Response to Systematic Review of Sensory Integration Therapy for Autism Spectrum Disorders

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We take this opportunity to respond to a systematic review published by Lang et al. (2012) on sensory integration therapy (SIT) for children with autism spectrum disorders (ASD) published in *Research in Autism Spectrum Disorders.* The goal of this response is to help occupational therapy practitioners to:

(a) become knowledgeable about the types of studies that were selected and reviewed in the Lang et al. paper;

(b) understand the problems inherent in the research methodology used in Lang et al.'s review;

(c) become aware of the accumulating evidence that indicates that occupational therapy interventions that adhere to sensory integration therapy principles produce beneficial results for children with ASD.

In their review, Lang et al. included 25 studies and concluded that only, "3 of the reviewed studies suggested that SIT was effective, 8 studies found mixed results and 14 studies reported no benefits related to SIT" (p. 1004). Based largely on this pattern of results, the authors reached their conclusion that SIT has, "no consistently positive effects as a treatment for children with ASD," (p. 1017) thereby casting SIT in a negative light.

Q: Did the studies reviewed legitimately assess the effectiveness of sensory integration therapy for children with ASD?

A: Although Lang et al. referenced the work of Ayres, they initially described it incorrectly by stating that SIT for ASD provides, "specific forms of sensory stimulation in the appropriate dosage" (p. 1005) to reduce problem behaviors. This limited and incorrect definition ignores the essence and primary goal of SIT, which is to promote the child's ability to organize progressively and increasingly complex, successful adaptive responses (Ayres, 1972). Most of the studies included in the review did not assess the effectiveness of interventions that targeted this outcome.

To their credit, Lang et al. later acknowledged the widely accepted published fidelity measure, which describes the "active ingredients" or essential structural and process elements of SIT (Parham et al., 2007; Parham et al., 2011). Based on the guidance implicit in this work, to correctly utilize the sensory integrative approach interveners must: (a) ensure physical safety; (b) present sensory opportunities; (c) help maintain appropriate levels of alertness; (d)

challenge postural, ocular, oral, or bilateral motor control; (e) challenge praxis and organization of behavior; (f) collaborate in activity choice; (g) tailor activity to present a just-right challenge; (h) ensure that activities are successful; (i) support the child's intrinsic motivation to play; and (j) establish a therapeutic alliance. Further, this measure stipulates that the intervention should be delivered by occupational therapists who are certified in SI/SIPT and are in environments which enable the safe provision of a wide range of types of sensory stimulation by evoking increasingly complex adaptive responses using a minimum of 23 different types of equipment.

Although as described in the preceding paragraph Lang et al. defined SIT appropriately, they did not consider these defining elements in establishing criteria for study inclusion in the review. Instead, they identified presumed relevant articles by performing a search using the following key terms: *sensorimotor, weighted vest, brushing, swinging, deep pressure*. This approach resulted in a skewed selection of studies in which brushing, swinging, and weighted vests were used in isolation, without incorporating the aforementioned requisite ingredients. For example, ten (40%) of the studies examined a single sensory strategy—use of a weighted vest, and eight of the ten vest studies were completed by non-occupational therapy researchers. Uniformly, these weighted vest studies reported negative results (no benefit), except in one case, which produced mixed findings. In each of these studies, the authors framed their rationale for targeting this strategy by stating that weighted vests are part of a sensory integration approach and are frequently used by occupational therapists. However, the use of a weighted vest in isolation is not consistent with the specifications for SIT as delineated in the fidelity measure described above. Unfortunately, Lang et al. go on to issue conclusions regarding the evidentiary base for SIT, despite their essential reliance on studies involving interventions which, unlike SIT, are based on the use of a single sensory strategy.

In the Lang et al. review, studies in which investigators applied a single sensory strategy were considered to be SIT, but these intervention protocols do not conform to best practice guidelines for the use of sensory-based interventions in occupational therapy (Parham & Mailloux, 2010; Watling, Koenig, Davies, & Schaaf, 2011). Occupational therapists may apply sensory-based interventions, such as a pressure vest, or recommend specific sensory strategies, but these prescriptions are embedded in a multi-faceted treatment plan and not offered in isolation. Sensory-based interventions are: (a) based on a thorough assessment; (b) individualized in accord with the child's sensory modulation and integration problems; (c) monitored closely to gauge the child's fluctuating responsivity then adapted or adjusted accordingly; and (d) periodically evaluated for their effects on the child's participation in play, school, and home environments. Finally, a key aim is to enable the child to recognize when the strategy is or is not needed in everyday life. In contrast, in the majority of sensory-based studies included by Lang et al., the protocols did not adhere to these requirements and, additionally, were neither delivered nor prescribed by occupational therapists. These protocol aberrations

invalidate Lang et al.'s conclusion that their findings apply categorically to occupational therapy practice.

Q. Were biased research methods used in this review?

A. The authors demonstrated bias in how they interpreted the findings. Of the 25 studies, 14 were classified by the authors as negative, which could mistakenly be interpreted to suggest the intervention was harmful or caused the participants to regress. However, in none of the studies were data reported to support this inference. Further, in the case of the two studies in which meaningful positive outcomes for SIT were reported (Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011; Ray, King, & Grandin, 1988), the authors mischaracterized the results as mixed and negative. Similarly, they resorted to a counterpointal interpretation in dismissing the findings of a third study, a randomized controlled trial by Fazlioglu and Baran (2008), which ostensibly demonstrated strong positive effects for SIT. As the sociologist Arnold Arluke (1991) has pointed out, when one field reinterprets formal knowledge from another field calling its legitimacy into question, counterpointal knowledge is created. Often, he maintains, such interpretations result from competition over the control of the right to treat particular patient groups. Filtering the results through the lens of applied behavioral analyses (ABA), Lang et al. argue that Fazlioglu and Baran's findings inadvertently used behavioral techniques when applying SIT, not only rendering that study's highly significant positive result inconclusive, but instead somehow supporting an approach based on ABA.

It is noteworthy that the authors of the Lang et al. review appear to be ABA researchers who have published extensively on behavioral interventions and discrete trial training. This background suggests that they may be biased against occupational therapy and sensory integration therapy. In the current health care environment, in which competition among the professions for reimbursement mechanisms is fierce, such biases are more likely to be expressed. Lang et al. go on to argue, without evidence or reference to research, that SIT, "may actually exacerbate behavior problems in some children" (p. 1016). They state that SIT, "may inadvertently cause an increase in problem behavior because SIT often provides access to enjoyable activities, attention from therapists and breaks from work" (p. 1016), thereby undermining the behavioral approaches in which the children follow a strict schedule of operant reinforcement for behaviors that are defined and cued by the instructor. These arguments are counterintuitive, suggesting that interventions emphasizing the types of activities to which children are naturally drawn and which foster their attainment of developmental gains, such as play, can be harmful.

Although ABA has been documented, mostly in single subject design studies, to be beneficial for certain children with autism, there is consensus that, given the heterogeneity of the population, parents must have access to a wide range of interventions. Occupational therapy,

ABA, and other services are needed to comprehensively address the complex needs of this diverse population and their families. Nevertheless, it is noteworthy that occupational therapy is among the most frequently requested and provided services for children with ASD (Goin-Kochel, Mackintosh, & Myers, 2009; Green et al., 2006; Mandell, Novak, & Levy, 2005). Even with occupational therapy's unique value, the profession's best practice guidelines advise occupational therapy practitioners to routinely collaborate and coordinate with educational and interdisciplinary teams toward the goal of maximizing the child's overall participation in the classroom, curriculum, and other daily life environments (Watling, Deitz, Kanny, & McLaughlin, 1999). Occupational therapists are urged to work closely with other professionals to assure that interdisciplinary treatment plans work synergistically to maximize beneficial effects.

Similarly, sensory integration approaches are now embedded in many comprehensive exemplary interventions for autism such as the Early Start Denver Model (Dawson et al., 2010; Rogers & Dawson, 2010), the Floor Time Model (Greenspan & Weider, 1997), and the SCERTS Model (e.g., Prizant, Wetherby, Rubin, & Laurent, 2003). The well-respected experts who designed these programs have noted their collaboration with occupational therapists in the development of the above treatment models to ensure the inclusion of sensory-motor enrichment and sensory strategies as part of fully manualized interventions (Rogers & Dawson, 2010). One can easily discern the influence of occupational therapy in these child-focused, play-based, comprehensive developmental approaches.

Q. What were the key findings of those studies that validly tested the effectiveness of sensory integration therapy for children with ASD?

Of the 25 studies in the Lang et al. review, only five fell in this category. Four of the five reported overall beneficial effects. Of the five studies, one demonstrated a strong positive effect (Linderman & Stewart, 1999), three reported a mix of positive and non-significant findings (Ayres & Tickle, 1980; Case-Smith & Bryan, 1999; Pfeiffer et al., 2011), and one did not find an effect (Watling & Deitz, 2007). Moreover, the evidentiary base for SIT is further strengthened if the findings of a study by Smith et al. (2005) on the impact of SIT in reducing self-stimulating behaviors, which was not included in Lang et al.'s analysis, are taken into account. A summary of these six studies is presented in Table 1, revealing that five of the six studies that actually tested the effectiveness of SIT reported at least some positive results. Additionally, if one were to also include studies of interventions that included at least two of the essential components as stipulated on the SIT fidelity measure, two additional studies contribute convincing evidence of the effectiveness of comprehensive, multisensory approaches (Fazlioglu & Baran, 2008; Thompson, 2011). Descriptions of these studies are contained in Table 2. Although both studies listed produced positive findings, Lang et al. explained them away so as to deny that they provide any evidence for the effectiveness of SIT,

accomplishing this by using the aforementioned counterpointal argument or critiquing study design, holding these studies to a higher standard than is typically used for studies of other autism interventions.

Q. What are the lessons learned for occupational therapy practitioners and researchers who work in the area of ASD and sensory integration?

A. Most of the studies included in the Lang et al. review investigated the effects of isolated, specific sensory strategies rather than those of a comprehensive sensory integration therapy approach incorporating the active ingredients identified in Parham et al.'s (2007) fidelity measure. Because the review by Lang et al. highlighted single strategy sensory interventions (e.g., a weighted vest) delivered outside of occupational therapy contexts, the lack of an overall positive outcome is not surprising. It is disappointing that Lang et al. have mischaracterized these findings by implying that they apply to SIT and occupational therapy.

Occupational therapists have taken a leadership role in contributing to interdisciplinary understandings of the sensorimotor and sensory processing concerns that characterize some children with autism. That said, as can be said of autism intervention research in general, continued studies are needed to further investigate the effectiveness of comprehensive multisensory interventions such as SIT on individuals with ASD. The studies reviewed by Lang et al. suggest that: a) single modality strategies that are provided in isolation do not appear to result in positive effects; and b) interventions which include the key active ingredient components of SIT typically *are* associated with positive effects.

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Table 1. Studies of the effectiveness of SIT that completely adhere to the specifications of the SIT Fidelity Measure

Authors	Research question	Research design	Results	Lang et al. conclusion ***Our interpretation***
Ayres & Tickle (1980)	What are the effects of SI-OT on response to sensory input in children with ASD and sensory processing problems?	Cohort study, pre-post measures; 10 participants received SI-OT twice per week for 1 year.	Six children were good responders and 4 poor responders. The good responders who individually improved in language, speech, perceptual motor skills, and stereotypic behaviors, were initially hypersensitive.	Judged to be "mixed" results. ***Although the findings were mixed and the design is weak, the majority of children in the treatment improved.***
Case-Smith & Bryan (1999)	What are the effects of SI-OT on play behaviors, non-engaged behaviors, and social interaction in children with ASD?	Single subject design (AB); 5 participants, 5 yrs. Participants received 10 weeks of SIT.	Three of 5 children improved in mastery of play; 4 of 5 demonstrated reduced non-engaged behaviors. 1 of 5 improved in social interactions with adults.	Judged to be "mixed" results. ***We agree that the design is weak; however, most of the findings were positive and the majority of participants received some benefit.***
Linderman & Stewart (1999)	What are the effects of SI-OT on functional behavior in children with ASD and	Single subject design (AB); 2 participants, 3 years. Participants	Both children improved in social interaction, approach to new	Judged to be "positive" findings. ***We agree that the design is***

	hypersensitivity?	received 18 45-minute sessions of SIT.	activities, and showed improved responses to holding and movement.	***weak; the findings are positive***
Pfeiffer et al. (2011)	What are the effects of Ayres sensory integration® on individualized goals, sensory processing, and social responsiveness in children with ASD?	Randomized controlled trial; 37 participants.	The children who received Ayres SI improved significantly more, relative to fine motor intervention controls, on goal attainment scales. They displayed fewer autistic mannerisms, improved more on the social responsiveness scale, and were more successful in completing the neurological screening test.	Judge to be "mixed" findings. ***Although judged to be inconclusive because the description of intervention was insufficient, the authors clearly state that Ayres SI was utilized and refer readers to the fidelity measures.*** ***The design of this study was strong and the intervention group showed positive changes on some, but not all, of the outcome measures.***
Smith et al. (2005)	What is the effect of SI-OT on self-stimulating behaviors in children with pervasive developmental disorder (PDD) and mental retardation (MR)?	Within-subject experimental design comparing a SIT condition to a fine motor condition; 7 participants; all had PDD and/or MR.	Self-stimulating and self-injurious behaviors are reduced 1 hour after SIT. Self-stimulating behaviors decreased 11% after SIT compared to 2% after fine motor activities.	This study was not included. ***The study design was limited; the findings showed improved behavior following SIT.***

Watling & Deitz (2007)	What is the effect of SIT on task engagement in children with ASD?	Single subject; 4 participants.	The participants did not improve in engagement in a fine motor task following SIT.	Judged to be "negative". ***The design was weak, with restricted outcome variable ranges and possible between-intervention carryover effects; this study did not show significant changes in performance following the SIT condition.***

Table 2. Studies of the effectiveness of other comprehensive multisensory approaches

Author	Research Question	Research Design	Results	Lang et al. conclusion ***Our Interpretation***
Fazlioglu & Baran (2008)	What is the effect of sensory-based treatment on sensory and motor behavior in children with ASD?	Randomized controlled trial; 30 participants with severe ASD.	The children in the SIT group showed significantly reduced sensory problems. Positive changes include less touch aversion, off-task behavior, orienting to sound, stereotypies.	Judged to be "positive" but inconclusive; the study provided insufficient detail to replicate and the intervention appeared to have similarities with behavioral approaches. ***The design was sufficiently rigorous to judge the findings as strong. The***

				ascription of the results to processes associated with ABA is arbitrary.
Thompson (2011)	What is the effect of child interaction in a multi-sensory environment?	One group with pre- and post-test; 50 participants, 10 of whom had ASD.	The 10 participants with ASD were found to have higher levels of sustained focus during and after the intervention.	Judged to be "positive." Findings are inconclusive due to design and reporting limitations. ***We agree that the design was limited.***