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Acknowledgments

This journal is dedicated in honor of Dr. Joseph Danto, on the occasion of your retirement as the Chairman of the Department of Speech-Language Pathology and Audiology at Stern College for Women for 25 years. You created the framework that has enabled us to succeed, and we will be forever grateful. We wish you continued success in your future endeavors in your new life in Israel.

* * *

Thank you to all of the teachers and mentors within the Speech-Language Pathology and Audiology Department at Stern College for Women.

A special thank you to Professor Goldstein Hellman for your continued dedication, guidance and support throughout our college career.

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Table of Contents

Amyotrophic Lateral Sclerosis (ALS)

Tova Wieder, Shayna Leiser, Jordana Levine

Amyotrophic Lateral Sclerosis (ALS) is a rapidly progressive, fatal neurological disease that impacts nerve cells in the brain and spinal cord. ALS results in degeneration and paralysis of voluntary muscles and affects the upper and lower motor neurons in the brain, brainstem, and spinal cord (Green, Kulkarni, Martino, Rong, Shellikeri, Yunusova & Zinman, 2016). According to Scab, Tuzim, Tuzim, Urbańczuk & Urbańczukv (2018), 95% of people suffering from ALS will ultimately lose their ability to speak. This disease will most often act on all voluntary actions and will eventually affect the speech and language centers in the brain. Scab et al. explain that ALS will lead to a paralysis of respiratory muscles and will usually lead to death within 3-4 years (Scab et al., 2018).

Bulbar ALS is most often associated with difficulties in speech intelligibility (Green et al., 2016). An individual with bulbar ALS, whose motor neurons have deteriorated in the brain stem, will experience impaired speech and swallowing functions. A rapid progression of articulation disorders, respiratory disorders, slowed speech and an eventual loss of speech are all common symptoms of Bulbar ALS. The articulatory subsystem, particularly the tongue, has been indicated as the primary locus of bulbar involvement in ALS (Green et al., 2016). Researchers have observed a significantly reduced lip and jaw movement variability in talkers with ALS during habitual speech compared to their healthy peers (Kuruvilla-Dugdale & Mefferd, 2017).

An individual with bulbar ALS can exhibit dysarthria. Speech difficulties that will result from ALS include prosodic changes, specifically a strained and strangled voiced, monotone speech, and slow and labored speech (Britton, Hanson & Yorkton, 2011). Dysarthria can prevent an individual's ability to speak loudly due to the weakening of the respiratory muscles and can affect word pronunciation due to weak, tight or rigid speech muscles (Britton et al., 2011). In the resonatory subsystem, an individual with ALS will experience velopharyngeal muscle weakness, which causes the velopharyngeal port to remain open. The opening of the velopharyngeal port will result in abnormal resonance in the nasal cavity, causing hypernasality in speech. Additionally, it is found that speech in those with Bulbar ALS is marked by short phrases and intervals between words. Lastly, Sialorrhea occurs as a result of an impaired ability of the oral muscles to seal the lips, transport saliva to the back of the mouth, and swallow it, all of which interfere with speech production (Britton et al., 2011).

Another common symptom of ALS is a disorder called Dysphagia. This swallowing difficulty often appears within the first two years of the ALS symptoms in 60% of patients with the spinal subtype and in all patients with the bulbar subtype. This can lead to choking, dehydration, malnutrition, and extreme weight loss. In order to prevent choking, patients with symptoms of dysphagia should thicken their food (Scab et al., 2018).

While ALS manifests itself differently across all individuals who have the disease and progresses at different rates, most individuals with ALS eventually lose all verbal communication. Patients may therefore end up relying on augmentative and alternative communication (AAC) in

order to be able to communicate effectively with those around them (Britton, Hanson & Yorkton, 2011).

Speech-Language Pathologists (SLP) help individuals who have symptoms of ALS, ranging from communication to swallowing. The communication that an SLP may help facilitate will not necessarily be verbal, especially if the individual is in the later stages of ALS. Although there is no cure for ALS, an SLP can greatly improve the quality of life of an individual with ALS by assisting them in routine functions such as feeding and improving their mode of communication with caregivers and loved ones.

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Bedside Dysphagia Screenings: A Preventative Measure for Stroke Associated Pneumonia

Anna Schuman

Pneumonia commonly affects stroke patients within one week of their hospitalization (Teuschl, Trapl, Ratajczak, Matz, Dachenhausen, & Brainin, 2018). Stroke associated pneumonia (SAP) increases the likelihood of mortality or dependency in stroke victims (Lee Titsworth et al., 2013). It is linked to worse functional outcomes, longer length of hospitalization, and higher health care costs (Bray et al., 2017). Dysphagia has been found to be a major risk factor in developing SAP, as 78% of stroke patients with dysphagia develop SAP. About half of all stroke patients have dysphagia within the first three days of a stroke (Lee Titsworth et al., 2013). Although there is little evidence for the effectiveness of bedside swallowing and dysphagia screenings, they are a well-established clinical practice for stroke victims, (Bray et al., 2017). Lee Titsworth et al (2013), Tueschl et al (2018), and Bray et al (2017) all intended to study the correlations between bedside swallowing screenings and SAP.

The Lee Titsworth et al (2013) study was conducted in a tertiary care center designated as a primary stroke center. Participants were conscious patients of all stroke subtypes. Prior to this study all patients in this facility with a suspected diagnosis of a stroke were screened for swallowing difficulties by a neurosurgeon or speech-language pathologist (SLP) before receiving any oral intake. According to Lee Titsworth et al (2013), this protocol resulted in poor assessment rates, long delays, and low patient satisfaction. Therefore, the researchers implemented a two-tiered system to reduce these issues. First, patients would be screened by a nurse using the Modified Nursing Dysphagia Screen (MNDS). If a patient failed the initial screening, a swallow evaluation by an SLP would be expedited. All patients received Nothing Per Mouth (NPM) until passing the first screening or until cleared by an SLP (Lee Titsworth et al., 2013).

After the implementation of this system, Lee Titsworth et al (2013) found an increase in professional compliance to dysphagia screening. Prior to this study, 39% of patients were actually screened for dysphagia, but after the new system was implemented 74% of patients were screened. Many of the patients were referred to an SLP by nurses, without a physician's order, which accelerated the process. Lee Titsworth et al (2013) found a significant decrease in pneumonia prevalence which strongly correlated to the implementation of the new screening protocol. Dysphagia and the type of stroke were found to be strong predictors of SAP, but age was not a predictor of SAP (Lee Titsworth et al., 2013).

This study represents a real-world implementation of successful bedside swallowing screenings. Despite some practical setbacks and modifications, the system used in this study was inexpensive, had high compliance, and reported sensitivities up to 96%. These results were limited because they did not consider the intubation statuses of the patients. Without this information Lee Titsworth et al (2013) could not draw any conclusions about the role of intubation as a risk factor for SAP. Furthermore, initial screenings conducted by a nurse are inferior to those of an SLP; however, having trained nurses perform an initial test was a practical

alternative at hours when SLP's are not available. Thus, the benefits of this protocol seemed to outweigh its limitations (Lee Titsworth et al., 2013).

Moreover, the Tueschl et al (2018) study investigated the use of the Gugging Swallowing Screen (GUSS) in an acute stroke unit in Austria. The GUSS is a brief bedside assessment screen for dysphagia and aspiration risk. It can be used by SLPs and trained nurses. The GUSS uniquely classifies dysphagia into severity codes and provides nutritional recommendations accordingly (Tueschl et al., 2018).

The Tueschl et al (2018) study occurred over two years and included 1,394 patients admitted to the acute stroke unit. Tueschl et al (2018) studied the factors that contributed to why patients were or were not screened with GUSS, the factors associated with the severity of Dysphagia, and the frequency of SAP in relation to the use of GUSS. All information was retrieved from data entries by experienced neurologists at the time of admission, discharge, and post-discharge follow up (Tueschl et al., 2018).

Tueschl et al (2018) found that 72% of patients in the acute stroke unit were screened with GUSS; however, patients with mild or very mild strokes were less likely to receive formal screening. Five percent of patients screened with GUSS and five percent of patients not screened with GUSS developed SAP. This rate is half of the national average for developing SAP. Furthermore, the risk factors for developing SAP included age, pre-existing conditions, stroke severity, and intubation. Nasogastric tubes correlated with a decrease in aspiration during eating and an increase in respiratory infections. The risk of respiratory infections was highest when a nasogastric tube was inserted within the first four days post stroke. Dietary modifications did not prevent pneumonia in all stroke cases, as 13% of NPO patients still developed SAP. It was also found that 35% of GUSS screenings were performed by nurses on weekends, holidays, and other hours when SLPs were not available (Tueschl et al., 2018).

Based on these results, Tueschl et al (2018) concluded that mild strokes should not be omitted from dysphagia screening, as there was a risk of SAP in those patients too. The risk of developing SAP was higher for patients with dysphagia, but early intervention by an SLP can reduce that risk. Tueschl et al (2018) emphasized the importance of an interdisciplinary bedside screen because of the high incidence of necessary screening when an SLP was not available (Tueschl et al., 2018).

Moreover, Bray et al (2017) assessed the associations between delays in bedside dysphagia screenings and the risk of SAP. They examined the data from a national register of patients in the United Kingdom with all types of acute stroke (Bray et al., 2017). In the UK the recommended practice is to administer a dysphagia assessment within four hours of admission for acute stroke. A more comprehensive assessment is recommended within 72 hours of admission. Bray et al (2017) hypothesized that due to the rapid development of SAP, delays in screening would be correlated with an increased incidence of SAP (Bray et al., 2017).

Patients were administered a bedside swallow screening for dysphagia and the Comprehensive Clinical Assessment of Aspiration Risk by the Speech-Language Therapist (SALT) as a more comprehensive assessment. The times of these screenings were recorded to the nearest minute for all patients who were screened. Patients admitted directly to the Intensive Care Unit and patients

who were intubated were excluded from this study (Bray et al., 2017). Bray et al (2017) found that 88% of patients had a dysphagia screen and 39% of patients were administered the SALT comprehensive assessment. Patients with the longer delays in dysphagia screening had a higher risk of developing SAP. This risk increased by 1% for every day of delay. There was a stronger association between the delays in carrying out the SALT and the risk of SAP than with the dysphagia screening (Bray et al., 2017).

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Communication Interventions for Patients with Alzheimer's Disease

Adi Atar

Even in the early stages of Alzheimer's disease, prominent sporadic memory impairments can limit a patient's ability to initiate and maintain conversations (Hopper, 2016). They may speak in ambiguous and incomplete sentences, go off on tangents, and repeat without realizing. (Bourgeois & Mason, 1996). They may forget what has been said or done, resulting in their inability to act on recently presented information. Written and graphic cues can make such information more permanent and accessible to patients with Alzheimer's dementia. They can take on many forms, including memory aids, which speech-language pathologist and dementia researcher Michelle Bourgeois developed as an intervention for people with dementia to help maintain their conversation skills (Hopper, 2016).

Memory aids, or wallets, are a collection of sentences and personally relevant picture stimuli designed to prompt recall of important people, places, and events in the life of the patient with dementia. They help the patient remember the things they like to talk about and provide them with a method for carrying out meaningful, on-topic conversations (Hopper, 2016). In her study Enhancing Conversation Skills in Patients with Alzheimer's Disease using a Prosthetic Memory Aid, Michelle S. Bourgeois evaluated the effectiveness of teaching caregivers to train Alzheimer's disease patients to use these memory wallets during conversations. The study was specifically designed to determine the extent to which middle-stage Alzheimer's patients used the memory wallets to deliver appropriate use of statements during conversation, and the degree to which ambiguous, repetitive, and unintelligible utterances were affected by the use of the wallets. Additionally, it investigated if caregiver participation in the treatment changed the patient's behavioral improvement (Bourgeois, 1990).

Three female participants between the ages of 59 to 66 were selected for this study (Bourgeois, 1990). All three were diagnosed with "probable Alzheimer's disease" (Bourgeois, 1990, p. 31). They each performed within the moderate dementia range on the Mini-Mental Status Examination (between 12-18 points out of 30) and demonstrated moderate to severe naming deficits on the Modified Boston Naming Test and on the Western Aphasia Battery (between 9-25 points out of 42). However, their performance in reading simple sentences consisting of four to six words was perfect (Bourgeois, 1990).

The husbands of the three women served as the caregiver trainers in this study. They each passed a hearing screening and scored very high on the MMSE (between 27 & 30 points). Three additional women (two neighbors and one daughter) between the ages of 29 to 62 were also selected in this study as familiar conversational partners. All three scored within the normal range on the MMSE and passed the hearing screening. The experimenter of this study, a certified speech-language pathologist, served as a conversational partner as well. The entire study was conducted in the homes of the three women diagnosed with Alzheimer's. All sessions were recorded, and conversational sessions were timed (Bourgeois, 1990).

In order to prepare appropriate stimuli for the patients, the husbands of the Alzheimer's patients assisted the speech-language pathologist by developing a list of facts that were personally

relevant to the patients who may have been experiencing memory failures with such familiar facts, such as names of family members. Three topics were chosen, each with a topic prompt and three declarative sentence stimuli. For example, the first topic was "My Day", the topic prompt was, "tell me about your day", and one declarative sentence stimuli was "I get up and get dressed around 9 AM" (Bourgeois, 1990, p. 31). Corresponding photographs for each fact were also given to the speech-language pathologist. The printed sentences and pictures were mounted on white paper, laminated, and put into a plastic wallet. Participants 2 and 3 had one wallet with 30 stimuli which were separated by tabs into the three topics. Participant One had trouble using the tabs so she used three different wallets, one for each topic (Bourgeois, 1990).

The speech-language pathologist met with the patients four times per week and conducted conversational probe sessions, lasting five minutes each. At first, the wallets were not available to the patients, but after the first treatment session the wallets were presented without prompting their use. These sessions began with the speech-language pathologist starting the countdown timer and stating one of the topic prompts. The speech-language pathologist appropriately responded to the patients' intelligible conversation by answering questions and offering short acknowledgments. The speech therapist did not interrupt the patients' unintelligible or repetitive statements, but instead sat quietly and maintained eye contact with them. At about 1.5-minute intervals, the experimenter would proceed to talk about the next topic. The session ended when the timer signaled that 5 minutes had passed (Bourgeois, 1990).

Conversational sessions were also conducted twice per week with the patient's conversational partner. Each conversation partner received an index card that had the three topic prompts. The conversational partners were instructed to have as natural a conversation as possible with the patients, who did not have access to the wallets. The session was recorded and lasted for five minutes, with 1.5 minutes to talk about each of the three topics. Both the speech-language pathologist's and the conversational partners' conversational sessions were accurately scored and analyzed by the speech therapist. Behaviors such as ambiguous utterances, unintelligible utterances, repetitive utterances, and error statements were found in the patients' speech (Bourgeois, 1990).

Once the husbands were trained at delivering all aspects of the treatment, including the purpose and procedures of the training, reinforcing correct responses, and recording responses on the data sheet, they began the memory wallet treatment. Twice daily, the husbands, patients, and their wives sat across from one another with the wallet, data sheet, pencil, and a tape recorder on the table. The session began with the husbands giving the patients the wallet with the stimuli and explaining to them that they are going to practice having a conversation. The husbands explained the use of the wallet and how it has pictures and sentences to help them remember what they want to say. They then encouraged the patients to open it up and asked them to talk about their day (Bourgeois, 1990, p. 33).

The patient was praised for any time they accurately read the sentences and for when they accurately elaborated on the presented stimulus item (Bourgeois, 1990). The husband then repeated and/or expanded on the patient's utterances and then waited about five seconds for the patient to initiate the following trial. If the patient did not turn the page, and/or read the next

sentence inaccurately, the husband would point to the sentence and say, "Wait, read this" (Bourgeois, 1990, p. 33). If the patient was still not able to provide the correct response, the husband prompted the correct response by reading the first word and pausing for the patient to continue. If the patient still did not continue, the husband would read each word and pause until the patient read the entire sentence. The session would end once all ten training items were read correctly. The husband would then score all the patient's responses and give the data sheets and the recordings to the speech-language pathologist. Treatment continued until the patient reached a criterion of 90% accuracy for four consecutive training sessions (Bourgeois, 1990).

All three patients understood and performed the memory wallet tasks with ease and with high levels of accuracy. Patients 2 and 3 required between four and eight trials to meet the criteria of each topic with accuracy, ranging from 70% to 100%, but patient 1 required 21 trials (Bourgeois, 1990). During the conversation session with the speech-language pathologist and the conversational partners, the patients tended to provide several statements when prompted to discuss a topic but appeared frustrated for not being able to offer more information. For example, they would frequently comment "I can't think of anything else to say" (Bourgeois, 1990, p. 35). However, during treatment all patients provided more on-topic statements and even generated new ones relating to the specific stimuli (Bourgeois, 1990).

Results of the Satisfaction Rating Form, which was completed by the husbands after they completed the entire treatment, indicated that the husbands saw positive changes in their wives' conversations following treatments. The overall data revealed that the patients were successfully able to learn how to use the memory wallets when conversing and significantly improved on all dimensions following treatment. The patients' speech was more coherent, stayed on topic longer, and provided more varied and unambiguous information. When the wallets could not provide all of the information they may have wanted to share, they did make some ambiguous utterances in an attempt to provide more elaborate statements. Their conversations gradually became more meaningful as the study progressed (Bourgeois, 1990).

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Diagnostic Methods of Dysphagia in Individuals with ALS

Nurit Esral

Perry, Martino, Yunusova, Plowman & Green (2018) define amyotrophic lateral sclerosis, also known as ALS or Lou Gehrig's disease, as a degenerative motor neuron disease characterized by rapid deterioration of both upper and lower motor neurons of the brain and spinal cord. Muscle function throughout the body progressively declines, including that of the bulbar structures comprising the face, mouth, pharynx, and larynx. This loss of muscle function in those with ALS can cause speech and swallowing impairments (Perry et al., 2018), which may hasten the likelihood of death due to the risk of malnutrition and aspiration pneumonia (Hiraoka et al., 2017).

In their 2016 study, Erdem et al. (2016) claim that breathing and feeding dysfunction are what ultimately determines the prognosis of someone with ALS, and dysphagia is among the earlier symptoms that appear. There are four stages of swallowing: oral preparatory, oral, pharyngeal, and esophageal, and deficits in any of these phases will lead to dysphagia (Jani & Gore, 2016), including trouble with mastication, oral preparation and lingual transport (Perry et al., 2018). The tongue plays a crucial role in swallowing and will likely be affected in a person with ALS, as the tongue is a muscular organ. Tongue pressure enables the bolus to be thrust from the oral cavity to the pharynx (Hiraoka et al., 2017). In the process, the anterior tongue forms a seal on the palate while the posterior tongue forces to bolus into the pharynx (Perry et al., 2018), so reduced tongue function will inhibit swallowing from proceeding as usual. Thus, it is imperative to manage and properly diagnose the swallowing abilities in those with ALS, as neglecting to do so can negatively impact their survival rate (Perry et al., 2018) and quality of life (Hiraoka et al., 2017).

Hiraoka et al. (2017) sought to evaluate if maximum tongue pressure (MTP) measurement is a useful tool in assessing the swallowing abilities in those diagnosed with ALS. The authors gathered 25 patients recently diagnosed with ALS between the ages of 37-76 years and examined their swallowing function using videofluorography (VF). The patients had to swallow 3 grams of yogurt and videofluorographic images were recorded and analyzed qualitatively for tongue function and residue accumulation, and quantitatively for bolus formation and oral transmit time (BFOTT - the time it takes for the bolus to travel from the oral cavity to the inferior border of the mandible) and pharyngeal transit time (PTT - the time it takes for the bolus to travel from the inferior border of the mandible to the esophagus). The bulbar and respiration-related functions of the subjects were then rated using the ALS Functional Rating Scale-Revised (ALSFRS-R). MTP was measured by a dentist using a tongue pressure manometer with a balloon probe. The patients had to place the balloon between their tongue and anterior part of their palate with their lips closed and then compress the balloon to quantify their MTP. A variety of statistical analysis tests and ranking systems were then used to analyze and compare the three variables simultaneously (Hiraoka et al., 2017).

Hiraoka et al. (2017) discovered that MTP may be a useful technique in early detection of a swallowing dysfunction in those with ALS. When analyzing the results of ALSFRS-R, Hiraoka

et al. (2017) determined that the mean MTP was lower in patients with a lower bulbar-related ALSFRS-R score. They also found that swallowing function in VF in those with ALS was significantly related to MTP (Hiraoka et al., 2017). Hiraoka et al. (2017) claimed that diminished BFOTT and PTT are strongly correlated with a reduced MTP. This is so because the time it takes to form a bolus increases with reduced tongue function, and reduced tongue pressure decreases the propulsive pressure toward the pharynx, making swallowing a very arduous task (Hiraoka et al., 2017). Thus, Hiraoka et al. (2017) declared that evaluating MTP can strongly enhance the quality of life of patients with ALS, as swallowing disorders such as dysphagia can be detected and then treated earlier.

Perry et al. (2018) set out to research the effectiveness of measuring kinematic changes of the tongue and jaw during swallowing using 3D electromagnetic articulography (EMA), a tool that captures and tracks tongue movement during deglutition, to determine early signs of swallowing impairment in those diagnosed with ALS. Sixteen participants in the early stages of ALS and 18 healthy individuals who spoke intelligibly and had a speaking rate greater than 150 words per minute were gathered for the study. The participants were required to drink a three-ounce cup of water while an EMA recorded their kinematic labial, lingual, and jaw movements during swallowing (Perry et al., 2018). Using EMA, Perry et al. (2018) examined the range of movement of the tongue and jaw, the maximum speed of movement of the tongue and jaw, the movement duration of the tongue, tongue coordination involving temporal lag, and lingual efficiency.

Through their research, Perry et al. (2018) discovered a decrease in posterior tongue speed and posterior tongue range of motion in patients with ALS before the onset of any speech or swallowing impairments. Those with ALS also had longer swallowing durations but shorter intervals between the anterior and posterior tongue movements, which can be a result of constrained lingual coordination (Perry et al., 2018). Perry et al. (2018) also found that changes in the posterior tongue are detected before that of the anterior tongue, suggesting that the posterior tongue is affected earlier in those with ALS. This is because the posterior tongue is more directly involved in swallowing with larger displacements and greater speeds, so the motor deficits will be more prevalent. The anterior tongue is simply fixed against the palate, so it will be more difficult to uncover any motor deficits there (Perry et al., 2018). Additionally, Perry et al. (2018) noticed that the jaw speed and range of motion increased in those with ALS, while the tongue range of motion decreased, suggesting that the jaw was compensating for this reduced tongue function, even before any official swallowing diagnosis (Perry et al., 2018). Thus, Perry et al. (2018) concluded that through EMA, it is possible to detect kinematic differences in those newly diagnosed with ALS in the tongue and jaw during deglutition before any formal diagnosis of speech or swallowing impairments.

Along with the previous studies, Erdem et al. (2016) also uncovered a method of early identification of dysphagia in those with ALS. The authors made use of the dysphagia limit (DL), the volume where a second or more swallow is required to swallow the bolus, in determining the association between swallowing and respiratory disorders. The ALSFRS was also employed to analyze the swallow and respiratory functions of the participants (Erdem et al., 2016). Erdem et

al. (2016) collected 27 individuals with ALS, 14 of whom had dysphagia and 13 who did not. Their respiratory function was first assessed with a variety of tests, including pulmonary function tests and forced vital capacities, and then the swallowing function was evaluated using DL. The participants were given increasing amounts of water (3, 10, 15, and 20 mL) with a syringe and were asked to swallow on command. If a second swallow was exhibited within the first eight seconds, it was considered pathologic. EMG was also used in testing the participants' swallowing and respiration, by testing organs such as the diaphragm and larynx during two successful swallows (Erdem et al., 2016).

Erdem et al. (2016) discovered that the ALSFRS showed a slight difference in the swallowing component of the test for those with dysphagia. Furthermore, they claimed that deglutition apnea durations, which are instances when it is impossible to breath when swallowing, were significantly longer in those with dysphagia. Swallowing durations were lengthier in those with dysphagia as opposed to those without the swallowing disorder (Erdem et al., 2016). Erdem et al. (2016) affirmed that most spontaneous swallowing occurs during expiration, but it can also happen during inspiration. They went on to say that all of the participants were able to swallow the fluids during expiration, but seven of those with dysphagia were unable to swallow during inspiration. This implies that dysphagia is not simply a deglutition issue, but rather, represents a deterioration of the connection between swallowing and respiration. The authors also found that the swallowing duration of those with ALS was significantly longer when compared to their healthy counterparts (Erdem et al., 2016). Hence, the data gathered from this study lead Erdem et al. (2016) to conclude that DL has the capacity to identify swallowing dysfunction and dysphagia in those with ALS at an earlier point than other available methods.

The authors of these articles agree that early detection of a swallowing disorder in an individual with ALS is essential; however, they differ in the methodology to do so. Hiraoka et al. (2017) view the measurement of MTP as an effective means of identifying dysphagia, while Perry et al. (2018) claim EMA to be successful in early diagnosis of a swallowing disorder. Erdem et al. (2016) take another approach and extrapolate from data of those with ALS and dysphagia to assert that DL has the means of identifying dysphagia earlier in the disorder's progression. Hiraoka et al. (2017) and Perry et al. (2018) both note that decreased tongue function affects the swallowing ability of those with ALS. Hiraoka et al. (2017) relate this reduced tongue function and pressure to bolus formation and the ability to thrust the bolus into the pharynx. They claim that the formation of the bolus will be prolonged in patients with ALS, and that the propulsive pressure of the tongue toward the pharynx will be decreased (Hiraoka et al., 2017). Perry et al. (2018) comment on many aspects of the tongue, including posterior tongue speed and range of motion, and that the changes in the posterior tongue are more easily detectable because of its active role in deglutition.

Both Hiraoka et al. (2017) and Erdem et al. (2016) make use of ALSFRS in examining the bulbar-related functions of their participants with ALS. They both state that the reduced bulbar-related ALSRFRS scores are directly related to decreased tongue function and swallowing difficulties in those suffering from ALS.

All of the researchers agree that dysphagia in patients with ALS is a likely determinant of death. Thus, it is evident that there is a great risk of swallowing dysfunction in those with ALS. Steps must be taken to ensure early diagnosis of dysphagia for individuals with ALS, permitting the best possible quality of life.

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The Etiologies of Selective Mutism

Daniella Azose-Katz

Selective mutism occurs when a child is unable to produce any speech in a social context yet is able to speak normally in other comfortable settings. Moreover, this taciturnity is completely unrelated to errors in the child's speech production mechanism. On average, this disorder lasts approximately 8 years, however, lasting effects regarding communication abilities may present themselves later in life. Although there are no definitively known causes of selective mutism, some proposed etiologies include the child's temperament, and the parent's treatment of the child (Muris *et al.* 2015). Muris, P., Hendriks, E., & Bot, S. (2016) found that a child's temperament may serve as an etiological precursor to selective mutism, by finding a strong correlation between a child's behavioral inhibition and failure to speak in communicative situations. Environmental factors were explored by Udy, C. M., Newall, C., Broeren, S., & Hudson, J. L. (2014), who found that parenting style may destabilize a child's confidence and increase anxiety, causing certain speech behaviors to manifest at an early age.

Behavioral Inhibition

One factor that may influence anxiety related speech disorders is the child's temperament or behavioral inhibition. Researchers, Gensthaler A., Khalaf, S., Ligges, M., Kaess, M., Freitag, C. M., & Schwenck, C. (2016), performed a study comparing the levels of early behavioral inhibition of various children, including those with anxiety related speech disorders. Behavioral inhibition is defined as an "initial tendency to withdraw, to seek a parent, and to inhibit play and vocalization following encounter with unfamiliar people and events" (p. 1113). Common examples of symptoms of inhibited temperament that may indicate speech related anxiety disorders include social anxiety, extreme shyness and low adaptability (Gensthaler *et al*. 2016).

The researchers compared four groups of children: children with lifetime selective mutism, children with social phobia alone, children with internalizing disorders, and a typically developing control group. Gensthaler *et al*. (2016) hypothesized that children with lifetime selective mutism would exhibit higher behavioral inhibition scores than children with social phobia alone. They assessed 334 participants, each between the ages of 3-18. After evaluating the results of all the children, it was found that children with lifetime selective mutism had the highest scores of behavioral inhibition. Likewise, among the children who participated in this study, children affected by social phobia alone had the next highest scores. The children with internalizing disorders and the control group equally had the lowest behavioral inhibition scores (Gensthaler *et al*. 2016).

This study revealed that behavioral inhibition is highly linked with failure to speak in communicative situations and selective mutism constitutes a severe language-based form of behavioral inhibition. One potential reason may be due to the relationship found between behavioral inhibition and higher heart rates with increased laryngeal muscle tension during stressful situations, possibly affecting speech production. Additionally, situations involving

social interaction have caused selective mutism to manifest itself more than situations involving prepared speech (Gensthaler *et al*. 2016).

Furthermore, another study demonstrated the association between behavioral inhibition and social anxiety symptoms with selective mutism. Muris *et al.* (2016) conducted a study in which they predicted that higher levels of behavioral inhibition and social anxiety would correlate with higher levels of selective mutism. In order to determine this, Muris *et al*. (2016) analyzed 57 children of similar familial and ethnic backgrounds, all between the ages of 3 and 6. Each child was tested by two female observers, with the child's parent present (Muris *et al*. 2016).

The children were each given two speech tasks to complete in order to assess the amount of speech they are capable of producing in a novel setting. The first speech task required the child to deliver a monologue about school. The child's parents first presented their own short monologue about a topic of their choice, in order for the child to understand what they were expected to do. After guiding the child on a topic choice, they began their oral presentation. The second speech task was an interview conducted by researchers who never met the child before, to determine the child's capability for spontaneous speech in the presence of an unfamiliar adult. The interview consisted of eight open-ended questions, enabling the children to respond spontaneously and elaborately. The researchers did not give explicit instructions to the child for the first half of the questions, to perceive the quality of the child's spontaneous responses. Alternatively, for the second half of questions, the researchers explicitly instructed the child to respond as verbose as possible, in order to determine the child's maximum response capabilities (Muris *et al*. 2016).

Inability to produce spontaneous speech in front of an unfamiliar adult represents one of the most typical symptoms of selective mutism. Since the children had never previously met the researches, they were used as a means to determine how the children responded spontaneously to unfamiliar people. The results of both speech tasks corresponded well with the temperamental indications of the children learned from the questionnaires. In conclusion, the study corroborated the researchers' hypothesis, showing that increased behavioral inhibition scores were proportional to greater anxiety and selective mutism. Similarly, symptoms of social anxiety and selective mutism more strongly correlated to fewer spoken words, than symptoms of non-social anxiety (Muris *et al*. 2016). Additionally, it was determined that selective mutism was more prevalent among younger aged children, and the older the child was the more spoken words they used in their oral presentation and interview.

Parental Influences

Correspondingly, another study was conducted by Udy *et al.* (2014), pointing to possible parental influences of the child's selective mutism, as well as the perpetuation of the disorder. Udy *et al*. (2014), described how parents of children with anxiety-induced disorders are often overly-attentive toward their children, especially when their child enters an anxiety-inducing situation. Since the parent tries to assist their child in such situations, they may unintentionally overcompensate for their child's inhibition through excessive reassurance and attention. The

parents' fear of the anxiety-provoking situation will be communicated to the child's observation of their behavior, inevitably causing the child to feel anxious.

In order to assess this phenomenon, Udy *et al*. (2014), initiated an experiment based on this situation. The researchers used an experimental group comprised of children diagnosed with selective mutism or other speech impaired anxiety disorders, and a control group comprised of typically developing children. The researchers selected 117 pairs of mother and child and the children were all between the ages of 8 and 14 years. First, the researchers asked the parents of each participating child to provide information regarding their child's behavioral temperament including stress and anxiety. This information was later compared to experiment results in order to ensure greater accuracy of the results. Each child was then given an anxiety-provoking speech task in which they would have five minutes to prepare a brief oral presentation to deliver in front of a video camera. The mothers were informed that their children would have to perform this task and were allowed to stay with their child for support during the preparation period. They were instructed that they may assist their child if they feel that they are struggling.

Udy *et al*. (2014) hypothesized that parents who expected their children at the outset to grapple with the speech task, were naturally more overbearing and controlling while aiding their child through the task. As suspected, this was the case, and all of the children of parents who believed such were unable to perform the speech task completely. On the other hand, the children of parents who did not have such low expectations of their child, were able to complete the speech task well. This suggests that parents' predisposed expectations and treatment of their child can have an overall effect on their child's speech performance (Udy *et al*. 2014). In fact, Muris *et al.* (2015), explained that "parents of children with selective mutism appear to be significantly more controlling and overprotective" (p. 159). This may serve as a possible etiological precursor to selective mutism or other anxiety related speech disorders. A parent's parenting style may destabilize a child's confidence and increase anxiety, causing certain speech behaviors to manifest themselves at an early age.

Conclusion

Although selective mutism is a relatively rare disorder, and research to conclude any definitive etiologies is extremely sparse, the findings of the various research studies described above provide multiple indications of possible etiological factors. Gensthaler *et al.* (2016) tested children with lifetime selective mutism, children with social phobia alone, children with internalizing disorders, and a typically developing control group, and found that children with lifetime selective mutism had the highest scores of behavioral inhibition. This indicated that a child's temperament may serve as an etiological precursor to selective mutism. Muris *et al.* (2016) corroborated these findings by conducting an additional experiment to assess the amount of speech that children with selective mutism and/or social anxiety are capable of producing in a novel situation. They found that increased behavioral inhibition scores were directly proportional to greater anxiety and selective mutism, showing that behavioral inhibition may serve as a cause of selective mutism. Udy *et al*. (2014) discovered that parents' predisposed expectations and treatment of their child can have an overall effect on their child's speech performance. Parents

may hinder their child's confidence causing certain speech behaviors to manifest themselves at an early age. These possible etiologies are important to note when considering different treatment options, in order for them to be as effective as possible.

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A Review and Analysis of Interventions for Childhood Apraxia of Speech

Tova Sklar

Childhood Apraxia of Speech (CAS) is a motor speech disorder, in which children experience difficulty coordinating the necessary oral movements involved in speech production. Symptoms of CAS include slurred, inconsistent, and fragmented speech (Luke, 2016). Because CAS is a disorder that a child cannot outgrow, children with CAS require early therapeutic intervention to develop speech with proper prosody and intelligibility (Strand, Stoeckel, & Baas, 2006). The mechanics of the interventions vary, treating CAS by capitalizing on functional areas of the brain to compensate for impaired regions, directly targeting specific oral malfunctions through repeated practice of accurate oral configurations, or by focusing on mastering prosodic patterns. Each treatment poses specific benefits and limitations. Therapists must carefully assess their clients' cognitive abilities, the severity of apraxia, and specific motor difficulties when determining which therapies would be most appropriate (Luke, 2016).

The implementation of augmentative and alternative communication (AAC) is an effective intervention for children with CAS, enabling them to compensate for their inability to produce intelligible speech through non-verbal methods of communication (Luke, 2016). Luke (2016) hypothesized that AAC treatment will not only increase non-verbal communication among children with CAS, but will also increase their oral speech by facilitating automation in their language production. Children with CAS typically struggle with oral-motor movements involved in intentional speech, although can respond automatically with ease (Luke, 2016). Children with CAS will experience greater oral-language gains by developing a language system heavily reliant on the neural networks involved in automatic speech. The development of automatic speech, however, must be preceded by the acquisition of intentional speech. To acquire intentional speech with a long-term goal of automating speech, Luke (2016) proposed that children with CAS should learn to intentionally communicate nonverbally through the use of SGDs. Once children are proficient in non-verbal communication, producing automatic responses with their SGD in conversations, they can learn to incorporate sound and oral-motor movements into their automatic-speech production.

To test the effects of AAC on children with CAS, Carina Luke (2016) performed a case study in which she treated L, a two-year-old boy diagnosed with CAS, using a form of AAC known as a speech-generating device (SGD). After tracking his language gains throughout 50 therapy sessions, taking place over the span of five years, Luke (2016) studied that the SGD intervention facilitated both non-verbal and verbal language gains. Initially, the introduction of SGD increased L's non-verbal communication. Over time, however, L's oral speech increased as well, eventually replacing the SGD as his primary mode of communication (Luke, 2016). Rather than treating children's oral-communicative difficulties by incorporating oral sounds into automatic responses, Dynamic Temporal and Tactile Cueing (DTTC) therapy directly addresses specific difficulties involved in intentional verbal communication. In DTTC therapy, therapists

teach patients to mindfully produce accurate jaw, tongue, and lip movements using physical touch or oral instruction. Children are instructed to hold specific oral configurations and, upon mastery, join them with other configurations to create fluid movements producing sounds. They slowly combine phonemes to make words, progress to multisyllabic words, and ultimately learn to produce multi-word utterances (Strand, Stoeckel, & Baas, 2006). Strand et al. (2006) tested DTTC on four non-verbal children with CAS. Over the course of six weeks, the children received an average of 45 sessions, focusing on teaching articulation patterns and reviewing already-learned concepts. The therapists initially provided immediate and specific feedback. Over time, they transitioned to giving general feedback, forcing the children to troubleshoot on their own when attempting to produce accurate sounds (Strand et al., 2006).

Strand et al. (2006) noted improvements in the participants' targeted speech consonants, most of which were plosives or sounds requiring glottal-pressure build up (Strand et al., 2006). While the majority of the participants' lexicons increased, their speech remained largely unintelligible after the six weeks of therapy. They attributed this to the short period of time over which the study took place. With more time, they conjectured that the therapists would be able to progress from focusing on general oral shapes to fine articulations, yielding clearer speech. Overall, DTTC intervention increased the children's use of verbal communication. The success in therapy instilled confidence within the participants and motivated them to continue treatment (Strand et al., 2006).

Another approach in overcoming CAS is to use prosodic mastery as a springboard to improve overall speech production. While therapies such as DTTC teach children to control oral movements and speak words in a specific manner (Strand et al., 2006), Preston, Leece, McNamara, & Maas (2017) found that these therapies did not effectively increase overall to language acquisition. They explain that it is not enough for children to learn a word in a neutral, rehearsed tone of voice -- they must learn how to use the word within realistic social contexts. Preston et al. (2017) therefore hypothesized that teaching children to mimic words with different voice inflections would yield greater generalization of speech.

To test the efficacy of prosodic variability in therapy, Preston et al. (2017) utilized motor-based ultrasound visual biofeedback. When treating with biofeedback, therapists place transducers beneath clients' chins. A real-time image appears on the screen, showing clients their tongue movements from different angles. The therapists then show images modeling proper tongue movement to the clients so that the clients can compare and match their oral movements to the accurate oral configurations. The goal of the treatment is for clients to apply concepts learned in therapy to new words that are not addressed during therapy sessions. While past studies verified the efficacy of visual biofeedback, they did not account for the prosodic difference of the spoken words. Preston et al. (2017) therefore questioned if the prosodic variation in the therapists' voices when modeling sounds contributed to the success of the biofeedback intervention.

To analyze the role that prosodic variation plays in the success of biofeedback therapy, Preston et al. (2017) treated six school-aged children with ultrasound biofeedback under the two

conditions; one where they spoke words with manipulated prosody (PROS) and one without manipulated prosody (No-PROS) spoken in neutral tones.

Overall, the treatments incorporating PROS and No-PROS target sounds were effective, although slightly higher rates of generalization were detected among probe words with the PROS target sound. Preston et al. (2017) discovered that the PROS treatment was particularly beneficial for children with CAS because it taught them to speak with proper prosodic patterns. Once the children acquired the proper prosodic patterns, they were able to insert the words within real-life conversations more easily, improving their generalization of speech (Preston et al., 2017).

Each of the treatments discussed poses specific benefits and limitations. Therapists must account for their patients' specific impairments when considering which therapy to employ. For example, it would not be wise to choose treatments incorporating visual biofeedback or DTTC when treating children with CAS who are cognitively impaired. If children receiving these treatments are unable to self-correct, problem solve, or understand that concepts learned in therapy must be applied to general speech, the therapy will not be effective.

The severity of apraxia must be taken into consideration as well. DTTC may be an appropriate intervention for children with severe apraxia because it helps them improve their speech by breaking the speaking process down into small, manageable movements. In contrast, visual biofeedback with and without prosodic variation can cause extreme frustration to children with severe apraxia who will struggle greatly to match precise tongue positions with the accurate ones featured on the screen. AAC or SGD caters to people of all cognitive abilities and severities of apraxia. Unlike the other interventions, however, AAC does not target specific problems with oral configuration or prosody, and therefore requires extensive use before any significant increases in oral communication are detected. While there are many treatments catering to specific cases, it should be noted that children without proper motivation will not experience success with any intervention (Preston et al., 2017). Once children with CAS are sufficiently motivated to improve their speech, therapists can begin to cautiously assess which treatment will best benefit their patients.

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Voice and Speech in Parkinson's Disease

Jordana Levine

Parkinsonism is a neurodegenerative disease acquired primarily by adults who are over 80 years old. According to the Institute of Neurological Disorders and Strokes, 500,000 Americans are currently living with Parkinson's disease (Matheron et al., 2017). Parkinsonism is characterized by the degeneration of dopamine neurons. The central symptoms of the disease are tremors, bradykinesia, and rigidity. Hypokinetic dysarthria is a speech disorder often seen in those with Parkinsonism, resulting in reduced volume, poor communication, and flat prosody (Harris et al., 2016). Rusz et al. (2012) found that 90 percent of individuals with Parkinsonism will develop Hypokinetic Dysarthria. Studies have also noted that patients with Parkinsonism are likely to experience a decline in phonation, articulation, and speech prosody (Rusz et al., 2012).

Matheron et al. (2017) state that typically aging individuals experience functional decline in their larynx, which results in the production of breathy speech and reduction of speech loudness. Onsets of these declines are even more common in adults with Parkinson's disease. Matheron et al. (2017) compared two groups of people with Hypophonia, i.e.; perceptually quiet voice, as an attempt to determine the effects of Parkinson's disease on laryngeal functioning. Matheron et al. (2017) researched two aspects concerning functioning of the Larynx. The first question pondered was whether individuals with Parkinsonism utilize the same laryngeal adjustment when sound pressure levels increase in comparison to healthy individuals. The second question assessed was whether both groups use the same laryngeal adjustments when sound pressure levels increase (Matheron et al., 2017).

For the study, Matheron et al. (2017) recruited 20 healthy adults and 42 individuals with Parkinson's disease. The groups were matched based on age to account for internal validity. Voice quality was assessed using a series of measures. Matheron et al. (2017) used a rating scale to evaluate characteristics such as hypophonia, loudness decay, breathiness, and hoarseness. Participants were asked to produce adequate airflow while speaking; intraoral pressure was also tested as well as the airflow from the opening of the vocal folds to the closure (Matheron et al., 2017).

In order to estimate intraoral air pressure and laryngeal airflow, Matheron et al. (2017) required the individuals to perform a speech task of saying the words, "buy pop" or "pop a papa". The results of this measure were not statistically significant. However, seven of the healthy older adults did not produce adequate voicing for the estimation of airflow (Matheron et al., 2017).

Matheron et al. (2017) found that both groups performed similarly in terms of sound pressure levels. Additionally, the groups produced similar laryngeal mechanisms such as vocal fold movement. However, there were some differences in vocal fold movement such as lateral displacement and the amount of time the vocal folds remained open. During quiet speech, the patients with Parkinson's disease produced a greater amount of airflow. It is possible that this was

the result of vocal fold atrophy, which displaces the vocal folds from the midline (Matheron et al., 2017).

Ultimately Matheron et al. (2017) discovered that individuals with Parkinsonism produce lower subglottal pressure as compared with healthy adults. Perhaps these results are correlated to atypical adductor laryngeal functions found in Parkinson's disease. In order for speech to be produced, the vocal folds must adduct to allow for a subglottal buildup of pressure. Atypical adductors with the presence of vocal folds that are open for a longer than average amount of time, will influence the subglottal pressure in patients with Parkinson's disease.

These results show that patients suffering from Parkinson's have laryngeal functions that are less efficient than healthy individuals. This is apparent in voice production, which requires patients to exert more effort when speaking. The main difference between the two groups was the higher amount of subglottal pressure in the healthy individuals and the lower amount of subglottal pressure in the patients with Parkinson's disease when the vocal folds were adducted (Matheron et al., 2017).

Similar to Matheron et al. (2017), Harris, Leenders, and de Jong (2016) sought to further understand the effects of Parkinson's disease on voice. Parkinson's is also characterized by expressive and receptive linguistic prosody and impairments. Harris et al. (2016) was interested in researching whether there is any correlation between the disease and singing. Singing is a form of expressive language and requires the use of pitch, rhythm, and sound intensity. Expressive linguistic prosody is a conspicuous feature of Parkinsonism. Patients may often fail to produce proper pitch when asking a question or repeating a sentence. Harris et al. (2016) hypothesized that the vocal behavior of singing in patients with Parkinsonism is similar to that of healthy individuals, although ordinary speech mechanisms are not the same (Harris et al., 2016).

Harris et al. (2016) explored the singing of 15 patients with Parkinson's disease who sang or played an instrument. 15 control patients were selected with matching characteristics to the 15 patients with Parkinsonism. The researchers recorded the singing of the participants, while a neurologist assessed dysprosody. There were two digital analyses of the recording. During the assessment of dysprosody, participants underwent several speech recordings, such as autobiographical narratives for at least one minute, and the recitation of song lyrics after listening to the beginning of the song. They sang several melodies of their choice and continued singing the lyrics to a song that was played to them (Harris et al., 2016).

Five senior neurologists and residents in neurology assessed the dysprosody of the participants with Parkinson's disease by listening to anonymized intervals of their speech (Harris et al., 2016). Multiple scores were distributed by the neurologist to the individuals based on the recordings. Most of the patients with Parkinson's disease were scored as having a diagnosis of dysprosody and the control group was scored with normal prosody (Harris et al., 2016). However, Harris et al. (2016) found that impairments of expressive linguistic prosody were not the same as deficits in the musical domain. No significant differences were found between the two groups, but the groups were able to be distinguished by the aural perception of their speech. Additionally, neurologists indicated that patients with Parkinson's disease have slower speech compared to the group of healthy controls. As hypothesized, there were no significant differences

between the groups for the mean pitch, pitch range, variability of pitch, and tempo. Harris et al. (2016) verified that there is no parallel between impairments of expressive linguistic prosody and the musical domain. Patients with Parkinson's will not experience the same prosodic impairments in singing as they do with speech (Harris et al., 2016).

In contrast to the other studies, which evaluated the different aspects of voice in Parkinson's disease, Rusz et al. (2012) executed a study focusing on the treatments for impairments of speech in Parkinson's disease. One of the main factors that causes the disease is the degeneration of dopamine neurons. Rusz et al. (2012) studied the effects of dopaminergic treatment on individuals with Parkinson's disease to see if speech improved or deteriorated (Rusz et al., 2012).

The study focused on 19 individuals with Parkinsonism, who displayed no speech disorders prior to the study and 19 matched controls. Patients diagnosed with Parkinson's disease were put on stable dopaminergic medication before the study. Rusz et al. (2012) implemented a procedure which consisted of the recording of a speech sample by a certified speech pathologist. Participants were instructed to perform four speech tasks: sustained phonation, a diadochokinetic task, a reading task, and a monolog. Acoustic analyses were taken using 18 different measurements (Rusz et al., 2012).

Rusz et al. (2012) compared the analyses of the Parkinson's disease patients before and after the treatment of medication. Not all of the four speech tasks improved by the intake of medication. The task in which participants were required to read a text did display significant improvements based on analysis before and after the measurement. According to Rusz et al. (2012) speech performance improved in loudness, voice quality, intonation, variability, and vowel articulation. Additionally, sustained phonation time and disfluency were found to have changed in patients after the intake of dopaminergic medication. Rusz et al. (2012) discovered that speech therapy along with medication had a positive impact on speech in patients with Parkinson's disease. The study concluded that many components of speech can improve or be maintained by medication as the disease progresses (Rusz et al., 2012).

Inasmuch as it seems, tremor, bradykinesia, and rigidity are not the only symptoms of Parkinson's disease. Many other functions are affected as well. Matheron et al. (2017) found that patients with the disease produce a significantly lower amount of subglottal pressure. Findings similarly concluded that the larynx functions differently in individuals with Parkinsonism. Furthermore, Harris et al. (2016) discovered that speech is more affected by the disease than voice. There is therefore hope for vocally talented affected individuals. Additionally, Rusz et al. (2012) ascertained that dopaminergic treatment was highly effective in maintaining or changing the speech of individuals with Parkinson's disease. In conclusion, the research offers optimism for those suffering from the disease.

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