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Providing Pretend Meaning Enhances Engagement in Messy Play for Children with Sensory Sensitivity

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Abstract

**Objective.** We examined the effects of assigning pretend meaning to messy tactile play, compared to a scenario with no meaning suggested, in typically developing children with a range of sensory processing patterns.

**Method.** Twenty-one children, ages five years and four months to seven years and four months (74.6±7.7 months, mean ± standard deviation) participated. A randomized counterbalanced design was used to measure engagement in messy play in two separate sessions, one with pretend meaning suggested and one without. We used a variety of harmless, messy substances. In each session, participants were presented with a substance they had rated as “[I would] least like to play with” in order to maximize the potential that the substance would be perceived as distasteful. Engagement was quantified through duration of the occupation, the Child Behavior Rating Scale (Mahoney, 1998) with items including Persistence, Involvement, Initiation, Affect, and Intrinsic Motivation, Bodily Contact, and the Fun Scale (Melchert-McKearnan, Deitz, Engel, & White, 2000). Sensory processing patterns were determined through the Sensory Profile (Dunn, 1997).

**Results.** There was a significant interaction between the experimental condition and the sensory processing pattern of the participants. For children who demonstrated Probable or Definite Differences for Sensory Sensitivity on the Sensory Profile, applying meaning to a scenario involving messy play yielded improved initiation, as measured by the CBRS, compared to the control condition.

**Conclusion.** This provides evidence for the use of the occupationally-embedded approach of suggesting pretend meaning to enhance engagement in an occupation that entails contact with tactilely messy substances for children with Sensory Sensitivity.
Children are often given the opportunity to play with or use messy substances throughout their day, such as during the creation of craft projects at school, in food preparation, and in exploratory play. Most children do not mind this type of interaction, and some thoroughly enjoy it. However, for some children these experiences may be unpleasant to differing degrees. One reason that a child may find these types of occupations more aversive than his or her peers do may be due to sensory over-responsivity, a disorder of sensory processing.

**Sensory Processing and Sensory Modulation Disorder**

Sensory processing refers to the ability of the brain to detect a variety of sensory stimuli, transmit them through the nervous system, and respond with the appropriate behaviors (Ayres, 1972). Sensory stimuli come from many sources including the environment (sights, sounds, smells, for example) and the body (touch, taste, the feeling of movement, for example). They inform an individual about the world around him or her and his or her status within the world, creating a picture of the demands the environment presents and the needs of the body. They influence an individual’s perceptual experience in combination with past experience, emotional and physiological states, and cognitive understanding. Together, these give rise to behaviors of an individual. While still a topic of investigation, sensory processing disorders are proposed to include sensory modulation disorder, sensory-based motor disorder, and sensory discrimination disorder (Miller, Anzalone, Lane, Cermak, & Osten, 2007). In this report, the specific focus has been on sensory modulation disorder. Sensory modulation reflects the ability of the nervous system to regulate its own activity in response to sensory stimuli (Ayres, 1972). Sensory modulation occurs when an individual’s responses do not accurately reflect the degree, nature, or intensity of the sensory stimuli received (Miller et al., 2007). In reference to sensory modulation, Dunn proposes a model (2007), which delineates specific patterns of sensory processing that
result from the intersection of two continua, neurological thresholds and self-regulation. The neurological threshold is obtained when a stimulus has sufficient intensity to elicit a response, and possesses a range from low to high. Self-regulation refers to temperament or behavioral strategies, and ranges from passive to active. The intersection of these two continua at their midpoints yields four quadrants of sensory processing patterns, Low Registration, Sensation Seeking, Sensation Avoiding, and Sensory Sensitivity (Dunn, 2007). A person who has a high threshold and a passive approach to self-regulation falls in the category of Low Registration. He or she may seem unaware of stimuli in the environment and may not seek out sensation that meets his or her threshold. An individual with a high threshold and an active approach falls in the quadrant of Sensation Seeking and may regularly engage in activities that provide intense stimulation. Low Registration and Sensation Seeking together can be considered under-responsivity. The remaining two quadrants represent over-responsivity. An individual who has a low threshold and an active approach is considered as Sensation Avoiding and may take precautions to protect him or herself from sensory stimulation. The last category, Sensory Sensitivity, describes an individual who has a low threshold and takes a passive approach to regulation. Children who display a Sensory Sensitivity pattern of sensory processing are often very observant of their surroundings. Rather than take an active approach to avoid a distasteful situation they will remain in the situation even to the point of being overwhelmed. Dunn states that, “children with sensitivity may be irritable, short-tempered, or demanding” (2007, p. 87). Other common characteristics of children with Sensory Sensitivity include excessive fidgeting, covering their ears with loud sounds, difficulty remaining on task, and dislike of messy tactile play (Dunn, 1997; Dunn, 2007). Disorders of sensory modulation can occur when sensory processing patterns interfere with meeting the demands of everyday life and may result from
patterns at the extremes of the continua or when an individual displays erratic, inconsistent responses to sensory stimuli.

The physiological mechanisms that account for sensory modulation disorders are still not well understood; however, recent studies are producing an emerging picture of imbalance in autonomic nervous system functioning (McIntosh, Miller, Shyu, & Hagerman, 1999; Schaff, Miller, ESawell & O’Keef, 2003) and decreased “gating out” of sensory stimuli in the central nervous system (Davies & Gavin, 2007; Davies, Chang, & Gavin, 2008).

The impact of disordered sensory processing on play, the primary occupation of children, has been described in two studies. Bundy, Shia, Qi, and Miller (2007), demonstrated that playfulness, as measured by the Test of Playfulness, was lower in 20 children with sensory processing disorders than in 20 typically developing peers. Case-Smith and Bryan (1999) assessed play mastery, engagement, and adult and peer interactions in five preschool age children with autism who had some features of sensory processing disorder. Typical behaviors observed included outbursts, transition difficulties, poor eye contact, picky eating habits, limited peer interaction, shaking of his or her head, tactile defensiveness, auditory hypersensitivity, and self-stimulation. The researchers suggested that sensory processing disorder affects the level of engagement a child may have, which can further lead to a deficit in his or her ability to play. Engagement is an essential aspect of the learning process, supporting opportunities to reach the highest developmental level and occupational performance possible.

To address sensory processing disorder, occupational therapists often employ a sensory integration approach for intervention. Ayres (1972) theory of sensory integration and the corresponding intervention strategies utilize a “bottom-up” approach in remediation of sensory processing disorders in which the underlying, presumably subcortical, dysfunctions are
addressed through defined sensory inputs that elicit behavioral responses, both of which (the input and the response) are proposed to exert organizing influences on the central nervous system. Sensory integration intervention strategies are frequently combined with occupation-based practices, such as engaging in meaningful play. This invokes cortical activation and implies a “top-down” approach to enhance participation in play and meaningful social experiences (Dunn, 2007).

Studies of the effectiveness of the sensory integration approach in improving play have yielded mixed results. Bundy et al. (2007) and Case-Smith and Bryan (1999) investigated whether occupational therapy intervention using sensory integration strategies improved play participation in their respective study populations (children with sensory processing disorders and preschoolers with autism featuring sensory processing difficulties). Bundy et al. (2007) collected data after children completed 20 intervention sessions utilizing occupations based on sensory integration theory and found that there was no significant difference on the Test of Playfulness scores as compared to before occupational therapy intervention. Case-Smith and Bryan (1999) reported that out of five children with autism, four showed decreased frequency of non-engaged behavior and three demonstrated an increase of mastery play after completion of a six week trial of occupational therapy emphasizing a sensory integration approach.

**Meaning**

Price and Miner (2007) investigated the effects of occupation-based practice on achieving meaningful client-centered goals in a single-case study with a young girl suspected to have sensory processing disorder. During the study, observations were made of therapy sessions between an experienced therapist and the child. Sessions were observed for various therapeutic strategies used to achieve the child’s goal of making friends and going to school. Successful
strategies included: changing environmental conditions of the therapy session, using cognitive
strategies, modifying the task, person, or social context, encouraging participation, and
renegotiating with the child (Price, 2003 as cited in Price & Miner, 2007). This suggests that
participation can be enhanced through creation of meaningful therapeutic situations to provide a
just right challenge for the participant.

Nelson and Thomas defined meaning as “the entire interpretive experience engaged in by
an individual encountering an occupational form. Meaning involves perceptual interpretation,
symbolic interpretation, and affect” (Nelson & Thomas, 2003, p. 101). In essence, meaning is
one’s own perceived experience or understanding of an object or situation, and can further be
subdivided into perceptual, symbolic, and affective meaning. Perceptual meaning involves
understanding the physical characteristics of an object or stimulus. Symbolic meaning involves
making sense of the sociocultural aspects of the situation. Affective meaning involves the
emotional experience that occurs when the stimulus is encountered. Typically, the individual
assigns meaning to a stimulus or object as he or she interprets it (Nelson & Thomas, 2003).
Ensuring that a task has personal, positive meaning for an individual is a core principle of the
practice of occupational therapy. Several studies have demonstrated improved engagement in
tasks that have a meaningful element (so called occupationally-embedded) compared to those
rote tasks that require the same skills (Licht & Nelson, 1990; Yoder, Nelson, & Smith, 1989).

**Present Study**

This study examined the effects of enhancing meaning through pretend on playful
engagement with a messy substance that may be perceived as distasteful or aversive. Two main
hypotheses were tested in this study. The first hypothesis was that suggesting pretend meaning,
as compared to simply offering messy substances for play, will influence engagement in messy
play. The second hypothesis was that the influence of providing pretend meaning would vary with sensory processing patterns such that scores of a standardized assessment of sensory processing skills would correlate with the magnitude of the effect of pretend.

**Methods**

**Participants**

Participants in this study were 21 children ranging in age from five years and four months to seven years and four months (74.6±7.7 months, mean ± standard deviation). There were 9 boys and 12 girls. Participants were recruited through flyers and word of mouth from the community and youth programs. Twelve were recruited from the Northwest Ohio region and nine were recruited from West Central Ohio. Parents or legal guardians provided informed consent, and child participants gave verbal assent for participation. Parents or guardians were able to discreetly observe sessions. Sessions were videotaped for offline behavioral analysis. The parents or guardians received a ten dollar gift card and the child received a small token such as a pencil, bubbles, play-doh, or stickers for completing participation. Procedures were approved by the biomedical institutional review board at the University of Toledo.

We recruited both typically developing children and children identified as having sensory processing difficulties by community occupational therapists. For the latter population, other diagnoses such as Down syndrome, autism, and cerebral palsy were criteria for exclusion in our attempt to obtain a homogeneous sample of children with sensory processing disorder. Unfortunately, this limitation narrowed the field such that no children were referred for participation from the therapy community. All participants in this study were typically developing.
Each participant was assessed using the Caregiver Questionnaire of the Sensory Profile (Dunn, 1999), given at the start of the first session, to determine his or her pattern of sensory processing. The Sensory Profile includes 125 items which describe behavioral reactions to everyday sensory stimuli. Caregivers are asked to rate how often the child demonstrates the behavior when given the opportunity. Rating utilizes a Likert scale ranging from (1) Always or 100% of opportunities to (5) Never or 0% of opportunities. Each item of the questionnaire describes a behavior that is reflective of one of the patterns of sensory processing proposed by the four quadrant model. Therefore, the sum of scores in each quadrant can be compared to the normative data to distinguish children with difficulties in sensory processing. Scores one standard deviation from the mean of the normative population (norm) are indicative of Probable Difference, and scores two or more standard deviations from the norm are indicative of Definite Difference. It is interesting to note that amongst the 21 typically developing children who participated, only four had Sensory Profile scores in the typical range in all four quadrants. The remaining 17 participants had scores in the Probable or Definite Difference range in at least one of the four quadrants. Amongst children with only Probable Differences (n=12), three had only one quadrant with Probable Difference; six had two quadrants with Probable Difference; one had three quadrants with Probable Difference; and two had a Probable Difference in all four quadrants. Amongst children with any Definite Differences (n=5), two had Definite Difference in one quadrant and a Probable Difference in one other quadrant; one had Definite Differences in two quadrants and a Probable Difference in a third quadrant; and two had Definite Differences in two quadrants. The number of participants in each range for each quadrant is reported in Table 1.

The psychometric properties of the Sensory Profile are described by the author, Dunn (1997). Reliability of the profile was assessed by using internal consistency. Cronbach’s Alpha
was calculated for each section and factor area of the profile. Scores ranged from .47, which was for Items Indicating Thresholds for Response to .91, for the factor area of Emotionally Reactive. Standard error of measurement was also conducted for each section and factor area. Scores for SEM ranged from .92, which was for the factor area of Sensory Sensitivity to 2.89, which was for the factor area of Sensory Seeking. Content, construct, and convergent validity were established for the Sensory Profile. Content validity was analyzed with literature review, expert review, and category analysis. Construct validity was analyzed by convergent validity with the School Function Assessment. Scores on the Sensory Profile were compared with those on the SFA with results showing a negative correlation between the two assessments as a low score is desirable on the SFA and a high score is desirable on the Sensory Profile.

**Study design and procedure**

This study employed a counterbalanced design. Each participant attended two sessions: one in the experimental condition and one in the control condition. The order of these sessions was random and counterbalanced across the participant pool. In each session the participant was presented with a harmless, messy substance for play. The experimental condition involved presentation of the stimulus with a specific suggestion for pretend play. In the control condition, the stimulus was simply presented for play. Sessions were held one to two weeks apart.

To adequately test the hypothesis that pretend play can enhance engagement in the face of sensory challenge, we sought to present participants with substances they found to be distasteful. Ten harmless, messy substances were used in this study. Each had an accompanying suggestion for pretend play to be used in the experimental condition. The substances, with their suggestions for pretend play in parentheses were: glue and sand (creating a picture of a beach), cotton balls and glue (creating a picture of a bunny rabbit), feathers and glue (creating a picture
of a bird), homemade slime (creating an amoeba with slime and a foam sheet), floam, a sticky craft substance made of small foam beads (creating snowmen on a large sheet of paper), shaving cream (drawing mustaches on smiley faces), paper maché materials (covering a car with wet paper), hair gel (finger painting hair onto smiley faces), “goo” made of cornstarch and water (fill cupcake liners with “goo”), paste (putting toothpaste onto pictures of toothbrushes). Control conditions utilized geometric forms of similar size/area. The stimuli that involved creating a picture utilized large banner paper taped on the wall. All items that were created during both conditions remained at the facility to eliminate the potential confound of a child finding meaning in creating something take home.

To select the substance presented at each session, the following procedure was used. The participant was presented with a set of photographs of five of the substances selected at random on the first visit and the remaining five on the second visit. In this way, he or she was presented with each photograph only once. Given the set of five photographs, the participant was asked to rank order them from “I would most like to play with this” to “I would least like to play with this.” Subsequently, the child was presented with the substance in the photograph the child ranked as “I would least like to play with this” for play.

To teach the rank ordering task and to ensure the participant’s cognitive ability to perform it, at the first session, the participant was asked to rank order five photographs of common foods from “I would most like to eat this food” to “I would least like to eat this food.” The foods included broccoli, peas, macaroni and cheese, chicken nuggets, and fruit snacks, selected to intentionally include foods which range in desirability for children. The parent or guardian was asked to verify the accuracy of the rank order of the foods. A poster board was used to assist the child in rank order tasks which contained five outlined rectangles the size of the
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photographs. Beside the rectangle on the top was a large smiley face and beside the rectangle on the bottom was a large frowning face.

After the selection process, the child was then given the opportunity to don a protective smock to help eliminate concerns or anxiety about getting his or her clothes messy. He or she was then presented with the item ranked as “least like to play with,” given standardized instructions to play, using hands and fingers, with the substance as long or as little as he or she would like. In the experimental condition, the instructions included overt reference to the suggested pretend meaning. Standardized instructions for each stimulus and condition are in Appendix A.

The researcher remained with the participant as he or she played, but offered neither encouragement nor discouragement. Play was completed when the child declared being done or when he or she responded affirmatively when the researcher asked “are you done?” after more than a minute’s pause. The researcher then recorded the areas of the body with which the child made contact with the messy substance and then gave the participant the opportunity to clean up, offering assistance as needed. Finally, the participant was asked to rate how much fun he or she had playing with the stimulus using The Fun Scale (Melchert-McKearnan, Deitz, Engel, & White, 2000), a self-report, Likert-type scale of six smiley faces ranging from happy to sad with a neutral face in the middle. The participant was told that the face with the biggest smile represented “the most fun you’ve ever had” and the biggest frown was “the least fun you’ve ever had.”

Measurement

Each child’s session was video taped to ensure accurate data collection. Engagement in play with a messy substance has been quantified in four measurements: duration of engagement;
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Child Behavior Rating Scale (Mahoney, 1998) score; bodily contact with the messy substance; and The Fun Scale.

Duration was measured as the time the child spent actively engaged in play from the conclusion of the verbal instructions until the indication of being done as described above. The measurement of duration was taken from the videotaped session.

The Child Behavior Rating Scale (CBRS) of the Pivotal Behavior Rating Scale (Mahoney, 1998) was used to rate the behaviors indicative of the level of engagement. The CBRS was developed by Mahoney and colleagues (Mahoney & Perales, 2005; Mahoney & Wheeden, 1999) to examine the effects of teacher and parent interaction on engagement of young children with disabilities. Mahoney and Perales state interrater reliability for the CBRS using the Spearman correlation at \( r = .77 \) and raters reached exact agreement 56% of the time and agreement within one point 100% of the time (2005). The scale has seven items: Attention to Activity, Persistence, Involvement, Compliance/Cooperation, Initiation, Joint Attention, and Affect, each of which is scored on a Likert-type scale of; 1- Very Low, 2- Low, 3- Moderate, 4 High, 5- Very High. The author of the scale provided clear descriptions of each item and their ratings, but encouraged refinement of the scale according to the behaviors observed in the study (G. Mahoney, personal communication, October 17, 2008). For use in the present study, only the items of Persistence, Involvement, Initiation, and Affect were used. Duration of engagement was used in lieu of Attention to Activity. Compliance was not included as participants were free to play as little or as much as they desired according to their own comfort and intrinsic motivation. The Joint Attention item initially reflected reciprocal interactions of a child with an adult who is simultaneously engaged in the same occupation. As our aim was to measure independent engagement, this item was modified and renamed Intrinsic Motivation. Summation of the five
Item scores gave the total CBRS score. See Appendix B for the detailed rating scales used in this study.

Contact with the stimulus was scored one point each for contact with face and neck; left and right shoulder, arm, forearm, and wrist; each proximal finger; and each finger tip. The researcher recorded these on a checklist after the participant completed play. The checklist used to record the amount of bodily contact is in Appendix C.

The Fun Scale is a self report, Likert-type scale, which coordinates a simple facial expression with a number (Melchert-McKearnan, Deitz, Engel, & White, 1999). The measure was used to assess how much fun the child had during the occupation he or she was just presented with. No tests for validity and reliability have been completed, however face validity can be assumed. The participants’ rating on the Fun Scale was quantified as 0 for “least fun” and 5 for “most fun” using all whole number points between.

**Data Analysis**

CBRS scores were obtained from the video taped observations of each session. The first two minutes of each session were analyzed for videos that were less than six minutes in length. Videos that were six minutes or greater in length were analyzed for the first two minutes, as well as the middle and last two minutes, yielding separate CBRS scores for each segment. When rating the middle and last two minutes, the Item of Initiation was omitted as the occupation had already begun.

Data were assessed for normal distribution (skewness and kurtosis) and found to be sufficiently normal to utilize parametric analyses. We describe percentages and means of descriptive measures, and correlations of measurements were assessed. Paired t-tests were used to test for differences in outcome measurements between the two conditions. Mixed model
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analysis of variance (ANOVA) with repeated measures was used in testing differences between CBRS scores from participants with Typical or Non-Typical (Probable or Definite Differences) sensory processing in the two conditions. Correlation was utilized to assess the relationship of Sensory Profile quadrant scores to the effect of suggesting pretend meaning (quantified as the change in score from the control to the experimental session). Significance was set at $\alpha=0.05$. To adjust for multiple comparisons when testing each of the five CBRS items in each quadrant, the $\alpha$ was adjusted to 0.01. Effect sizes are reported by Partial eta-squared ($\eta^2$) representing the proportion of the variation attributable to the factor while excluding other factors. Data are presented as mean ± standard error, unless otherwise noted.

To assess the reliability of the CBRS, a research assistant rated a random 30% of the video taped sessions. Prior to rating, the assistant was trained on the CBRS to 80% agreement within 1 point on the 5-point Likert scale. The assistant was an occupational therapy student who was blind to the Sensory Profile score of each child and the hypothesis of the study. A linearly weighted Kappa was calculated for each of the five items.

Results

Twenty-one children participated in the study, and each child completed both sessions. However, technical difficulties resulted in the loss of video for three sessions. As a result, pairwise comparisons and change scores for duration and the CBRS could only be calculated for 18 participants.

When presented with the photographs of substances used in this study, 14 children ranked shaving cream first as “I would most like to play with.” It was ranked as “least like to play with” by only two children. Floam and slime were ranked fourth out of five by nine children. Paste was ranked as “least like to play with” by eight children. Rankings of the remaining items were
quite evenly distributed. The substances presented for play and the number of times presented in each condition (No Meaning, Meaning) in parentheses were: glue and cotton balls (3, 2), glue and feathers (3, 4), slime (1, 0), floam (2, 1), glue and sand (2, 1), cornstarch “goo” (3, 1), hair gel (3, 1), paste (2,6), shaving cream (0, 2), and wet paper (2, 3).

For all sessions, participants engaged in play for an average of 10.2±2.4 minutes, ranging from 29 seconds to 1 hour, 1 minute, and 23 seconds. They rated the amount of fun they had at 3.4±0.3 on the 0-5 point Fun Scale. One participant made no bodily contact with the substances at either session, and one participant did not touch the substance at one session but made contact with all fingers of one hand in the other session. In 54.8% of sessions, participants limited contact to one hand. In 47% of the sessions where the participants made contact with two hands, they also made contact with the wrist. One participant made contact with the forearm in both sessions, and two others made contact with the forearm in one of their two sessions. Only one participant had any contact of the substance to the face. The average ratings for the items of the CBRS (on scales ranging from 1-5) were 3.0±0.2 for Persistence, 3.0±0.2 for Involvement, 2.9±0.1 for Initiation, 3.4±0.2 for Intrinsic Motivation, and 3.4±0.2 for Affect. The total CBRS score averaged 15.9±0.6 out of 25.

To probe for validity in our measurements of engagement, we assessed them for correlation with one another. The correlation coefficient (Pearson’s) and r-squared value for the correlations are reported in Table 2. The four measurements of duration, CBRS total score, bodily contact, and Fun Scale were all significantly, positively correlated with one another suggesting convergent validity. Each of the items of the CBRS correlated with the total, indicating that they each relate to the overall construct of engagement, however, they did not all
correlate with one another, suggesting dissociation between them. Taken together, this suggests
that the CBRS was a valid tool for measuring engagement and its components.

To test the hypothesis that the suggestion of pretend meaning would enhance engagement
in play with a messy substance that may be distasteful, the measurements of duration, CBRS
scores, bodily contact, and Fun Scale were compared across conditions in pair wise testing.
There were no differences in duration (control: 9.58 minutes±13.22 minutes, experimental: 12.05
minutes±17.43 minutes, p >0.05), bodily contact with substance (control: 23.38±17.85,
experimental: 19.48±18.48, p >0.05), or Fun Scale (control: 3.62±1.39, experimental: 3.28±1.92,
p >0.05). Similarly, no differences were noted in CBRS items or total scores, as depicted in
Figure 1.

To control for possible order effects, novelty, or growing familiar with the setting and
researcher, the two conditions were presented in random order across two sessions. There were
no significant differences in engagement between the first and second session across the study
population (CBRS total score, first visit: 16.06±3.52, second visit: 16.44±2.97, p >0.05).
Similarly, there were no differences between the CBRS scores by gender in either condition (No
Meaning: 14.75±1.3 and 15.75±1.13 for boys and girls respectively; Meaning: 15.63±1.3 and
17.0±0.9 for boys and girls respectively, p>0.05)

To test the hypothesis that the effect of suggesting pretend meaning on engagement in
messy play may vary with sensory processing patterns, we utilized the scores of the Sensory
Profile (Dunn, 1997) in each of the four quadrants of Dunn’s model ((1) High Threshold/Passive
(Sensory Registration); (2) High Threshold/Active (Sensory Seeking); (3) Low
Threshold/Passive (Sensory Sensitivity); and (4) Low Threshold/Active (Sensory Avoiding)).
Low scores are indicative of sensory processing difficulty, though the cut scores vary by
quadrant. To allow for robust comparisons to children with Typical performance on the Sensory Profile, participants whose scores were in the range of Probable Difference (outside of one standard deviation from the mean) and Definite Difference (outside of two standard deviations from the mean) were grouped together and termed Non-Typical.

A mixed model ANOVA (2 (Sensory Profile: Typical, Non-Typical) X 2 (Condition: Meaning, No Meaning)) with repeated measures was used to test main effects and interactions of the outcome measures in each of the four quadrants. The sole significant finding of this analysis was that compared to participants with Typical scores (n=13) in Quadrant 3: Sensory Sensitivity, children with Non-Typical scores (n=8) demonstrated lower Initiation on the CBRS in the No Meaning condition and higher scores in the Meaning condition. This was demonstrated in a significant interaction of sensory processing and condition (Figure 2, F(1,16)=8.516, p=0.01, partial $\eta^2=0.566$, a medium effect, Keppel & Wilkins, 2004).

It is interesting to note that when comparing the participants with Non-Typical scores in Sensory Sensitivity without respect to condition (Meaning or No Meaning), there were no differences in their measures of engagement compared to the participants with Typical scores in this quadrant. Their duration was similar (Non-Typical, 14.9±5.9 minutes; Typical, 7.9±2 minutes, across conditions, p>0.05). Their total CBRS scores were not different (15.2±1.2, 16.2±0.6 for Non-Typical and Typical, respectively, across conditions, p>0.05), nor were any of the item scores, aside from Initiation. Also, they rated the engagement as being just as fun (Fun Scale scores 4.0±0.5, 3.2±0.3 for Non-Typical and Typical, respectively, across conditions, p>0.05), and they did not touch the substances any less (scored at 28.6±5.1, 19.0±3.3 for Non-Typical and Typical, respectively, across conditions, p>0.05). Yet, there is a distinct decrease in Initiation of play with the messy, distasteful substance in the No Meaning condition (Initiation
item score of 2.3±0.3 for participants with Non-Typical scores in Sensory Sensitivity compared to 3.0±0.2 in participants with Typical scores) which was rescued, even enhanced beyond the Typical participants, in the experimental, Meaning condition (3.7±0.5 compared to 2.9±0.2), giving rise to the significant interaction described above.

To aid in conceptualizing the therapeutic effect of providing enhanced meaning to messy play, we calculated the change score for Initiation as Meaning – No Meaning. The change score was significantly larger for participants with Non-Typical scores in Sensory Sensitivity compared to the participants with Typical scores (1.17±0.4 compared to -0.25±0.28, p=0.01).

To further investigate the interaction of Sensory Sensitivity and the effect of meaning on engagement in play with messy substances, linear regression was performed on the scores in Quadrant 3: Sensory Sensitivity and the change scores for the outcome measures. If the therapeutic effect of suggesting meaning is more effective with Sensory Sensitivity, we would expect to see a negative relationship between these variables such that participants with low scores indicative of disorder on the Sensory Profile would have larger change scores in the measurements of engagement. There was a negative relationship ranging from -0.44 to -0.06 between the Sensory Profile scores in this quadrant and the change scores for all measurements (Persistence, Involvement, Initiation, Intrinsic Motivation, Affect, CBRS total, Bodily Contact, and Fun Scale), except Duration which had a slight positive relationship of 0.14. However, only the change score for the total CBRS showed a significant, negative correlation to Sensory Profile scores (Figure 3, $R=-0.47$, $r^2=0.22$, $p<0.05$, $F(1,19)=4.14$). In participants with Sensory Sensitivity, as indicated by low Sensory Profile scores, adding meaning to a messy play task increased overall engagement as evidenced by the CBRS.
Finally, to assess the reliability of the use of the CBRS an interrater viewed and scored 30% of the research videos. For Affect and Involvement, 100% of videos were rated within one point by both raters; for Persistence and Initiation, 89% of videos were rated within one point; and for Intrinsic Motivation, 78% of videos were rated within one point. Analysis for interrater statistics was completed using a linearly weighted Kappa statistic, a correlation statistic which corrects for chance agreement yet accounts for degrees of difference between two scores (Landis & Koch, 1977; Cohen, 1968). The weighted Kappa for Persistence was 0.47, moderate agreement; for Involvement 0.40, fair agreement; for Initiation, 0.38, fair agreement; Intrinsic Motivation 0.30, fair agreement; and Affect 0.51, moderate agreement.

Discussion

In this study we sought to evaluate the effects of pretend meaning on engagement in messy play with potentially distasteful, but harmless, substances. The findings provide valuable insight for occupational therapy clinicians as well as child educators. The results shed light on engagement in messy play amongst children with Sensory Sensitivity, for whom the suggestion of pretend meaning was selectively effective in enhancing initiation of messy play. This finding may be applicable to engagement in messy occupations such as hobby crafts, cooking, learning occupations, and therapeutic occupations.

Children with Sensory Sensitivity have a low threshold for registration of stimuli and a passive approach to responding to sensory experiences. These children may be fidgety and prone to tantrums (Dunn, 2007) and they will often participate in sensory occupations until they simply cannot tolerate the experience any longer. They may be viewed as moody or unpredictable as a result. The participants of this study were all considered to be typically developing and free of any specific diagnosis or condition, however, for eight out of 21 of the
children their caregivers reported behaviors indicative of a Probable or Definite Difference in the area of Sensory Sensitivity on the Sensory Profile (Dunn, 1999). Participants of this study whose scores fell beyond the cutoff for Sensory Sensitivity may not warrant a diagnosis, yet may still have some difficulties meeting demands in certain settings.

When analyzed across conditions, the children with Sensory Sensitivity did have a similar duration of engagement as the other participants. Similarly, they rated the engagement as being just as fun, and they did not contact the substances any less. However, when their engagement was analyzed in the No Meaning, control condition, they demonstrated lower initiation than typical peers. This suggests that when sufficient context is not available to them, they hesitate to begin playing with a substance that they may find aversive. Though subtle, a decrease in initiation may reduce a child’s access to learning opportunities. Initiation is essential for participation and success in school (Skinner, Wellborn & Connell, 1990), influencing cognitive performance as judged by grades and test scores (Fincham & Cain, 1986 as cited in Skinner, Wellborn, & Connell, 1990). Self-initiation, along with choice, and personal responsibility contributes to beneficial outcomes, both personal accomplishments and societal status (Deci, Vallerand, Pelletier, & Ryan, 1991). Through self-determination and support for autonomy adults can facilitate conceptual understanding, problem solving, personal adjustment, and social responsibility (Deci et al.). We demonstrate that the suggestion of pretend meaning enhanced initiation for participants with Sensory Sensitivity such that it surpassed the initiation of typical peers. Together, these differences were seen in the significant interaction of Sensory Profile score categorization and the experimental condition (Figure 2). This provides evidence in support of the use of enriched context and pretend meaning, both staples of occupational therapy practice, to enhance occupational engagement in an at risk population of children.


Limitations

Several limitations must be considered when interpreting this study. First is the concern that the CBRS demonstrated only fair to moderate reliability. Several factors may account for this. The first author of this paper served as both the primary rater and administered data collection, therefore, she was present with the participants as they engaged in the study. The interrater, on the other hand, rated the behaviors on videotape without ever meeting the participants. It is notable that the CBRS scores of the first author were consistently higher than those of the interrater, suggesting that the personal connection made with each participant may have influenced the CBRS scores upward. The quality of the video tape may have also prevented the interrater from discriminating subtle facial expressions or hearing soft vocalizations which the first author may have been primed to after observing participation first hand. We suggest that future studies employ a primary rater and interrater who both only rate the videotape without meeting the participants. It does appear, however, that the CBRS was a valid measurement of engagement in this study as it correlated with other factors indicative of engagement such as duration, fun, and bodily contact with the substances.

The next limitation is the lack of a finding in support of our hypothesis that pretend meaning would enhance engagement. There were no differences in any of our measures across the two conditions in this study. We postulate that the typically developing children in this study were less reliant on contextual cues and the suggestion of pretend meaning in their play with messy, but harmless, substances. Though all rated a substance as “least like to play with” relative to the other substances presented, they may not have found the substance they received truly distasteful as they were not identified as having Sensory Processing disorder. This is supported in analysis of our second hypothesis in which only participants with Sensory
Processing scores indicative of over-responsivity showed any decrease in engagement. Alternatively, the sample size in this study increases the risk of falsely rejecting the null hypothesis.

The specific measurements and tasks used in the study may also present limitations. For example, the Fun Scale did not reflect any differences in engagement. Perhaps the participants would have felt rude or guilty telling the researcher they didn’t have fun completing the task. Or they may have associated other events with the participation in the study such as being rewarded by their parent afterward or being intimidated by the novel setting and the presence of the researcher. Duration of engagement also reflected no differences across conditions. This may have resulted from variability in the demands of the tasks associated with the substances presented. For example, the “goo” made of cornstarch and water is more challenging to handle and may take more time compared to cotton balls and feathers. Similarly, bodily contact with the stimulus demonstrated no differences between the experimental and control conditions of the study. The lack of significance may be attributed to the varied requirements for handling of the stimulus. For instance, with some stimuli it was best if the child used a scooping action and a whole hand to work with the item, whereas other stimuli, such as glue, only required a fingertip to complete the task. Yet, the children who were truly engaged in the occupation often had a greater amount of bodily contact with the stimulus than may be considered absolutely necessary as seen in the correlation of these measures. For future study, it would be beneficial to further confine the parameters for each stimulus to ensure similar time requirements and bodily contact for each occupation.

Though the sample size was quite small, 21, this study employed a counterbalanced approach that allowed for pair wise testing. This reduced, but did not eliminate the possibility of
errors of false negativity. On the contrary, several analyses were performed repeatedly, such as the effect of the experimental condition in each of the quadrants of the Sensory Profile. The number of tests conducted here may have increased the risk of false positive findings; however, the comparisons were either planned (as in the 2X2 ANOVAs in each quadrant) or followed from significant findings (as in the case of the regression of change scores against Sensory Profile scores) such that the tests were independent of one another. Using an adjusted significance level for multiple comparisons in each quadrant reduced the chance of false positive findings. In the regression analyses, the relationship between the CBRS total score and the Sensory Profile raw score stood out in being significant, but was so at the $\alpha<0.05$ level and therefore must be interpreted with caution.

**Conclusions**

As this study suggests that occupationally-embedded therapeutic approaches may have an immediate and robust impact on engagement in children with Sensory Sensitivity in tasks that they may face regularly in their lives, continued study of the effects of meaning on engagement is warranted. For future studies, allowing participants to have Sensory Processing disorder in conjunction with other diagnoses might allow for expansion of the findings here to populations with overt Sensory Processing disorders.

This study demonstrates that children who may not garner sufficient attention to warrant evaluation and intervention may be at significant risk for lowered engagement in occupations that they find distasteful because of their sensory processing patterns. We show that a creative, yet subtle, modification of the instructions given which enhance meaning through pretend can rescue and even enhance engagement, giving children with Sensory Sensitivity the opportunity to get the most out of every learning experience.
References


Kim, J.M., & Mahoney, G. (2004). The effects of mother’s style of interaction on
children’s engagement: Implications for using responsive interventions with parents.

*Topics in Early Childhood Special Education, 24*, 31-38.


### Table 1. Summary of Sensory Profile quadrant results for participants, number of participants whose scores fell into each range (n=21).

<table>
<thead>
<tr>
<th></th>
<th>Low Registration</th>
<th>Sensory Seeking</th>
<th>Sensory Sensitivity</th>
<th>Sensory Avoiding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical</td>
<td>14</td>
<td>6</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Probable Difference</td>
<td>5</td>
<td>11</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Definite Difference</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 2. Summary of correlations amongst measurements. Pearson’s coefficient (r-squared), *p<0.05, **p<0.01

<table>
<thead>
<tr>
<th></th>
<th>Duration</th>
<th>Persistence</th>
<th>Involvement</th>
<th>Initiation</th>
<th>Intrinsic Motivation</th>
<th>Affect</th>
<th>CBRS Total</th>
<th>Bodily Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistence</td>
<td>0.30 (0.9)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Involvement</td>
<td>0.26(0.06)</td>
<td>0.57(0.32)**</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Initiation</td>
<td>0.32(.11)*</td>
<td>0.37(0.14)*</td>
<td>0.57(0.32)**</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>0.02(0)</td>
<td>0.22(0.05)</td>
<td>0.41(0.16)*</td>
<td>0.31(0.09)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Affect</td>
<td>0.34(.13)*</td>
<td>0.38(0.14)*</td>
<td>0.21(0.04)</td>
<td>0.14(0.02)</td>
<td>-0.07(0)</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>CBRS Total</td>
<td>0.36(0.13)*</td>
<td>0.78(0.61)**</td>
<td>0.81(0.66)**</td>
<td>0.67(0.45)**</td>
<td>0.6(0.36)**</td>
<td>0.47(0.22)**</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Bodily Contact</td>
<td>0.55(0.3)**</td>
<td>0.28(0.08)</td>
<td>0.38(0.14)*</td>
<td>0.38(0.14)*</td>
<td>0.04(0)</td>
<td>0.22(0.05)</td>
<td>0.36(0.13)*</td>
<td>--</td>
</tr>
<tr>
<td>Fun Scale</td>
<td>0.37(0.14)*</td>
<td>0.25(0.06)</td>
<td>0.32(0.10)*</td>
<td>0.22(0.05)</td>
<td>0.08(0)</td>
<td>0.33(11)*</td>
<td>0.35(0.12)*</td>
<td>0.49(0.24)**</td>
</tr>
</tbody>
</table>
Figure 1. Participants engaged in play with messy substances in two experimental conditions, No Meaning, where the substance was simply offered, and Meaning, where the substance was offered with suggestions for pretend play. Engagement was measured by five items of the Child Behavior Rating Scale (CBRS), rated on a 1 to 5 scale, where 5 indicates high engagement. Comparisons were made by paired t-tests, n = 18. There were no significant differences.
Figure 2. Comparison of CBRS Scores in Meaning and No Meaning Conditions for Children with Sensory Sensitivity.

Figure 2. Comparison of Initiation scores on the CBRS for Meaning and No Meaning conditions between children with Sensory Sensitivity as judged by the Sensory Profile (Non-Typical) and children with Typical Performance in the area of Sensory Sensitivity (Typical). Significance was tested with a mixed model 2X2 ANOVA, revealing a significant interaction between Sensory Profile and condition, F(1,16)=8.516, p=0.01, partial $\eta^2=0.566$. 

Quadrant 3: Sensory Sensitivity

- Typical
- Non-Typical
Figure 3. Change scores for the CBRS total (Meaning-No Meaning) for all children plotted in comparison with his or her score in the quadrant of Sensory Sensitivity of the Sensory Profile. 

R=$-0.47$, $r^2=0.22$, $p<0.05$, $F(1,19)=4.14$. 
Appendix A

Standardized Instructions

Explanation

The goal of this study is not to coerce children to play with an item. A friendly tone of voice will be used at all times. “Hi _____, my name is ‘researcher’. Today I am going to give you a chance to play with some messy stuff. You can play as long or as little as you would like.”

Rating five foods

“First, I want you to look at these pictures of different foods. Put them in order of “I would most like to eat this” to “I would least like to eat this.” Place them on the mat in front of you in the order you choose.”

“Nice job!”

Rating five stimuli

“Now, I would like you to put these five picture cards in order of “I would most like to play with this” to “I would least like to play with this.” Place them on the mat in front of you in the order you choose.”

“Nice job!”

Play with the substances

“Now I am going to give you one of those five messy things to play with. Would you like to put on a smock to keep your clothes clean? You can play as long or as little as you would like. Please tell me when you are all done.”

Glue and sand

Meaning- “Here is some glue and sand. Using your hands and fingers, I would like you to glue the sand onto the paper to create a picture of a beach. Do you have any questions?”
No Meaning- “Here is some glue and sand. Using your hands and fingers, I would like you to glue the sand onto the paper. Do you have any questions?”

**Cotton balls and glue**

 Meaning- “Here is some glue and cotton balls. Using your hands and fingers, I would like you to glue the cotton balls onto the paper to create a picture of a bunny rabbit. Do you have any questions?”

 No Meaning- “Here are some glue and cotton balls. Using your hands and fingers, I would like you to glue the cotton balls onto the paper. Do you have any questions?”

**Feathers and glue**

 Meaning- “Here is some glue and feathers. Using your hands and fingers, I would like you to glue the feathers onto the paper to create a picture of a bird. Do you have any questions?”

 No Meaning- “Here is some glue and feathers. Using your hands and fingers, I would like you to glue the feathers onto the paper. Do you have any questions?”

**Amoeba and slime**

 Meaning- “Here is a foam cutout of an amoeba, a slimy, cell like creature. Using your hands and fingers, I would like you to cover it in slime. Do you have any questions?”

 No Meaning- “Here is a foam cutout. Using your hands and fingers, I would like you to cover it entirely with slime. Do you have any questions?”

**Floam**

 Meaning- “Here is some toy floam. Using your hands and fingers, I would like you to fill in the circles on the sheet of paper to make snowmen. Do you have any questions?”

 No Meaning- “Here is some toy floam. Using your hands and fingers, I would like you to fill in the circles on the sheet of paper. Do you have any questions?”
Shaving cream

Meaning- “Here is some shaving cream. Using your hands and fingers, I would like you to give all of the faces on the sheet of paper mustaches made of shaving cream. Do you have any questions?”

No Meaning- “Here is some shaving cream. Using your hands and fingers, I would like you to draw lines with the shaving cream onto the circles shown on the sheet of paper.”

Wet paper

Meaning- “Here is some wet shredded paper. Using your hands and fingers, I would like you to cover the car with the paper, and try to keep the shape of the car. Do you have any questions?”

No Meaning- “Here is some wet shredded paper. Using your hands and fingers, I would like you to cover the cube with the paper, and try to keep the shape of the cube. Do you have any questions?”

Hair gel

Meaning- “Here is some hair gel. Using your hands and fingers, I would like you to create large shapes on the large sheet of paper with the hair gel. Do you have any questions?”

No Meaning- “Here is some hair gel. Using your hands and fingers, I would like you to swirl your fingers in the gel on the paper. Do you have any questions?”

“Goo”

Meaning- “Here is some slimy goo. Using your hands and fingers, I would like you to scoop the goo “batter” to fill these cupcake wrappers and make pretend cupcakes. Do you have any questions?”
No Meaning- “Here is some slimy goo. Using your hands and fingers, I would like you to fill the tube with the goo. Do you have any questions?”

*Toothpaste*

Meaning- “Here is some paste. Using your hands and fingers, I would like you to smooth the paste onto the pictures of the toothbrushes. Do you have any questions?”

No Meaning- “Here is some paste. Using your hands and fingers, I would like you to smooth the paste onto the pictures of rectangles. Do you have any questions?”

*After Presenting Substance*

“Are you all done playing?”

“Can I see your hands and fingers?”

“Okay, we’re all done! Let’s go find ______(name of guardian)!”
Appendix B

Child Behavior Rating Scale

**Persistence**

This section refers to the child’s problem solving for the task. Does he or she try different methods to complete the task or quickly give up if task is difficult to complete.

**Rating of 1:** Very Low: Child gives little or no effort to participate, quickly gives up, attempts very little of the occupation or to figure occupation out.

**Rating of 2:** Low: Completes a very small amount of the occupation, but does make more than one attempt to complete or figure out the occupation.

**Rating of 3:** Moderate: Participates in the occupation, including multiple attempts, but does not complete what is in front of him or her, gives up if in the face of an ongoing difficulty.

**Rating of 4:** High: Completes all of what is shown, using as many strategies as needed, is all done when stimulus is gone.

**Rating of 5:** Very High: Repeated attempts at task, asks repeatedly for more of the stimuli, tries many strategies.
Child Behavior Rating Scale, Continued

**Involvement**

This reflects how much the participant focuses on the occupation versus the environment. This is reflected by looking around, commenting on the mirror, video camera, and other surroundings of the research room.

**Rating of 1:** Very Low: Avoidance, excessive looking around at the researcher, mirror, camera, and surroundings.

**Rating of 2:** Low: Child looks at stimulus, but occasionally looks around or at the researcher, stares blankly at the stimulus.

**Rating of 3:** Moderate: Play with stimulus is somewhat rote, child is not looking around excessively, but appears to be going through the motions.

**Rating of 4:** High: Child is focused on the occupation, involved in his or her performance, but makes no attempt to engage researcher or show researcher the work he or she is doing.

**Rating of 5:** Very High: Very focused on the occupation, is intently involved with the task and rarely looks at the mirror or camera. Child may make attempts to engage researcher in occupation.
Child Behavior Rating Scale, Continued

**Initiation**

This section relates to how eager the child is to get started and begin the occupation. Does the child get his or her hands dirty right away or linger about and make attempts to stall.

**Rating of 1:** Very Low: Participant fails to engage in occupation at all.

**Rating of 2:** Low: Participant engages in occupation for a short while after a moderate period of stalling.

**Rating of 3:** Moderate: Waits until researcher completes instructions and begins participation in occupation.

**Rating of 4:** High: Plays with stimulus during instructions for occupation.

**Rating of 5:** Very High: Plays immediately when he or she sits down and fails to wait for instructions.
Child Behavior Rating Scale, Continued

**Intrinsic Motivation**

This area reflects if the child is self involved in the occupation versus if the child depends on the researcher for instructions and guidance.

**Rating of 1:** Very Low: Makes excessive eye contact with the researcher, excessive conversation, and asking a lot of questions that may not pertain to the occupation.

**Rating of 2:** Low: Eye contact made with researcher, and may question if he/she is doing it right.

**Rating of 3:** Moderate: Makes frequent eye contact as if looking for approval.

**Rating of 4:** High: Listens to instructions from researcher and rarely looks to researcher for guidance.

**Rating of 5:** Very High: Listens to instructions from researcher and then fails to interact with researcher for the rest of the session. Participant is completely independent in occupational performance.
Child Behavior Rating Scale, Continued

**Affect**

This area pertains to the positive and negative signs of affect the participant may show. Signs may range from severe distress to elation.

**Rating of 1:** Very Low: Child shows severe signs of distress, ranging from frowns, winces, and negative verbalizations.

**Rating of 2:** Low: Child shows some signs of distress, ranging from an occasional frown or a wince.

**Rating of 3:** Moderate: Child remains neutral and somewhat somber during occupation.

**Rating of 4:** High: Child seems pleasant and smiles occasionally.

**Rating of 5:** Very High: Child smiles frequently, laughs, and displays positive vocalizations.
Appendix C

Contact with Stimulus Score Sheet

Contact with Stimulus Check-off Sheet

___ Finger tip ___ Number of fingers ___ Right, Left, or Both

___ Proximal finger ___ Number of fingers ___ Right, Left, or Both

___ Palm of hand ___ Right, Left, or Both

___ Wrist ___ Right, Left, or Both

___ Forearm ___ Right, Left, or Both

___ Arm ___ Right, Left, or Both

___ Shoulder ___ Right, Left, or Both

___ Neck ___ Right, Left, or Both

___ Face ___ Right, Left, or Both
Acknowledgments

We would like to acknowledge the children and families who completed this research study; without your assistance and willingness to participate the completion of this study would have never been possible. We would also like to acknowledge Aleasha Decker, OTD student, for devoting her time and assisting with data analysis. Lastly, we would like to thank the University of Toledo, College of Graduate Studies for assisting in the funding of this research study.

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