The Adult Sensory Profile: Measuring Patterns of Sensory Processing

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Key Words: behavior • neurological model • sensation

Objective. *This article describes a series of studies designed to evaluate the reliability and validity of the Adult Sensory Profile.*

Method. *Expert judges evaluated the construct validity of the items. Coefficient alpha, factor analysis, and correlations of items with subscales determined item reliability, using data from 615 adult sensory profiles. A subsample of 20 adults furnished skin conductance data. A heterogeneous group of 93 adults completed the revised Adult Sensory Profile, and item reliability was reexamined.*

Results. *Expert judgment indicated that items could be categorized according to Dunn's Model of Sensory Processing. Results suggested reasonable item reliability for all subscales except for the Sensation Avoiding subscale. Skin conductance measures detected distinct patterns of physiological responses consistent with the four-quadrant model. Revision of the Adult Sensory Profile resulted in improved reliability of the Sensation Avoiding subscale.*

Conclusion. *The series of studies provides evidence to support the four subscales of the Adult Sensory Profile as distinct constructs of sensory processing preferences.*

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Sensory processing is recognized as a domain of concern in occupational therapy and is included as a performance component in the third edition of the *Uniform Terminology for Occupational Therapy* (American Occupational Therapy Association, 1994). Occupational therapists typically assess sensory processing with measures of behavioral response to sensation. Although there are a number of measures available to assess sensory processing, the majority were developed for children. For example, in a recent review of sensory processing tests used by occupational therapists, all measures listed were for children (Kohlmeyer, 1998).

The lack of adult measures is unfortunate, given evidence that sensory processing concerns in children also are experienced by adults. When selected subtests of the Southern California Sensory Integration Test (SCSIT) were administered to adults with psychiatric disabilities (Falk-Kessler, Quittman, & Moore, 1988), significant relationships were found between the SCSIT and the neurological dysfunction present in the sample. A study of sensory defensiveness in persons with developmental disabilities showed that four of six behaviors were equally prevalent in children and adults (Baranek, Foster, & Berkson, 1997). Another study proposed a conceptual framework for sensory defensiveness in adults after identifying common themes related to response and coping to sensory stimuli (Kinnealey, Oliver, & Wilbarger, 1995).

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Clearly, adult measures of sensory processing are warranted and needed. A measure that is based on a theoretical model and includes all sensory modalities also is desired. This article describes the process of developing the Adult Sensory Profile, which is based on Dunn's (1997) Model of Sensory Processing and the procedures used to examine the psychometric properties of the measure.

Background

Sensory History as a Behavioral Measure of Sensory Processing

One way to measure sensory processing from a behavioral perspective is to obtain a sensory history. Advantages of sensory histories over other measures include ease of administration and contextual relevance (Dunn, 1994). Sensory histories are contextually relevant because they allow evaluation of behaviors in the natural environment rather than the commonly used alternative of observation of performance in a clinical setting. Additionally, sensory histories allow the person or family member who is the focus of the history taking to be an active participant in the evaluation.

The Sensory Profile

The Sensory Profile is a sensory history developed as a measure of children's responses to everyday sensory experiences (Dunn, 1994). The original version of the measure is divided into six sensory categories (auditory, visual, taste/smell, movement, body position, touch) and two behavioral categories (emotional/social, activity level) for a total of 125 items. A principal components factor analysis of the Sensory Profile was conducted on the basis of the responses of 1,115 children 3 to 10 years of age who were typically developing (Dunn & Brown, 1997). The resulting factor structure did not suggest categories of sensory modalities but rather patterns of behavioral responsiveness. This factor analysis led to the development of Dunn's (1997) Model of Sensory Processing, which characterizes four different sensory processing tendencies.

Dunn's Model of Sensory Processing

Dunn's Model of Sensory Processing explains behavioral responses to sensation in children. The findings from the factor analysis of the Sensory Profile (Dunn & Brown, 1997) contributed to the model's conceptualization on the basis of the relationship between a neurological threshold continuum and a behavioral response continuum. The factor analysis resulted in nine factors: (a) sensory seeking, (b) emotionally reactive, (c) low endurance/tone, (d) oral sensory/sensitivity, (e) inattention/distractibility, (f) poor registration, (g) sensory sensitivity (h) sedentary, and (i) fine motor/perceptual. From these data, Dunn developed a four-quadrant model based on the intersections of a neurological threshold continuum and a behavioral continuum. Figure 1 illustrates the grouping of factors into the four-quadrant model. The ninth factor, fine motor/perceptual, is not included in the model because it includes behaviors across all continua.

Further explanation of Dunn's Model of Sensory Processing follows, with a clarification of the two continua and the resulting quadrants. The two poles of the neurological threshold continuum are *low* and *high.* A low neurological threshold indicates that the person requires low-intensity stimuli for neurons to fire and for the person to react. Conversely, a person with a high neurological threshold requires high-intensity stimuli or takes longer to react to the same stimuli. The two poles of the behavioral response continuum are accordance and counteract. Accordance indicates that the behavior corresponds with the neurological threshold. Responding in accordance with a low threshold means that the person easily and quickly recognizes and responds to sensory stimuli. Conversely, responding in accordance with a high threshold means that the person takes longer to respond to or misses available sensory stimuli. Counteracting behaviors indicate that the person is responding contrary to the neurological threshold. When a person counteracts a low threshold, the behaviors involve avoiding sensory stimuli because he or she perceives even low-intensity stimuli and easily is inundated or overwhelmed by the input. On the other hand, counteracting a high threshold entails pursuit or immersion in sensory stimuli because the person is attempting to meet a threshold that requires intense stimuli.

Dunn (1997) described each quadrant resulting from the interaction of the neurological threshold continuum and the behavioral response continuum. The first quadrant, *sensitivity to stimuli,* represents behaviors in accordance with a low neurological threshold. Distractibility, difficulty screening stimuli, and discomfort with sensation characterize this quadrant. The second quadrant, counteracting a low neurological threshold, is labeled *sensation avoiding* and includes behaviors that limit exposure to stimuli. The third quadrant, *low registration,* reflects responses in accordance with a high neurological threshold. This quadrant includes a disregard of or slow response to sensation. The final quadrant, *sensation seeking,* is a counteractive response to high neurological threshold and encompasses pleasure derived from rich sensory environments and behaviors that create sensation.

Dunn's Model of Sensory Processing depicts sensory processing preferences as stable traits; therefore, applying the model to adults is inherently reasonable. The extension of the model led to the development of the Adult Sensory Profile as a measure of adult responses to everyday sensory experiences. The purpose of the current article is to report the results of a series of studies designed to evaluate the reliability and validity of the Adult Sensory Profile as a measure of the four patterns of sensory processing described in Dunn's model.

NEUROLOGICAL THRESHOLD CONTINUUM	BEHAVIORAL RESPONSE CONTINUUM Accordance	 Counteract
High	LOW REGISTRATION Factor 3 (low endurance/tone) Factor 6 (poor registration) Factor 8 (sedentary) *Expected physiological response* to *sensation is a weak response* (due to high threshold) and *quick habituation* (due to accordance behavior that continues to limit response)	SENSATION SEEKING Factor 1 (sensation seeking) Expected physiological response to sensation is a weak response (due to high threshold) and slow habituation (due to counteract behavior that pursues sensation)
Low	SENSORY SENSITIVITY Factor 4 (oral sensory/sensitivity) Factor 5 (inattention/ distractibility) Factor 7 (sensory sensitivity) *Expected physiological response to sensation is strong response* (due to low threshold) with *slow habituation* (due to accordance behavior that involves a sustained recognition of available sensation)	SENSATION AVOIDING Factor 2 (emotionally reactive) Factor 8 (sedentary when motivation is to keep away from sensory experiences) *Expected physiological response to sensation is a strong response* (due to low threshold) with *quick habituation* (due to counteract behavior that withdraws from sensation)

Figure 1. Sensory Profile (child version) factors and relationship to Dunn's (1997) Model of Sensory Processing.

Method and Results: Steps 1 Through 4

Design

The study was conducted in a series of four steps; the method and results for each step will be presented together. The first step of instrument development consisted of a review of the items on the Sensory Profile. Non-age-specific items were maintained and new items were created to ensure an adequate number of items representing the four quadrants of Dunn's Model of Sensory Processing and the sensory modalities. A 60-item measure, with 15 items for each quadrant, was created. Subsequent instrument development included a review of the items by an expert panel, item reliability and factor analysis of typical adult responses, and an analysis of construct validity using Adult Sensory Profile scores and skin conductance measures. All steps of the study were approved by the university's Institutional Review Board.

Step 1: Expert Panel

Purpose. The purpose of the first step was to examine the face validity of the Adult Sensory Profile. This step was accomplished by determining whether persons familiar with Dunn's Model of Sensory Processing could accurately categorize items according to the intended quadrant.

Participants. Eight expert judges comprised the panel, which consisted of three faculty members from an occupational therapy department and three graduate students and two psychology faculty members from a research seminar.

Procedure. The researcher defined the four-quadrant model of sensory processing for the judges, encouraging clarifying questions. Once familiar with the concepts, each judge received the 60 items written individually on a set of shuffled index cards. The judges were instructed to sort the cards into the four quadrants of sensory processing. They did not know how many items were developed for each category. The result from each judge was four sets of cards representing sensory sensitivity, sensation avoiding, low registration, and sensation seeking. After the card sorting, the researcher read each item aloud and asked each judge to identify the quadrant to which the item was assigned.

Analysis. The researcher recorded each judge's responses to determine the proportion of agreement. Item acceptability was set at 75% agreement among the judges (Crocker & Algina, 1986).

Results. On the basis of the review of 60 items by eight expert judges, all but one item was sorted accurately. Thus, the items could be categorized according to the extant theory. Accurate sorting in this case meant that at least seven of the eight judges sorted the item as it was intended. This degree of agreement exceeded the previously set criterion of 75%. The problematic item (miscategorized by three judges), "I need to hold onto walls or banisters to go down steps" (a low registration item), was revised to read, "I am unsure of footing when walking on stairs." Judges were able to categorize the item correctly once it was reworded.

Step 2: Item Reliability and Factor Analysis

Purpose. In this step, the researchers examined the consistency of the psychometric properties of the Adult Sensory Profile and the quadrants of Dunn's Model of Sensory Processing. Specifically, the questions addressed were as follows: Are the quadrant subscales internally consistent? Do the items correlate or load on the intended subscale? Do the items result in factors compatible with the four-quadrant model?

Participants. A total of 615 adults completed the Adult Sensory Profile. Psychology students and occupational therapy students from a large midwestern university (n = 476) were recruited through their departments. The researchers obtained additional participants through the Sensory Profile mailing list, which consists primarily of practicing occupational therapists who have shown an interest in the measure. The researchers sent letters requesting that each list member complete the Adult Sensory Profile and that they ask another adult of the opposite gender to complete the form. This effort provided a larger sample, a more even gender ratio, and a wider age range. The total sample included 38.8% men and 61.2% women, with a mean age of 30.7 years (SD = 13.3, range = 17–79 years).

Procedure. All participants were informed via a cover letter that completion of the Adult Sensory Profile indicated consent to participate in the study. Participants independently completed the Adult Sensory Profile and returned the form to the researcher.

Analysis. Several analyses were conducted to obtain information on the reliability of individual items and subscales (i.e., Sensory Sensitivity, Sensation Avoiding, Low Registration, Sensation Seeking) of the Adult Sensory Profile. Coefficient alpha was calculated as an internal consistency estimate for each 15-item subscale (Green, Salkind, & Akey, 1997). Next, each item on a subscale was correlated with the total score for the subscale, using Pearson product-moment correlations (Green et al., 1997). Finally, the 60 items of the Adult Sensory Profile were analyzed with a principal component factor analysis (Gorsuch, 1983).

Results. For item reliability, first, the Sensory Sensitivity subscale yielded a coefficient alpha value of .81, with alpha values of .66 for the Sensation Avoiding subscale, .82 for the Low Registration subscale, and .79 for the Sensation Seeking subscale. The Sensation Avoiding subscale lacked the internal consistency desired in attitude scales; however, the remaining three subscales appear reasonably internally consistent.

Second, each item on a subscale was correlated with the total score for the subscale, using Pearson product-moment correlations. All items on the Sensory Sensitivity (r = .32–.56), Low Registration (r = .33–.56), and Sensation Seeking (r = .26–.50) subscales correlated most highly with their intended subscale. In contrast, the Sensation Avoiding subscale (r = .11–.52) had 11 items correlating highest on a subscale other than its own. These items had their highest correlations with the total scores on the Sensory Sensitivity or Low Registration subscales.

Next, the 60 items of the Adult Sensory Profile were analyzed with a principal component factor analysis. The criteria used to determine the number of factors to rotate included the scree test, the a priori hypothesis of four factors, and the interpretability of the factor solution. The criterion of eigenvalues greater than 1 was not useful because it would have yielded an unwieldy 16 factors, with most factors contributing less than 4% of variance. The scree test suggested a four-factor solution, and the four-factor solution led to the most interpretable results. Consequently, four factors were rotated, using a Varimax rotation procedure.

The four-factor solution is generally supportive of Dunn's Model of Sensory Processing, with some stipulations. Item loading of .40 or more was set as the criterion of magnitude to be a meaningful item for a particular pattern of sensory processing. Of the four factors, low registration (Factor 1) and sensation seeking (Factor 2) were consistent with the theory. Inconsistent with the theory was the finding that the items of sensory sensitivity and sensation avoiding loaded together on two factors (Factor 3 and 4) (see Table 1). This finding is not entirely unexpected because these two quadrants make up the low end of the neurological threshold continuum. However, the finding creates some doubt about whether these two factors can be interpretable as separate dimensions—one that reflects a response in accordance with a low threshold (sensory sensitivity), and one that reflects a response that counteracts a low threshold (sensation avoiding). Three additional problems with the factor structure occurred: (a) Some items loaded contrary to expectation (i.e., two sensitivity and six avoiding items loaded on the low registration factor, and one avoiding item loaded on the sensation seeking factor); (b) one item loaded on both Factors 1 and 3 (i.e., "I stay away from crowds"); and (c) eight items did not load on any factor. Factor 1 accounted for 10.89% of the variance; Factor 2 accounted for 7.85% of the variance; Factor 3 accounted for 7.59% of the variance; and Factor 4 accounted for 6.18% of the variance. The total variance accounted for by the four factors was 32.5%.

When the information from the internal consistency analysis, item correlations with subscales, and factor analysis is taken together, the Sensation Avoiding subscale does not exhibit adequate psychometric properties. It has questionable internal consistency and lacks factorial validity (Green et al., 1997). Many of its items relate to other subscales. To improve the Sensation Avoiding subscale, its items were examined to determine characteristics that distinguished between items that were performing well and items that were performing poorly. The discrepancy between the two sets suggested a revision such that items on the Sensation Avoiding subscale reflected more deliberate avoidance behaviors. Problematic items were revised, deleted, or rewritten so that the original design of 15 items per subscale was maintained. Conditions that led to changes included the items that correlated highest with an unintended subscale, items with no loadings greater than .40 in the factor analysis, cross-loading of items, and clarifying comments written on the measure by participants.

Step 3: Construct Validity—Physiological Response and the Adult Sensory Profile

Purpose. The purpose of this step was to examine construct validity of the Adult Sensory Profile by determining whether a strong preference for a sensory processing pattern resulted in different physiological response patterns as measured by skin conductance amplitude of response and trials to habituation. The a priori hypotheses were as follows:

1. Persons with low thresholds (sensory sensitivity and sensation avoiding) would have a greater amplitude of skin conductance response than persons with high thresholds (low registration and sensation seeking).
2. Persons with high scores on sensation avoiding and low registration would be quick to habituate but for different reasons. (Sensation avoiding is a withdrawal from the stimulus, whereas low registration has a limited response along with limited interest.)

Table 1
Four-Factor Model of the Adult Sensory Profile

Intended Subscale	Item	Factor 1	Factor 2	Factor 3	Factor 4
A	I avoid eye contact.	.588			
A	I prefer sedentary activities.	.584			
S	I become disoriented after bending over.	.535			
A	I choose to spend my time in quiet activities.	.509			
R	I have to ask people to repeat things.	.503			
R	I don't notice when my name is called.	.494			
R	I seem slower than others when trying to follow an activity or task.	.488			
R	I don't notice when other people come in the room.	.486			
R	I don't pick up on what others are saying.	.480			
R	It takes me more time to wake up in the morning.	.454			
A	I keep the shades down.	.454			
R	I am unaware of odors that others notice.	.438			
R	I trip over or bump into things.	.426			
A	I avoid situations where unexpected things might happen.	.418			
R	I don't seem to notice when someone touches me.	.416			
R	I don't seem to notice when my hands or face are dirty.	.414			
R	I have a high pain tolerance.	.411			
S	I gag easily with food textures or food utensils.	.409			
A	I stay away from crowds.	.408		.405	
R	I don't get jokes as quickly as others.	.408			
R	I miss street signs.	.403			
K	I enjoy how it feels to move about.		.674		
K	I like to wear colorful clothing.		.582		
K	I choose to engage in physical activities.		.573		
K	I do things on the spur of the moment.		.569		
K	I find opportunities to visit places that have bright lights.		.564		
A	I wear sunglasses when outside.		.564		
K	I like to attend events with a lot of noise.		.519		
K	When I see fresh flowers, I go over to smell them.		.481		
K	I touch others when I'm talking.		.457		
K	I find activities to perform in front of others.		.444		
K	I like how it feels to get my hair cut.		.440		
K	I enjoy being close to people who wear perfume or cologne.		.439		
K	I work on two or more tasks at the same time.		.438		
K	I like to go barefoot.		.435		
K	I hum, whistle, sing, or make other noises.		.420		
S	I am distracted if there is a lot of noise around.			.743	
A	I stay away from noisy settings.			.691	
A	When others are watching TV, I leave the room or ask them to turn it down.				.635
S	I find it difficult to work with background noise.			.629	
S	I am bothered when I see lots of movement around me.			.551	
S	I am bothered by unsteady or fast-moving images.			.538	
A	I use strategies to drown out sound.			.529	
S	I startle easily from unexpected or loud noises.			.409	
S	I stay away from crowds.	.408		.405	
A	I avoid stores with strong odors.				.649
S	I am uncomfortable in certain fabrics.				.531
S	I dislike having my back rubbed.				.510
S	I don't like particular food textures.				.573
S	I don't like strong-tasting mints or candies.				.422
S	I feel discomfort when brushing my teeth.				.420
A	I stay away from standing in line.				.409

Note. Table includes items with factor loadings > .40. R = low registration; S = sensory sensitivity; A = sensation avoiding; K = sensation seeking.

3. Persons with high scores on sensory sensitivity and sensation seeking would be slow to habituate but, again, for different reasons. (Sensory sensitivity is a continued recognition of the stimulus, whereas sensation seeking involves a desire to respond to and an interest in the stimulus.)

Participants. The total subscale scores from occupational therapy students were examined to identify the five highest scoring students in each of the four quadrants. These students were invited to complete the skin conductance protocol. All but one agreed to participate, and this student was replaced with the one with the next highest score.

Physiological measure–skin conductance measures. Amplitude and frequency of a skin conductance response is used as a measure of attentional response allocation and processing of a stimulus (Dawson, Filion, & Schell, 1989). The auditory stimulus used consisted of 12, 108 dB white-noise presentations of 1 sec duration. The interstimulus interval was 30 sec to 50 sec. Electrodermal activity was recorded as skin conductance responses from 8 mm silver chloride electrodes placed over the tips of the second and third fingers of the participant's nonpreferred hand. The skin conductance signal was recorded with a LabLinc-V[1] system

[1]Coulbourn Instruments, 7462 Penn Drive, Allentown, Pennsylvania 18106.

equipped with bioamplifier and isolated skin conductance coupler. The signal was digitized at a rate of 20 Hz for 3000 ms before to 8000 ms after the presentation of each stimulus. Skin conductance response amplitudes were computer scored off line as the change in conductance occurring within a latency window of 1 sec to 3 sec after stimulus onset. Skin conductance level was scored at each 1-sec interval across the recording window.

Skin conductance measures of responsiveness and trials to habituation were obtained. Responsivity was measured as the amplitude of the response to the first auditory stimulus. Trials to habituation was measured as the number of stimuli presented before a participant had two consecutive nonresponses to an orienting stimulus.

Procedure. Written informed consent was obtained from all participants. Skin conductance measures were obtained in a laboratory located at a university setting. Participants were instructed that they would hear a series of sounds and that they should simply sit quietly during the process.

Analysis. One-way analyses of variance (ANOVAs; 1 x 4) were conducted to examine the differences among the four groups on the skin conductance–dependent measures of responsivity and trials to habituation. Tukey's test was used to examine pair-wise differences among the means (Green et al., 1997).

Results. The results of the ANOVA were consistent with the a priori hypotheses. There was a significant difference in responsivity across the four groups: sensory sensitivity, sensation avoiding, low registration, and sensation seeking, $F(3, 17) = 8.38$, $p = .001$. A Tukey's test indicated that the sensory sensitivity and sensation avoiding groups were more responsive than the low registration and sensation seeking groups. There was also a significant difference in trials to habituation across the four groups, $F(3, 17) = 46.85$, $p < .001$. Habituation was defined as two consecutive nonresponses. A Tukey's test indicated that the sensory sensitivity and sensation seeking groups took more trials to habituate than the sensation avoiding and low registration groups (see Table 2).

Examination of the two ANOVAs together revealed that each group was distinguished from all other groups by a different pattern of responses consistent with the underlying theory of Dunn's Model of Sensory Processing. The groups with low neurological thresholds (sensory sensitivity and sensation avoiding) responded intensely to stimuli but had different habituation patterns. The sensory sensitivity group responded intensely to the stimulus but did not habituate to the noise, which is consistent with a behavioral response in accordance with a low neurological threshold. Conversely, the sensation avoiding group also responded intensely to the stimulus but habituated quickly to the noise, suggesting a behavioral response that counteracts the low neurological threshold.

The two groups with a high neurological threshold (low registration and sensation seeking) had restricted responsivity to the stimulus with different habituation patterns, and the low registration group had a limited response and habituated quickly to the noise, both indicating a behavioral response in accordance with a high neurological threshold. The sensation seeking group also had a limited response but did not habituate. This response is consistent with a counteractive behavioral response to a high neurological threshold.

Step 4: Reliability of the Adult Sensory Profile—Revised Version With a Heterogeneous Group

Purpose. The purpose of this step was to determine whether the psychometric properties of the revised Adult Sensory Profile indicated improved reliability of the Sensation Avoiding subscale, with continued adequate reliability of the Sensory Sensitivity, Low Registration, and Sensation Seeking subscales.

Participants. The final version of the Adult Sensory Profile was administered to 93 adults for the purposes of making group comparisons among persons with schizophrenia, persons with bipolar disorder, and persons who were mentally healthy. The group comparisons will be presented in another article. The three groups were combined for the current analyses to provide an adequate sample size. Participants were recruited from consumers and staff at three community mental health programs. Forty men and 53 women comprised the sample. The mean age was 38 years (SD = 11.2, range = 18–68 years).

Procedure. Written informed consent was obtained, and a research assistant administered the revised Adult Sensory Profile to all participants.

Analysis. As in the previous analysis, coefficient alpha for each subscale and item correlations with each subscale using Pearson product–moment correlations were conducted. Factor analysis was not used because of the small sample size.

Results. Item reliability was first examined by computing coefficient alpha as an internal consistency estimate for each 15-item subscale. In this case, the Sensation Seeking subscale had the poorest internal consistency (alpha = .60), whereas the Sensory Sensitivity (alpha = .78), Sensation Avoiding (alpha = .77), and Low Registration (alpha = .78) subscales demonstrated strong internal consistency. Compared with the previous analysis, the Sensation Avoiding subscale improved, but the internal consistency estimate for the Sensation Seeking subscale was worse. The items in the Sensation Seeking subscale remained virtually

Table 2
Group Means for Skin Conductance Responsivity and Trials to Habituation

Group	Responsivity *M* (*SD*)	Trials to Habituation *M* (*SD*)
Sensory sensitivity	2.04 (.20)	11.67 (0.82)
Sensation avoiding	2.05 (.17)	6.8 (1.09)
Low registration	1.69 (.12)	6.2 (0.84)
Sensation seeking	1.63 (.19)	11.2 (1.09)

the same for both phases of the study. Only one item received minor revision. Therefore, the decrement in internal consistency is probably due to the difference in the second sample (i.e., smaller and including persons with severe mental illness).

Next, item reliability was examined using the correlation of each item on a subscale with the total score for each Adult Sensory Profile subscale using Pearson product-moment correlations. Only two items did not have their highest correlation on the intended subscale. One sensation avoiding item, "When I smell a strong odor in a store, I move to another section or leave the store," had a higher correlation on the Sensory Sensitivity subscale (r = .299) than on the Sensation Avoiding subscale (r = .275). A sensation seeking item, "I find opportunities to visit places that have bright lights and are colorful," had a higher correlation on the Sensory Sensitivity subscale (r = .280) than on the Sensation Seeking subscale (r = .273). Overall, this finding suggests a major improvement in the items because before revision, 11 items on the Sensation Avoiding scale had a higher correlation with an unintended subscale.

Discussion

Psychometric Properties of the Adult Sensory Profile

An examination of the reliability and validity of the Adult Sensory Profile guided changes in items and allowed for increased confidence in the instrument as a measure of sensory processing in adults. The remarkable agreement among the expert judges' sorting of items according to the four quadrants of Dunn's Model of Sensory Processing indicated that the items could be categorized according to the extant theory. An examination of the relationship between scores on the Adult Sensory Profile and skin conductance measures supported the construct validity of the instrument. Responsivity and habituation to stimuli were examined for participants with high scores on each of the four quadrants. This analysis yielded unique patterns for each group consistent with Dunn's model. Participants with high scores on sensory sensitivity were more responsive and took longer to habituate. Participants with high scores on sensation avoiding were also more responsive but quick to habituate. Participants with high scores on low registration were less responsive and quick to habituate, whereas participants with high scores on sensation seeking were less responsive but slow to habituate.

It should be noted that there is a discrepancy between the sensation seeking results in this study and Zuckerman's (1994) findings of rapid habituation among sensation seekers. The most likely explanation is related to a difference in the sensation seeking construct of Zuckerman and the construct of Dunn (1997). Zuckerman's sensation seeking emphasizes behaviors that involve impulsivity and risk taking, whereas Dunn's sensation seeking is manifested as behaviors that indicate pleasure and interest in exposure to everyday sensory stimuli.

The item reliability measures and factor analysis suggested that the Low Registration and Sensation Seeking subscales were internally consistent and could be distinguished from the other quadrants. Conversely, the factor analysis revealed that the Sensory Sensitivity and Sensation Avoiding subscales were not distinct quadrants because items on these subscales loaded together. Other analyses provided additional evidence that the Sensation Avoiding subscale was not discrete. The Sensation Avoiding subscale had a lower coefficient alpha than the other subscales, and 11 sensation avoiding items correlated higher with the total scores on the other subscales than they did with their own total score. This evidence led to a substantial revision of the Sensation Avoiding subscale to reflect more deliberate avoidance behaviors.

To determine whether changes in the Sensation Avoiding subscale were favorable, the performance of the Adult Sensory Profile was reexamined with the sample of participants selected for group comparisons. Coefficient alpha for the Sensation Avoiding subscale improved from .66 with the original items to .77 with the revised items. When item reliability was examined using the correlation of each item on a subscale with a total subscale score, only one item on the Sensation Avoiding subscale correlated higher on other subscales than it did with the total score on its own subscale. Overall, the Sensation Avoiding subscale appears more distinct after item revision.

We acknowledge that skin conductance tests should be readministered in conjunction with the revised Adult Sensory Profile to determine whether the same results are found with the revised items. That study is currently under way.

Collectively, there is evidence to support the four subscales of the Adult Sensory Profile as distinct constructs of sensory processing preferences. The evidence also indicates that the Sensation Avoiding subscale, which had the weakest properties initially, was improved with item revision.

Clinical Applications of the Adult Sensory Profile

The findings of these series of studies provide evidence that supports the reliability and validity for use of the Adult Sensory Profile in practice settings. Information from the Adult Sensory Profile can have several intervention applications. First, providing the results to the person completing the measure gives insight into personal behavior and responses to different environments. Furthermore, this information can increase understanding for family members, friends, coworkers, and so forth regarding a person's behaviors and responses to stimuli. The measure also can help explain areas of conflict when persons have different sensory preferences.

Service providers can use results of the Adult Sensory Profile to design more effective interventions. Such interventions might include environmental adaptations to support performance. For example, persons with low registration may need stimuli to be intensified, whereas persons with sensory sensitivity may need a reduction in intensity or quantity of stimuli to avoid distractibility. Sensory processing preferences also are important when making judgments about environmental fit. For example, when a person is making decisions about a living situation or job choice, results from the Adult Sensory Profile may enhance the decision-making process. A workplace with quiet surroundings and clear expectations might suit a sensation avoider, whereas a sensation seeker might prefer lots of activity and variety. There are also strategies that persons can adopt when encountering adverse environments. For example, persons with sensory sensitivity may need to develop strategies for maintaining focus in distracting environments.

Future Directions for Research

Efforts to ascertain reliability and validity of an instrument is a never-ending process. An important next step is to examine the psychometric properties of the Adult Sensory Profile as revised with a large normative population. However, too often psychometric properties of an instrument are obtained only on a normative population. The reliability and validity of the instrument still needs to be examined for individuals from special populations. Currently, studies are under way that are examining sensory processing patterns in schizophrenia, bipolar disorder, learning disabilities, post-traumatic stress disorder, and aging.

This study supports the reliability and validity of the Adult Sensory Profile. The skin conductance data provide physiological evidence to support construct validity for the instrument's ability to measure four distinct patterns of sensory processing. The item revisions improved the internal consistency of the Sensation Avoiding subscale. A lingering concern, however, is the reduction in internal consistency on the Sensation Seeking subscale with the revised measure. Because the Sensation Seeking subscale received very few changes, the lower estimate of the subscale's internal consistency in Step 4 compared with Step 2 may be specific to the sample. The change in reliability from sample to sample further points to the importance of investigating the psychometric properties of the instrument in a variety of populations.

Conclusion

Overall, the Adult Sensory Profile provides a credible method for applying a unique theoretical model toward the understanding of sensory processing. Although the data from this study initially support the reliability and validity of the Adult Sensory Profile, further exploration of the revised measure as well as studies with special populations will provide additional useful information regarding application in clinical practice. ▲

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References

American Occupational Therapy Association. (1994). Uniform terminology for occupational therapy—Third edition. *American Journal of Occupational Therapy, 48,* 1047–1054.

Baranek, G. T., Foster, L. G., & Berkson, G. (1997). Sensory defensiveness in persons with developmental disabilities. *Occupational Therapy Journal of Research, 17,* 173–185.

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory.* Orlando, FL: Harcourt Brace Jovanovich College Publishers.

Dawson, M. E., Filion, D. L., & Schell, A. M. (1989). Is elicitation of the autonomic orienting response associated with allocation of processing resources? *Psychophysiology, 26,* 560–572.

Dunn, W. (1994). Performance of typical children on the Sensory Profile: An item analysis. *American Journal of Occupational Therapy, 48,* 967–974.

Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and their families: A conceptual model. *Infants and Young Children, 9,* 23–35.

Dunn, W., & Brown, C. (1997). Factor analysis on the Sensory Profile from a national sample of children without disabilities. *American Journal of Occupational Therapy, 51,* 490–495.

Falk-Kessler, J., Quittman, M. S., & Moore, R. (1988). The SCSIT: A potential tool for assessing neurological impairment in adult psychiatric outpatients. *Occupational Therapy Journal of Research, 8,* 131–154.

Gorsuch, R. L. (1983). Factor analysis (2nd ed.). Hillsdale, NJ: Erlbaum.

Green, S. B., Salkind, N. J., & Akey, T. M. (1997). *Using SPSS for Windows: Analyzing and understanding data.* Upper Saddle River, NJ: Prentice Hall.

Kinnealey, M., Oliver, B., & Wilbarger, P. (1995). A phenomenological study of sensory defensiveness in adults. *American Journal of Occupational Therapy, 49,* 444–451.

Kohlmeyer, K. (1998). Evaluation of sensory and neuromuscular performance components. In M. E. Neistadt & E. B. Crepeau (Eds.), *Willard and Spackman's occupational therapy* (9th ed., pp. 223–259). Philadelphia: Lippincott-Raven.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking.* New York: Cambridge University Press.