

MODULE SIX: SWITCH & SCANNING OPTIONS

Definition – Switches

A switch acts as an interface between the user and a computer, speech generating device, toy, environmental control unit or other device. It allows the user to indicate a choice by the use of one or two motor responses. Switches provide access to:

- Environmental controls for work, play or participation (toys, machines or appliances)
- Communication devices
- Computing devices - with switch activated software, or as keyboard or mouse function

Switches are used by students who have limited motor output or motor control. Switch use is commonly confined to a limited number of body “sites” over which the person has motor control, including the hands, head, foot or particular muscle group. Switches may be the preferred access for students who:

- Cannot access a regular keyboard
- Cannot control the mouse
- Cannot click or drag
- Cannot use a touch screen
- Have fatigue issues when using any of the above methods

Key Features of Switches

Switches may be single, dual, multiple or joystick types. They vary in:

- Sensitivity
- Adjustability
- Degree and size of surface area
- Height
- Sensory feedback alerting the user that the switch has been activated (visual, auditory or tactile)

Switch Activation Methods

Switches can be made to respond to a variety of user responses. These include:

- Pressure differences
- Use of a puffer reed (sip and puff)
- Motion detection (mercury)
- Pneumatic
- Light sensitivity
- Sound sensitivity
- Myoelectric (muscle activity)
- Proximity
- Brain activity



MicroLite Switch



Pneumatic Switch



Cordless Big Red



Grasp Switch

Switch Interfaces

A switch almost always requires a third party interface (switch interface box) which is connected to a computer in order to allow any given switch to function in a variety of ways. A switch can be set to close or open an electrical circuit (on/off) or can be programmed to function as a key on a computer keyboard. An Intellikeys alternate keyboard (www.intellitools.com) may also be programmed to function as a switch interface.

There are an increasing number of wireless switches which require a receiver (e.g. Intelliswitch). Many of the newer switches incorporate blue tooth technology eliminating the need for wires and attachments.



Intelliswitch (www.intellitools.com)



Switch Interface Pro
(www.donjohnston.com)



Crick USB Switch Box
(www.cricksoft.com)

Mounting

The switch may need to be positioned in a specific location or mounted to a specific site to allow easy access for the user and to capitalize on the most appropriate “body site”.

There are a variety of commercial mounting systems available for this purpose or a custom mount may be required. The occupational therapist can advise on positioning and mounting issues.

Matching student need to technology

In selecting switches the following factors should be taken into consideration:

- Range of motion
- Strength of motion - use of gravity or lift action, adjust required pressure
- Size of target area - accuracy of motion
- Steadiness endurance and consistency of motion
- Reliability of access site
- Mounting and positioning relative to all of the above factors

Critical questions for single switch evaluation are offered by Cook and Hussey in *Assistive*

Technologies: Principles and Practice (ISBN: 978-0-323-03907-9).

- Can the student activate the switch?
- Can the student wait for the appropriate selection?
- Can the student activate the switch at the right time?
- Can the student maintain switch activation (hold)?
- Can the student release on command?
- Can the student repeatedly carry out the steps necessary for selection?

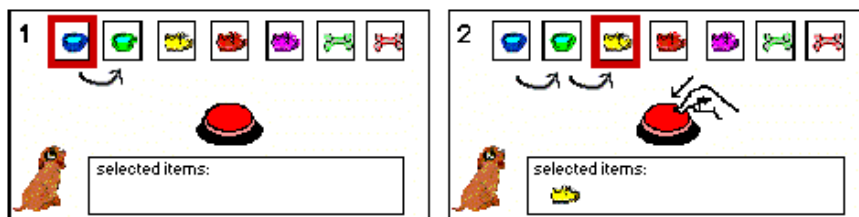
Ways to Utilize Switches

- *Direct selection* - Student must be able to navigate independently and activate the switch directly with a reliable body part
- *Indirect selection* – Student makes selection by scanning choices with visual or auditory prompting before activating switch to make choice
- *Morse code* – Student uses switches to “tap out” morse code to enter text

Definition – Scanning

Scanning is an indirect selection method. An array of choices is presented and sequentially scanned by a cursor or light. The user selects a choice by pressing a switch. Scanning is employed when the user is unable to use a pointing device on a screen through direct motor control. Scanning is generally slower and less desirable than direct selection. Scanning or indirect selection reduces the user’s output to a binary decision of:

- “This one” – *SELECT* with switch, or
- “Not this one” - pass over and move to next item.



Visual Scanning Techniques

- **Automatic** - the array of choices is offered automatically and the user presses the switch to indicate a choice when the desired choice is offered.
- **Continuous / ongoing** - This is a form of automatic scanning where the scan continues on along the array from the last point of selection or switch hit. The scan does not automatically return to the beginning of the array after the selection has been made.
- **Step** -The user advances the cursor or scanning indicator one item at a time. Choice selection is then by a second switch or by a different acceptance dwell time.
- **Inverse** - This is a selection method whereby the user must hold the switch to keep the cursor moving. Selection of choice is indicated by releasing the switch.

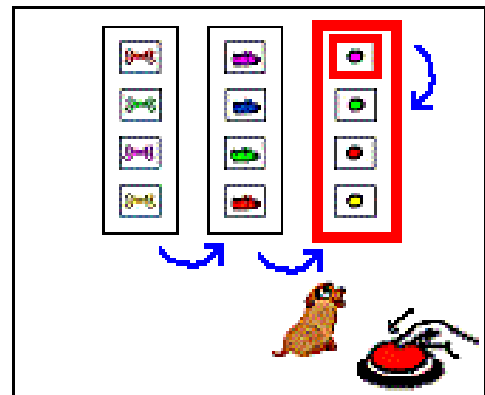
Auditory Scanning Techniques

In auditory scanning, the items in an array are offered with auditory prompts rather than visual prompts. The automatic, step and inverse methods of selection can be employed. Often there will be an additional auditory preview provided as a cue. This may be a key word or a category prompt.

Scanning Formats and Arrays

In order to increase efficiency of the scanning method, consideration must be made for how the array is presented paying attention to the frequency of use of each item in the array.

- Dependent on number of switches in use
- Scan presentation
 - one item at a time
 - in linear, circular or snake sequence
 - sets or groups in...
 - row/column
 - column/row
 - group/block
 - quadrant



Scanning Factors

- **Scan Displays** - Targets can be offered by:
 - Light panels
 - Highlight box
 - On screen
 - Dynamic or branching – when a target is hit, the screen changes to another array
- **Scanning Arrays** - Arrays will depend on what the user is required to do for a given task. This may vary depending on:
 - Letters, number, keyboard function, mouse keys for navigation, icons
 - Customized to user's need
 - Frequency of use
 - Auditory or visual feedback
 - Scripts and macros
 - Built in word prediction
 - Pre-defined messages
 - Mouse – movements , functions and screen locator

Switch Skill Progression

It is helpful to follow a progression when introducing switches to students.

1. Cause and effect

- Beginning - large graphics, bold movements, blank screen between activation
- Intermediate - medium sized graphics, less movement, no blanking between activations
- Advanced - small graphics/movement, no blanking.

2. Maintaining switch activation - Holding switch continues actions

3. Switch release – activation does not begin until switch is released

4. Timed (locking) activation - user must activate or deactivate switch to achieve response

5. Two switch use – user has 2 switches, each providing a specific action. For example, hitting switch 1 advances you through options and hitting switch 2 selects the current option.

(Adapted from Caroline Musselwhite)

Linda Burkhart in her “Stepping Stones to Switch Access” offers the following progression.

1. Single switch cause and effect
2. Single switch multiple locations, multiple functions.
3. Two switches two functions.

Software for Switch Use with Scanning

A number of commercial software programs offer accessibility features making them available for students who require switches and scanning options for access. The following are some examples.

- Clicker 5 (www.cricksoft.com)
- Classroom suite 4 (www.intellitools.com)
- Boardmaker Plus and Speaking Dynamically Pro (www.mayer-johnson.com)
- SOLO (www.donjohnston.com)

There are also a variety of customizable onscreen keyboards which can be used with scanning and switch options.

- Wivik (www.wivik.com)
- Discover screen (www.madentec.com)

Morse Code

Morse code is a faster input method than scanning, but requires precise switch control and ability to memorize the code.

- 1, 2 or 3 switch input with training mode
- Tonal or timing changes
- Programmable
- Letter, number and function keys
- Click or speech feedback
- Scripts, macros, and pre-programmed messages

A ·—	S ...
B —···	T —
C —·—·	U ··—
D —··	V ···—
E ·	W ·—·—
F ··—·	X —··—
G —·—·	Y —·—·—
H ····	Z —··—·
I ··	1 ·—·—·—
J ·—·—·	2 ···—·—
K —·—·	3 ···—·—
L ·—·—	4 ···—·—
M —·—	5 ····
N —·	6 ····
O —·—·	7 —·—·
P —·—·	8 —·—·
Q —·—·	9 —·—·
R —·	0 —·—·

Student Scenerio – Switches – Collaborative Consideration of AT Devices and Services

Part 1: Consideration of Student Need

Student: Meaghan

Date: November 2009

Perspective: Writing and communication challenges

Examining Current Conditions to Consider Educational Need

Student	Environment	Tasks
<ul style="list-style-type: none"> • Meaghan has Cerebral Palsy, Spastic Quadriplegia • She has some control over her right hand and the left side of her head • Her speech is very soft and halting; there are many sounds which she cannot produce • She cannot read regular size print (needs 72 point or larger) • She can spell the first three or four letters of many of the words in her spoken vocabulary • Her expressive writing resembles that of an eight-year old • Fatigue and response rate are huge concerns when Meaghan is speaking or writing • Meaghan cannot complete assignments with pencil and paper, keyboard or mouse • IEP goals include allowing her to participate as much as in classroom activities; improving her speech; writing a daily journal; • She loves the Canucks, Hannah Montana and her wheelchair 	<ul style="list-style-type: none"> • Grade 7 classroom is large and airy • Meaghan has a very supportive classroom teacher • The support worker is very comfortable with Meaghan's technology • Meaghan requires extensive support throughout the day from the support worker • Meaghan is an outgoing youngster and popular with her classmates 	<ul style="list-style-type: none"> • Language Arts <ul style="list-style-type: none"> ○ To write a short poem (six to eight stanzas long) about being in Grade 7 • Personal Growth and Development <ul style="list-style-type: none"> ○ To write two or three paragraphs about her power wheelchair

Part 2: Assistive Technology Solution - Meaghan



- After several years and several communication systems, Meaghan's team has found an access method which allows her to communicate effectively with those in her home and school environment.
- Meaghan uses two switches to control her laptop. With her head switch she moves the mouse pointer on her computer screen and, with her hand, directly activates a switch to make selections.
- For her writing, Meaghan uses Speaking Dynamically Pro (SD-Pro www.mayer-johnson.com). With SD-Pro Meaghan is able to move to any area on the screen array and choose any single item in the selected area.
- To increase her writing output, Meaghan uses the word prediction option in SD-Pro. As she chooses the letters that begin a word, the word prediction software tries to guess the correct word ending. For example, when Meaghan 'types' the letter "h" followed by the letter "o", the word prediction software creates a list of words beginning "ho" including "hockey", "home", "house", and "hold".
- SD-Pro is set up so that Meaghan can hear an auditory preview of each item in a scanning array. Following the auditory preview, Meaghan can select an item by hitting her hand switch, or move to the next area by hitting her head switch.
- Her team reports that this particular combination of physical access technologies and communication software allows Meaghan to create her own unique messages that let her personality shine through to everyone around her.