Sensory Processing, Sensory Integration and Seating and Access

By Karen M. Kangas OTR/L
Nationally Certified and State Licensed Occupational Therapist, Consultant
Seating and Positioning Specialist, Assistive Technology Specialist, Clinical Educator
1 Beaver Road, Camp Hill, PA 17011
Email: kmkangas@ptd.net

I. Sensory Integration; "self initiated, self modulated and self controlled" (J.Ayres)

1. The Body's processing systems
   a. Tactile processing, body is "resting"
   b. Vestibular processing, the body is "active"
2. Kinesthetic and Proprioceptive Sense
3. Coordinated Visual Sense
4. Motor Planning, what is this really?

II. Physiological Process of movement

ALWAYS based on body's need to SURVIVE and PROTECT itself. Moving within its sensory systems, primarily utilizing the tactile system and the vestibular system.

1. Initiation of motor acts, new patterns vs. automatic ones
2. Transitional patterns, a precursor to isolation of movement
3. Equilibrium reactions and postural security (a personal relationship to gravitational forces) are developed through active/dynamic and independent movement, & are dulled by lack of movement.
4. Impact of independent mobility & cognitive exploration & understanding
5. Stability, is an active "holding on"
6. Consistency in process of movement is based on sensory information and repetition
7. Importance of routines, for predictable anticipation of motor acts
8. Importance of novelty, for consistency development
9. Repetition of act. vs. repetition of activity
10. Isolated patterns develop through functional demand and use (cognitive and emotional),NOT from "motor" or "visual-motor" practice.
11. The task defines the motor act, NOT the ACCESS method.

III. Motor/Muscle Tone, varies with diagnostic category

1. Cerebral palsy, quadraplegia, hemiplegia, diplegia
   a. Spasticity, Athetosis, mixed
   b. Dystonia, Ataxia
   c. Rigidity
2. Hypotonicity vs. hypertonicity: really tactile processing vs. vestibular processing or "a non-weight bearing" pelvis
3. Other Central Nervous system disorders
4. Progressive disabling diseases
   e.g. Spinal Muscular Atrophy, m. dystrophy, arthrogryposis, osteogenesis imperfecta
5. Traumatic Brain injury

IV. Seating for_Postural Management; what we do to "manage" a child's body, imposed seating

1. Safe, passive Transport
2. Being fed by another person, swallowing
3. Body stillness, relaxation is necessary
4. Primarily demands use of the tactile system, Tactile processing
5. Needed when body is to be receptive

V. Seating For Postural Control, what is needed for the child to control her body, situationally specific

1. Independent control of movement
2. Pelvic stability (mobility) is critical
3. Using weight bearing, especially pelvic and lower extremity
4. Primarily demands use of the vestibular system, Vestibular processing
5. Needed when body is to be active

VI. Learning Styles and Learning Theory

1. Mastery of adaptation, development of mastery
2. Assimilation, Accommodation, Construction, & Conservation
3. Auditory, Visual, & Combo
4. Cognitive conscious, Limbic emotional
5. Interest driven, curious, talents
6. Assumption of Competence
7. Development is NOT hierarchical, but multi-levelled, simultaneously functioning and changing & maintaining
8. We are all "learning disabled" or have "sensory processing problems" at any given time, as we all have sensory impairment & sensory disorganization
9. Lack of experience, enhanced anxiety
10. Speed of learning based on task, and all above and is individual
11. Different tasks have different demands

Generalization is never as easy as behaviorists would like us to believe, if a motor task is a process, only the process approach can reassure us, e.g. a joystick does not mean it will work in every situation & the converse of this is true also: a switch used for momentary acts will NOT be confused as the same switch for a continued action task, the TASK defines the motor act, NOT the ACCESS method.

VII. A Definition of Access

1. How an individual is able to manage an activity of interest with intention, Independently
2. How to manage a particular machine at a particular time for a specific activity which will produce an output (vocal or printed)

VIII. Old Paradigms we need to leave behind

1. Figuring out ACCESS first, before involvement in activity
2. Finding the OPTIMAL site (this is an adult paradigm of assessment developed for

IX. New Paradigms we need to embrace

1. Access is the last, not the first
2. Child must know activity
    a. The machine, how it works
    b. The software,the machine controls, the real activity
    c. How a method of access works, by seeing it work first
    d. Beginning, middle and end of activity
    e. Repeating the activity in frequency, rather than in length of time
3. In children, switch sites develop, and the number of them can increase
4. Scanning can lead to direct selection (2 switch, 3 switch, Head mouse)
5. Direct selection and scanning can both be used, simultaneously and task specifically

XI. Old Paradigms we need to leave behind

1. Seating for function is to be restrictive, controlling the body
2. The seating the child comes to school in, is the "right" seating for activity
3. If only the student could hold up her head then we could work
4. The student wants to use her hands

XII. New Paradigms we need to embrace

1. Seating must allow for task participation and performance
2. Seating must provide pelvic weight bearing for visual convergence
3. Seating must be situationally specific, task specific and change
4. For hands to work, for heads to work, the pelvis must be weight bearing

XIII. Old Paradigms we need to leave behind

1. Consistent switch site/s exist and are to be "found" in assessment before AAC/AT device assessment can occur
2. Single switch scanning is where to start, it's the simplest
3. "Hand over hand" helps the child to learn to use her hands

XIV. New Paradigms we need to embrace

1. Access sites (body sites) develop from interest, intention, and experience with activity, not in isolation
2. Consistency is not what is needed; interest, intention and attention are needed
3. The activity must be known, with the beginning, middle and end obvious
4. Repetition of the activity will bring anticipation of motor use and support its accuracy
5. Motor learning requires: no verbal prompts, a mental rehearsal, and specific feedback at activity's end
6. The switch is not the activity
7. Electronic (zero pressure) switches vs. mechanical switches for AAC, computer, mobility (automaticity and transparency)
8. Don't use automatic scanning first, 2 switches are needed, or step scanning
9. Set up activity for student to join, supporting postural control to the activity itself, and its anticipation
10. Activities need to build, to be interesting, and complex
11. Mistakes will be made, expected, and encouraged
12. Alternative access must be used by others to support the "mental rehearsal"

and/or "visualization"

13. Work for short periods, frequent breaks, support knowledge of beginning, middle, and end of activity
14. Increase numbers of activity, to support a larger repertoire off experience and control
15. Expect real "access" to be "revealed" rather than "taught"
16. The activity must be known, and contain success and challenge, risk and reward

XV. Understanding CP/Tone Problems

1. Tone Management/Relaxation
2. Use and Knowledge of Body Postures
3. Sensory Integration inexperience
4. "Primitive" Reflexes and their use
5. Opisthotonic Reaction/Startle Reflex
6. Obligatory Reflexes/Extensor spasm
7. Spasticity, Athetosis, Ataxia, Dystonia, Mixed

XVI. Shared Struggles with Real Students

Equipment List:

This is an equipment list of equipment I am currently using, prefer and have demonstrated. It is not meant to be inclusive, just an FYI (for your information).

Electronic Switches, interfaces, etc. that I currently use:

1. **Proximity Switches**
2. **Fiber optic switches**

From: COMATION, 125 Spur 191, Suite D, P.O. Box 255, Spicewood, TX 78669;
Phone: 830-798-1914; Fax: 830-798-6021

From: Adaptive Switch Labs, Inc. (for powered chairs)/ 125 Spur 191, Suite C, Spicewood, TX. 78669;1-800-626-8698. www.asl-inc.com

3. **TASH SCATIR switch** (Self calibrating auditory tone infrared) switch, mounted on a gooseneck

From: TASH, Inc.(Technical Aids & Systems for the Handicapped), *www.ablenetinc.com*

4. **Mouse emulation, 3 switch, both wired and wireless, USB**

This 3 switch configuration (one switch moves cursor up & down, one switch moves cursor right and left, one switch controls click, double click and click 'n drag). The "hard-wired" mouse emulator is both a 3 and 5 switch, can be configured either way. However, if "wireless" is chosen and you obtain both a transmitter and receiver, then the emulator is only 3 OR 5 switch and cannot be reconfigured. As far as I know at this time, the 3 switch wireless configuration can only be obtained from Comation.

From: Adaptive Switch Labs, Inc. 125 Spur 191, Suite C, Spicewood, TX. 78669;
1-800-626-8698. www.asl-inc.com

5. **The Head Mouse**

I love the head mouse. However, many of the individuals I work with can't get control of it quickly, as they are very unfamiliar or inexperienced with the programs/software they are attempting to control. Consequently, another form of mouse emulation or alternative mouse, I think, is more helpful to begin. Once an application or other software becomes very familiar, then a new method of access can be tried. This is when a Head Mouse can be tried. Many of the manufacturers of these costly products do have "loaner" programs, please avail yourselves of these for your students/patients/clients. However, you need to learn to use it first, not just set it up for them to use. You move it through the programs to be tried, and become more familiar with it yourself. I have been around these Head Mice for a long time, and they have come down in price, and "new" ones appear periodically. Please don't just look for the cheapest one, make sure you know the company, how long they've been around, how many have they sold and serviced, and what happens if one breaks?. . Instead of "saving" money up front, "spend" money wisely, by purchasing reliable, durable products. Here is my favorite:

Origin Instruments' Head Mouse and Head Mouse Extreme: www.orin.com

You will need to also look at **On-Screen Keyboard programs** when using a head mouse. Make sure you look carefully through these, too. Again, you can find them through searches on the internet, your local AT resources may have some, but, again, look at **Infogrip**, as they carry several choices, including the popular REACH on-screen keyboards. Then, you need to choose looking at **word prediction and screen reading programs** too.

Basic Products I use for assessment with seating and seating with access simulation:

1. **EZ Back; Standard** comes in pediatric size, can be used on manual chairs or other seating, this is what I use most often in assessment, now, to assist in trunk support.
From: Advanced Mobility Systems, 621 Justus Drive, Kingston, Ontario K7M 4H5
Phone: 800-661-6716; **www.amstilt.com**
2. **Mother Earth Pillows**; Flaxseed pillows/bolster in various shapes, used for simulated seating as demonstrated;. Primarily Small bolster(5" x 15") and small flaxseed pillow (7"x 10") 2024 Key West Drive, Suite E, Arnold, MO, 63010; Phone: 800-344-2072; www.motherearthpillows.com
3. **Elite Head array with mini-laterals and Pediatric or Mini-head array:** these are the two head supports I use with proximity switches embedded within them.
From: Adaptive Switch Labs, Inc. (for powered chairs)/ 125 Spur 191, Suite C, Spicewood, TX. 78669;1-800-626-8698. www.asl-inc.com
4. **Chest Strap, Elastic, large or small**, from Bodypoint Designs, Inc. www.bodypoint.com
5. **Neck towel roll**: 100% chamois, PaKTowl (brand name) I get mine from Campmor; www.campmor.com but they can be obtained from many camping/hiking/outdoor stores.
6. **Chair Hugger and Cuddle loop** (from Abilitations catalog) www.abilitations.com

NEW(er) PRODUCTS I'm using with children:

1. **The Tiger CUB,** will use Invacare's Mark 6 electronics, a small powered chair, half the size of Invacare's powered Tiger, will have new, pediatric seating, a real chair for little kids. Should be ready any day now. Will be distributed by Adaptive Switch Labs, Inc. 125 Spur 191, Suite C, Spicewood, TX 78669, 1-800-626-8698; www.asl-inc.com
2. **X-Panda,** a great high/low chair, uses only one tool (and it's on-board); seating is truly adjustable, not just one piece, can get feet onto floor by taking off footrests completely. Developed by therapists from Europe. Uses one tool, and it's "on board." Also can be configured as a "dynamic" seat, similar to Rock Active's motion. Has various bases, to work from. Distributed by Snugseat, www.snugseat.com
3. **Nandu,** a new high/low chair again from snugseat. Just played with it, haven't yet used with a student, but love it, as it is. Let me know if it works for you. www.snugseat.com
4. **KidWalk,** finally a hands-free walker, meant to help kids get close, also able to get child in in less than 30 seconds (and that's true) only in two sizes, but will be three. Developed by pediatric therapist with real kids, for real movement, nothing like it!! Two sizes (with lots of growth), already available. Can use headrest bracket with a head array and proximity switches too!! Can potentially replace standers. Is manufactured and obtained from Prime Engineering, Inc. www.primeengineering.com
5. **Activity Chair,** another high/low chair by Rifton. Comes with a rolling base or a standard base. I have only played with it, but I am so glad we are getting choices. Let me know what you think. www.rifton.com
6. **Leckey's High/Low Chairs; Leckey Mygo and Squiggles;** distributed by Ottobock. Will see in class this year. I haven't yet used, but am happy to see re-design. www.ottobockus.com

Interesting Further Reading:

This is not a bibliography, as I have shared with you, instead my own understandings and musings as a treating therapist who has had so many wonderful children as a part of my clinical life. However, I do attempt to base my observations, thoughts, and attitudes not only on experience but also on current and past readings, and studies of others. These books I have found particularly helpful to me, I offer them to you for further study yourself, if you so choose. This is by no way a comprehensive list, but rather a good beginning.

1. Prescriptive Seating for Wheeled Mobility, Vol. 1, Theory, Application and Terminology, By Diane E. Ward, M.Ed., OTR, Published by: Healthwealth International, 517 NW 103 Avenue, Ft. Lauderdale, FL 33324-1625; www.hlthwlth.com ; 954-472-0517
*****I love this book, every therapist involved in seating should have it to refer to, and read frequently. Will help in the "big" picture, and explain all terminology accurately. I use this text in my graduate course. Don't think it's "old" just because AOTA no longer carries it.*

2. Ergonomic Seating, A True Challenge; Wheelchair Seating and Mobility Principles, By Bengt Engstrom, P.T., Published by: Posturalis Books, Sweden, copyright, 2002
Email: pbooks@telia.com ******I also love this book, not for "kids" but for its humanity expressed by a therapist who really did and does observe the client. Wonderful section in last chapters on training and use of manual wheelchairs.*

3. Clinical Assessment and Training Strategies for the Child's Mastery of Independent Powered Mobility By Karen M. Kangas OTR/L, updated 2008, booklet can be purchased directly from author

4. Sensory Integration, Theory and Practice by Anne G. Fisher ScD, OTR, Elizabeth A. Murray, ScD, OTR and Anita C. Bundy, ScD, OTR copyright 1991; published by F. A. Davis Company, Philadelphia OR (I think this has replaced it)
Sensory Integration, Theory and Practice, 2nd edition, By Bundy, Anita; Lane, Shelly; Murray, Elizabeth, ISBN ; 0545-5 from F.A. David Company, 1-800-323 3555; www.fadavis.com

5. Early Diagnosis and Intervention Therapy in Cerebral Palsy edited by Alfred Scherzer, 2001, ISBN: 0-8247-6006-9, Marcel Dekker, Inc., New York, Basel; www.dekker.com

6. Sensory Integration and the Child by A. Jean Ayres from Harcourt Publishing (previously Therapy Skill Builders); www.psychcorp.com (Dr. Ayres wrote this book for parents, but I think it is so readable, it helps all of us in our busy lives to remember the issues and concepts we need. Then, we can go back and re-read her textbooks.)

Some Additional Articles of interest:

Streaming Video: *http://pattanat.com*

"The Challenge of Developing Consistency of Access

1. "Translating Motor Control and Motor Learning Theory into Occupational Therapy Practice for Children and Young Adults," Part One, Nov. 17, 2008, Part Two, Jan .19, 2009, American Occupational Therapy Associations (AOTA Publications) OT Practice.

2. "Prognosis for Gross Motor Function in Cerebral Palsy" by P.Rosenbaum, S. Walter, S. Hanna, JAMA (Journal of American Medical Association), Sept 18, 2002; 288; 1357-1363

3. "Abnormalities of tactile sensory function in children with dystonic and diplegic cerebral palsy" By Sanger, Dept of Neurology, Journal of Child Neurology, (2007) vol. 22, 289-293

4. "Sensory Processing Abilities in Children Who Have Sustained Traumatic Brain Injuries" By Galvin, Froude, Imms, ***American Journal of Occupational Therapy, Nov/Dec 2009, Vol. 63, Nbr. 6***

5. "Can spasticity, dystonia be independently measured in cerebral palsy" By Gordon, Keller, Stashinski, Hoon, Bastian, ***Pediatric Neurology*** (2006), Vol. 35, p. 375-381