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Stern College for Women

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* * *

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Sensorimotor Influences on Speech Perception in Infancy

Katie Matofsky

The effortless exchange between production and perception of speech is the foundation for language acquisition. Infants are born with the ability to discriminate perceived speech sounds within all human languages. However, as an infant grows older, this ability only increases for the infant's native language. Similarly, despite an immature vocal tract, the infant's production of sounds resembles the infant's native language. Although an infant's perception and production of speech seem to share discrimination abilities within a native language, this is not sufficient evidence to conclude a bidirectional relationship between the perceptual and productive systems.

Alternatively, in adults, the relationship between the production and perception of speech is more clear. Production affects perception, as proven with brain imaging, showing that the movement and shape of adult articulators affects phonetic perception. Perception affects production because perceived speech from the temporal cortex connects with the motor and premotor areas of the cortex, which then activates speech production. In children, however, this pathway between the temporal cortex and the premotor cortex is slightly different than adults, causing researchers to be uncertain whether or not speech production influences speech perception just as much as auditory input supports motor planning. Since an even exchange of information between perception and production is only known in adults, Bruderer, Danielson, Kandhadai, and Werker (2015) sought to prove that just as language theorists suggest that the developing production system depends on perceptual input, motor processes can also directly influence auditory perception.

In *Sensorimotor Influences on Speech Perception in Infancy* (Bruderer et al 2015), infants were tested in order to determine whether or not they could discriminate between the Hindi dental /d̪/ and the retroflex /ɖ/. One reason these Hindi phonemes were chosen was because they are sounds that are not distinguished in English, thereby eliminating the possibility of priming English-learning infants. A second reason was because these two sounds require different tongue placements, thereby enabling researchers to determine whether the manipulation of the infants' tongues was a factor in their ability or inability to discriminate between these two sounds. Discrimination between these two sounds was determined by analyzing the amount of time that infants looked up for alternating trials, when the infant would hear /d̪/ and /ɖ/ alternate, and non-alternating trials, when only one of the Hindi phonemes would be said (Bruderer et al 2015).

Three different experiments were conducted to prove if infant speech perception relies on speech production (Bruderer et al 2015). In the first experiment, or the control group, the infants' tongues were not manipulated in order to determine if they were even able to discriminate between the two Hindi phonemes. The second experiment required a teether that blocked the tongue tip in order to test if manipulating the specific articulator required to produce the Hindi sounds had any influence on the way the infants perceived those sounds. Contrastingly, the teether that was used in the third experiment did not affect tongue tip movement. Therefore,

Bruderer et al (2015) hypothesized that the infants would fail to discriminate between the /d̪/and /d̺/ in the second experiment yet succeed in discriminating those phonemes in the third experiment proving that speech production, or in this case the shape and movement of the articulator required for production, strongly influences speech perception.

The auditory stimuli that the infants listened to in all three experiments were triplet sets of /d̪a/ and /d̺a/ syllable tokens (/d̺a/, /d̺a/,/d̺a/) that were recorded by a female native Hindi speaker who spoke in parentese. Each 20 second trial consisted of alternating or non-alternating syllable sets. Half of the infants in the study began with alternating trials and the other half began with non-alternating trials in order to reduce distraction amongst the infants (Bruderer et al 2015).

Bruderer et al (2015) took further precautions to reduce infant distraction throughout the study in order to preserve the integrity of the results. Parents were asked to listen to music through headphones and remain silent while their infants sat on their laps and listened to the recordings. Additionally, the rooms the participants were in were dimly lit and sound reduced. Furthermore, the screens that captured infants' gazes also displayed calming visual stimuli (Bruderer et al 2015).

An ultrasound was conducted in order to determine the validity of the teething toys used in the second and third experiments. The infants' tongue movements were recorded without a teether in their mouths, with a flat teether and a U-shaped teether. The ultrasound proved that there was no significant difference in tongue tip and blade movements when using the flat teether versus no teether. Alternatively, the flat teether significantly suppressed the infants' tongues making the flat teether perfect for the second experiment while the U-shaped teether was ideal for the third experiment (Bruderer et al 2015).

The first experiment proved that 24 six-month-old English learning infants are able to distinguish between /d̪/ and /d̺/ (Bruderer et al 2015). Researchers conducted this experiment in four pairs with one alternating and one non-alternating trial per pair. The infants looked longer during the alternating trials than during the non-alternating trials suggesting that infants heard a difference between /d̪/ and /d̺/ and were surprised by the distinction. Additionally, the pairs in this experiment were significant because the infants' looking time drastically declined across the four pairs indicating that the infants became habituated to the sounds and were therefore less interested even when they heard two different sounds (Bruderer et al 2015).

The second experiment proved that the temporary inhibition of speech production restricted speech perception (Bruderer et al 2015). This experiment was performed with the same participants and procedure as the first experiment with only the addition of the flat teether which caregivers held in the infants' mouths for the duration of the experiment. The results of this experiment were similar to those of the first experiment with regards to pairs but differed significantly with respect to looking time between the trials. While the flat teether was in the infants' mouths, suppressing their tongue tips, the looking time between the alternating and non-alternating trials was the same. These results proved that the infants were not able to discriminate between the two Hindi phonemes because of the lack of sensorimotor information (Bruderer et al 2015).

The purpose of the third experiment was to test whether or not the infants did not look up for the alternating trials because they could not discriminate between /ɖ̪/ and /ɖ/ or because they were distracted by the teether. Therefore, all of the variables from the second experiment were consistent in this experiment except for the teether, which was replaced with the U-shaped teether that did not interfere with tongue movement. The results of this experiment mirror the results of the first experiment and therefore corroborate that the results of the second experiment were due to the fact that the sensorimotor information from the tongue could not support the perception of /ɖ̪/ versus /ɖ/, not because the teether was generally disruptive (Bruderer et al 2015).

The results of the experiment conducted by Bruderer et al (2015) prove that as infants acquire their native languages, they use input from their own articulatory movements to influence their speech perception just as much as they use their auditory input to guide their speech motor behavior. Although previous experiments were conducted in order to establish a relationship between perception and production of speech, sensorimotor influences on speech perception in infancy is the first experiment to eliminate the factor of a native language (Bruderer et al 2015). Using a non-native language allowed Bruderer et al (2015) to confirm that specific "articulatory-to-auditory mappings" can take place without earlier perceptual or productive experiences.

The findings of Bruderer et al (2015) could have serious implications for speech and language development. Since even the temporary disability of the infants' tongues caused them to struggle with speech perception, children with chronic oral-motor difficulties will be much more likely to have trouble with speech perception. Additionally, children with regular speech perception difficulties, such as children with hearing loss, are more likely to struggle with speech production. Therefore, Bruderer et al (2015) suggest that even though thumb-sucking or the use of teethers and pacifiers would not normally be enough to perturb language acquisition in typically hearing children, because they receive enough undisturbed sensoriomotor experience, children who already struggle with language perception or have a lower "sensorimotor-articulatory perturbation threshold" should be more careful to avoid anything that can interfere with their speech and language development (Bruderer et al 2015).

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Limited Salience of Speech in Selective Attention to Faces: Children with ASD

Abbie Fleeter

Authors Quan Wang, Suzanne L. Macari, and Katarzyna Chawarska (2019) evaluated whether children on the autism spectrum avoid looking at faces and if that avoidance has any connection to maintaining eye contact or using appropriate speech. Within our daily lives, we are forced to communicate using both our visual and auditory senses. When a child hears someone speak and simultaneously sees the speaker's face, it allows them to gain recognition of the face. This concept can be seen with regards to a newborn baby. When a newborn baby sees their mother's face and hears her voice at the same time, it allows them to gain recognition of their mother's face. The emergence of facial gestures is an important aspect to focus on for infants in their first year of life. These gestures are naturally developed through the child's own experience. For children who are on the autism spectrum, the development of these gestures may be interrupted. With regards to typically developing children, they seem to pay more attention to the faces of those speaking to them than children with ASD do. Through observation, one can see the difference in the development of these multi-sensory gestures for TD children and children with ASD. When placing a child with ASD into a situation where someone gives them social cues, such as eye contact and speech, the child often does not pick up the cues. When the child again is given directions for an activity without cues, they seem to pay more attention to the speaker. Children on the autism spectrum seem to have some issues with paying attention to another's face when placed in a social interaction. The Quan Wang et al, (2019) study seeks to discover whether or not children with ASD try to avoid contact with others' faces or find them to be less important, and whether this has a connection to the presence of eye contact or speech. The authors want to determine what the underlying mechanism is for children with autism in order to help them gain skills in attention when socializing with others (Quan Wang et al, 2019).

The authors chose 97 child participants to take part in this study. Due to the ages of the children, the authors gathered parental consent forms prior to the study. The study consisted of 50 toddlers with ASD and 47 typically developing toddlers (Quan Wang et al, 2019).

The study consisted of two different parts. The first part used a video with an actress surrounded by four toys as a stimulus, and the second part of the experiment consisted of four conditions. In the first condition, the actress would look at the child and speak to them using speech. The second part consisted of the actor using a direct gaze to look at the child. In the third part, the actress would look at the table in front of her and speak to the child. Lastly, the actress would sit and look at the table without speaking. Every child that was part of the experiment went through 32 trials that were each 10 seconds long. All of the children in this study viewed these blocks in the same order (Quan Wang et al, 2019).

The children involved in the experiment were placed in a car seat in a dark and soundproof room in front of an LCD monitor. The first part of this session allowed the child to watch a cartoon on the screen in order to get them in a comfortable state. The researchers then conducted a five-point calibration procedure which had dynamic targets. Each child watched the video described prior (Quan Wang et al, 2019).

The conclusion of this study showed that both typically developing children and children on the autism spectrum adjust their visual attention depending on the visual and vocal cues for social engagement. There are some specific times where changing visual attention is atypical for a child. These specific differences that can be seen in the children with ASD predict the severity of

the symptoms the child currently has and how they will progress. The typically developing children paid more attention to the actor who was speaking than the children with ASD. The largest difference that was seen between these two groups was with the test on the children's attention when no social cues were involved. When there were no social cues present, both the typically developing children as well as children with ASD preferred to look at the actor's eyes rather than their mouth. When the actor did speak, the typically developing children preferred to turn their attention to the actor's eyes. The children on the autism spectrum seemed not to have a preference of where to place their attention. Children with ASD paid close to no attention to the actor's mouth when she was speaking. These studies suggest that children who do not look at the speaker's mouth can have disadvantages with regards to future language development. When an infant is born it is important to look at the newborn's sensitivity to speech and how they pay attention to faces, because these can be early signs of autism. If a parent or clinician finds these symptoms early on, they can help the child's speech development and prevent future disadvantages (Quan Wang et al, 2019).

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Management of Swallowing and Communication Difficulties in Down Syndrome

Chani Boczko

In the scholarly article "Management of Swallowing and Communication Difficulties in Down Syndrome: A Survey of Speech-Language Pathologists," Meyer, Theordoros, and Hickson (2017) examined the provision of speech-language pathology services for people with Down syndrome across their lifespan. Using an online instrument, Meyer et al (2017) surveyed speech-language pathologists (SLPs) in Australia and focused the study on three major aspects of SLP service delivery for people with Down syndrome. The three areas of study included: aspects of service delivery, areas of service provision, and factors that impacted SLP service provision. Meyer et al (2017) proposed that the purpose of the study was to examine current SLP services for people with Down syndrome in order to identify the current state of services as well as to improve SLP service delivery. In addition, Meyer et al (2017) claimed that the examination of current SLP services for people with Down syndrome would provide valuable information about the delivery of SLP services, which should be sustainable and cost effective.

Meyer et al (2017) presented a thorough review of the literature examining the current status of SLP services for people with Down syndrome. What was most interesting about the review of the literature by Meyer et al (2017) was the absence of data on services provided to individuals with Down syndrome who suffered from dysphasia; this was especially the case in older individuals. There were also discrepancies concerning the amount of services delivered to people with Down syndrome, as reports from families indicated inconsistent visits and consultations. Meyer et al (2017) discovered much higher percentages of services (85-95%) for children with Down syndrome in the age groups less than 5 years and 5-13 years. There was a significant drop (60%) in services for those children between the ages of 14-17 years, and a drastic decline (less than 10%) for individuals with Down syndrome 18 years and over. One of the significant reasons as to why children under 18 received services can be attributed to the services provided by the government while children are in school; however, when children left school, families reported that they were not satisfied with the inconsistent service delivery of speech therapy services (Meyer et al, 2017). Because of the current research available and the lack of information as to why services for those 18 years and over have declined, as well as have not been well-documented, Meyer et al (2017) proposed to develop a sustainable cost-effective model of speech and language services to people with Down syndrome across their lifespan.

Meyer et al (2017) developed a methodology that proposed to survey all Australian SLPs who deliver services to people with Down syndrome. The survey was an online survey, which was open for six weeks between the dates August 27, 2012 to October 8, 2012. Meyer et al (2017) distributed the survey to all members of Speech Pathology Australia, which included 4,786 individuals, and to many SLPs who worked at the University of Queensland's Speech Pathology Clinic state distribution list, which listed 574 individuals. The final sample totaled 390 completed responses, which represented a low response rate. One possible reason for this low response rate might be that SLPs did not see the survey as relevant to what they do because only a small percentage of SLPs work with people with Down syndrome (Meyer et al, 2017).

For SLP service provision, the results of this study indicated that most of the respondents (86%) worked in just one primary workplace. In addition, slightly more than half worked as an SLP in a full-time capacity (Meyer et al, 2017). Most of the full time SLPs worked in government-funded services as well as at community intervention services or private practice. Sixty-two

percent (241) of the SLPs stated that they had either assessed or treated a patient with Down syndrome in the last 12 months. Service provision results indicated that most of the services were given to children with Down syndrome who were younger than seven years of age; those children with Down syndrome between 13-17 years of age received the fewest services (Meyer et al, 2017). Unfortunately, only two SLPs in the survey reported that they had adult clients with Down syndrome who were 65 years and older.

Meyer et al (2017) reported that the most frequent services provided to individuals with Down syndrome included an assessment of communication and individual intervention for communication difficulties. From the sample of SLPs, 39% reported that they provided dysphagia management to individuals with Down syndrome (Meyer et al, 2017). Dysphagia management involves helping the person with Down syndrome with strategies in swallowing, proper posture when swallowing, and nutritional guidance, such as consuming foods that are easy to swallow.

Among the areas of service provision, dysphasia management was the top priority for children 0-3 years and adults with Down syndrome. For children, feeding difficulties were most apparent. As for adults, swallowing difficulties were common. In addition, most SLPs provided services for receptive and expressive language for children and adults. What was most interesting about the findings of the study was the lack of services available for people with Down syndrome with communication difficulties.

This article has been very insightful and has enriched my knowledge of children and adults with Down syndrome. Although this study was conducted in Australia, there exists comparisons that can be made with the delivery of speech and language services in the United States. Most young children receiving speech and language services are not children with Down syndrome; it is important to recognize that Down syndrome children have special needs, such as assistance with feeding. Learning how to prepare and manage food is very important. Moreover, because therapists devote much time to feeding and swallowing, therapists need to also devote time to communication difficulties experienced by children with Down syndrome. It is important to keep in mind that good receptive and expressive language skills, as well as pragmatics, contribute to the social development of the individual.

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Compare and Contrast Analysis of the Different Treatments for Stuttering

Ashley Galitzer

There are many types of treatments for clients who suffer from stuttering. According to Euler, Lange, Shroeder, and Neumann (2014), stuttering treatments are crucial for clients with stutters since these treatments are proven to have long-lasting effects and can improve a person's quality of life socially, emotionally, and cognitively. The aim of this study was to compare treatment durations, effectiveness, satisfaction, as well as the aspects of therapy that had the most impactful results (Euler et al 2014).

Euler et al (2014) gathered 88 participants to take part in their study. Each participant had received between one to seven stuttering treatments in the past. The participants filled out a questionnaire stating what type of stuttering treatment they had previously received as well as the duration of their therapy, the effectiveness and satisfaction of the treatment, and if the therapy was individual or group-based (Euler et al 2014).

The results of this study demonstrated that the most effective treatments for stuttering were stuttering modification and fluency shaping, while breathing exercises and hypnosis had little effect (Euler et al 2014). Euler et al (2014) also found that group therapy was far more effective than individualized therapy for stuttering modification and fluency shaping. As a result of this research, Euler et al (2014) suggest that the most effective treatment for stuttering would be to combine stuttering modification and fluency shaping, rather than using new and unproven strategies.

In another study that analyzed treatment techniques for stuttering, Emge and Pellowski (2019) researched the effects of adding a mindfulness meditation exercise into treatment. Emge and Pellowski define mindfulness as "being attentive and non-judgmental to the present moment". High levels of anxiety are related to stuttering, while mindfulness has been proven to lower anxiety, psychological distress and depression. Therefore, Emge and Pellowski hypothesized that including a mindfulness meditation exercise as part of treatment could help alleviate stuttering. Additionally, previous studies have shown that stuttering techniques integrating cognitive components assist in the maintenance of fluency.

Emge and Pellowski (2019) recruited a 21-year-old male with a severe fluency disorder to participate in this study. The participant received 15 weeks of speech therapy once a week for 50 minutes. At the beginning of each session, a 100-word speech sample was collected from him before the mindfulness meditation technique was implemented. The participant then listened to a 3-minute long mindfulness meditation video and engaged in a conversation with his speech therapist, where an additional 100-word speech sample was taken. Afterward, the participant was given 15 minutes of fluency shaping stuttering treatment and a third 100-word sample was recorded. The three 100-word samples were analyzed for speech disfluencies using the Stuttering Severity Instrument (SSI). The participant also filled out a survey which rated how mindful he felt during the sessions (Emge and Pellowski 2019).

The results of Emge and Pellowski's (2019) research showed that the participant had an increase in mindfulness and psychosocial well-being, and his stuttering reduced from severe to moderate. The participant had produced significantly fewer disfluencies after the mindfulness meditation exercise, suggesting that speech-language pathologists should incorporate mindfulness in their therapy sessions with clients as a way to enhance the client's quality of life as well as decrease their client's stuttering. Emge and Pellowski (2019) promote the idea that mindfulness can help with disfluencies, but "it cannot be concluded with complete confidence that these improvements found *posttherapy* were *solely due* to the mindfulness component rather than the fluency shaping component, or a combination of the two" (Emge and Pellowski 2019). The researchers suggest creating future studies using a larger and more diverse sample size to further explore the benefits of mindfulness and stuttering.

This research was very different to Euler et al's (2014) research which concluded that speech-language pathologists should "improve combinations of treatment components which have been shown to be effective, rather than new creative treatment packages without long-term evidence of effectiveness". Contrary to Euler et al (2014), Emge and Pellowski (2019) believe that mindfulness, a technique that has no long-term evidence of effectiveness, can benefit the client who stutters. Furthermore, Euler et al (2014) also suggest that breathing exercises have little effect on a client's speech, contradicting Emge and Pellowski's (2019) findings that mindfulness and breathing exercises can benefit a stuttering client.

In comparison, Lindsay and Langevin (2016) discuss the experience of the client when psychological counseling is used as an adjunct to stuttering treatments. This is similar to Emge and Pellowski's (2019) research, as both studies aim to see if there is value in adding additional non-conventional therapies to help a client who stutters, as opposed to Euler et al's (2014) research which is primarily focused on classic speech therapy practices.

Lindsay and Langevin (2016) evaluated psychological intervention and determined its relevance in an individual's stuttering treatment. Although there is research that supports a need for psychological counseling for those who stutter, not much is known on how it affects a person's stuttering management. Therefore, this study addresses the benefits of counseling on a stuttering client's overall treatment (Lindsay and Langevin 2016).

This study compared a group of stuttering individuals who had free psychological counseling in addition to stuttering treatment, and another group who opted out of psychological counselling (Lindsay and Langevin 2016). Interviews were conducted with both groups to see what influenced their decision to seek counseling and to determine if the participants deemed psychological counseling important in stuttering treatment. Participants added relevant information and filled out an additional questionnaire that was given. The data from the interviews were then transcribed, coded and analyzed (Lindsay and Langevin 2016).

The results found that the participants who accepted psychological counseling felt that counseling aided their speech progress, since allowed them to discuss their stutter and treatment with another individual (Lindsay and Langevin 2016). Participants also commented that psychological counseling helped them cope more easily with the challenges of daily living and taught them beneficial breathing exercises (Lindsay and Langevin 2016). Although participants

in the study who did not seek counseling said they had their stuttering needs met through speech therapy, all the participants at the end of the study felt that counseling could be beneficial, and there should be an option to have it built into stuttering treatment. Lindsay and Langevin (2016) suggest that speech-language pathologists should collaborate with mental health specialists who have an awareness of fluency disorders, as well as consider including cognitive behavioral therapy into their sessions. Uri Schneider, a speech-language pathologist who uses a counseling lens within his speech therapy stuttering sessions, views all his clients as a "person first" and works with them to customize their stuttering therapy while understanding their individual and personal goals and struggles.

There are many treatments out there today that will benefit different types of people. Although Euler et al (2014) believe that stuttering modification and fluency shaping is the best form of therapy for stuttering, it is important to realize that other techniques may work for different people. Emge and Pellowski's (2019) research proved that mindfulness can have an impact on an individual who stutters, and it may be beneficial for speech-language pathologists to implement this technique in their therapy. Similarly, Lindsay and Langevin (2016) feel that psychological treatment may in fact help some individuals with their stuttering treatment. Not all clients will benefit from mindfulness or seeing a psychologist, but it is important to note that these means of therapy have been scientifically proven as beneficial remedies. Overall, the client and the speech therapist should work together and make an individual speech therapy plan using the techniques that work best for that individual and their stuttering. As Uri Schneider says, "we don't treat stuttering: we treat *people*".

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Beginning to Talk Like an Adult: Increases in Speech-Like Utterances in Young Cochlear Implant Recipients and Typically Developing Children

Liba Kurz

Ertmer, Jung, and Kloiber (2013), studied the differences in speech utterances of children with cochlear implants (CI) and typically developing children who hear without cochlear implants (TD). The purpose of this study was to compare the rapidness of speech-like utterances in typically developing children and CI-recipient children. In order to determine this, the experiment studied how many months of hearing experience is needed for coherent speech-like utterances to emerge in CI and TD children. Ertmer et al (2013) wanted to determine if children with CIs have the same speech-like utterances as TD children.

Ertmer et al (2013) evaluated the speech utterances of the CI children in order to determine if the consonants and vowels were rapidly combined in order to make the word productions more coherent. There were 24 participants total in the study, 12 participants with CIs and 12 TD children. Ertmer et al (2013) recorded speech samples from children with CIs every three-months beginning with their first two years of CIs. The TD children were recorded at different times between six months and 24 months (Ertmer et al 2013).

This longitudinal study was performed for two years in order to evaluate the children's utterances during adult-child play interaction (Ertmer et al 2013). The CI recipients were either video or audio recorded during the first two years of their CI use. The TD children were recorded every three months between the ages six and 24 months. The utterances were classified based on a system developed to determine which utterances were more advanced than others. This was done in order to make sure that the children's best speaking and hearing abilities were represented correctly (Ertmer et al 2013).

Ertmer et al (2013) explained how the first two years of life are known as the child's prelinguistic vocal development. This is when noises such as grunts and squeals start to become more meaningful than just sounds. These vocalizations are then used within words or sentences. Children start to use these sounds more meaningfully as they begin to vocalize their thoughts and desires. When looking at this type of development, researchers found that the children with CIs were higher in their prelinguistic vocal development compared to the TD children (Ertmer et al 2013). When delving deeper into this feature of development, the following attributes were found: the rapidness in speech-like utterances in children with CIs was attributed to the CI signal connected to the brain, the amount of increased communication effort a child with CIs must put forward in order to speak helps them develop better, and the different neurological and emotional maturity levels of these children aid them in speaking more (Ertmer et al 2013).

Ertmer et al (2013) completed analyses to determine if and when there were differences in the speech-like utterances of the two groups. All in all, the CI group had a greater percentage of speech-like utterances compared to the TD group. The CI group's mean percentage utterances increased from 40% at six months to 83% at 24 months. The TD group also had increasing percentages but theirs were not as high (Ertmer et al 2013).

Even though children who have CIs are not born with the same auditory abilities as TD children, this Ertmer et al (2013) study proves that children with cochlear implants learn and adapt quicker than TD children. Although they were born with a hearing impairment, these children aren't necessarily at a disadvantage in regard to vocal development if they receive a CI at an early age. The CI users in this study showed more rapid speech development than the TD

children during the first two years of using their devices (Ertmer et al 2013). This study confirms that CI recipients and TD children both get to the same point, even though they may get there at different speeds.

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The Effectiveness of Treatment Interventions for Adults with Traumatic Brain Injuries

Tamar Weber

Background

Traumatic Brain Injury (TBI) can be categorized as a public health problem as it affects the individual with TBI, their friends, family and the broader community. TBI can lead to cognitive-communication impairments, which are communication deficits that result from trauma to the frontal and prefrontal sections of the brain. A person with this type of injury may face challenges with hearing, listening, comprehending, reading, writing, and expressive language. Injury to the brain can cause a slowed processing of information, problems with attention and working memory, confusion, and difficulty with executive functions. Due to the many challenges a person faces with cognitive-communication processes, individuals with TBI have a much more difficult time functioning in society and communicating properly with others. (Brunner, Hemsley, Togher and Palmer 2018). There are various treatments that can serve as methods of intervention for a patient with TBI. Treatments include a cognitive pragmatic treatment program and a social-communication metacognitive intervention in rehabilitating individuals. Although each treatment may lead to a different outcome in patients with TBI, they both target communication skills with the common goal to enable individuals to improve their language and social interactions.

Social Communication and Metacognitive Intervention

After the experience of a traumatic brain injury, social communication may be difficult and even debilitating for some individuals. Authors Finch, Cornwell, Copley, Doig, and Fleming (2017) explain that TBI can cause cognitive damage in the brain and result in an impairment in communication, called cognitive-communication disorder (CCD). A typical CCD that occurs after TBI involves social-communication difficulties, characterized by struggles with pragmatics, social-interaction skills and social cognition. Individuals with social communication difficulties can exhibit challenges with maintaining eye contact, starting and maintaining conversation, long-winded speech, changing a communication to meet the listener's needs, and maintaining a cohesive verbal interaction. Finch et al (2017) sought to evaluate the effectiveness of an innovative metacognitive, goal-centered method of intervention to address communication deficiencies in individuals with TBI. The researchers studied whether or not this therapy helped increase and sustain the social communication abilities of an individual with TBI. An additional aim of the study was to assess whether the social-skill intervention would help a patient reach his or her goals of treatment and improve language skills.

In order to conduct their research, Finch et al (2017) recruited patients with TBI from a brain injury rehabilitation facility. Eight individuals with TBI participated in the study. All were over 18 years of age and had sufficient memory and receptive and expressive communication skills as determined by a speech-language pathologist.

The study consisted of three steps of research. First, a baseline was established over a four-week timeframe. Next, an eight-week intervention program that focused on the social communication difficulties was conducted. The therapeutic intervention was conducted by a speech pathologist and was only implemented in the intervention stage of research. Finally, the study concluded with a four-week follow-up phase to complete the research.

Those participating in the study took the Profile of Pragmatic Impairment in Communication (PPIC), which was a test used to determine pragmatic difficulties that resulted from TBI. The test featured 10-minute conversational assessments that included discourse tasks

such as casual discussion, purposeful discussion, and a problem-solving task. Another test conducted was the LaTrobe Communication Questionnaire (LCQ), which consisted of two forms for participants and their significant others to each fill out. The forms included questions on communication capabilities such as maintaining conversation, inhibition or lack of inhibition in verbal communication, and the ability to have an appropriate conversation. Finally, patients participated in the Goal Attainment Scaling (GAS) test, which evaluated individual growth in social communication (Finch et al 2017).

In the eight-week intervention stage of research, the patients with TBI were enrolled in two therapy sessions, one individual and one group session, that took place each week for one hour at a time. The sessions focused on social communication skill remediation through goal-based intervention and metacognitive strategies. The speech pathologists focused on client centered goals and created strategies to work on social communication goals for each patient (Finch et al 2017).

Finch et al (2017) found that metacognitive and goal-centered therapeutic intervention might be a valuable method for improving social communication difficulties after TBI. Based on the results from the PPIC test after intervention, some improvement was noted. After evaluating the LCQ and GAS results, there appeared to be a considerable improvement and development. The conclusions of the study showed that after completing intervention, the participants were able to reach their goals for social communication. Although more research and a larger sample size is needed, this study demonstrated the effectiveness of intervening and improving social communication skills in patients with TBI (Finch et al 2017).

Efficacy of Cognitive Pragmatic Treatment

Adults with TBI often face cognitive challenges that can negatively affect their daily living. Authors Bosco, Parola, Angeleri, Galetto, Zettin, and Gabbatore (2018) noted that communication difficulties resulting from TBI can hinder an individual's ability to interact socially, be independent, and complete everyday activities, and can continue long after the trauma took place. The authors describe pragmatics, or language use, as a main difficulty that follows TBI. This can include incorrect, unclear and repetitive speech, as well as conversation that may be out of context, tactless, out of turn, and self-centered, which can negatively impact an individual's social interactions and day-to-day living. In severe cases of TBI, understanding literal meaning versus sarcasm, making inferences, and even making requests can be difficult. Programs of intervention and rehabilitation are designed to help an individual with TBI better communicate and enhance their view of their quality of life. The goal of Bosco et al's (2018) study was to evaluate in particular how beneficial the Cognitive Pragmatic Treatment (CPT) is in helping those with chronic TBI advance their communication capabilities, which would then help them manage communication on a daily basis.

In order to perform this study, Bosco et al (2018) selected 19 participants with TBI, ages 22 to 58 years old. The patients were recruited from a brain injury rehabilitation center in Italy. When the study was conducted, the participants were in a post-acute phase and living at home with a family member or spouse. Each member of the study had suffered a severe TBI. The 12-week CPT study consisted of 24 sessions twice a week. The sessions each dealt with various aspects of communication including language, gestural use, paralinguistic prompts, social aptness, and abilities to interact. Some of the sessions also covered theory of mind, self-awareness, and planning capabilities, since these play a part in effective communication. The overall goal of the CPT sessions was to provide individuals with a space to practice their communication skills and to help them learn how to navigate communication in their daily lives. CPT sessions involve role-playing, videos, and activities to help participants comprehend, make inferences, and help

them better understand literal and intended speech in verbal communications. This treatment is also designed to help an individual focus and use expressive modes of communication, such as linguistic, non-verbal and paralinguistic. During each step of intervention, feedback is given, and a self-examination occurs. The CPT sessions begin with introductions, then move on to comprehension activities, such as video recordings, followed by activities including role playing. The concluding session included homework for participants to practice and strengthen lessons learned in CPT (Bosco et al 2018).

The CPT was measured through various assessments. The participants' pragmatic capabilities were looked at before and after they took part in the CPT through the Assessment Battery for Communication (ABaCo) which assessed production and comprehension. A linguistic scale and paralinguistic scale were also used to assess production and comprehension of language. Through the Communication Activities of Daily Living test (CADL-2), participants were screened for functional communication before the CPT and after. This test specifically measured verbal skills in role-play and other daily tasks. The CADL-2 test was administered for approximately 35 minutes and utilized pictures and cues to test participants. Lastly, a neuropsychological and theory of mind test was conducted before and after CPT to evaluate an individual's theory of mind and cognitive abilities (Bosco et al 2018).

The results of Bosco et al's (2018) study showed that before and after treatment scores in ABaCO, which measured language production and comprehension, improved for a few participants. Results from the CADL-2 test from before and after treatment showed increased functional communication skills. Researchers also examined the correlation between the ABaCo and CADL-2 assessments and found that there was an affirmative connection between them. Finally, looking at the results from the neuropsychological and Theory of Mind tests, the authors found that participants improved on the neuropsychological assessment after treatment. Overall, although more research is needed, the study demonstrated the effectiveness of CPT in helping those with chronic TBI improve in their language performance and comprehension (Bosco et al 2018).

Conclusion

Cognitive-communication deficits in adults with TBI can be a struggle for the individual with TBI, their families and friends, and those they interact with on a daily basis. Through the use of various treatments and interventions such as social communication and metacognitive intervention as well as the cognitive-pragmatic treatment program, a person with TBI can have improved language outcomes and social interactions. Although each treatment and method of intervention is different and targets different specific goals, they both share the overarching goal to help patients with TBI succeed, grow in their cognitive communications, and rehabilitate to be able to better function in society.

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Treatments for Adults with Post-Stroke Aphasia

Sarah Nathan

Background

Aphasia is the inability to comprehend or express speech, typically caused by brain damage. It takes away a person's ability to communicate properly and affects a person's writing skills. Aphasia is very common post-stroke, and researchers are seeking various treatment methods that can most effectively address this deficit. Speech-language pathologists are involved in providing therapy to patients with aphasia, but other methods of therapy are being sought as an effective add-on to this primary form of therapy treatment (Kesav, S.L., Sukumaran, Sarma, & Sylaja, 2017). Speech-language therapy with an add-on computer-based language therapy software, acupuncture, and transcranial direct current stimulation are three studied therapeutic methods to treat individuals with post-stroke aphasia.

Speech-Language Therapy Either Alone or With Add-on Computer-based Language Therapy Software

The add-on computer-based language therapy software study by Kesav et al (2017) sought to measure the effectiveness of a new and innovative intervention in addition to speech-language therapy for treating post-stroke aphasia in different countries and in languages other than English. In many countries, there is very little therapy being provided to people with post-stroke aphasia. This study used a computer-based language rehabilitation therapy in the Indian language. A speech-language pathologist offered a therapy session to individuals with post-stroke aphasia, followed by another session with computer-based exercises. The study was not intended to replace a speech-language pathologist, but, rather, its purpose was to test whether the computer program could be an effective add-on to a regular speech-language pathology session. The computer-based programming incorporated a comprehensive set of exercises that consisted of yes/no questions, naming items, and writing. In order to be part of the study, the individuals with post-stroke aphasia had to be right-handed, 15 years or older, and evaluated within three months. There were 24 candidates in the study with different types of aphasia. One group received both speech-language therapy and the computer-based software program component; the control group only received therapy from a speech-language pathologist in a series of therapy sessions. The individuals who received only the therapy sessions participated in 12 one-hour-long sessions, over the course of four weeks. The variable group met with a speech-language pathologist in exactly the same way and with the same amount of sessions, however, in addition to these sessions, the patients performed the computer-based language therapy software. These computer sessions were one hour in length and immediately followed the session with the therapist (Kesav et al, 2017).

Three evaluations were conducted of each participant to evaluate the effectiveness of treatment: at baseline, the four-week mark, and the twelve-week mark (Kesav et al, 2017). A total of 11 people had different types of aphasia than at baseline with all of the individuals converting to less severe aphasia subtypes (Kesav et al, 2017). In general, study results showed that everyone benefited from the therapy.

An oddity in the study was that the group without the computer-based language therapy software actually had experienced relatively better improvement. Some explanations could be that the group on average started with a more severe stroke; there may have been inadequate computer expertise; and the design of having the computer sessions following an hour of therapy with a speech-language pathologist, thereby resulting in two-hour sessions, could have led to patients' mental fatigue and drowsiness. Although this was a very small study, the concept of

computer-based language therapy software may be very effective in the future or if executed in a different way. It is also a cost-saving methodology (Kesav et al, 2017).

Acupuncture is Effective in Improving Functional Communication in Post-Stroke Aphasia

Zhang, Han, Huang, Liu, Li, Chang, and Gao (2019) conducted a meta-analysis, whereby they analyzed other studies. They researched various databases to find where acupuncture had been used for patients with post-stroke aphasia in a randomized controlled trial. Of all the therapies for treating stroke, speech-language therapy seems to be the most effective, but Zhang et al (2019) say that new treatment methods should be researched and established if speech-language therapists are not available. There were no previous studies that demonstrated a direct relationship between acupuncture and language. In this meta-analysis, Zhang et al (2019) chose functional communication as the primary outcome and had seven secondary outcomes, including naming and repetition, for which Zhang et al (2019) were primarily gathering data. In the treatment group for all of the studies, the individuals participating were those who were treated with acupuncture. The control group either received nothing or a form of imitation acupuncture called sham acupuncture, aka non-acupoints acupuncture, which was a way of providing a placebo effect. Zhang et al (2019) were trying to primarily measure the effect on functional communication, which was the first outcome, but they were also looking at seven other language functions, such as spontaneous speech and naming. One of the ways in which Zhang et al (2019) ranked whether the study should be used or not was the possible risk of bias. Zhang et al (2019) divided the groups according to the type of acupuncture that was provided to the patient. For example, traditional acupuncture, scalp acupuncture, and tongue acupuncture were all different types of acupuncture that were performed. All of the Zhang et al (2019) studies in their survey emanated from China, and the age of patients ranged from 38-79 years old. The assessments for primary outcomes included CADL (Communicate Abilities in Daily Living). Secondary outcomes were measured by the WAB (Western Aphasia Battery), aphasia quotient of BDAE (Boston Diagnostic Aphasia Examination), severity classification and language abilities, such as spontaneous speech, auditory comprehension, and writing (Zhang et al, 2019).

Zhang et al (2019) made it known that the risk of bias still existed. There was unclear allocation concealment, which occurs when a person who is responsible for setting up a study does not have any knowledge about which person is getting what treatment. In addition, there was a lack of control for blinding in outcome assessment, meaning that a person who was assessing the results could be someone who knew the patient or doctor.

Acupuncture greatly improved functional communication, especially compared to the control group (Zhang et al, 2019). In terms of secondary outcomes with regard to the various forms of acupuncture, all of the types of acupuncture seemed to have a positive impact on many of the patients. Zhang et al (2019) are not implying that it is about the different types of acupunctures, but, rather, it is about how the studies measured their outcomes. Underlying mechanisms of why acupuncture is helpful for patients with post-stroke aphasia are still unclear; however, Zhang et al (2019) saw through neuroimaging that acupuncture stimulates language regions of the brain, such as Wernicke's area which may be a link between the two.

Limitations of the Zhang et al (2019) study include the risk of bias in allocation concealment and assessment blinding. Zhang et al (2019) point out that this was a good start, but it is important to do far more studies with different types of acupuncture and with greater sample sizes.

Transcranial Direct Current Stimulation in Post-Stroke Aphasia

Transcranial direct current stimulation (TDCS) in post-stroke aphasia has shown to have positive effects (Sebastian, Tsapkini, Tippett, 2016). TDCS is a safe and non-invasive electrical stimulation, using two electrodes: the anode and the cathode (Sebastian et al, 2016). If one wants to create activity, one uses the anode. If a person wishes to inhibit activity, he/she uses the cathode. The cathode is thought to decrease the cortical excitability. Sebastian et al (2016) found that this practice of putting electrodes on the brain to either create suppression or excitation influences mechanisms that are critical for learning and memory, and it appears that this method has been able to improve communication in post-stroke aphasia. Most importantly, there have been no serious adverse side effects for any patients. The apparatus is very portable, easy to use, and inexpensive. In addition, a placebo stimulation may be used. The electrical stimulation method seems to work well, and at the same time, one is also providing the usual speech-language therapy (Sebastian et al, 2016).

The Sebastian et al (2016) study helped people with naming, although it was not a permanent effect. Sebastian et al (2016) found that with more sessions, the benefits persisted longer. Nevertheless, there are issues that researchers and therapists may have to confront. For example, the stimulation might not work because the distribution of the current could be diffused and the regions one is hoping to simulate can be unpredictable; one may not be sure where the stimulation is really penetrating. Most of these studies have not conducted follow-ups on patients. In fact, the longest follow-up to date was only 44 weeks post stimulation (Sebastian et al, 2016). Therefore, long-term effects of this therapy method are unknown.

The people who were not severely affected by their stroke and who received treatment soon after the onset of post-stroke aphasia exhibited the greatest improvements (Sebastian et al, 2016). Sebastian et al (2016) relate that there is insufficient evidence that shows that the TDCS actually assisted the speech-language pathology intervention.

Conclusion

A stroke and its effects may be very difficult for an individual, as well as for the patient's loved ones and friends. Aphasia due to stroke may cause the patient to feel distant or separate from the people around him/her because of the lack of the ability to communicate. Speech-language therapy has been the primary method for treating patients with post-stroke aphasia, but other methods such as computer-based language therapy software, electrical stimulations to the brain targeting specific areas, and acupuncture have been instituted to treat post-stroke aphasia and its negative effects.

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