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Stepping Stones to Switch Access

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Disclosures

Financial: Linda Burkhart owns a small home business and authors books and software activities that utilize many of the principles in this article. Every effort was made to include a full range of vendors and products when describing the Stepping Stones to Switch Access process.
Nonfinancial: Linda Burkhart has presented, and continues to present, on various concepts related to the topics covered in this manuscript at numerous national and international conferences since 1982. She has written and self-published books and software activities that are also related to this topic. She has also voluntarily consulted with vendors about features needed to include in products that are accessed via switch scanning.

This article will focus on teaching switch access for individuals who have significant communication and physical and sensory disabilities and are unable to use their hands for direct access to a speech-generating device. These individuals may also have other multiple challenges that limit their ability to use eye-pointing or other methods to access a speech-generating device. In addition, some individuals may require multiple access strategies, including switch access, in relation to their physical position, environmental factors, fatigue, strategic competencies, and individual preferences throughout the day. The use of switch access with scanning will be explored in terms of how to teach the motor/cognitive aspects in a parallel fashion with nonelectronic, robust, aided language receptive input and expressive use. A multiplicity of factors that influence the learning process will also be addressed.

Individuals who face complex communication needs and physical and sensory challenges require access to assistive technology and robust augmentative and alternative communication (AAC) systems to participate more fully in life. Access is multifaceted and includes components that are physical, cognitive, and psychosocial. All of these aspects need to be addressed when teaching switch access.

As discussed by Swinth, Anson, and Deitz (1993), children who experience repeated failure and limited control of their environment may develop learned helplessness—the perceived inability to control the outcomes of their experience. Frustration and passivity may be observed in individuals who are not able to access the typical environment to explore, manipulate, and play with their world (L. J. Burkhart, 1980, 1982). Successful access can provide opportunities to develop a sense of self as an active and valued member of the community. In a study, adults using AAC who had access to leisure activities and community improved their physical health, enjoyment, mental health, increased independence, enhanced social networks, and education (Datillo et al., 2008).

Autonomous use of a speech-generating device (SGD) for communication requires knowledge, judgment, and skill in linguistic, operational, social, and strategic competencies along with numerous psychosocial factors, including motivation, attitude, confidence, and resilience (J. Light, 1989; J. Light, 2003: J. Light, Arnold, & Clark, 2003; J. Light & McNaughton, 2014). Teaching access with these individuals is challenging and complex. This process involves developing motor automaticity, learning the access method, expanding language skills, and juggling social and cognitive components. This requires frequent opportunities to practice across a range of interactive, supportive, and authentic learning environments (Beauchamp, Bourke-Taylor, & Brown, 2018).

One method of access for individuals with more complex physical and multiple challenges is through the use of adaptive switches. For many individuals, learning to use switches for access requires specific teaching, carefully engineered opportunities, and a thoughtful progression of skills. Beauchamp et al. (2018) found "that significant skill and expertise is involved with [...] delivering intervention to support children with severe physical and complex communication needs to use switches for leisure and to operate a complex speech-generating device" (p. 61).

Motor access refers to the ways individuals with physical challenges approach and use AAC systems. Vanderheiden and Lloyd (1986) define *direct selection* as the action of pointing with a finger or using another method to point to indicate the desired item to make a selection. Direct selection is widely considered faster and less cognitively taxing, and requires more motor control than scanning. In contrast, switch scanning is an indirect method of AAC or computer access that entails stepping through choices that the individual selects by switch activation (Beukelman & Mirenda, 2005; Glennen & DeCoste, 1997). Individuals who are not able to use direct access may be able to develop the ability to use switch scanning as an access strategy. Scanning techniques (automatic, inverse or directed, and step scanning) should be considered and selected on the basis of an individual's needs and performance (Angelo, 1992).

Functionally, all scanning methods utilize either a timed activation of a single switch (automatic, inverse, step scanning with a delay) or nontimed activations of two switches (two switch step scanning; L. J. Burkhart, 2004, in press). Goodgold-Edwards and Gianutsos (1990) found that individuals with spastic cerebral palsy experienced challenges with timing movements. All timed methods of switch scanning require the individual to have a certain level of automaticity of motor skill to be functional. Research on learning to scan frequently focuses on timed scanning and uses typically developing children who do not face motor challenges (McCarthy et al., 2006). Instead of teaching the most sophisticated skill of timed movements from the start, the Stepping Stones to Switch Access process systematically eliminates the timing component and focuses on incremental motor-cognitive learning steps that build skills over time. This provides the individual with a series of achievable goals that builds a sense of success throughout the learning and facilitates engagement and motivation as the more challenging motor skills are practiced.

Motor-Cognitive Learning

Although our desire is for individuals to use healthy automatic movements to access switches, one cannot assume that this is simply a matter of finding the existing automatic movements that the individual may have already mastered. Historically, the field of assistive technology has looked for existing movements for switch access, sometimes with the assumption that there exists a perfect switch site that just needs to be located for each individual. This author's experience shows that, more often, therapists need to explore several switch sites for the individual to learn to use (L. J. Burkhart, 2004, in press). Careful attention to the individual's position in relation to pelvic weight bearing, gravity, weight shift, and seating surface is also a critical aspect of accessing switches for function (Kangas, 2007). Individuals who face significant motor challenges often deal with "key movement issues," such as sensory processing, set patterns of movements, gravity, muscle tone, symmetry, weight bearing, disassociation, stability, weight shift, and motor planning, that impact controlled, graded movement (Cotter, Porter, & Burkhart, 2016). Therefore, automaticity of healthy movement patterns may need to be consciously taught over time. A more detailed discussion of positioning considerations and teaching movements is beyond the scope of this article. However, both must be addressed in the process of learning to use switches for access to communication, computers, environmental control, mobility, and so forth.

Motor learning is a problem-solving process, with active cognitive engagement and thousands of practices (Lee, Swanson, & Hall, 1991). Movements performed automatically do not create new connections in the brain (Baniel, 2012; Jueptner et al., 1997). Learning a motor

skill to the level of automaticity first requires attention from the brain to the movement being learned by the individual. Initial motor learning requires active involvement of the prefrontal cortex along with a wide range of neural circuits across the brain (Jueptner et al., 1997). As movements become automatic, they are mostly controlled through more consolidated subconscious networks that now require very little firing of the prefrontal (conscious thinking) areas of the brain. New neurological connections that result in learning movements to the level of automaticity are created through thousands of repetitions with intent, purpose, and variation (L. J. Burkhart, 2004, in press).

Active Participation, Motivation, and Feedback

Active participation, problem solving, appropriate feedback, and motivation are also critical components to learning motor skills for access. Individuals who face complex physical and sensory challenges must have the incentive and encouragement to independently act, explore, and master challenging tasks (Miller, Ziviani, Ware, & Boyd, 2014). Intrinsic motivational drives may be based upon drives for cognitive curiosity, such as the need to know and figure things out, the drive for autonomy (sense of self), and/or the drive for social connection (L. J. Burkhart, in press).

These findings suggest that we must provide individuals with many opportunities to experience motor success with appropriate feedback and motivating activities so that they can actively learn how to move their bodies to access assistive technology. Providing access to assistive technology and communication systems affords individuals with complex physical and communication needs the ability to connect with others and to experience a more active, independent, and fulfilled life.

Parallel Learning

Carol Goossens used the term *parallel training* to describe the application of a dual intervention using nonelectronic eye-gaze communication and electronic switch access programming with a child who had a severe physical disability (Goossens & Crain, 1992). Learning to use an alternative form of access to autonomously communicate one's thoughts and ideas on an SGD is a complex challenge with many discrete and interconnected components for individuals to master. L. J. Burkhart, Gardner-Fox, Hanser, and Wagner (2005) have often used the term *juggling* as an analogy to describe the extensive coordination of tasks required for an individual to access technology, while also attending to the motor, cognitive, academic, sensory, linguistic, social, strategic, and operational aspects of using an SGD to communicate and/or for accessing curriculum via technology. As discussed above, learning motor skills requires conscious effort and, therefore, occupies the individual's working memory until it reaches a level of automaticity. The brain's working memory can only focus on a limited amount of information at one time. Anything that is not automatic occupies working memory, which limits available working memory for learning new tasks. It is now widely accepted that individuals can learn skills in parallel.

Individuals are able to develop switch access and communication concurrently by introducing nonelectronic, robust, aided language systems to support autonomous communication and by participating in cognitively stimulating experiences and academic content with reduced motor demands. Juggling all aspects at one time may be too challenging. With deliberate long-term team planning, each aspect can be taught by balancing the difficulty level of different components in various activities throughout the day within natural contexts. Focusing on one new difficult skill balanced with familiar, more automatic skills during one activity allows the working memory enough space to succeed and build new skills. Different activities can shift this focus to allow for parallel development of a range of more challenging skills. For example, a robust aided language system may be introduced in a nonelectronic or paper form, where access is less dependent upon precise movements (Porter, 2007, 2017). These aided language

systems may be operated by a "smart partner" who is able to recognize and interpret less precise motor movements, while focusing on the more complex aspects of using aided language to develop autonomous communication throughout genuine interactions (Porter, 2007, 2017). In a different parallel activity, the individual may engage in learning more challenging motor switch access skills with reduced cognitive load within highly motivating activities that provide appropriate feedback. For example, the individual may use switches to select favorite songs or videos on a computer as they are learning the more challenging motor task of stepping through a list with one switch and selecting an item with the second switch (L. J. Burkhart, 2004, in press). Throughout all activities, a robust, nonelectronic, aided language system is used receptively to model the pragmatic use of language, the language organizational structure, methods of access, and communicative competencies in natural contexts (Beauchamp et al., 2018; L. Burkhart & Porter, 2010).

Switches and Switch Placement

The scope of this article is too brief to extensively discuss the types of switches used for access. In general, switches should be selected and mounted according to individual's needs with attention to positioning considerations as discussed above. Switches should not be used solely as the object of movement itself but as a means to achieve something else (Kangas, 2007). Mechanical switches that require movement to approach, force to press and, then, to be released generally require more graded control than sensor or proximity switches that may be activated by approach alone (Kangas & Rotelli, 2012). In addition, because mechanical switches require a push to activate, individuals who use whole body movement patterns may have difficulty discriminating which body part is moving and may exhibit numerous associated reactions that may cause fatigue and confusion as to which movements cause something to happen. Sensor and proximity switches may be initially positioned quite close to the body part that will be moving and require much smaller movements without extra exertion of force, making it easier for some individuals to disassociate and discriminate movements for activation. These switches may then be moved farther away from the body over time as the individual develops more graded movement control. Eventual placement of the switches should be positioned where they are not activated accidentally but are still close enough for easy intentional activation, when used within a variety of functional activities. While a variety of body movements may be used, early motor control typically develops proximally to distally, so head movements are often a good place to start. The use of multiple switch placements will be discussed in the Stepping Stone to Switch Access process below.

Stepping Stones to Switch Access

Historically, many cause-and-effect–type switch activities were widely used for teaching switch access as well as activities that required access via automatic, or other forms of timed switch scanning. This is often still the case today. This author found a void of practices and strategies that fell between these extreme ends of the skill continuum. The Stepping Stones to Switch Access process (L. J. Burkhart, 2004, in press) grew out of the need to be more deliberate in teaching the motor-cognitive learning steps that many individuals need to move from cause-and-effect understanding to automaticity of motor skills used to access technology via scanning. This is not a rigid hierarchy but, rather, a fluid guide to help teachers and therapists move individuals along the continuum of cognitive motor learning for switch access. Within a session, a learner may move up and down through several steps, beginning at a simpler step for a few minutes to provide a familiar reminder of switch placements and movements previously learned along with a sense of active control and then moving up to more challenging steps. The intent is for the learner to feel successful via active participation and problem solving throughout. They should feel challenged and successful, not frustrated or confused. As fatigue becomes a factor, a simpler step may be revisited to end that activity with a sense of success and accomplishment. Motivation, problem solving, and clear feedback are critical components as activities are customized

to bring in familiar natural contexts that the learner understands well and can relate to on a more automatic level, while practicing more challenging motor skills. Some individuals will enter at different steps, and some will skip steps altogether.

Stepping Stone 1: Single Switch—Cause and Effect

At this beginning step, the individual begins to associate an intentional movement with the ability to cause something to happen using a switch. Human beings do not learn cause and effect through specific prompting and direct teaching. Individuals learn cause and effect through experiencing the effects of their own random movements via trial and error and then making the connection that they can use one of their current movements to make something happen again. Cause and effect is not a cognitively challenging skill. Children as young as 2 to 3 months demonstrate this skill (Acredolo & Goodwyn, 2000). Individuals who have severe physical and multiple challenges may have experienced many random cause-and-effect situations and not had the opportunities needed to naturally develop discrimination of movements and causal relationships. In addition, they may develop learned helplessness and not see themselves as active participants but, rather, as passive beings where things happen to them without their control. For example, it is not uncommon for individuals with severe challenges to learn that switch access is done by waiting for someone to take their hand and activate the switch, with no thought to initiate that movement themselves. It is, therefore, the intent of this stepping stone to engineer experiences that enable the natural process of learning cause and effect to take place through active learning. For many individuals, this step, if done correctly, may only take a few minutes before the learner gets the needed "ah ha" and can move on to the next step. In this author's experience, people learn cause and effect very quickly when components are carefully designed. If within three different sessions the individual is not grasping the concept, then each of the many factors (position, movement, switch placement, choice of effect, motivation, relevance, emotional state, etc.) should be revisited and readjusted as needed.

At this stepping stone, a new movement is not taught. Instead, the environment is set up for the individual to use an existing motor pattern to accidentally activate a switch for an effect. Factors that must be considered include positioning to encourage voluntary known movements, positioning of the switch for most likely activation, personalized motivational components of what is activated, and appropriate, immediate feedback that can be perceived by the learner as a positive experience. It is important to select a movement that the individual can move into and out of on their own and is likely to initiate voluntarily without the need for another person to be in contact with them or prompting them. This helps the individual understand that he or she is the one causing the effect. The instructor provides the setup, social connection, and feedback to the individual but does not prompt or direct the movement at this stage. Please note that, for a very short time, the individual may need to use an unhealthy pattern of movement, if that is the only movement that the individual can perform independently. The movement must be something the individual can perform independently and recover from. As soon as the individual understands that they are causing the effect, then more appropriate movements should be shaped through positioning and specifically taught by therapists as the learner moves to the next stepping stone.

The use of momentary or direct activation may be utilized to help individuals clearly discriminate motor movements and associate these movements with their effect. In momentary or direct activation, the effect starts immediately and continues only as long as the switch is activated. One example of this is with an old-fashioned, adapted cassette tape player, where the music plays only when the individual is in direct contact with the switch. Newer electronic music players do not often allow this function but, instead, only provide an on/off toggle and, therefore, do not allow momentary or direct activation. Some individuals may have difficulty maintaining contact with the switch and may benefit from short effects of 3 to 6 s. Keeping the effect direct or short helps the individual to more easily find the movement that caused that effect. While many software programs and apps are labeled for use as cause and effect, this

author feels that this is often an incorrect label. Any effect that plays for an extended time may be great for recreation and leisure activities but is not helpful in teaching the motor–cognitive association of cause and effect. Recreation and leisure software/apps may be used at some of the higher stepping stones. However, attention must be paid to how much control the individual has to select, play, stop, and reject activities according to their own interests in order to keep motivation high for providing thousands of repetitions with intent, purpose, and variation. Delay timers that play more than a few seconds and timed or latch activation modes are not appropriate at this stage. Do not stay in this step longer than needed. When set up well for a learner's needs, this step may only last a few minutes or a few sessions. Individuals may habituate to the activities and lose interest. This can be misinterpreted as not understanding cause and effect.

Specific activities to practice Stepping Stone 1:

- Music directly activated on an older adapted cassette tape player.
- Battery toys that work in direct or momentary mode.
- Very short phrases of a song on a sequenced message device—each activation plays the next part of the song.
- Rad Sounds in momentary mode (RJ Cooper).
- Boom Box in momentary mode (Judy Lynn Software).
- Switch Kids, Everybody Has Feet, Sharon Won't Share (Marblesoft/Simtech).
- Cause Effect Direct activities from Steps Before Step Scanning (Burkhart).

Stepping Stone 2: Single Switch—Multiple Locations and Multiple Functions

At this step, the individual understands the most basic concept of cause and effect and can now use that knowledge to learn new movements. At this step, the individual needs practice intending and executing movement(s) for different purposes or with different body parts or when a switch is moved to a new location or used for a new function.

It is far more useful for individuals to have experience with multiple switch sites than to perfect skill with just one location. With appropriate body positioning, pelvic weight bearing, and support as needed, move the switch to different locations and use highly motivating activities to encourage the individual to move in different ways within their abilities to activate the switch. For example, use both sides of the individual's head or body (one side at a time), different body parts, different movements, and use of a hand to different locations on a surface. Learning to use multiple switch locations is important for moving on to the next step and for the long-term implications of the individual's orthopedic status and health. This is especially true for frequent repetitive use, such as accessing an SGD via switches for typical interactions throughout days and years. A number of individuals who have used only one switch site to access technology have, over time, tended to overuse a specific set of muscles and joints that later caused them pain, structural deformities, and/or repetitive motion disorders. Some were no longer able to use a switch for access. Note: Strive to achieve a balance between leaving a switch in one place long enough for the individual to accommodate to it and experimenting with moving the switch to alternate places for the individual to learn to use. Engage the individual in deciding switch placements when possible.

Another aspect of this stepping stone is to experience the use of a switch to effect multiple functions for different purposes. It is important for cognitive understanding, generalization, and avoiding habituation for the individual to experience that the same switch sites can impact the world in a variety of ways for different functions. Remember that developing automaticity requires thousands of repetitions with intent, purpose, and variation.

Specific activities to practice Stepping Stone 2:

- Give battery-operated toys and novelties a purpose—help the individual see a meaningful reason for activating a switch.
    - Battery-powered doll pushing something to deliver a snack.
    - Battery-powered pig knocking over blocks.
    - Battery-powered penguin kicking a ball to a friend.
    - Battery-powered drink butler delivering a drink to a friend.
- Use a battery-powered spinner or dice roller to play a game with others.
- Create a switch-accessible recipe to spin a spinner with a single switch on an iPad.
- Create and use Co-planned Sequenced Social Scripts on sequenced message devices (Musslewhite & Burkhart, 2001)
- Steps Before Step Scanning (L. J. Burkhart, in press)

Stepping Stone 3: Two Switches—Two Functions

Once the individual can access switches in multiple locations for multiple functions, keep motivation and engagement high by using two switches. Automaticity of switch access is not necessary to move to this step. The individual will continue to practice toward developing automaticity using these activities. This step encourages more active cognitive engagement and the development of discrimination and problem solving. Up to this point, the individual's options consisted of do it or do not. Now, two options with different functions are added.

Specific activities to practice Stepping Stone 3:

- One switch works, one that does not work.
- Two switches positionally related to function—object permanence left and right (Steps Before Step Scanning; L. J. Burkhart, in press).
- Two switches for related objects or two functions on one object (Switch Skills for Two—Inclusive TLC, and Learning to Two Switch Step Scan; Judy Lynn).
- Two voice-output messages: appropriate but different pragmatic intents for each switch.
- One switch battery-operated toy or novelty and one voice-output device (single message or sequenced device with different wordings for the same function; switch-adapted pig knocks down blocks and a switch-activated voice output says, "build it up!" "make it taller," "put on another block," etc.)
- Game spinner switch and voice-output comments.
- One switch computer activity, one switch-related toy, novelty or voice-output device.
- One switch blender-making smoothies and other switch voice-output comments.
- Two Switch Activities in Steps Before Step Scanning (L. J. Burkhart, in press).
- Two separate but related activities on the screen in a computer activity (Switch Skills for Two—Inclusive TLC; Learning to Two Switch Step Scan; Judy Lynn).
- Two switches—powered mobility—one turns right and one left to enable the individual to explore and look around the room

Why Two Switch Step Scanning?. Two switch step scanning uses two switches that each have a different function. One switch is the mover or step switch. Activation moves the cursor or highlight to the next item in an array. The second switch is the selector and is activated to select the current highlighted item in the array.

Technical Points for Two Switch Step Scanning:

- In two switch step scanning, one switch moves the cursor, light, or highlight from one item to the next. The second switch activates the item that is currently highlighted.
- Reactivation of the switch interrupts the auditory and/or visual cue and immediately moves to the next item in the array.
- A critical feature is that each switch be required to be released and then reactivated in order for the scan to move to the next item or selection to be reselected. (Note: The absence of this feature changes step scanning into a type of inverse scanning that includes timing the release of the first switch.)
- Another useful feature is the option to set a "bounce" or delayed acceptance time. This feature would be an optional setting to not accept another switch activation for a specified fraction of a second. Time would be adjustable to accommodate for the individual's physical abilities and reduce unintentional activations.

The use of two switch step scanning is taught in this stepping stone process as it is the only type of scanning that does not require automaticity of movements for timed activations. The use of two movements that may be used without timing is frequently easier than using a single movement prior to achieving motor automaticity. In timed methods of scanning, the individual is required to use fast automatic movements, which do not allow for development of improved motor function as discussed above. This does not mean that the individual will use two switch step scanning for access long term. Some individuals move to automatic scanning or other timed methods once automaticity of motor access is achieved. Additional beneficial factors for two switch scanning as a learning strategy include the following:

- Less focused concentration required, which allows for more distraction and appropriate social skills and pragmatics. If distractions or social opportunities interrupt scanning, the selection is still in the same place after the distraction.
- Allows time for cognitive, visual, and auditory processing for each option before moving to a next item and for selection of an item.
- Active versus passive control of scan is by the individual, not a set time on the device.
- The individual controls the speed of the scan.
- Separate function for each switch: simpler cognitive map, one switch advances scan with each activation; the second switch selects the item versus single-switch timed activations where the same switch starts and stops the scan.

Stepping Stone 4: Learning to Two Switch Step Scan

Some individuals understand the concept of two switch step scanning and just need more practice. Those individuals may skip this step and move directly to Stepping Stone 5. This step helps individuals learn that one switch moves something along a path (mover switch) and the other switch selects the item at the end of that path (selector switch). Activities are specifically designed to move one item along a path or across a screen with repeated activations of the first switch, whereas the second switch is not active. Once the item reaches the destination, the first switch stops working, and the second switch becomes active to allow for selection of the destination

item. Only one switch is active at a time; therefore, the individual receives clear feedback that assists in learning this process. Modeling of the process by partners taking turns with the individual is an effective strategy at this step.

Specific activities to practice Stepping Stone 4:

- A battery-powered toy or novelty item attached to a delay timer set for a few second is repeatedly moved toward a specific object or target. Once the destination is reached, a second switch can operate a different action or comment with a single or sequenced message device.
- Move, move, get switch activities (Steps Before Step Scanning; L. J. Burkhart, in press)
- Move-Get activities on the screen in a computer activity (Switch Skills for Two—Inclusive TLC; (Learning to Two Switch Step Scan; Judy Lynn).

Stepping Stone 5: Two Switch Step Scanning: Failure-Free Learning With Feedback

This stepping stone provides numerous opportunities to practice switch activation with intent, purpose, and variation. All selections result in some type of feedback, and at this point, there are no right or wrong selections, only selections that have different effects. This format allows an individual to use problem-solving strategies and explore opportunities to select from a variety of options. It is also important at this step that each activity has a user-controlled way to end the activity and select a different activity. The learner is presented with a self-controlled "launcher" or "bookshelf" of activities to select from using two switch step scanning.

Specific activities to practice Stepping Stone 5:

- Software and apps that incorporate the ability to present options that may be selected via step scanning, where every option is selectable and provides feedback. Items may be songs, videos, stories, games, other visual and/or audio effects, and so forth (Communicator, Compass, GoTalk Now, Clicker, Mind Express, Grid 3, Classroom Suite, etc.).
- Partner-assisted use of software, apps, or array of toys, objects, food, and so forth. One switch (connected to a voice-output device that says, "next") instructs the partner to present the next item in the array. The second switch (connected to voice-output device that says, "that's it") directs the partner to select/play/click/use the indicated item.
- Scribbling with the full alphabet with printed and/or speech output via step scanning. The individual is given access to the whole alphabet with a talking word processor that allows letters to be spoken as selected and then blended and pronounced when space or punctuation is selected. Note: At this stage, many individuals are utilizing nonelectronic supports for other literacy learning activities.

Stepping Stone 6: Two Switch Step Scan to a Target—Activities for Increasing Accuracy and Cognitive Engagement

Before using this step, individuals must have had numerous opportunities to explore activities in a failure-free manner at Stepping Stone 5. Moving to this step too soon puts too much pressure on the individual to select a specific item without having enough experience to learn the motor–cognitive connection of step scanning. Stepping Stone 6 is designed for those individuals who do not naturally move from random selection to intentional selection after many opportunities. Individuals who are able to select items on the basis of desire may skip this step and move on to Stepping Stone 7. Some individuals need more clear opportunities to select an intended target as is the aim here. One switch moves the cursor, highlighter, or partner's indication over an array of null, blank, or nonselectable items. The second switch activates/selects the one active target in the array.

Specific activities to practice Stepping Stone 6:

- Software and apps that incorporate the ability to present options that may be selected via step scanning, where only one option is selectable and provides feedback. Other items in the array do nothing. Selectable items may be songs, videos, stories, games, other visual and/or audio effects, and so forth (Communicator, Compass, GoTalk Now, Clicker, Mind Express, Grid 3, Classroom Suite, and others).
- Commercial software activities (Switch Skills for Two—Set 2: "move and get" - difficult level - Inclusive TLC; Two Switch Step Scan; Judy Lynn).

Stepping Stone 7: Practice for Increasing Accuracy With Two Switch Step Scanning

At this step, the individual is developing the ability to integrate the motor component of step scanning with the cognitive component of selecting an item for a desired purpose. Many of the same activities in Stepping Stone 5 may be used at this step. However, items in the array will frequently represent a wider variety of desirable and undesirable options. Activities at this level may be failure free with feedback, or they may contain right and wrong options, as long as every option provides clear feedback. At this stage, a simple powerful electronic AAC scanning page set (Cotter, Porter, & Burkhart, 2016; Porter 2017) may be introduced along with the individual continuing to use a robust nonelectronic communication system that would require less refined motor skills to access.

Specific activities to practice Stepping Stone 7:

- Activities listed in Stepping Stone 5 with more variety in desirable and nonpreferred or right and wrong options.
- Simple powerful electronic AAC scanning page sets.
- Scribbling with the alphabet with increasing intent and progression toward developmental spelling.

Stepping Stone 8: Switch Automaticity—Reducing Time for Success and Demonstrating Knowledge

Automaticity of switch access has now been reached, and scanning switch access may be used for more challenging and functional tasks. This level must be reached before scanning may be used as a means for testing knowledge. The individual now has sufficient automaticity with the motor access to the switches to focus on the generation of language and pragmatic discourse for interactive communication. A full robust AAC electronic page set that parallels the individual's nonelectronic AAC system is utilized for communication in a wide variety of contexts. Social and strategic competencies of using electronic AAC may now be further taught and practiced.

Specific activities to practice Stepping Stone 8:

- Electronic switch accessible scanning robust AAC system.
- Writing with word prediction.
- Multiple choice assessments for academic work.
- Activities designed to teach specific skills that include opportunities to test knowledge of learning the information.

Conclusion

Individuals who face severe physical and sensory challenges along with complex communication needs should be given opportunities to learn switch access through a

continuum of carefully selected activities, with active engagement and engineered problem-solving experiences. A feeling of success at each stage leads to increased motivation and active engagement. Specific teaching to refine use of graded movements for access and to develop healthy motor patterns can occur in parallel to using a robust nonelectronic communication system.

Further research is needed in this area. Due to the complexity of the motor–cognitive learning process and the multiplicity of factors that influence success, it is difficult to research the longer term motor–cognitive process of learning switch access. Additionally, motor learning for individuals who face physical challenges, such as cerebral palsy, should be looked at separately from individuals with typical motor development. Comparison of individual components, such as timed methods of scanning versus step scanning with individuals who experience motor challenges, would be useful.

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