et al.* 2000; Berkowitz 1993). In the mental health inpatient units studied by Johnson and Delaney (2007), a post hoc review of violent events that happened suddenly without apparent warning discovered that the signals were indeed there but were lost in the background 'noise' of the environment. Within the GAM framework, situational factors, including sensory aspects of the social and physical environment, may be targeted to prevent the development of agitation and distress. People with psychiatric illnesses have been found to be hyper- or hyposensitive to sensory input (Abernethy 2010; Brown *et al.* 2002) and may have associated problems moderating autonomic arousal (Porges 2004). Sensory aversion is relevant to aggressive behaviour as 'unusually high and low levels of arousal may be aversive states and may therefore stimulate aggression in the same way as other aversive or painful stimuli' (Anderson & Bushman 2002; p. 39). However, experimental evidence suggests that even in the presence of sustained physiological arousal, a salient cue of safety 'can be associated with a relatively unusual or novel response, namely enhanced inhibition of aggression in the face of a provocateur' (Ward *et al.* 2008; p. 590). Thus, the creation of physical and social environments that not only reduce aversive stimuli, but also communicate safety and comfort, may aid in the prevention of aggression.

Communicating a safe environment requires an understanding of the distinction between two types of sensory input. External sensory input comes from the organs that

communicate with the external world (visual, gustatory, olfactory, auditory, and tactile), and provide information about the safety of our environment. Somatic senses communicate a sense of internal safety, including awareness of firm pressure on the skin (deep touch) and the sense of where one's limbs are in space (proprioception), and of balance and awareness of spatial orientation (vestibular). These somatic senses are referred to as the 'powerhouses of calming', as they provide a grounding orientation to the person (Moore & Henry 2002). Together, these internal and external environmental cues signal safety through activating a specialized aspect of parasympathetic neural circuitry, promoting a 'bottom-up' pathway toward optimized arousal.

In the polyvagal theory of emotional regulation, Porges (2001) describes a specialized branch of the vagal nerve, unique to mammals, that works in a hierarchical relationship with sympathetic fibres and the dorsal vagus. This specialized branch, the 'ventral' vagus – so-called because it controls muscles of face, head, neck, and heart – mediates parasympathetic influence to support adaptive social responses. The phylogenetic creation of this complex also developed the opposing mechanisms of excitation and inhibition to allow for rapid, but graded, shifts in metabolic output in response to sensory and motor stimulation (Porges 1995a; 1995b). This means that arousal is neither an on/off node, nor does it activate along a linear trajectory, because not every threat stimulates arousal (Ward *et al.* 2008). Deliberate use of sensory inputs can promote a recursive regulation of arousal by accessing evolutionarily advanced neural pathways that promote adaptive, social behaviours.

### Shifting attention and affective state

Sensory input can help minimize risk of aroused behaviour, but can also moderate arousal and affective pathways where a person is already feeling unsafe, stressed, and agitated. In these situations utilizing 'top-down' regulation through higher cortical functions such as problem solving, validation, or verbal negotiation can be limited as a de-escalation tool. The allostatic load created by prolonged stress, along with the acute perceptual and cognitive changes associated with psychiatric symptoms, may compromise a person's ability to think and process verbal information clearly (McEwen 2007). A further contributor to this limitation is the physiological impact of the arousal itself. In states of stress, alarm, or rage, the muscles in the middle ear constrict, decreasing the flexibility of the ossicles, with the result that the human voice is not discriminated from background sounds (Koike & Wada 2005). The mammalian reflex that makes humans

scan the environment for threats when feeling unsafe, rather than listen to each other, may contribute to the unreliability of verbal de-escalation techniques (Donovan *et al.* 2003; Johnson & Delaney 2007; Perkins *et al.* 2012). In the acuity of a moment, an appeal to the cognitive script or the decisional process alone may go unheard or be misconstrued. Thus, sensory calming may be an important precursor to other therapeutic approaches. Figure 2 revisits the GAM to display the impact of expanding the model to include sensory-based inputs and their neurological or biological impacts on arousal and affect.

The accounts in the present pilot study indicate that deliberate sensory inputs can shift attention away from negative cognitive scripts or distressing symptoms towards the participants' bodies or immediate environment. Distraction or re-focussing of attention reduces arousal more effectively than venting of pent-up feelings (Bushman 2001), possibly through dampening the activity of the amygdala (de Gelder *et al.* 2012). The most helpful forms of distraction reported by participants were activities that induced a calm physical state. Examples including listening to soothing music, watching coloured lights, blowing bubbles, and doing plastic maze puzzles were found to be soothing and useful in reducing agitation. Staff also provided significant sensory input, with the potential to support the shifting of attention and affective state through their tone of voice, movements, and body language.

Stabilizing was a key mechanism for many service user participants. The massage chair and weighted modalities (e.g. heavy blanket) were frequently reported as being useful, supporting the notion that sustained stimulation of deep pressure receptors appears to be one of the most effective ways of inducing calm, through 'grounding' the person in their body (Novak *et al.* 2012). Staff can enhance the grounding features of the weighted blankets, massage chair, and other items by encouraging service users to shift their attention to the here and now and to focus on the physical sensation.

Inducing positive experiences and the associated shift in affective state can open up thinking and behavioural repertoires, which over time builds sustainable resources for coping with difficult situations (Garland *et al.* 2010). Positive association was less frequently mentioned as a calming mechanism, but for some participants it provided a welcome escape from the present. Natural or home-like settings were mentioned as having calming associations in participants' accounts. Using and finding appropriate music, sounds, images, smells, and tactile objects in conjunction with guided imagery can all facilitate calming through positive association. It is also possible that new

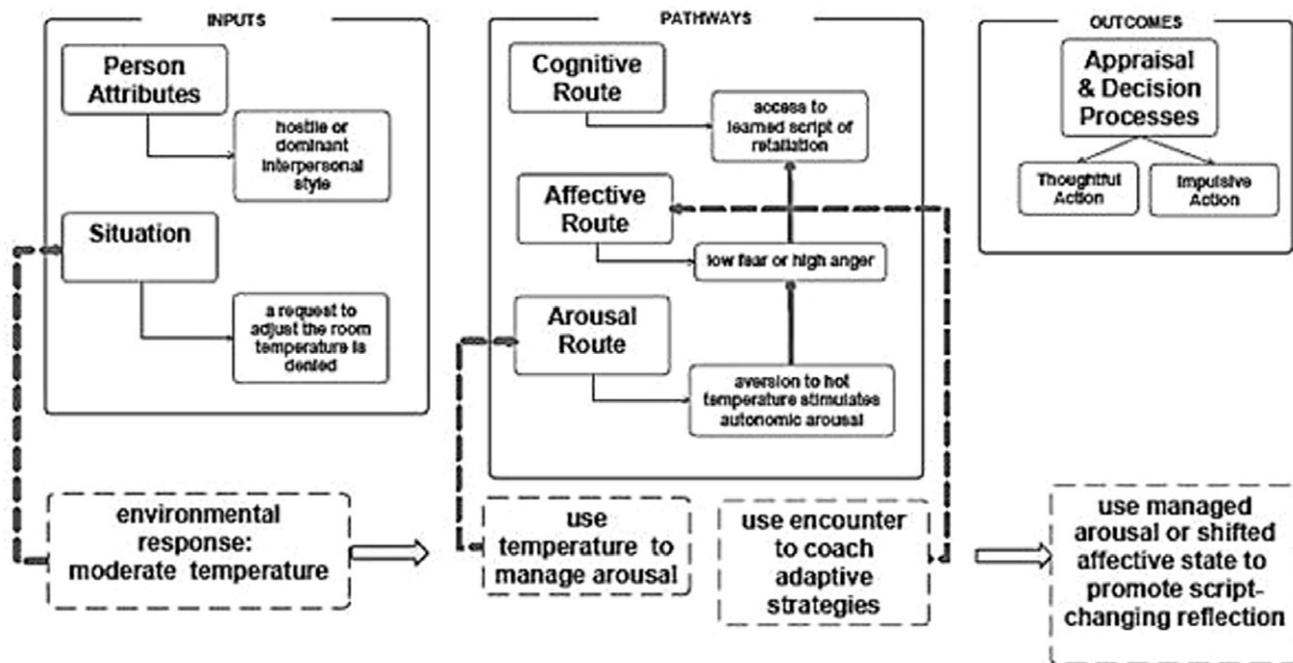


FIG. 2: Model of sensory-based aggression prevention pathways.

associations were created during positive experiences in the sensory room. Green and Ben-Sasson (2010) suggest that responses to particular sensory input may be conditioned through repeated exposure, leading to the expectation of being calmed and a shift in affective state. Over time, this may lead to the alteration an individual's cognitive script from being unable to control their arousal, to being able to take some responsibility in managing their distress. The use of sensory strategies to create positive affect may 'exert a countervailing force on the dysphoric, fearful, or anhedonic states characteristic of psychopathologies typified by emotional dysfunctions' (Garland *et al.* 2010; p. 849).

Overall, there were enough general reports of success and specific exemplars in the qualitative findings to indicate that sensory modulation intervention supported de-escalation of arousal or regulation of emotion in the majority of people who used it. Staff recounted situations where they would have needed to use some form of medical or coercive practice if the sensory intervention had not facilitated de-escalation. However, the participant accounts also suggested that the effectiveness of sensory modulation is influenced by many variables, including staff engagement with service users, early recognition of agitation or disengagement by staff and service users, an understanding of service user sensory preferences, and the service users' experience with

self-regulation in extreme states. Applying the GAM framework within acute mental health services would involve tailoring interventions to fit the individual constellation of contributing factors. 'Any intervention that has the potential for increasing an organism's experience of safety has the potential of recruiting the evolutionarily more advanced neural circuits that support pro-social behaviours' (Porges 2008; p. 13). A broadened view of the factors involved in arousal opens the door to re-conceptualizing clinical training that promotes optimal arousal and a sense of safety through sensory experience as the frontline in aggression management.

## LIMITATIONS AND FUTURE RESEARCH

The data presented are from a pilot study of an intervention in inpatient mental health settings. The units self-selected for participation in the trial of the new practice, and participants in the interviews were volunteers who had engaged with the sensory intervention and self-selected to discuss it. No young people participated in focus groups or interviews after discharge, so these responses are from adults only. While the data are suggestive of useful additions to clinical training and even to the planning of ward environments, more research is needed to validate and understand the impact of sensory modulation on arousal and emotion in persons with a

psychiatric illness. Findings from observational studies have provided association of sensory interventions with reduced instances of seclusion or restraint (Barton *et al.* 2009) and the management of psychiatric symptoms (Knight *et al.* 2010), but controlled trials are required to establish the empirical link between the intervention and physiological or psychological arousal. Inpatient mental health settings, with distressed clients, present unique challenges to research design, particularly given the interaction of person, situation, and modifiable internal mediators in managing clinical aggression. Further research would benefit from coupling the intervention with the routine application of a validated tool for identifying the likelihood of potential aggression, such as the Dynamic Appraisal of Situational Aggression (Ogloff & Daffern 2006). This could provide a better gauge for estimating episodes of prevented aggression rather than the usual intuitive use of a continuum of behaviours as a basis for assessing for intervention.

Assessing the impact of sensory interventions on arousal and aggression is problematic. Even though the most common measures of autonomic arousal – heart rate variability (Thayer & Brosschot 2005) and respiratory sinus arrhythmia (Porges 2008) – are non-invasive, the practical and ethical challenges to conducting this investigation in an inpatient mental health setting are daunting. The challenge remains for direct assessment in real-life situations of how sensory interventions recruit the ventral vagus to optimize arousal to support adaptive emotional regulation to enable the more effective management of aggression.

## CONCLUSION

Sensory modulation (Champagne 2011) has emerged as a suite of sensory-based interventions that provide an alternative, afferent, or 'bottom-up' response to arousal or aggression. These complementary interventions have been largely ignored in theoretical summaries of aggression management, although they have been highlighted in recent policy initiatives to reduce seclusion and restraint (Huckshorn 2006). Research on these practices in mental health settings, though growing, is only emerging and the theoretical basis remains underdeveloped.

The analysis of narrative data from pilot sensory interventions presented here suggests that sensory tools have a role in optimizing arousal and regulating emotion. From a theoretical perspective, polyvagal theory provides a reliable framework to integrate sensory modulation interventions with aggression management models. Importantly, both polyvagal theory, extant research, and the pilot study

results support a staged approach to sensory and cognitive interventions, as these can be mapped against the GAM. These theoretical extensions underpin contributions to practice. The use of sensory tools, originally developed within occupational therapy, into a mental health nursing strategy, improves the range of effective options within aggression management practices.

Currently, to determine the acceptability and impact of sensory-based intervention within inpatient mental health services, we must rely on feedback from service users and staff who have experienced it. Continued development and evaluation of this approach is needed, as it appears to be a promising component in the evolution of more effective and humane responses to aggression.

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