# Appendix A

# Use of Clinical Reasoning in Occupational Therapy: The STEP-SI Model of Intervention of Sensory Modulation Dysfunction

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> *Sensory integration is the neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment.*
>
> —Ayres, 1989, p. 11

Occupational therapy using a sensory integration frame of reference is complex and is based on a core set of principles originated by Ayres (1972). Ayres' principles guide the provision of intervention across a broad spectrum of occupational therapy practices worldwide. Although all occupational therapy is individualized, often incorporating a variety of frames of reference, methods, and modalities, detailed principles provide a structure to ensure consistency of application. Kimball (1988) described how "sensory integration intervention is neither predetermined nor fixed, but rather varies from one individual to the next, and changes in response to the individual's responses to therapy" (p. 423).

We, as a profession, must begin to write replicable intervention protocols for effectiveness intervention research. Although these written descriptions can and should be modified by others who use them, using a written manual increases accuracy of application and permits systematic study. Using a reasoning framework described by Mattingly and Fleming (1994) and working in collaboration with members of the occupational therapy sensory integration team at The Children's Hospital in Denver, Colorado, we embarked on a process to develop a means for ensuring consistency across individualized intervention. This process ultimately resulted in the formation of the STEP-SI clinical reasoning model. The reasoning process, based on Mattingly and Fleming's (1994) seminal work, is briefly synthesized. This Appendix, describes the development and principles of the STEP-SI (Stackhouse et al., 1997) and then details the application of the STEP-SI model to assessment, direct intervention, and home- and community-based intervention. Finally, we illustrate the use of the STEP-SI clinical reasoning model in a direct intervention setting with a case story.

## Critical Reasoning in Intervention Based on Sensory Integration Theory

Mattingly and Fleming (1994) completed a detailed study of the ways in which master clinicians make decisions about how to engage in ef-

fective intervention. The three types of reasoning they described apply to the framework presented here and elsewhere (Miller & Summers, 2001).

1. *Procedural reasoning:* A highly cognitive approach whereby a practitioner actively considers a child's strengths and difficulties and thinks in advance or retrospectively about specific procedures or activities in which the child might engage to remediate problems.
2. *Interactive reasoning:* An interactive approach that occurs during a session and that assists the practitioner and other caregivers to understand the "whole" child, guiding the ensuing events based on the child's responses; also relates to integrating parents and children's priorities into intervention.
3. *Conditional reasoning:* A complex reasoning process that incorporates interactions, context, and individual clients' responses and needs to achieve quality of life goals. During and after sessions, practitioners use a vast array of information to think about the whole child and family in a social context, including the meaning that the disability has for their client.

Mattingly and Fleming (1994) posited that practitioners use two forms of "knowledge" during intervention. One type, *explicit knowledge,* is information that can be articulated through a conscious reasoning process. The other type, *implicit* or *tacit knowledge,* influences intervention on a moment-to-moment basis. "Tacit knowledge forms the base of all other thoughts and actions that comprise practice" (Mattingly & Fleming, 1994, p. 26). Tacit knowledge is further subdivided into two parts. These are:

1. Background working knowledge (i.e., facts once learned but stored in long-term memory that become part of the wealth of knowledge that the practitioner possesses).
2. Knowledge that is difficult to put into words but uses underlying principles, assumptions, values, judgments and "gut" feelings to guide action. The latter form of tacit knowledge is akin to the "art of therapy" described by Ayres (1972) and further delineated in Chapter 11.

> Experts have an implicit understanding of a whole range of minute details of the phenomena that they understand. They recognize small details and nuances and interpret them with impressive speed and accuracy. . . . Therapists . . . can feel small changes in muscle tone . . . or quality of movement . . . and they adjust their own tone of voice or body position almost instantaneously in response to subtle cues indicating the emotional status of the patient (Mattingly & Fleming, 1994, p. 27).

## Delineation of the STEP-SI Clinical Reasoning Model

To examine our reasoning process, our team videotaped and later analyzed numerous intervention sessions. We found that our master clinicians used their explicit knowledge to guide their intervention. But more importantly—and certainly much more difficult to describe—these master clinicians used implicit, tacit knowledge *and* an ongoing, interactive reasoning process to decide "in the moment" how to proceed. Ongoing observation, diagnostic assessment, reflection on multiple hypotheses, and *implicit* understanding of the child's needs at the moment guided each individual intervention session.

From these observations, we added several dimensions to the occupational therapy sensory integration principles originated by Ayres (1972) and used by our master clinicians. Analyzing these dimensions, *including (but not limited to) enhanced sensation,* provided a rich basis for enhancing our descriptions of intervention. Eventually, all the components were collapsed into an acronym, STEP-SI (pronounced "Step", "S", "I"), for Sensation, Task, Environment, Predictability, Self-monitoring, and Interaction (Stackhouse & Wilbarger, 1998). The acronym provides a convenient means to discuss the elements of intervention that occur, an important step in promoting our narrative reasoning (Mattingly & Fleming, 1994). The model incorporates elements unique to a master clinician's perspective, specifically a unique understanding of how moment-to-moment and global adaptation to challenges affect our clients. We hope that clarifying the elements and principles of the STEP-SI process will result in development of a replicable and effective intervention protocol useful in future multisite occupational therapy sensory integration intervention efficacy studies.

## STEP-SI Clinical Reasoning Model: General Principles

The STEP-SI clinical reasoning model was developed originally for use in treating children with sensory modulation dysfunction (SMD) (Stackhouse et al., 1997). Although it targets children with SMD, the model is also applicable to individuals with other patterns of sensory integration dysfunction. The STEP-SI model is a thinking tool that is intended to facilitate reasoning and communication among parents, occupational therapy practitioners, and other professionals. It provides a structure to organize evaluation and intervention information and to effectively set priorities. Originally conceptualized to assist us to make more effective decisions in the flow of direct intervention, it also assists in training parents, teachers, and other caregivers to construct home and community intervention programs. The model serves to expand a practitioner's conception of intervention beyond the use of enhanced sensory experiences to a more encompassing occupation-based intervention in which sensation plays one key part (see also Chapter 12).

A number of authors have provided good summaries of the principles of intervention based on sensory integration theory (e.g., Ayres, 1972; Fisher et al., 1991; Kimball, 1999; Kinnealey & Miller, 1993; Parham & Mailloux, 2001) (see also Chapter 12). These long-standing principles include:

- Active participation by the client
- Client-directed, intrinsically motivating, and purposeful activities
- Individualized interventions based on the age, developmental status, needs, and responses of the client
- Intervention that provides the "just-right challenge" resulting in an adaptive response (i.e., the task is challenging enough to engage the child yet does not preclude success)
- Use of enhanced sensory experiences in the context of activity
- Focus on improving underlying neurologic processing rather than developing academic or motor splinter skills

Critical to the STEP-SI model is an understanding of Ayres' (1972) traditional principles of intervention such as the adaptive response and the "just-right challenge" (see Chapter 11). Ayres proposed that through the just-right challenge, the level of adaptive response increased, thus facilitating changes in function. We use this core concept to begin the process of STEP-SI clinical reasoning. The practitioner first assesses the child's capacity for adaptation and then *scaffolds* specific challenges to stabilize, broaden, and promote flexibility in the child's range of adaptation. This results in growth toward independent management of behavioral organization.

In the course of intervention, the practitioner manipulates the STEP-SI dimensions to support or challenge the child, developing capacities or skills in identified problem areas. The appropriateness of the child's adaptive response becomes a monitor that guides modification of intervention. Table A–1 elaborates the dimensions of the STEP-SI model.

The four general principles of the STEP-SI model of clinical reasoning are:

- Understand the child's adaptive capacity. Determine the child's state of arousal and ability to attain and maintain appropriate behavioral organization. Attend to the range of arousal and the ability of the child to stay within an optimal range. Be aware of the child's responses to challenges in the day or week and compare the conditions that result in organized versus disorganized responses.
- Examine how each STEP-SI dimension affects the child's state of arousal and ability to attain or maintain appropriate behavioral organization. Determine which aspects of each STEP-SI dimension enable the child to have the best adaptive response and which challenge adaptation.
- Prioritize the use of each STEP-SI dimension to support or challenge clients. Manipulate dimensions of the model to maximize appropriate levels of adaptation and occupational performance.
- Monitor and readjust each STEP-SI dimension based on ongoing assessment of adaptive responses. After optimum adaptive performance is achieved, introduce another just-right challenge by altering some aspect of one or more dimensions of the STEP-SI model. This constant "upping the ante" while scaffolding the child to maintain organization within each new "challenge state" is the key to making the adaptive

**STEP-SI Clinical Reasoning Intervention Model**

| STEP-SI Dimension | | Description |
|---|---|---|
| S | Sensation | Sensory modalities: Tactile, vestibular, proprioception, audition, vision, taste, olfaction, oral input, and respiration<br>Qualities of sensation: Duration, intensity, frequency, complexity, and rhythmicity |
| T | Task | Structure, complexity, demand for skill, demand for sustained attention, level of engagement, fun, motivation, and purposefulness (based on standard task analysis) |
| E | Environment | Organization, complexity, perceived comfort and safety, and possibilities for engagement exploration, expansion and self-challenge |
| P | Predictability | Novelty, expectation, structure, routine, transitions, and congruency<br>Level of control by child or practitioner and control of events and routines |
| S | Self-monitoring | Moving the child from dependence on external cues and supports to self-directed and internally organized ability to modify own behavior and manage challenges |
| I | Interactions | Interpersonal interaction style, including responses to supportive, nurturing styles versus more challenging, authoritative styles; locus of control (practitioner guided vs. child directed); and demands or expectations for engagement (i.e., passive awareness to active collaboration) |

changes suggested by the original intervention theory (Ayres, 1972).

These principles are further delineated below in the context of their use in:

- Assessment
- Specific goals and priorities for intervention
- Direct intervention
- Home and community programs

### *Using the STEP-SI in Assessment*

The STEP-SI model can be used as a structure to organize assessment data. As in any occupational therapy intervention model, the goals of assessment, the parent conference, and the first several intervention sessions are to:

- Build a therapeutic alliance with the child and family members
- Identify the specific challenges that affect the child in daily activities and routines
- Identify child behaviors that affect the family's well being and caregiving capacity

The STEP-SI framework also can assist the practitioner in designing intervention specifically aimed at the events that impact a child's ability to self-regulate. This information, combined with standardized assessment data, assists the practitioner, working in collaboration with families and other caregivers, to establish levels of adaptation in each of the dimension of the STEP-SI model. A comprehensive interview is recommended to initiate this process (for an example, see Miller & Summers, 2001). In addition to reviewing the results of all tests and clinical information gained through interview, we recommend that the occupational therapy practitioner and parents meet without the child present to formulate specific goals pertinent to improving the quality of life for children and their families (see Cohn et al., 2000; Chapter 9).

During sessions early in the intervention process, the family and occupational therapy practitioner observe and discuss the child's responses to input in each sensory domain and the child's capacity for adaptation in the other dimensions. Initially, we use reasoning to examine how each sensory system serves to support or challenge the child's overall adaptive behavior, using the following guiding questions.

1. How does sensation serve to challenge or support the child?
   - What, if any, sensation (sensory modalities) does the child seek? Avoid?
   - What qualities of each sensation (e.g., intensity, duration) does the child seek? Avoid?
   - How do these seeking and avoiding behaviors enhance or diminish behavioral organization and functional performance?
   - What qualities of sensation enhance or support behavioral organization or functional performance? What qualities of sensation enhance or support challenges in the other dimensions?
2. What kinds of tasks and qualities of tasks serve to challenge or support the child?
   - What qualities of tasks enhance or support behavioral organization or func-

tional performance? What qualities of tasks enhance or support challenges in the other dimensions?
- How does task structure enhance or diminish the child's behavioral organization or functional performance?
- How does task simplicity vs. complexity enhance or diminish the child's behavioral organization or functional performance?

3. What kinds of environments and qualities of the environment serve to challenge or support the child?
   - What qualities of the environment enhance or support behavioral organization or functional performance? What qualities of the environment enhance or support challenges in the other dimensions?
   - How does the level of stimulation, enrichment, structure, organization, perceived comfort and safety, or possibility for exploration influence the child's ability to adapt in a particular environment?
4. How does predictability serve to challenge or support the child?
   - What qualities of predictability enhance or support behavioral organization or functional performance? What qualities of predictability enhance or support challenges in the other dimensions?
   - If events that occur are consistent and expected versus surprising and unanticipated, is the child's functioning enhanced or diminished?
   - If the child has more or less control over events is his or her functioning enhanced or diminished?
5. How does the child's ability to self-monitor serve to support him or her in challenging situations?
   - Can the child recognize how his or her own internal state affects the ability to complete activities or have appropriate adaptive responses?
   - What strategies and activities help the child to self-monitor (i.e., modeling, verbal, cue cards, checklist)? What strategies does the child already use?
6. How do interactions challenge or support the child?
   - What qualities of interactions enhance or support behavioral organization or functional performance? What qualities of interactions enhance or support challenges in the other dimensions?
   - How does the child's performance change with active scaffolding and support compared with more remote and nonintrusive methods of suggesting change? What kinds of social relationships engage the child and intrude on the child?

The above questions, although they are not comprehensive, demonstrate the complexity of the reasoning challenge that faces the occupational therapy practitioners as they strive to find the just-right challenge. Helping parents and teachers understand these complexities is one of our most important jobs—and gifts.

### *Establishing Specific Goals and Priorities for Intervention*

The primary focus of the occupational therapy practitioner is to assist clients to improve their occupational roles and functional performance. Occupational therapy may assist a child by remediating specific sensory or motor dysfunction, but always in the context of occupations, and always focusing on the family's priorities for change. Cohn (2001a, 2001b; Cohn et al., 2000) found that parents of children with SMD valued social participation, self-regulation, self-esteem, and sometimes specific skill areas. Thus, occupational therapy practitioners establish goals before intervention that generally address:

- *Occupational performance:* Activities of daily living, play skills, work and school performance and behaviors, and specific performance components such as fine and gross motor skills
- *Self-regulation:* Adaptability during daily routines; organization during structured and unstructured tasks; sustained concentration and ability to divide attention between two or more focused tasks; task completion; and ability to monitor own behavior in context before it becomes a problem
- *Social participation:* Play with others, cooperation, making and keeping friends
- *Self-esteem:* Positive self-concept and feelings of self-worth.

Significant improvement in the first two goals often facilitates positive social interaction as well as family and peer acceptance. Improvements in occupational performance, such as increased competency in academic and motor (athletic) skills, along with peer and family acceptance lay the groundwork for a positive self-concept (Harter et al., 1998).

A family's priorities for intervention are our guiding beacons when designing intervention. Although we may believe that toilet training is the most important adaptive skill that a 5-year-old client needs to succeed at school, we may find out that in the culture of her particular family, toilet training is not important. Instead, the family may be more concerned about going out in public without worrying if the child is going to fall apart or being able to sleep through the night. Some families' highest priority may be to have one family meal together without someone always having to take the child into the other room. No matter how clear a practitioner may be about what the goals should be, they must always be defined by the priorities of the family.

### *Case Story for Assessment and Intervention Planning*

Now we illustrate the model with a vignette. Jose, a 6-year-old boy in first grade, was from a first-generation American family. Both his parents worked full time and had high expectations for their children, including getting a good education and a high-level professional job. Jose, like his siblings, had above average intelligence. However, Jose had significant problems at school; he often became aggressive with other children or withdrew to a position under the desk. He did not play with other children at recess. He preferred to eat alone, and never ate the school cafeteria food. At school, many children made fun of him, and his teachers worried.

When tested on the Sensory Integration and Praxis Tests (SIPT), Jose demonstrated severe hypersensitivity to touch. In our parent interview, we found that he refused to eat many foods, was extremely sensitive to smells (e.g., refused to enter the kitchen when his mother was cooking certain foods), and became out of control after fast movement experiences (e.g., riding the merry-go-round at the park). We also learned that Jose often sought strong hugs from his parents, and when he felt overwhelmed, he would squeeze himself into a small space (e.g., under a table or in the back of a closet). He did best when he had a predictable routine, but "fell apart" when the routine was changed or he went somewhere new.

Before his first intervention session, the occupational therapist arranged the environment with several pieces of movement equipment for Jose to explore. First she observed Jose's choices of activities. Jose was curious and explored many movement opportunities. He gravitated toward the glider swing and climbing up a jungle gym. He also loved the small tent with dim lighting. After several minutes, Jose initiated faster movement on the swing and engaged in a tossing game. As the intensity of movement increased, his voice became louder and he began to throw the beanbags randomly, sometimes at the practitioner. After several minutes, Jose dove into the small tent and buried his head under the heavy pillows.

From the assessment and the first few intervention sessions (in reality, an ongoing diagnostic assessment), the occupational therapist learned about Jose's capacity for adaptation. His sensory defensive behaviors were evident; they disrupted his ability to modulate responses to sensation, limited his adaptation to new tasks and environments, and interfered with transitions. Jose was easily overwhelmed and became aroused particularly by stimuli that were intense and nonstructured. His ability to maintain an age-appropriate arousal level after changes in the intensity of stimuli was limited. The occupational therapist discovered that Jose responded positively to deep tactile pressure and proprioception. Other sensory experiences with low intensity and rhythmical quality promoted more adaptive states of arousal. He was bright and capable of excellent focus on challenging academic tasks *if* the environment was nonstimulating. Together, Jose's practitioner and parents reviewed the guiding questions that explore how each dimension of the STEP-SI model served to enhance or disrupt his functioning.

They began by analyzing Jose's responses to qualities of sensation in each sensory domain. They discussed how his extreme tactile, oral, and olfactory sensitivities were minimized by deep pressure and proprioception, slow movement, rhythmical auditory, and low-level visual stimulation. Table A–2 illustrates the outcomes of the reasoning process in

which the parents and occupational therapist collaborated.

Next they discussed the other STEP-SI dimensions, again using the guiding questions as a structure. Responses highlighted how Jose's sensory overresponsivity was exacerbated when tasks were unstructured and the environment was cluttered. When overaroused, Jose became aggressive and unable to focus on work at a desk. Neither he nor his parents had "tools" to help him regulate when he became "wired."

To summarize the outcomes of the interview, the occupational therapist and family identified the STEP-SI dimensions that supported more adaptive functioning for Jose.

1. What kinds of tasks and qualities of tasks serve to support Jose?

A task that is cognitively interesting and requires active problem solving or involves an interesting pretend theme will support Jose when he is being challenged in sensory domains or other STEP-SI dimensions.

2. What kinds of environments serve to support Jose?

Environments that are ordered and without clutter, that are consistent each time he sees them, and that offer opportunities for age-appropriate seclusion will allow Jose to handle sensory and STEP-SI challenges.

3. How can we use predictability to expand his abilities in other areas?

Jose will do best when things are consistent, orderly, and scheduled and when he has preparation time for transitions.

4. What kinds of self-monitoring techniques does Jose already use, and what strategies can he learn to remain regulated when challenged?

Jose does not consistently recognize when he is overwhelmed and does not seek out quiet, secluded spaces to become organized. When he does anticipate difficult situations, he refuses to participate, often appearing uncooperative. At other times, he is unable to make overt adaptations, becomes aggressive and "melts down." Jose should be guided to recognize when he is becoming overwhelmed and given some options for appropriate self-monitoring.

5. How are interactions used to support Jose?

Jose prefers situations in which he is allowed to have "distance" from others. Sometimes support from one parent can scaffold him to attempt tasks that are hard for him, but most of the time he resists advice and suggestions from others.

This information is used to plan direct intervention and develop home and community programs. These questions and answers reflect an explicit reasoning process (Table A–3).

Finally, the parents and occupational therapist collaborated on goals for Jose's intervention, which resulted in construction of long-term goals for occupational therapy intervention (Table A–4).

We have found that to gauge success, both families and practitioners benefit from *written goals*. In addition, we bring our *tacit* knowledge to the level of *explicit* knowledge by writing goals as well as charting what we know about each child's sensory systems and other information covered in the STEP-SI dimensions.

**IN EACH SENSORY SYSTEM**

| Sensory Domains | Jose is Supported by | Jose is Challenged by |
|---|---|---|
| Touch | Deep pressure touch | Light or unexpected touch |
| Movement | Slow, rhythmic, linear movement | Fast, rotary, intermittent, unpredictable movement |
| Proprioception | Joint input and muscle resistance | None |
| Vision | Low levels and natural light | Visually distracting environments; bright or fluorescent lights |
| Vision | Low levels and natural light | Visually distracting environments; bright or fluorescent lights |
| Auditory | Low, consistent, rhythms and music | High-frequency, loud, intermittent or odd sounds |
| Olfactory and taste | Sweet smells and tastes | Acrid smells and "yucky" tastes |
| Oral sensation | Deep pressure and proprioception in mouth | Unexpected textures of food, especially when combined with "yucky" smells or "disgusting" taste" |

**TABLE A–3 REFLECTIVE QUESTIONS FOR THERAPISTS' ASSESSMENT AND ESTABLISHING GOALS**

What are the child's areas of competency and strength in daily life activities?
Do I understand how the child's strengths can help him or her cope with his problems?
Which STEP-SI dimensions support the child's performance and positive adaptive responses in daily life activities?
Do I understand the family's priorities for the child?
What is the best way to collaborate with the child's parents and share my observations? Do I need to spend more time talking to parents; provide more written materials; or suggest other audio, video, or print resources?

### *Using the STEP-SI Clinical Reasoning Model in Direct Intervention*

To implement the STEP-SI model in direct intervention, an occupational therapy practitioner uses both explicit and tacit reasoning skills. The practitioner carefully considers all the *procedural* information (facts) that he or she has gleaned about the child. Next, the practitioner makes explicit the domains or dimensions of intervention with which he or she will begin intervention (e.g., the equipment to set up before the child arrives and activities that might be needed to increase or decrease the challenge). The general principles of the STEP-SI Model guide the questioning and planning. As the practitioner continues to implement intervention, he or she revisits the STEP-SI guiding questions and the reflective questions above.

First the practitioner works to understand the adaptive capacities of the child. For a child with SMD, the practitioner starts by focusing on how the child responds to sensation and how it affects his or her level of arousal and behavioral organization. The occupational therapy practitioner asks if the child can attain an optimal level of arousal and determines if he or she can maintain this regulated arousal level across various sensory experiences. The optimal level of arousal is the range of activity associated with an individual's most efficient task performance and adaptability, related to central nervous system and autonomic nervous system functions. In Jose's case, we saw that he was overresponsive to sensation and became overaroused and disorganized easily. But children with SMD rarely reach an optimum level of arousal. Some children seem to have behaviors indicating both under- and overarousal, either at different times or in different sensory systems.

**TABLE A–4 JOSE'S LONG-TERM GOALS FOR OCCUPATIONAL THERAPY INTERVENTION**

Can successfully manage aggressive tendencies when others invade his "space"
Can successfully engage in social interactions in a stimulat ing environment, such as the lunchroom or playground
Can stay on task in his classroom and work at a desk
Can increase variety in his diet and eat most meals with his family
Can identify when he is beginning to get overstimulated and use strategies that allow him to stay in the environment or exit in an age-appropriate manner
Can enjoy a variety of movement activities on the play ground, and remain regulated

From the initial assessment, the practitioner should have a fair idea of the child's adaptive capacities. The practitioner continues to observe the child's behavior and reexamine the child's adaptive capacity and arousal levels during each intervention session.

Second, the practitioner must explicitly understand the supportive and disruptive aspects of each STEP-SI dimension. Furthermore, the occupational therapy practitioner should understand or be developing ideas about how to use each dimension in an intervention session. Each idea the practitioner has about what either supports or disrupts a child should be thought of as a question, and each question tested in an intervention session over the course of several weeks. We conceptualize the first few sessions as an ongoing diagnostic assessment as well as the beginning of intervention.

The third principle is to prioritize which dimensions (and their qualities) will be held constant or used for support and which will be subtly changed. The idea is to choose a single dimension and artfully challenge the child with one aspect of it. After a practitioner understands the child better by testing what challenges and supports the child, the practitioner can balance multiple challenges with multiple supports. The challenge areas are based as much on the practitioner's reasoning as the child's own drive. Following the child's lead is important, and children often gravitate toward a certain activity to challenge themselves while sometimes avoiding areas of challenge. Children also selectively avoid certain challenges. We want

to achieve a balance between providing opportunities for child-directed activities and guiding them toward challenges they avoid. Sensation is often a productive dimension to examine first because, by definition, children with SMD have significant disruptions in processing sensation.

The fourth principle, which is key during direct intervention sessions, is to constantly observe the child's adaptive responses with your "critical reasoning" mind actively engaged. Does the child show a positive adaptive response? (e.g., maintaining appropriate arousal, organization, posture, emotional tone, social engagement?) Is the child able to maintain adaptation for increasingly longer time periods? Does the child begin to seek further challenges on his or her own? You can begin to develop an understanding of what works for this particular child. If the child is not demonstrating good adaptation, further supports can be added or challenges reduced. Changes should be subtle. To abandon or radically change an entire activity, especially if the child choses it, often is a mistake. Instead, consider the possibilities for modifying the activity. The acronym *STEP-SI* can provide a reminder of the dimensions that can be changed or adjusted. If a child is demonstrating a good adaptive response, you might want to keep the dimensions constant until the child demonstrates mastery. However, it is important to keep the child moving forward at a just-right rate of challenge. Practitioners must support the child right to the edge of his or her ability to adapt, but not beyond it. The push toward the edge of adaptive ability allows the child to expand his or her adaptive capacities.

The general principles of the STEP-SI model are used dynamically, both within an intervention session and to plan for future sessions. Master clinicians reflect during and after each session regarding the appropriateness of activities, tasks, and the environment. The information gleaned is shared with the family and used to make suggestions for the child at home and in the community. Practitioners must be prepared to explain their *reasoning* to parents. Forcing oneself to articulate the purpose for each intervention activity will improve the practitioner's skills as well as make the rationale for intervention clear to parents.

### CASE STORY OF DIRECT INTERVENTION

Now we return to Jose, who has a narrow range of optimal arousal and can easily escalate beyond that range. We have seen how the domains of sensation and the other STEP-SI dimensions either support or disrupt Jose, which allows us to prioritize his intervention. The example below addresses one of Jose's challenges in the dimension of movement sensation. We will explore this one domain as an example of how a practitioner uses reasoning during an intervention session. Jose is challenged by fast or rotary movement, which causes him to become overaroused and disorganized. In his first session, Jose chose to engage in swinging but was not able to maintain adaptation when the movement became faster or rotary. The occupational therapy practitioner, therefore, began the session by asking:

> *How can I best use sensation to support Jose while he tries to maintain a regulated state? What sensory options will support him during movement activities to maintain an optimal arousal range?*

Table A–5 shows how, by writing some initial answers, the occupational therapy practitioner made tacit ideas explicit regarding ways to help Jose. Through this process, she designed the first features to be tested during intervention.

The practitioner should start with one particular supportive domain and then incorporate several ideas from it into the movement activity that she planned for Jose. To find out what is effective, she tests each idea separately and then tests them in various combinations. If too many new features are added at the same time, the overall activity may become too complex. In addition, the practitioner is unable to judge the effect of each feature. Complexity alone adds a dimension of challenge even though all the individual facets may be supportive. *Sometimes less is more.* Table A–6 contains options for using the STEP-SI dimensions to support Jose in upcoming intervention sessions. Before beginning the intervention session, the practitioner has all the sensory equipment and STEP-SI tools nearby that she may use in the session.

### INTERVENTION

In the story in this section, the practitioner is referred to as "I" and the child as "he/his." The practitioner's reasoning is italicized.

As a result of the reasoning process summarized in Tables A–5 and A–6, I brought a linear glider into the treatment space so I could manipulate the intensity and rhythmicity of movement Jose experienced. Other movement equipment was available nearby but was not suspended to

## ■ TABLE A–5 EXAMPLE OF THE USE OF THE SENSORY DOMAINS TO SUPPORT A CHALLENGE

| Challenge | Options for Support of Challenge in Each Sensory Modality* | | | | | | |
|---|---|---|---|---|---|---|---|
| | *Tactile* | *Movement* | *Proprioception* | *Auditory* | *Visual* | *Oral and Respiratory* | *Taste and Smell* |
| Poor modulation of fast or rotary movement in a swinging activity | Deep pressure before movement (getting the "warrior" ready for battle)<br>Wrap Jose's extremities or trunk in Ace wraps (as a "shield of armor") | Begin with slow, rhythmic movement (warrior's first exercise)<br>Choose a swing that allows for grading the speed and excursion of movement (ready to ride horse) | Combine movement with muscle resistance such pulling a rope or pushing with arms to move the swing (ready for the lance in battle)<br>Weight the swing to provide more resistance to the movement (strong arms to wrestle the enemy to the ground) | Reduced extraneous sound (the hush before the battle)<br>Slow, rhythmic music** (getting ready for the troops to move all together) | Establish a point of focus or target (focus on other side's troops)<br>Dim lights (ready for a dawn attack) | Provide things for Jose to put in his mouth to bite, chew, suck, or blow*** (to keep the troops quiet until the leader raises the battle call) | Try different taste qualities for things in his mouth such as sweet, sour, salty or bitter (things he can sucked on during battle to give him special powers)<br>Avoid wearing perfumes, hairspray, and so on** |

*These suggestions should occur in the context of a comprehensive intervention plan for addressing Jose's sensory defensiveness (e.g., a sensory diet and the Wilbarger approach to treating sensory defensiveness; see Chapter 14).

**Specific sound therapy programs have been developed (see Frick's section in Chapter 14).

***See Oetter et al., 1993.

**EXAMPLES OF THE USE OF STEP 5 DIMENSIONS TO SUPPORT A CHALLENGING ACTIVITY**

| Task | Environment | Predictability | Self-Monitoring | Interaction |
|---|---|---|---|---|
| Use structured targeting activities and tasks that emphasize a cognitive challenge (e.g., shooting arrows at a target during swinging to practice for battle) | Low levels of background noise and light; structured and neat<br>Provide only a few interesting options for activities (e.g., clear the battlefield so the great warrior can focus) | Set up a routine for beginning and ending sessions with taking off shoes<br>Start with a familiar activity from the previous session<br>Give Jose control through choices (e.g., warriors must have a ritual they follow) | Provide a hideout space<br>Give Jose verbal feedback regarding when he is able to stay calm and when he is getting overwhelmed (e.g., use hideout when the battle "gets too rough") | Use a nurturing, low demand and a calm and steady voice (e.g., you are the battle coach and you don't want the other side to hear you) |

keep the environment more organized visually. A variety of activity options were available but out of sight. I had decided to try the "warrior in King Arthur's army" as a fantasy theme to make our sessions more playful. These were built into each step but are not explained in detail here.

I began with Jose with our previously established, predictable routine of removing and storing his shoes. Before entering the "King Arthur's campground," Jose was talking rapidly and incessantly about a TV program he had seen. He seemed overaroused. We entered the gym, and Jose immediately approached the familiar linear glider swing and then stood on it. He tried to move the swing forward and backward, but he was unsteady and disorganized in his movement. Quickly, Jose began acting silly and making quick, repetitious, and ineffective attempts to get the swing going.

*I need to get his state more organized right away. How can I slow him down and get better postural responses? . . . Maybe I should try intensifying the deep pressure and proprioceptive input to get his movement more organized?*

I got a weighted vest (armor) and helped him put it on (*use of sensation).*

*How can I help him control the speed, rhythmicity, and direction of movement?*

I decided to get on the swing with him so that I could guide the glider's movement (*use of sensation*). I realized that Jose's poor postural control was exacerbating the problem.

*How can I get him to sit down to improve his postural control? . . . Maybe a task that engages his attention will help him achieve a more organized state?*

I asked his mother if she would build a huge tower of blocks in the center of our battleground for practice with the lance, near one end of the swing (*use of task).* Jose then began to swing more rhythmically, pretending he was swinging a lance at the enemy. He became intent on knocking down the tower. He gradually stopped talking, and the volume of his voice volume lowered to a normal range (*manipulation of sensation and task*).

*This might quickly get too easy and boring. What can I do to increase the challenge so that it is just right for Jose without adding so much challenge that he cannot succeed?*

After twice using his "lance" to knock down the tower his mother built, I guided him to stand up and continue without me on the swing. As Jose started to stand, I could see that he was beginning to lose his balance. He started talking loudly, and then he jumped off the swing and tried to bang the tower with the glider swing!

*Too much challenge . . . now what should I do?*

With firm, steady pressure on his shoulders (*use of sensation),* I physically guided him back to the swing. Then I sat behind him and stabilized his pelvis while he pushed and pulled on the rope to activate the swing (*use of deep touch pressure, postural support, and rhythmical movement)* until his movements become smooth and symmetrical. He focused on the activity and began having fun. He laughed and said, "I can do this! Better watch out, Enemies!" He slowly began to incorporate more adaptive postural organization.

*I know that I've got to keep this session moving forward . . . keep it fun but just a little more challenging from moment to moment.*

I asked Jose's mother to put cotton balls (spies) on top of the tower, at the level of Jose's eyes. Giving Jose a straw, I said, "Can you eliminate the enemy spies [blow the cotton balls] off the lookout

tower?" He playfully engaged in the task of moving the glider swing back and forth, while blowing the enemy spies off the "lookout tower." *(We have subtly manipulated the task for more challenge, and the sensory input has assisted him to stay organized.)* I modeled for Jose's mother, giving reinforcing verbal feedback to Jose, using my "steady and calm voice" (*manipulation of interaction*). Soon Jose's mother took over giving positive reinforcement. Jose was demonstrating an adaptive response, with increased postural organization, purposeful engagement in the task, and persistence.

*Where do I go from here?*

I wanted to challenge him to maintain this regulated state with more movement. I asked his mother, "What can we do to make it just a little harder for him?" She suggested that we move the tower back gradually (enemy forces slowly withdrawing from Jose's powerful onslaught) to allow the movement to increase, as Jose continued blowing. We tried this. After several minutes, Jose was still able to focus on this activity and was playful. However, I soon realized, by Jose's waning interest in the activity, that he was going to need another subtle shift, a new challenge, but along the same lines, not a big change in activity.

*Jose gets especially overaroused by rotary movement, yet he is really focusing here. I wonder if I can use the focus of the task and the fact that the swinging and blowing is happening in a predictable manner to begin rotary movement?*

I decided to shift the movement of the swing so that it offered a circular pattern (looking for other enemy spies that were out there in other directions).

*What can I do to help him stay focused during this transition while I switch the glider to a different hook that allows rotary movement?*

Intuitively, I began conversing with Jose (*using interaction).* I asked him to help me carry the heavy glider (cannon) (*using sensation)* and talked about how strong he is in fighting the enemy. We talked more about how he could help his mother by carrying heavy things for her at home.

During this conversation, Jose got off the glider swing, removed his weighted vest, and conversed appropriately. I encouraged Jose to get on the rotary swing in prone while I placed sequential picture cards of a battle scene in a circle on the floor beneath the swing (*using a challenging task to increase demand for cognitive concentration).* "Jose, see if you can pick up the pictures *in order* as you swing," I said. Jose propelled himself around to explore the pictures (*using rotary movement sensation)* and began collecting them in sequence.

*I see that he is doing pretty well, but I sense that he is about to go out of an appropriate arousal level, and so I decide to ask him to tell me the story of the pictures as he picks them up (using interaction and manipulating the task).*

He calmed as he verbalized the story about the warriors and their battle shown in the pictures. In addition, the proprioceptive input he received through his extensor muscles in the prone position and by pushing with his upper extremities, the visual scanning and focus, and the challenge of the cognitive task supported him to stay organized. These supports helped grade the speed and intensity of his rotary movement. When all the cards were picked up, he immediately began spinning faster and faster.

*Should I let him experiment a little, or should I introduce another task?*

I decided to allow him to explore the rotary movement briefly, encouraging intermittent direction change. In the meantime, I explained to his mother the behaviors I look for as specific signs that he is still maintaining a regulated state of arousal rather than escalating out of control. However, I knew this activity had the potential to get Jose overaroused.

*What should I add to this now? I'm feeling just a little "stuck" here. I want him to experience the rotary movement, but I don't want him to escalate. Well, if he is to maintain this level of organization, perhaps I should add some heavy work patterns.*

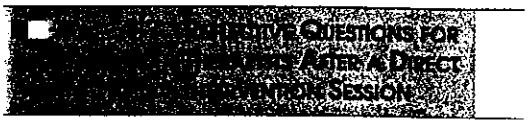
I then guided Jose to throw weighted "cannon balls" into a bucket as he went swinging by (*use of proprioception*). He stayed with this activity for 5 minutes as I varied the targets (*use of novel task)* and increased the weight of the balls (*use of proprioception).* Our session was nearing a close. Realizing that warning Jose about the coming up transition out of the intervention session would help him be regulated through the transition, I said, "We've almost won the battle! Only 10 more minutes . . . 6 more minutes . . . 3 more minutes" (*use of predictability).* And then I said, "What should we do to finish up this battle for the last 3 minutes, Jose?" He decided to swing freely forward and backward, "planning his attack for the next battle" while gently tossing some balls (giving verbal instructions to his soldiers and to his mother). I put a slow, quiet tape in the tape recorder and let him play catch and plan his next attack plan with his mother for a cou-

ple of minutes. Then I said, "Now its time to clean up," which we did together at the end of each session (*use of predictability*). Today Jose was able to voluntarily stop throwing the ball and help clean up. He also put on his shoes while maintaining an organized state. Jose seemed much more regulated than when he came into the session.

As I walked out Jose and his mother, we discussed how what happened today in our session could translate to home during the week. I explained the kinds of sensory input we have used (proprioceptive, linear, and then rotary movement) and the adaptive and nonadaptive responses that we observed. I reminded her of the STEP-SI acronym and described how this sessions used Sensation, Task, Predictability and Interaction to calm Jose as he began to escalate out of an appropriate range. Because Jose's mother had seen him play with movement while remaining organized and the effects of specific interactions with him, she understood exactly what I meant. She said that she would go to the playground a couple of times that week with the whole family after dinner. Jose could try out the merry-go-round, and his mother would monitor his activity level and excitability. She would guide him to intersperse play on the merry-go-round with climbing and digging activities. And, the next week was Jose's father's turn, so his father would then fill me in on how the playground time went.

*Where will I direct the intervention next week? Should I continue with the "battle theme" or suggest another one? What happens if I set up the environment with more challenging movement equipment in the beginning? Can Jose verbalize to me how his "engine" is speeding up? Can he choose between several options for calming himself if I have them out and ready? What would happen if I made the environment more challenging (i.e., more distracting)? Is Jose ready to bring a sibling into his session so we can work on maintaining a good state of arousal while being challenged to remain socially engaged in play with a stimulating movement activity as preparation for success with peers on the playground at school . . . or maybe I should wait a few more weeks for that one . . .* (Table A–7).

The STEP-SI clinical reasoning model is a "decision tree" analysis that is automatic and ongoing, directing the practitioner's choice of intervention during each direct session. Decisions are made in the moment by master clinicians based on knowledge gained during years of experience and responses from many young clients who have become their "professors." The more explicit the occupational therapy practitioner's understanding of the child's competencies and needs, the better prepared he or she is for each session. This takes time, of course, time that is precious to everyone. However, with experience, many of the options are integrated into the practitioner's tacit knowledge and become a part of an ongoing reasoning process. However, to practitioners new to this way of thinking, the process may seem overwhelming. Take the time to ask and answer questions about the child's responses as you conduct each session, and you will find that you have the information you need to decide how the intervention should proceed (Table A–8).



What important things happened in this intervention session?
How did the child respond? What was the adaptive response? Did the child or therapist find the just-right challenge? Was any of the session child directed? Was the child purposeful and intrinsically motivated?
What worked to provide support and appropriate challenges? How did you know what worked? Why did it work?
What didn't work to provide support and appropriate challenges? How did you know it didn't work? Why didn't it work? Did the child's overall adaptive capacity change as a result of this intervention session?
What will you do next time? What would you do the same or different from this session?
What questions do you have for the next intervention session?

## Using the STEP-SI to Develop Home and Community Programs

Next practitioners bring their reasoning skills to the development of home programs. What the practitioner has learned in direct intervention about the child's adaptive capacities and how to support the child during real-life challenges is then translated into the child's daily routine. The home or community program should provide family members and other caregivers with the following:

- An education about the meaning of the child's behavior
- Concrete and reasonable solutions to everyday challenges
- Tools to solve problems on their own

**REFLECTIVE QUESTIONS FOR THERAPIST AFTER SEVERAL WEEKS OR MONTHS OF DIRECT INTERVENTION**

Do the parents seem comfortable with me and the direction of intervention? Am I communicating adequately with the family?
Do the parents understand the meaning of their child's behavior from a sensory integration frame of reference?
Do they understand the rationale behind intervention and home program suggestions?
Have I tried to counteract problems in sensory domains using strategies based in the dimension of the STEP-SI model?
What can I do to better meet the needs of the child as well as of family members?

Education for caretakers, suggestions for activities, and adaptations for the home should be established immediately after assessment.

Providing education to families and other caretakers about the nature of their child's strengths and problems is a critical feature of occupational therapy. As parents begin to understand their child's responses to the world, tensions often begin to ease and more positive interactions are established. Parents and caregivers can refocus on developing new solutions to the child's behaviors.

The practitioner and parent together build a home program to support the child in mastering challenging situations. The practitioner reviews the child's daily routine with parents, identifies problem areas, and develops a plan to support child through the challenge. An example for Jose is provided in Tables A–9 and A–10.

The charts constructed for Jose are examples of how social participation, self-regulation, self-esteem, and daily living tasks are addressed for a small part of the day for one child. This approach includes using specific dimensions of the STEP-SI model to address a specific problem at home, at school, and in the community.

These recommendations require multiple levels of reasoning on the part of the practitioner, who must give equal consideration to the family's priorities and the child's needs. Any plan

**TABLE A–9 JOSE'S HOME PROGRAM**

| Activity | This Is Easy Because | This Is Difficult Because | Suggestions to Support |
|---|---|---|---|
| Waking up in the morning | It is not easy, but it is assisted by a loving and understanding family | Jose is very sluggish in the morning and can't seem to alert himself | Use sensation to support appropriate levels of alertness in Jose<br>Have a morning wake-up routine with a song to sing while jumping on the mini trampoline |
| Getting dressed | Once clothes are decided on, his ability to dress himself is excellent | Jose has trouble choosing what to wear and seems overwhelmed by possibilities | Modify the task to support Jose to make clothing choices<br>Use Garanimals<br>Limit choices to a few known favorite clothes |
| Eating breakfast | His feeding skills are good; the only struggle is what to eat | Jose is a very picky eater and will only eat smooth vanilla yogurt or dry cereal for breakfast | Use sensation to support the task of eating<br>Use oral pressure 10 minutes before meals<br>Have Jose "drink" yogurt with a straw and then offer him a new food choice |
| Completing daily care activities (e.g., brushing teeth) | This is not easy, but it is helped by a behavioral chart with stickers that he uses | Jose is extremely sensitive to tactile stimulation in his mouth | Use sensation to support the task of tooth brushing<br>Use oral pressure 10 minutes before meals and tooth brushing |
| Leaving for school | This is not easy, but it is supported by his siblings' leaving at the same time and understanding that he needs to be able to leave with them | Transitions are always a battleground<br>Jose tantrums and refuses to leave the house | Combine sensation and predictability to support Jose through a transition<br>Develop a "stomp-march" routine for transitions and use in conjunction with a picture schedule |

**TABLE A-3 JOSE'S COMMUNITY PROGRAM**

| Activity | This Is Easy Because | This Is Difficult Because | Suggestions |
|---|---|---|---|
| Participating in circle time at school | Jose is very smart and quick to respond to all cognitive tasks as long as no one is too close to him | Teachers report that Jose will not sit near the other children | Use sensation to support by engaging in a deep pressure or proprioceptive task before circle or modify the environment by giving him "special" mat next to an adult or quiet child who won't touch him |
| Transitioning to lunch | This is not easy, but his teacher and all other classroom personnel are aware of his problem related to regulation and are willing to assist him by putting him at the end or beginning of line, giving him warnings, and so on | Jose hates to change from one place to another | Support with modification to the environment by allowing him to stay in the classroom with a buddy at lunch<br>Support with preparatory sensation such as wall push-ups |
| Playing on the playground | This is not easy, but playground personnel are aware and willing to help him | Jose has difficulty with unexpected touch and dislikes recess very much | Support play by altering the playground task (challenge)<br>Show him games he can play with one other child or a small group<br>Encourage self-monitoring (e.g., when his engine gets too fast, its time to go try a pull-up or get into a small space on the climbing structure) |
| Going to Cub Scouts | This is not easy, but the Cub master is open to trying to learn about Jose so that Jose can participate | Jose has difficulty if the activities are not well supervised<br>He can be terrified if he doesn't know what is coming up next | Support Jose by reinforcing the Cub master's positive interactions<br>Support with increased predictability by asking the Cub master to start each meeting by listing what is going to happen that day or by making a daily chart |
| Going to Tae Kwon Do | This is not easy, but Jose is extremely motivated to be like the other children and to participate | Jose has a hard time keeping focus when other children are around | This activity intrinsically incorporates sensation that is supporting his ability to be part of a community group |

must be sensitive to the beliefs, resources, and limitations of the family. Sometimes small alterations can make a huge difference (e.g., as soon as Jose wakes up, he is immediately urged to jump on a mini trampoline in his bedroom). This facilitates his ability to alert and self-regulate in the mornings. However, sometimes what seems like a "small alteration" to a practitioner can feel overwhelming to a parent (e.g., "How do you expect me to lay out all his clothes the night before? I'm so tired I can barely drag myself to bed!"). All matters related to the child's functioning in the home must be handled with cultural competence, maturity, and flexibility.

An equally important feature of the home or community program is providing education to help the family and the child learn critical reasoning skills. We may provide parents with education about the principles of sensory integration and teach them to use the STEP-SI dimensions as a guide to their own reasoning process. We point out how each intervention idea addresses a supportive feature of one of the dimensions of the STEP-SI model. We model problem solving by

constructing options for helping a specific goal using the STEP-SI dimensions.

In addition to his parents developing tools for problem solving, Jose must also understand his own behavior and how to regulate it. Expanding Jose's capacities for self-monitoring is an essential feature. Modeling for the parent is essential, and specific programs such as the Alert Program may also be useful (Williams & Shellenberger, 1994; see also Chapter 14).

Probably the most important feature of successful critical reasoning is self-reflection. Questions such as those in Table A–11 may assist practitioners as they begin to use the principles outlined in this chapter.

## Summary and Conclusions

Occupational therapy administered with a sensory integrative frame of reference is complex; it may seem like play when it really is work for both the practitioner and child. Effective intervention requires balancing multiple dimensions and principles. Because each program is individualized, not only in its overall focus but also "in the moment" based on the responses of the child, no concrete protocol or sequence of activities can be prescribed. Therapists must rely on tacit reasoning, which develops after explicit knowledge is obtained about the principles of intervention. While retaining individuality, for intervention research purposes, occupational therapy must be described in a manner that it is replicable and so that fidelity to an intervention model can be guaranteed and that model tested empirically. The framework laid out in this chapter is designed to guide practitioners' critical reasoning by articulating the principles that guide intervention. The STEP-SI clinical reasoning model is a "thinking tool" for understanding how to apply and adjust multiple dimensions in the course of intervention. We have discussed this reasoning process for a child with severe movement sensitivity and an overall difficulty with sensory modulation. A similar thinking process is engaged for the other patterns of sensory integration dysfunction.

"Just as the continued production of research results in constantly changing neurological concepts, so also will this theory need to undergo frequent revision" (Ayres, 1972, p. ix).

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■ TABLE A–11 REFLECTIVE QUESTIONS FOR THERAPISTS

| |
|---|
| Have I developed the home program address the family and child's key issues and goals? |
| Is my program easy for the parents able to carry out at home? Does it fit the family's values and resources? Does it flow with the family's schedule? |
| Have I explained the STEP-SI model well enough that parents can automatically use it to assist their child at home and make adaptations as needed? |
| Have I given the parent and child a "toolbox" of ideas that they can use in everyday situations to assist the child? |
| Have I adequately addressed the child's social participation at home or community? What problems does he still have participating with his parents, siblings or peers in activities? Are there additional special family or social activities that I can recommend? |
| Have I adequately addressed the child's self-regulation at home or community? Have I given the parents and teachers tools to help the child begin to recognize when he is losing control? Do they understand how and when to use the tools? Am I helping the child recognize when he is beginning to become dysregulated? Are there any additional strategies I could add to the child's daily intervention? |
| Have I adequately addressed the child's self-esteem issues at home or in the community? Is the child able to verbalize what his or her sensory modulation dysfunction is and how it affects him or her? Does the child realize that the problem is not his or her "fault" but is caused by how his or her brain was when he or she was born? How does the child feel about the problems? What can I do to address affective issues for the child related to the dysfunction? |
| Have I adequately addressed the child's occupational performance needs? Is the child able to participate adequately in self-care and assist in household chores? Can the child adequately care for his or her belongings at home or at school? Does the child have an appropriate range of play skills and activity? Is the child adequately participating in school-related tasks? |

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# Sensory Integration

## Theory and Practice

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