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Development and Validation of a Probability Discounting Task of Communication for Adults Who Stutter

by

Luis R. Rodriguez

A dissertation

submitted in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy in the Department of Psychology

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Spring 2021

Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of Luis Rodriguez find it satisfactory and recommend it be accepted.

_____
Erin B. Rasmussen
Major Advisor

_____
Nicki Aubuchon-Endsley
Committee Member

_____
Xiaomeng Xu
Committee Member

_____
Chad Yates
Committee Member

_____
Daniel Hudock
Graduate Faculty Representative

Human Subjects Committee Approval

October 9, 2019

Luis Rodriguez
Psychology
MS 8112

RE: Study Number IRB-FY2020-102 : The development and validation of a probability discounting task for communication among adults who stutter

Dear Mr. Rodriguez:

Thank you for your responses to a previous review of the study listed above. These responses are eligible for expedited review under OHRP (DHHS) and FDA guidelines. This is to confirm that I have approved your application.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You may conduct your study as described in your application effective immediately. The study is subject to renewal on or before October 8, 2020, unless closed before that date.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; email humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

TABLE OF CONTENTS

List of Figures

List of Tables

Development and Validation of a Probability Discounting Task of Communication for Adults Who Stutter

Dissertation Abstract—Idaho State University (2021)

The choice to engage in a conversation is emotionally and socially risky to adults who stutter (AWS). Speaking is critically important to functioning as a human, but the consequences of a potential stuttering episode can create psychological distress. Therefore, understanding and quantifying decision-making related to speaking is an important part of treatment with AWS. To date, no measure exists that specifically quantifies communication decision-making for this population. Therefore, the present study was aimed to develop and validate this measure. The measure was based on probability discounting (PD), a behavioral measure of risk-taking that determines the extent to which the subjective value of a reward decreases as its odds against receipt increases and is assessed by presenting individuals with a series of choices between smaller, certain rewards versus larger, uncertain rewards. AWS (n=67) and adults who do not stutter (AWNS; n=93) were recruited online and from a national stuttering organization listserv. Participants completed the novel PD task for communication, in addition to self-report measures of stuttering, communicative participation, anxiety, self-efficacy, and demographics. Results revealed that engaging in communication decreased hyperbolically as a function of increasing dysfluency likelihood, consistent with previous PD patterns with other types of outcomes. In addition, a magnitude effect was apparent—larger magnitudes of negative social reaction risk led to higher communication discounting with both AWS and AWNS. Importantly, AWS showed more systematic response patterns compared to AWNS with the PD task, which suggests AWS may be more sensitive to outcomes involving communication, dysfluencies, and listener reaction. Significant associations also were observed between the PD task and stuttering, communication

participation, anxiety, and self-efficacy measures among AWS and AWNS. Overall, the newly developed PD task for communication creates a way for researchers to assess underlying decision-making patterns related to communication in a stuttering population, which may have importance in treatment decision making for providers.

Key words: communication, fluency, probability discounting, risk-taking, stuttering

Development of a Probability Discounting Task of Communication for Adults Who Stutter

Chapter 1: Full Literature Review

According to the *Diagnostic and Statistical Manual for Mental Disorders—Fifth Edition* (DSM-5), stuttering (i.e., childhood-onset fluency disorder or developmental stuttering) is a neurodevelopmental disorder characterized by one or more disruptions in speech fluency (e.g., repetitions, prolongations, blocks) that arise during the earliest stages of speech development which leads to both emotional and communication difficulties across multiple contexts (e.g., social participation, academics, occupation; American Psychiatric Association [APA], 2013). Speech disruptions are not related to an underlying neurological condition (e.g., stroke, tumor, brain injury), occur at a higher rate than is appropriate for one's age, and persist across time. The age of onset has been estimated to range from 2 to 7 years (APA, 2013) with more recent studies showing an average onset of approximately 33 months (Yairi & Ambrose, 2013) and approximately 3:1 ratio of males affected relative to females (Bloodstein & Ratner, 2008; Guitar, 2014; Neumann et al., 2017; Yairi & Ambrose, 2013). The incident has been estimated to be between 5-8% and 65-91% of children who stutter will show recovery (APA, 2013; Neumann et al., 2017; Yairi & Ambrose, 2013). However, if stuttering does not subside within one year after onset, then it is likely the individual will continue to meet criteria for life (Neumann et al., 2017). Overall, the prevalence of persistent stuttering into adulthood has been estimated to be less than 1% (Yairi & Ambrose, 2013).

Multifactorial Model of Stuttering

Stuttering is largely considered to be a disorder of the central nervous system (Maguire et al., 2002) with structural and functional differences in the brain compared to those without a stutter (e.g., Alm, 2004; Watkins, Smith, Davis, & Howell, 2008; Wu et al., 1995, 1997). However, no single factor for the cause of fluency disorders has been identified. Historically, theories spanning across both physiological and psychological processes have been proposed emphasizing one process over the other (see Bloodstein & Ratner, 2008 and Packman & Attanasio, 2017 for book length reviews). Recent theories, however, have recognized stuttering to be a complex disorder with multiple interacting factors (Packman, 2012; Smith & Weber, 2017; Walden et al., 2012). Through a multifactor framework, persistent stuttering is thought to be the result of ongoing disruptions in the underlying neurological mechanisms of the speech motor production areas that lead to high rates of dysfluencies. These mechanisms can be further disrupted by increased demands in linguistic complexity (e.g., variable syllabic stress) and ineffective self-regulation abilities in response to a dysfluency (Packman, 2012; Packman & Attanasio, 2017; Smith & Weber, 2017).

Overt and Covert Symptoms

Speech disruptions associated with stuttering typically consist of sound and syllable repetitions, sound prolongations, audible pauses within a word, filled or unfilled pauses in speech (i.e., blocking), avoidances of problematic words, producing words with excess physical tension, and monosyllabic whole-word repetitions (e.g., I-I-I-I). Other overt symptoms may include "secondary behaviors" such as physical gestures (e.g., eye blinks, head jerks, banging fists, tremors, etc.), speech interjections (e.g., "um," "er," "well," "like"), alterations to vocal tone or

rate, and alteration of words used to avoid stuttered words (i.e., circumlocutions) may also rise (APA, 2013; Bloodstein & Ratner, 2008; Guitar, 2014).

These overt aspects of the disorder (e.g., repetitions, blocks, prolongations) are more noticeable, readily lend themselves to empirical measurement, and have been the primary focus of research and treatment. Yet, they are a rather small portion in comparison to the private experiences that occur for the individual who stutters. Indeed, a metaphor used to describe stuttering is that of an "iceberg" (Sheehan, 1970) consisting of visible dysfluencies up top and emotional difficulties that arise as a function of the dysfluencies (e.g., fear, shame, guilt, anxiety, hopelessness, isolation, denial, suicidality) that make up the larger base of the iceberg (Corcoran & Stewart, 1998; Sheehan, 1970). During a dysfluent event, individuals may experience additional "introspective" concomitant behaviors that include affective reactions such as frustration, negative attitudes regarding communication, or even mental dissociation (Bloodstein & Ratner, 2008; Guttormsen et al., 2015; Vanryckeghem & Brutten, 2011), which in turn can moderate the occurrence of dysfluencies (Lewis, 1997).

Inattention and Stuttering

There is evidence that suggest that both children and adults who stutter (AWS) may have underlying differences in aspects of executive functioning (Bajaj, 2007; Bowers et al., 2018), which could have significant impact on the cognitive processes necessary for language production (Maxfield et al., 2016). Children who stutter have demonstrated relatively lower performance in underlying neurocognitive processes (i.e., inhibitory control and attentional shifting) compared to children who do not stutter (Eggers et al., 2009, 2010). Further, it is suspected that these differences may be due to relatively lower efficiency in attentional networks (Eggers et al., 2012). In addition, Karrass et al. (2006) noted that difficulties in self-regulation

among children who stuttered showed similarities to children with ADHD, and Ajdacic-Gross et al., (2010) noted an increased risk for ADHD—although not overwhelmingly strong—among children who stutter. Indeed, in a sample of 185 children who underwent stuttering therapy, approximately 50% exhibited symptoms consistent with ADHD (Druker et al., 2019). Overall, these results suggest that aspects of executive functioning, particularly, attentional processes, may play a role in developmental stuttering (Bowers et al., 2018; Eggers et al., 2012).

Anxiety and Stuttering

Approximately 33% of AWS met criteria for one to two mental health diagnoses (Iverach et al., 2009) with several studies indicating a high rate of anxiety disorders occur across the lifespan for those who stutter (Gunn et al., 2014; Iverach et al., 2009; Menzies et al., 2008). Among AWS, studies utilizing a clinician-administered diagnostic interview have reported the occurrence of social anxiety in at least 60% of the sample (Menzies et al., 2008). In a meta-analysis with a larger sample (N=1300), AWS showed higher rates of trait anxiety and social anxiety with moderate to large effects (g=0.57-0.82) compared to adults who do not stutter (AWNS; Craig & Tran, 2014). AWS report greater concerns of being negatively evaluated by others—a symptom of social anxiety—relative to AWNS (Messenger et al., 2004).

The occurrence of a comorbid anxiety disorder with stuttering creates greater psychological impact upon the individual, which can negatively impact speech gains made in treatment. Among a clinical sample of AWS, those diagnosed with social anxiety disorder were more likely to report increased avoidance of speaking situations and increased emotional and behavioral difficulties (e.g., higher depression symptoms) relative to those who did not have a social anxiety disorder diagnosis (Iverach et al., 2018).

Quality of Life Among Individuals Who Stutter

Relative to their fluent peers, individuals diagnosed with stuttering report lower quality of life due to decreased communicative and psychological functioning (Beilby et al., 2012b, 2013; Craig et al., 2009; McAllister et al., 2013). AWS have reported lower engagement in communication compared to those who do not stutter (e.g., Bricker-Katz, Lincoln, & McCabe, 2010; Plexico, Manning, & Levitt, 2009) and those who experience a higher number of overt dysfluencies are less likely to engage in communication relative to individuals with fewer dysfluencies (Boyle et al., 2018).

In addition, AWS have reported decreased self-efficacy (Bricker-Katz et al., 2013), which has accounted for more variance in lower communicative participation scores relative to measures of overt stuttering (Boyle et al., 2018). Further, it appears that psychological variables (e.g., fear of negative evaluation from others, self-efficacy, levels of social support) possibly mediate or moderate the individual's quality of life in relation to stuttering (Boyle et al., 2018; Brundage et al., 2017; Craig et al., 2009) suggesting the importance of focusing research efforts to understand underlying psychological processes.

Stigma. The decrease in communication and increase in emotional difficulties may be due to stigma. AWS have reported being teased, bullied or excluded due to their speech (Bricker-Katz et al., 2010; Butler, 2013; Plexico et al., 2009) and have described being unable to advance in their job due to their stutter or have been excluded from engaging in work specific tasks that involve increased communication (e.g., giving a presentation; Bricker-Katz et al., 2013; Klein & Hood, 2004). Indeed, fluent individuals have rated AWS as less suitable for occupations that require more speaking relative to their fluent counterparts (Boyle, 2017; Logan & O'Connor, 2012). Furthermore, AWS have been perceived as nervous, shy, less intelligent, less emotionally

stable, less romantically desirable, and less mentally healthy (Boyle, 2017; Zeigler-Hill et al., 2019) and AWNS have reported feeling uncomfortable, anxious, annoyed, or impatient when speaking with AWS (Boyle, 2017). Indeed, when listening to a speaker who stutters as opposed to a speaker who is fluent, AWNS have exhibited significantly higher physiological arousal and "unpleasant" emotions compared to baseline as measured by skin conductance and heart rate (Guntupalli et al., 2006, 2007; Zhang et al., 2010). Additionally, AWNS have described being unsure of how to respond or communicate with AWS (Boyle, 2017) or have been reported as intentionally speaking for or excluding AWS from a conversation (Butler, 2013).

Avoidance. Given the stigma AWS faces in their daily life, they are more likely to engage in forms of coping to prevent aversive communication experiences to both protect themselves from emotional hurt and to elicit comfort from the fluent listener (Plexico et al., 2009, 2019). For example, compared to fluent speakers, AWS are more likely to avoid eye contact, look away, pretend not to know an answer, omit or change certain words, take a deep breath using a starting phrase (e.g., "let me see"), rehearse sound, phrases, or words, or have other people speak for them in an attempt to avoid a dysfluency and accompanying anxiety (Helgadottir et al., 2014; Vanryckeghem et al., 2004). In addition, AWS have reported decreased social engagement with others (Bricker-Katz et al., 2010; Corcoran & Stewart, 1998; Plexico et al., 2009), intentionally choosing different careers or not taking a promotion (Bricker-Katz et al., 2013; Klein & Hood, 2004), and refusal to seek health care services (Boyle & Fearon, 2018) as ways to avoid both dysfluencies and aversive communicative experiences. While the engagement in these coping behaviors may be useful in the short-term removal or postponement of negative communicative events, the long-term consequences may be detrimental to one's quality of life. Specifically, limiting one's communication long-term can decrease access to valued life

activities, pursuing one's chosen occupation, sustaining physical health, and decrease sense of self-acceptance and identity (Beilby et al., 2012b; Boyle & Fearon, 2018; Bricker-Katz et al., 2013; Butler, 2013; Corcoran & Stewart, 1998; Klein & Hood, 2004; Plexico et al., 2019).

Stuttering and Sensitivity to Risk

A lifetime of adverse communicative interactions makes engaging in communication particularly challenging for AWS (e,g., Bricker-Katz et al., 2010; Plexico et al., 2009). Although numerous studies have been conducted that describe the communicative experiences of AWS (e.g., Boyle et al., 2018; Butler, 2013; Corcoran & Stewart, 1998; Plexico et al., 2009), to our knowledge no studies have directly examined decision-making processes that may be involved in communication. Indeed, a history of negative communicative experiences may heighten sensitivity to risk-taking within social interactions among AWS.

Multidimensional theories and models highlight the probabilistic nature around the moment of a dysfluency occurring (e.g., Packman, 2012; Smith & Weber, 2017). Although an individual may be aware of the factors that increase the likelihood of a moment of stuttering (e.g., who the listener is, topic of conversation, complexity of words, emotional state, neurological limitations; Helgadottir et al., 2014; Packman, 2012) its occurrence is still uncertain. In addition, negative reactions of the listener (e.g., mocked, laughed at, bullied, etc.) to a person who stutters are probabilistic (Bricker-Katz et al., 2013; Butler, 2013; Corcoran & Stewart, 1998; Logan & O'Connor, 2012). For AWS, the choice to engage in communication with another individual increases the likelihood of a stuttering event and possible negative social reaction, whereas the choice to not engage in communication can prevent both. However, a repeated choice of not communicating can also prevent access to reinforcers that functional

communication allows him or her to receive, which can have long-term physical and mental health consequences (Boyle & Fearon, 2018; Plexico et al., 2019).

Given the risks in speech that AWS experience, it is critically important to understand the conditions involved in making choices to speak. Currently, however, there is no objective measure that allows for the quantification of sensitivity to risk as a function of dysfluency and negative social encounter, which makes it difficult to determine the extent to which these factors are important processes in communicative engagement among AWS. The development and validation of this measure would be an important first step in conducting research in this area. One area in decision-making that may be useful for this kind of measurement is probability discounting.

Probability Discounting

Probability discounting (PD), a behavioral measure of risk-taking, refers to a decrease in the subjective value of an outcome as the odds against its receipt increase (Green & Myerson, 2010; Rachlin et al., 1991). In a PD task, individuals make a series of choices between smaller, certain outcomes (e.g., $1 for sure) versus larger, uncertain outcomes (e.g., $10 with a 90% chance of receipt). The vast majority of studies use money in their choice options (e.g., Hart, Brown, Roffman, & Perlis, 2019; Jarmolowicz, Bickel, Carter, Franck, & Mueller, 2012; Myerson, Green, & Morris, 2011; Rachlin et al., 1991; Richards, Zhang, Mitchell, & de Wit, 1999)

For human subjects, a typical PD task is the adjusting amount procedure (Madden & Johnson, 2010), which involves the systematic manipulation of the smaller, certain amount over varying probabilities. For example, if an individual were to select the larger, uncertain outcome from the choices “$1 for sure versus $10 with a 90% chance of receipt”, the smaller, certain

amount would be increased systematically (i.e., “$2 for sure versus $10 with a 90% chance of receipt”). If the individual continued to select the larger outcome, the smaller amount would be incrementally adjusted upward (e.g., “$3 for sure,” “$4 for sure,” “$5 for sure”…) until one would potentially see a *preference reversal* for the smaller, certain outcome. When the individual is presented with “$7 for sure versus $10 with a 90% chance of receipt,” one may see a switch in selecting for the smaller, certain outcome (i.e., preference reversal). This point is used to calculate the “indifference point”—the current subjective value of the larger, uncertain outcome. In the previous example for the individual who selected “$7 for sure” on the current trial and selected the “$10 with 90% chance of receipt” on the previous trial, his or her indifference point would be calculated as the median of the smaller, certain values of the current and previous trials—$6.50. For this individual “$6.50 for certain” is subjectively equal to “$10 with a 90% chance of receipt,” meaning that if this option is repeatedly presented, 50% of the selection would be for the smaller, certain amount and 50% would be for the larger, uncertain amount.

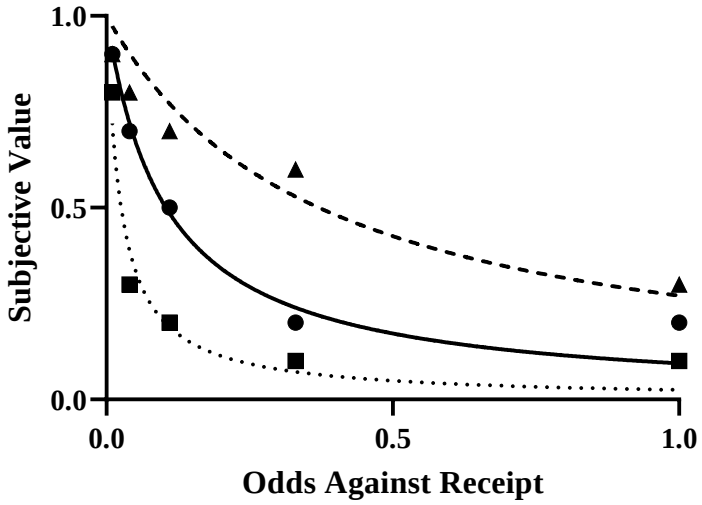
Indifference points are determined across a wide range of amounts and probabilities. Then indifference points are plotted against the odds against receiving the outcome. The resulting pattern is a hyperbolic function in which the indifference points (or subjective value) show a hyperbolic decay as odds against its receipt increases. That is, subjective value declines steeply at smaller odds and asymptotes as the odds against receipt increase (see Figure 1). This pattern can be described using a hyperbolic equation (Mazur, 1987):

$$V=A/1+h\Theta, \quad (1)$$

where *V* is equal to the subjective value (i.e., indifference point), *A* is the larger, uncertain amount, ϴ is the odds against receipt ([1/*p*]-1, *p*=probability of receiving), and *h* is a free parameter that indexes one's rate of discounting. Higher *h* values indicate a greater preference for the smaller, certain outcome or a higher sensitivity to probabilities (i.e., "risk-aversion"), whereas lower *h* values indicate less sensitivity to probabilities and a greater preference for the larger, uncertain outcome (i.e., "risk-taking" behavior).

Figure 1

Example of subjective values in a hyperbolic pattern



Note. Example of subjective values decay in a hyperbolic pattern as odds against receipt increase in standardized units. The free parameter *h* from the hyperbolic equation (Mazur, 1987) describes the slope of the line with the dashed-line representing a relatively less risk adverse individual compared to the dotted-line, which would be considered more risk adverse.

An alternative to the hyperbolic model is the hyperboloid model of discounting, which includes an additional parameter that raises the denominator to a specified power (Green et al., 1994; Myerson & Green, 1995):

$$V=A/(1+h\Theta)^{s}. \quad (2)$$

In the hyperboloid function, *s* refers to a nonlinear scaling parameter that is proposed to characterize sensitivity to the differences between odds. The inclusion of *s* alters the shape of the hyperbola leading to a leveling off of values at higher odds. An *s* value of 1 indicates that differences between odds are perceived similarly; however, individual's subjective values may show little sensitivity across higher odds against reward receipt ($s<1.0$) compared to lower odds, or vice versa ($s>1.0$).

The conceptualization of the additional parameter is based on the psychophysiological literature in that differences between physical stimuli are not perceived in a linear fashion. Indeed, "just noticeable differences" refers to the amount a particular variable must be changed before a difference is perceived, and within PD individuals may show different sensitivities between differences in the odds of receiving a reward ($[1/p]$-1) (Stevens, 1957; Vanderveldt, Oliveira, & Green, 2016). For example, the differences between two weights at smaller values may be more readily perceived than differences of weights at higher values. Specifically, individuals may report a difference between picking up a one-pound versus a five-pound weight but may not so readily report a difference between 56 versus 60 pounds. Similarly, for PD, a just noticeable difference might occur between 15% chance of receipt and 25% of receipt, but not necessarily 80% and 90%.

Area Under the Curve

An alternative analytic approach to using the *h* and *s* free parameters to characterizing PD is area under the curve (AUC; Myerson, Green, & Warusawitharana, 2001). To calculate AUC, the area beneath the discounting curve is determined by creating trapezoids formed by the area

between each successive subjective value and the corresponding odds. The following equation is used to calculate the area of each trapezoid:

$$AUC=\Sigma(x_2-x_1)[(y_2+y_1)/2], \quad (3)$$

where *x* refers to the successive odds and *y* refers to the corresponding subjective values. The discounting rate is the sum of the trapezoid areas and is bound between 0 (steepest discounting possible) and 1.0 (no discounting).

AUC offers an atheoretical analysis but can offset some of the limitations associated with the hyperbolic equation (i.e., positive skewness, nonhyperbolic patterns) that create difficulties for parametric analysis. This method is not bound by a specific theory (i.e., hyperbolic pattern of discounting), but values tend to be normally distributed and more readily lend themselves to parametric analyses. Further, due to its atheoretical nature, an additional benefit of AUC is it allows for the comparison of discounting values across differing discounting studies (Myerson et al., 2001). Researchers using both *h* and AUC have shown a related, inverse relation between the values (Myerson et al., 2011). Therefore, the use of both *h* and AUC values in determining effects of a particular variable is indicative of robust associations with individual discounting patterns.

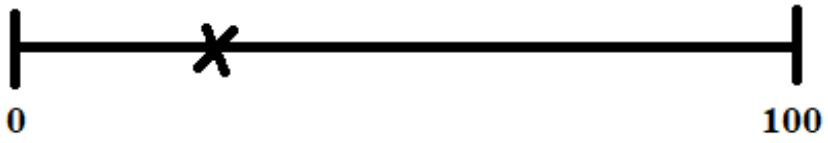
Visual Analog Scales

The discounting literature is full of studies that have utilized the adjusting amount procedure described earlier (e.g., Madden & Johnson, 2010; Rasmussen, Lawyer, & Reilly, 2010; Richards, Zhang, Mitchell, & de Wit, 1999; Rodriguez, Hendrickson, & Rasmussen, 2018). This procedure, however, can be limited in certain settings due to the number of

questions (over 100) and time duration of administration. Therefore, alternatives with fewer questions that reduce administration time have been developed. These include choice questionnaires (Madden et al., 2009; Rodriguez et al., 2018), a 5-trial procedure (Cox & Dallery, 2016), and the use of visual analog scales (VAS; Johnson & Bruner, 2012; Johnson, Herrmann, & Johnson, 2015; Kaplan, Reed, & McKerchar, 2014). A VAS typically consists of a 100-millimeter line which is usually anchored to a scale of 0 to 100 with descriptions on each end. Each millimeter is considered to be one unit, and ratings for a particular item on the scale are determined by measuring the placement of the mark from one end of the scale. For example, in Figure 2, the X occurs at 23 mm from zero indicating their response is equivalent to 23 specified units. For example, in a money PD procedure with a VAS, the mark at 23mm would indicate that $100 at a specified probability (e.g., a receiving 50% chance of receiving $100) is subjectively valued at $23 for certain.

Figure 2

Sketch of VAS representing a 100 mm line



Note. The X occurs at 23mm.

The VASs have been used with PD across different outcomes including money (Johnson et al., 2015), sex (Johnson & Bruner, 2012; Johnson, Johnson, Herrmann, & Sweeney, 2015), and concern about climate change (Kaplan et al., 2014) and offers a more rapid approach to

measuring discounting across a variety of outcomes and can be easily adapted for electronic or pencil-and-paper administration.

Systematic versus Non-systematic Responding

Although PD asserts that a systematic decrease occurs as odds increase, not all individuals demonstrate this expected pattern of responding (Johnson & Bickel, 2008; Smith, Lawyer, & Swift, 2018); rather, they exhibit non-systematic responding. The occurrence of non-systematic responding can introduce variance that skews results and subsequent interpretation of discounting data. Therefore, to help researchers identify these types of responders, Johnson and Bickel (2008) developed a two-criterion algorithm that can be used to aid researchers in identifying non-systematic data. First, indifference points should decrease in a systematic manner across odds such that subsequent indifference points are no larger than 20% in magnitude of the previous indifference point. Second, the last indifference point should be 10% or less in magnitude than the first indifference point. Violation of either criteria would be classified as non-systematic.

A non-systematic pattern may indicate noise in the data from a participant (e.g., a haphazard pattern that suggests inattention or limited comprehension of the instructions). In this situation, a researcher needs to make the determination of whether to use the data the participant provides. In some cases, researchers use the a-priori rules from Johnson & Bickel to justify removal of the data from the analysis (e.g., Berry et al., 2018; Holt, Newquist, Smits, & Tiry, 2014; Johnson et al., 2015), while others report the analyses with them and without them (e.g., Hendrickson & Rasmussen, 2013; Johnson, Herrmann, Sweeney, LeComte, & Johnson, 2017; Rodriguez et al., 2018).

Methodological issues can also affect non-systematic responding. For example, non-monetary commodities, such as food, drugs, or sex result in more non-systematic responding compared to monetary outcomes (Smith et al., 2018). Further, methodological variations such as sampling from a university versus non-university setting or the discounting task itself can also influence the number of nonsystematic-responders (Smith et al., 2018).

Non-systematic data in discounting tasks can also indicate something meaningful about the data. Indeed, some individuals demonstrate limited sensitivity to changing risk and exclusively select either the smaller, for sure outcome or the larger, uncertain outcome resulting in a flat line as opposed to a hyperbolic curve; these patterns would indicate an especially risk averse or risky pattern of behavior, respectively. In addition, it has been shown that outcomes that do not function as a reinforcer for individuals also result in patterns with higher non-systematic responding (e.g., Lawyer, 2008; Lawyer, Williams, Prihodova, Rollins, & Lester, 2010). For example, Lawyer (2008) found higher rates of non-systematic responding for discounting of erotica among individuals who identified as "non-users" (i.e., found erotica aversive) compared to individuals who used erotica indicating that aberrant responding may indicate a commodity may not hold particular value for an individual or could function as aversive.

Indeed, the comparison of non-systematic and systematic responders may highlight different demographic factors that make individuals sensitive to specific discounting tasks relative to others. For example, AWS may show relatively more systematic responding in discounting tasks with communication as an outcome across differing fluency risks given their lifetime experiences with these variables. AWNS, however, may show relatively more non-systematic responding and less sensitivity to fluent communication as an outcome given their

limited experience in navigating the occurrence of dysfluencies while communicating with other individuals.

Risky Decision Making for Health and Treatment Outcomes

Comparatively speaking, a majority of the discounting literature has focused on impulsive decision-making by examining sensitivity to delay (see Madden & Johnson, 2010 for book length review) as opposed to sensitivity to odds or risk (i.e., PD). However, the use of PD has increased in research examining decision-making related to health outcomes that involve risk, such as sexually transmitted infections, cardiovascular health, and medication side effects and benefits (Asgarova, Macaskill, Robinson, & Hunt, 2017; Berry et al., 2018; Bruce et al., 2016; Johnson et al., 2015). This research is reviewed here.

Sexually Transmitted Infections (STI). While sex is a strong reinforcer, there are risks such as unexpected pregnancy, disease transmission, condom availability, and partner preference that affect the probabilities in which individuals will engage in sexual activity. Generally, sexual riskiness in adult populations can be measured by PD (e.g., Lawyer & Mahoney, 2018). For example, Berry and colleagues (2018) demonstrated that condom-protected sex showed a hyperbolic decay in value as odds against STI contraction increased. Further, individuals who were more sexually risky showed steeper discounting of condom-protected sex across differing STIs regardless of curability or partner preference compared to individuals who were less sexually risky. Indeed, these results indicate that individuals with increased sexual risk taking are more likely to contract sexually related disease that can have life-long health consequences (e.g., HIV/AIDS).

Additional research in sexual PD has also examined the influence of substances within this domain. For example, Johnson et al. (2015) compared both probability and delay discounting

rates for money and condom use in adults with cocaine use disorder compared to non-using controls. Both groups showed an increase in unprotected sex as condom availability was with likelihood of STI infection and with delay to a preferred partner. Compared to non-using controls, participants with cocaine use disorder were more likely to engage in unprotected sex as delay to a condom increased regardless if their partner was more or less preferred. For choices involving partners who were more or less likely of having an STI, no differences between groups were observed, meaning that participants with cocaine use disorders and controls discounted delayed condoms similarly. In terms of sexual PD, both groups demonstrated a similar decrease in condom use as the odds against contracting an STI increased. Similar patterns were observed for delayed and probabilistic monetary outcomes. The cocaine group showed significantly higher delay discounting rates (i.e., more impulsive) for money compared to controls, but no differences between groups were observed.

In addition, acute cocaine administration can affect sexual PD. Healthy cocaine users who were randomly administered high doses (250mg/70kg) and medium doses (125mg/70kg) of cocaine demonstrated significantly lower condom usage as probability of STI decreased compared to when they were administered placebo (Johnson, Herrmann, Sweeney, LeComte, & Johnson, 2017). However, researchers did not observe dose dependent effects for money PD suggesting a potential domain-specific effect. It is possible that cocaine administration could have led to differences between groups in Johnson et al., (2015). More research in the area of sexual PD is needed.

Medication Adherence. The role of risk can also play influence one's adherence to effective disease modifying treatments given that medications can be associated with the occurrence of main effects and side effects. Indeed, although a specific treatment may increase

odds for alleviating symptoms, these are often distant benefits and may be accompanied by immediate, uncertain side effects.

To help examine the extent to which behavioral economic decision-making processes, specifically with the use of PD, could characterize treatment adherence, Bruce and colleagues (2016) developed the Medical Decision-Making Questionnaire (MDMQ). The MDMQ asked patients to mark on a visual analog scale the likelihood they would take a medication (0% = "will not take" to 100% = "will take") across varying probabilities in which a side effect would occur (10%, 50%, or 90%) and varying probabilities the medication would be efficacious (5%-95%). When comparing AUC values between patients with multiple sclerosis who were adherent to their medication versus those who were non-adherent, adherent patients showed significantly higher AUCs (i.e., they more likely to take medication) compared to non-adherent patients. Further, adherent patients showed sensitivity to side effect severity, with their odds of taking a medication decreasing (i.e., lower AUC values) as side effect severity increased (Bruce et al., 2016; Jarmolowicz et al., 2017, 2018). Comparatively, non-adherent patients showed similar AUC values across all three side effect severities (Bruce et al., 2016).

Additionally, the initial study using the MDMQ indicated that the inclusion of the scaling factor (i.e. *s*) from the hyperboloid function showed a better fit to the data (R^2=0.89-0.99) as opposed to the hyperbolic function (R^2=-1.91-0.86; Bruce et al., 2016). The authors postulated that the better fit for the hyperboloid function indicated that perception in differences between odds (i.e., the scaling factor, *s*) may be an important variable in understanding health decision-making (Bruce et al., 2016; Green et al., 2010). However, the inclusion of additional parameters in a model are known to increase model fit and this reason alone does not justify their addition. Indeed, another study with the MDMQ showed that the hyperbolic equation (equation 1) that did

not have the additional scaling factor showed similar R^2 values to models including the scaling factor (0.89-0.96; Jarmolowicz et al., 2017) suggesting that its inclusion may not be necessary.

Interestingly, when analyzing data derived from the hyperboloid equation, researchers have excluded the scaling factors from analysis citing concerns of multicollinearity between *s* and *h* values (Bruce et al., 2016, 2018). However, the extent to which scaling variables can be classified as "redundant" (Bruce et al., 2018, p. 3307) and excluded from data analyses warrants further investigation as the scaling factor may represent a related but differing discounting process (Vanderveldt et al., 2016). Indeed, future research would benefit from inclusion of these variables in analyses to determine if there are differential effects.

Nonetheless, the values obtained from the MDMQ (*h* and AUC) have shown utility in the guidance of actual treatment outcomes. Jarmolowicz et al. (2017) reported that AUC values obtained from the MDMQ showed a positive association with increases in self-reported motivation to adhere to treatment. In addition, Bruce and colleagues (2016) found that AUC was predictive of adherent versus non-adherent classification in a group of patients with approximately 83% accuracy. However, only AUC values obtained for medication with a 10% chance of a side effect were significantly predictive of group whereas medication at 50% and 90% chance of side effects were not. This effect was later replicated across a larger range of values for side effects (0.01% to 99%). In addition, individuals who showed higher *h* values based on side effect probabilities were less likely to report medication adherence as well as knowledge about their disease (Bruce et al., 2018). Further, individuals who discounted medication adherence under ideal treatment conditions (99% efficacy and 0% side effects) also demonstrated greater cognitive decline (i.e., poorer symbolic processing, decreased delayed recall, poorer set shifting). These different sensitivities to efficacy and side effect offers a

quantifiable understanding of decision-making that could help guide specific types of intervention to be used with certain populations (e.g.., psychoeducation, motivational interviewing, neurocognitive strategies, etc.; Bruce et al., 2018; Jarmolowicz et al., 2018).

Summary of PD and Relevance to Stuttering. Overall, the use of PD has been used to better understand and quantify medical decision making and choices related to sexual health—two areas of health that involve risk. Indeed, the literature for PD in these two areas highlights its utility in understanding decision-making for outcomes other than money and potential for treatment guidance, which indicates its usefulness in quantifying patterns around other commodities (i.e., communication) and other populations (i.e., stuttering).

As previously discussed, for AWS, engagement in communication and likelihood of a dysfluency are probabilistic in nature. Further, a lifetime of aversive experiences within a stuttering population may have influenced their sensitivity to risky outcomes while attempting to communicate with others, which in turn can influence treatment in this population. In other words, each time a person chooses to speak there are likely as least two probabilities in place: one, there is probability of a dysfluent episode and two, there is a risk of an aversive event of a dysfluency occurs. However, there was currently not a PD measure that directly examines decision-making around communication or how it is altered by dysfluencies.

Purpose of the Present Study

The purpose of the present study was the development and validation of a PD task that can be used in the stuttering population. Specifically, we determined the extent to which choices about communication made by AWS could be modeled using a PD task that varies as a function of dysfluency probability and listener reaction to the dysfluency. Further, to help assess the validity of the discounting task, discounting values and systematic responding was compared

between AWS and AWNS. In addition, we examined the extent to which previously established measures of communication participation, overt stuttering symptoms, and covert stuttering symptoms show a relation to the PD task. To further validate the measure's relation to stuttering, we examined the extent to which anxiety and self-efficacy are related to the measure as they have been shown to be associated with stuttering (Craig & Tran, 2014).

Chapter 2: The Study

Stuttering (i.e., childhood-onset fluency disorder or developmental stuttering) is a neurodevelopmental disorder with a complex etiology characterized by one or more disruptions in speech fluency (e.g., repetitions, prolongations, blocks). Speech disruptions arise during the earliest stages of speech development (i.e., 2 to 7 years of age), occur at a higher rate than is appropriate for one's age, persist across time, lead to emotional and communication difficulties across multiple contexts (e.g., social participation, academics, occupation), and are not attributable to an underlying neurological condition (e.g., stroke, tumor, brain injury; APA, 2013; Bloodstein & Ratner, 2008; Packman, 2012; Packman & Attanasio, 2017; Smith & Weber, 2017; Walden et al., 2012). Furthermore, the experience of stuttering can be further classified into two classes: overt and covert symptoms.

Overt symptoms are those that typically consist of audible speech dysfluencies and "secondary behaviors" (e.g., eye blinks, heard jerks, tremors, sound or syllable avoidance). They are generally more noticeable and readily lend themselves to empirical treatment (APA, 2013; Bloodstein & Ratner, 2008; Guitar, 2014). Covert symptoms, however, refer to emotional or cognitive experiences (e.g., fear, shame, anxiety, denial, frustration, mental dissociation, etc.) that can arise during a dysfluent episode and can further moderate the occurrence of dysfluencies (Lewis, 1997; Sheehan, 1970). The occurrence of either overt or covert features has been linked to a lower quality of life in adults who stutter (AWS), due to experiences with stigma and avoidant coping styles that prevent aversive communicative experiences (Beilby et al., 2012b, 2013; Boyle, 2017; Boyle et al., 2018; Bricker-Katz et al., 2010, 2013; Butler, 2013, 2013; Corcoran & Stewart, 1998; Craig et al., 2009; McAllister et al., 2013; Plexico et al., 2009, 2019). While the avoidance of communicative experiences for AWS may reduce harm in the short-term,

the long-term consequences may be detrimental to one's quality of life by limiting one's valued choices in important life domains, such as occupation, physical health, sense of self-acceptance, identity, and development and maintenance of intimate relationships (Beilby et al., 2012; Boyle & Fearon, 2018; Bricker-Katz et al., 2013; Butler, 2013; Corcoran & Stewart, 1998; Klein & Hood, 2004; Plexico et al., 2019).

Stuttering and Sensitivity to Risk

Although studies describe aversive communicative experiences of AWS across the lifetime (Boyle et al., 2018; Bricker-Katz et al., 2010; Butler, 2013; Corcoran & Stewart, 1998; Plexico et al., 2009), to our knowledge no studies have directly examined decision-making processes that may be involved in avoidant communication strategies. Indeed, the probabilistic nature surrounding dysfluency occurrence (e.g., Helgadottir et al., 2014; Packman, 2012; A. Smith & Weber, 2017) and a history of negative communicative experiences (i.e., negative responses from others in the form of bullying, mocking, or laughter) may heighten sensitivity to risk within social interactions among AWS. For AWS, the choice to engage in communication with another individual increases the likelihood of a stuttering event and possibly negative social reaction, whereas the choice to not engage in communication can prevent both. However, a repeated choice of not communicating can also prevent access to reinforcers that functional communication allows him or her to receive, which can have long-term physical and mental health consequences (Boyle & Fearon, 2018; Plexico et al., 2019).

Given the risks in speech that AWS experience, it is critically important to understand the conditions involved in making choices to speak. Currently, however, there is no objective measure that allows for the quantification of sensitivity to risk as a function of dysfluency and negative social encounter, which makes it difficult to determine the extent to which these factors

are important processes in communicative engagement among those who stutter. The development and validation of this measure would be an important first step in conducting research in this area. One area in decision-making that may be useful for this kind of measurement is probability discounting.

Probability Discounting

Probability discounting (PD), a behavioral measure of risk-taking, refers to a decrease in the subjective value of an outcome as the odds against its receipt increase (Green & Myerson, 2010; Rachlin et al., 1991). In a PD task, individuals make a series of choices between smaller, certain outcomes (e.g., $1 for sure) versus larger, uncertain outcomes (e.g., $10 with a 90% chance of receipt) across a variety of probabilities. Repeated preference for the smaller, certain outcome over the larger, uncertain outcome is indicative of a greater sensitivity to risk-taking. Moreover, a pattern of risk aversion can be characterized by plotting the subjective value of the larger, less probabilistic outcomes (determined from the preference pattern of smaller certain vs, larger, less certain choices) against the odds of receiving that outcome. The subjective value of those outcomes hyperbolically declines with the odds against receiving them and a free parameter of this hyperbolic relation known as an *h*-value can characterize the pattern (see Mazur, 1987; Rachlin et al., 1991). Relatively higher *h*-values indicate a risk averse pattern of responding and relatively lower *h*-values indicate greater risk-taking.

The use of PD has increased in research examining decision-making related to health outcomes that involve risk, such as sexually transmitted infections (STIs) and medication side effects and benefits (Berry et al., 2018; Bruce et al., 2016; Johnson et al., 2015). For example, condom usage showed a decrease as odds against STI contraction increased (Berry et al., 2018). Moreover, sensitivity to odds of medication side effects and efficacy was strongly predictive

(83%) in classifying treatment adherence and non-adherent multiple sclerosis patients (Bruce et al., 2016). Because the use of PD has been used to better understand and quantify medical decision making and choices related to sexual health—two areas of health that involve risk—it has utility in characterizing decision-making for outcomes other than money (the standard outcome used in PD studies). Moreover, PD has potential for treatment guidance, which indicates its usefulness in terms of quantifying patterns of choice using commodities other than money in clinical populations. The choice to speak, and its risks, in AWS may be one such area.

Each time a person chooses to speak there are likely as least two probabilities in place: 1) there is probability of a dysfluent episode and 2) there is a risk of an aversive event that follows the dysfluency. However, there is currently not a PD measure that directly examines decision-making around communication or how it is altered by dysfluencies. The purpose of the present study, then, was the development and validation of a PD task that can be used in the stuttering population. Specifically, we determined the extent to which choices about communication made by AWS could be characterized using a PD task. In this task, the value of communication was manipulated as a function of dysfluency probability and probability of a negative listener reaction to the dysfluency. Further, to help assess the validity of the discounting task, discounting values and systematic responding was compared between AWS and adults who do not stutter (AWNS) to determine the extent to which group membership differed on this variable. In addition, we examined the extent to which previously established measures of communication participation, overt stuttering symptoms, and covert stuttering symptoms showed a relation to the PD task. To further validate the measure's relation to stuttering, we examined the extent to which anxiety and self-efficacy are related to the measure as they have been shown to be associated with stuttering (Craig & Tran, 2014).

The study hypotheses were:

1. AWS would demonstrate orderly (hyperbolic) and steeper discounting patterns for speech risks compared to AWNS.
2. Among AWS, a PD task of communication would show significantly negative associations with a measure of communicative participation.
3. A PD task of communication would show significant, positive associations with established clinician measures of stuttering and self-report measures of stuttering among AWS.
4. Among AWS, a PD task would show significantly negative associations with measures of self-efficacy and significant, positive associations with measures of anxiety. No associations were expected to be observed among AWNS.
5. Among AWS, self-report measures of self-efficacy and impact of stuttering experience would account for significantly more variance when predicting scores on a PD task of communication and measures of communication participation than measures of overt stuttering symptoms and anxiety.
6. The two-parameter hyperboloid equation (Equation 2) would show a significantly better fit for PD of communication than the single-parameter hyperbolic equation (Equation 1) among AWS compared to AWNS.

Methods

Participants

The researchers recruited adult participants from an online listserv through the National Stuttering Association, social media, Amazon's Mechanical Turk (MTurk), and by contacting regional speech language pathologists. To be included in the study initially, individuals needed

to be 1) at least 18 years old, 2) have access to a reliable internet connection, 3) be fluent in reading and speaking English, and 4) a willingness to download Zoom® video conferencing software. Given difficulties with recruitment, the downloading of the video conferencing software was subsequently removed as an inclusion criterion. Participants were excluded from participation if they self-reported a past or current diagnosis of a speech/language or communication disorder other than stuttering (i.e., alalia, aphasia, cleft lip or cleft palate, developmental verbal dyspraxia, dysarthria, expressive or receptive language delay disorder, laryngeal or oral cancer, orofacial myofunctional disorders, speech sound disorder, or voice disorder) or a past or current diagnosis associated with difficulties in communication (i.e., autism spectrum disorder, dementia, hearing loss, intellectual disability, social pragmatic communication disorder, stroke, or traumatic brain injury). Participants who met the inclusion criteria and did not endorse any of the exclusion criteria were eligible to continue with the study. Participants who completed the study were placed into a drawing for one of ten $25 Amazon Gift Cards.

Prior literature examining PD using the Medical Decision Making Questionnaire found medium to large effect sizes (e.g., Bruce et al., 2016). Similarly, research examining the related process of delay discounting in a substance using populations have also noted medium to large effect sizes (MacKillop et al., 2011). A priori power analyses using G*Power and estimations from Cohen (1992) with a medium effect size (d=0.5) and a power of 0.8 were conducted. Power analysis for ANOVA suggested approximately 34 participants. For Pearson's *r* and chi-square analyses, approximately 85-87 participants would be required. Further, the power analysis for multiple regression with 7 predictors related to overt stuttering severity, covert stuttering severity, self-efficacy, anxiety, alcohol use, substance use, and nicotine use indicated

approximately 107 participants would be required, whereas the power analysis for t-test suggested a total of 128. Based on these analyses we planned to enroll approximately 128 participants (64 per group) for the main study. In addition, we enrolled 32 additional participants (16 per group) to pilot the online procedure to determine if any adjustments were warranted. Therefore, a total N of 160 participants were required to pilot the procedure and complete the study.

Materials

Probability Discounting of Communication (PDC; Appendix A). The PDC is a novel task in which participants are asked to recall their most severe moment of stuttering and rate it on various dimensions (e.g., age it occurred, length dysfluency lasted, people present and their relation to the individual, reaction of others). They are then asked to imagine themselves in a speaking-scenario with another individual where they will experience their most severe moment of stuttering during the conversation and that the individual with whom they are conversing will have a negative reaction (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated). Across 21 trials, participants use a visual analog scale to mark their likelihood of participating in the conversation on a scale of 0 ("I definitely will NOT participate in the conversation") to 100 ("I definitely will participate in the conversation") across seven probabilities of occurrence of a severe moment of stuttering (e.g., "During the interaction, there is a *90% chance you will* experience a severe moment of stuttering"): 1%, 10%, 25%, 50%, 75%, 90%, and 99%. In addition, three probabilities of a negative reaction from the listener are presented (10%, 50%, and 90%; e.g., "There is a 10% chance the person will respond negatively"). In other words, across the 21 items, each of the probabilities for an occurrence of a negative reaction are held constant while the probability of experiencing a dysfluency is manipulated. In addition, a single

item is included that assessed participants responding under an "ideal condition" (0% occurrence of a dysfluency and 0% negative reaction).

Communicative Participation Item Bank (CPI; Baylor et al., 2013; Appendix B). The CPI is a 10-item self-report measure that assesses the extent to which an individual's life situation or experience with a communication disorder affects his or her ability to participate in differing speaking situations. Individuals rate level of interference they experience on a 4-pt Likert scale (0=Very Much to 3=Not at all), which are summed into a total score. Higher scores indicate greater communicative participation and fewer difficulties in speaking situations. Baylor and colleagues (2013) recommended the conversation of total scores into either logit scale or *T*-scores as it allows for approximately equal intervals and more valid mathematical operations. *T*-scores ranged from 24.20 to 71 with a mean of 50 and standard deviation of 10. The 10-item CPI was developed from the previously established 46 item CPI with a high correlation between the two measures (r=0.97) as well as a similar distribution in item responses across differing levels of communicative participation (Baylor et al., 2013). Further, prior research on longer versions of the CPI have revealed high internal consistency (α=0.99; Baylor, Yorkston, Eadie, Miller, & Amtmann, 2009); however, further research on the psychometric properties (e.g., re-test reliability; validity) on the shorter version is warranted. Recently, the CPI has shown utility in assessing different variables that influence communication engagement in stuttering populations (Boyle et al., 2018) and was used to establish the convergent validity of the PDC.

Overall Assessment of the Speaker's Experience of Stuttering-Adult (OASES-A; Yaruss & Quesal, 2006, 2010; Appendix C). The OASES-A is a self-report measure that assesses the overall impact stuttering has on the individual's life from the perspective of the speaker. Items are scored on a 5-point Likert-scale across four sections: participant perceptions of her or

his fluency, overt and covert reactions to his or her stutter, functional communication difficulties experienced across different environments, and how the stutter has affected his or her quality of life. Impact scores are totaled across the four sections and an overall impact rating is calculated and compared to specific cut-offs to determine severity with higher scores indicating increased severity. Internal consistency within the four sections and total score have ranged from 0.94-0.99 and retest reliability across a 10-14 day period have ranged from 0.89-0.95 (Yaruss & Quesal, 2010). Scores from the OASES were compared to the stuttering discounting task to determine the extent to which one's subjective experience of stuttering is related to his or her decision-making behavior.

Stuttering Severity Instrument, Fourth Edition (SSI-4; Riley, 2009; Appendix D). The SSI-4 is a clinician-administered standardized behavioral assessment of an individual's stuttering behavior across two-to-three speaking situations (e.g., conversation with another individual, monologue, telephone call, and a reading sample). An individual's speaking behavior is assessed for frequency of syllables stuttered, average length of the three longest stuttering events, and presence of physical concomitant behaviors (e.g., noisy breathing, clicking sounds, jaw jerking, lip pressing, jaw muscle tension, head movements, poor eye contact, arm and hand movements, leg movements, foot-tapping, etc.). Raw scores are converted into standard scores and summed into a total score. Performance is compared to the performance of similar aged peers with higher total scores indicating greater severity. Administration of the SSI-4 is videotaped which helps to facilitate scoring. With proper training among coders, the interrater reliability for ratings of frequency and duration of dysfluent events and overall total scores has ranged from 84-93% on average (Riley, 2009). Scores from the SSI-4 were intended to determine the extent to which overt stuttering behaviors are related to an individual's decision-making behavior.

Subjective Stuttering Scales (SSS; Riley, Riley, & Maguire, 2004; Appendix E) The SSS is an 8-item measure that assess an individual's perception of their fluency and dysfluency over the past week and its impact on their daily functioning with close friends, an authority figure, and using the telephone. Three subtotals are calculated across three domains (Severity, Locus of Control, and Avoidance), which are then summed into a total score with higher score indicating greater severity. Item-to-area correlations among the subscales have ranged from 0.81-0.97, and retest reliability across a two span also has ranged from 0.79-0.93. Further, subscales scores showed high correlations with the overall total scores (r=0.92-0.95). The SSS provided a recent subjective perception of an individual's stutter over the past week, which could have influenced discounting patterns.

Level of Speech Use Rating Scale (LSURS; Baylor, Yorkston, Eadie, Miller, & Amtmann, 2008; Appendix F). The LSURS is a self-report measure that asks participants to rate their perceptions of speech use demands over the past year using a categorical scale: undemanding, intermittent, routine, extensive, and extraordinary. Description of speech amount, frequency, type, and importance of speaking situations are provided for each anchor to help in choice selection. While no formal testing of reliability have been conducted, researchers have collected data examining level of speech use in samples with and without communication disorders, in addition to examining the influence of employment, education, and age on speech usage (Anderson et al., 2016; Baylor et al., 2008). Among AWS, levels of speech use has shown to be a significant predictor of communication participation (Boyle et al., 2018) and was measured here to further establish the PDC's validity and to determine the extent to which speech usage impacted communication decision-making.

Social Anxiety Disorder Dimensional Scale (SAD-D; Lebeau et al., 2012; Appendix G). The SAD-D is a 10-item self-report questionnaire that assesses the presence of DSM-5 cognitive and physical symptoms related to fear/nervousness of upcoming social situations and avoidance behaviors using a 5-pt Likert scale (0=Never to 4=All of the time). Responses on items are summed into a single total score with higher scores indicating greater severity of symptoms. Items have shown high internal consistency (α=.083-0.93), high re-test reliability across one week (r=0.81), and convergent validity with other measures of anxiety (e.g., GAD-7 r_s=0.47; GAD-D r_s=0.48; ADIS-IV social anxiety disorder clinical severity rating scale r=0.64; Lebeau et al., 2012).

Overall Anxiety Severity and Impairment Scale (OASIS; Norman, Hami Cissell, Means-Christensen, & Stein, 2006; Appendix H)**.** The OASIS is a 5-item self-report screener that assesses an individual's symptoms of anxiety and severity over the past week. Participants rate items using a 5-pt Likert scale, which are summed into a total score. Higher scores indicate greater severity of symptoms and impairment with total scores ≥8 indicating clinically anxious individuals (sensitivity=89%, specificity=71%; Campbell-Sills et al., 2009). OASIS items have shown high internal consistency (α=0.80), strong retest reliability at one month (r_s=0.82), and excellent convergent validity with other measures of anxiety (r=0.41-0.67; Campbell-Sills et al., 2009; Norman et al., 2006). Scores from the OASIS were used to control for possible effects of anxiety symptoms on communication given the high rate of reported trait and social anxiety in persons who stutter (Craig & Tran, 2014).

General Self-Efficacy Scale (GSE-6; Romppel et al., 2013; Appendix I). The GSE-6 is a 6-item self-report measure that assesses an individual's belief she or he can engage in adaptive action to help control challenging environmental demands (i.e., self-efficacy). Participants rate

each item on 4-pt Likert scale (1= “Not true at all” to 4= “Exactly true”). Scores across items are summed into a total score with higher scores indicating greater self-efficacy. Items of the GSE-6 have shown high internal consistency (α=0.79-0.88) and moderately strong retest reliability at 12 months (r=0.50) and 28 months (r=0.60). The GSE-6 has shown negative associations with measure of depression (r=-0.45) and anxiety (r=-0.35), positive associations with social support (r=0.30) and mental health (r=0.36). Further, research with the GSE-6 have shown it to be predictive of both mental and physical health scores at 28 months (Romppel et al., 2013). As prior research has shown that self-efficacy is predictive of communicative participation (Boyle et al., 2018), the GSE-6 was included to determine if the PDC showed similar associations.

Adult ADHD Self-Report Scale (ASRS-v1.1)-Part A (Kessler et al., 2005; Appendix J). The ASRS is a self-report scale that assess symptoms and additional executive functioning deficits consistent of attention-deficit/hyperactivity disorder (ADHD) over the past six months on 5-pt Likert scale (0=Never to 4=Very often). The 6-item screener has demonstrated acceptable internal consistency (α=0.63-0.72) and test-retest reliability ranged from 0.58-0.77 over the course of a year (Kessler et al., 2007). Given that attentional abilities have shown significant differences between persons who stutter and persons who do not stutter (Bowers et al., 2018; Druker et al., 2019; Maxfield et al., 2016), and the effects ADHD can have on discounting (Jackson & MacKillop, 2016; Wilson et al., 2011), the ASRS-v1.1 was included as a brief, but valid, measure to control for potential effects of inattentive symptoms on the PDC.

Barrett Impulsivity Scale-11 (BIS-11; Patton et al., 1995; Appendix K). The BIS-11 is a 30-item measure that assess the extent to which an individual exhibits general impulsive behavior, including response inhibition, using a 4-pt Likert scale (1=Rarely/Never to 4=Almost Always/Always). Responses are summed to provide a total score with higher scores indicating

greater impulsive behavior. Further, the BIS-11 underlying factor structure indicates distinct facets of impulsivity with three second-order factors subsuming two first-order factors. The first order factors of attention and cognitive instability are associated with the second order factor of Attentional Impulsiveness. Motor impulsiveness and perseverance are associated with Motor Impulsiveness. Self-control and cognitive complexity are associated with Non-Planning Impulsiveness. The BIS-11 total score has shown high internal consistency (α=0.79-0.83; Patton et al., 1995; Stanford et al., 2009) as well as high re-test reliability at one-month (r_s=0.83; Stanford et al., 2009). Further, the BIS-11 has demonstrated utility in differentiating levels of impulsive behaviors across clinical and non-clinical samples (Patton et al., 1995; Stanford et al., 2009). The BIS-11 was included to control for potential differences in impulsiveness and response inhibition between a stuttering and non-stuttering samples given that individuals who stutter have a higher propensity to be referred for ADHD-related symptoms (e.g., Druker et al., 2019).

Substance Use (Appendix L, M, N, & O). Alcohol, nicotine, and illicit substance use are known factors that can influence rates of discounting (see review MacKillop et al., 2011). Therefore, to control for these factors, participants who endorse a history of alcohol-, illicit substance-, or nicotine-use will complete the Alcohol Use Disorders Identification Test—Version C (AUDIT-C; Barry, Chaney, Stellefson, & Dodd, 2015; Bush, Kivlahan, McDonell, Bradley, & for the Ambulatory Care Quality Improvement Project (ACQUIP), 1998), the Drug Abuse Screening Test (DAST-10; Skinner, 1982), the Penn State Cigarette Dependence Index (PSCDI), and the Penn State Electronic Cigarette Dependence Index (PSECDI; Foulds et al., 2015). All four measures assess an individual's current use and consequences with higher scores indicating an increased risk for a possible substance use disorder.

Both the AUDIT-C and DAST-10 have shown high internal consistency (AUDIT-C α=0.72; DAST-10 α=0.86-0.94) as well as good sensitivity (AUDIT-C=86%-98%; DAST-10=80%) and specificity rates (AUDIT-C=60%-72%; DAST-10=88%; (Barry et al., 2015; Skinner, 1982; Yudko et al., 2007). The PSCDI and PSECDI are based upon previously established measures of nicotine use (e.g., Fagerstrom Test for Nicotine Dependence; Heatherton et al., 1991) and designed to be consistent with DSM-5 criteria for nicotine dependence (APA, 2013; Foulds et al., 2015). Although limited research has been conducted on the psychometric properties for either PSCDI and PSECDI, the PSCDI scores have been predictive of smoking cessation rates (Foulds et al., 2015), whereas the PSECDI has shown significant associations with other measures of electronic cigarette dependence (Morean et al., 2019).

Demographic Questionnaire (Appendix P). The demographics questionnaire asked participants about basic demographic variables (e.g., age, gender, SES, etc.) and stuttering history. Individuals reported on whether they had previously or currently enrolled in stuttering treatment, who was the primary treatment provider, noticed improvement in their dysfluencies, and rated their satisfaction with stuttering treatment using a 5-pt Likert scale (1=Very Unsatisfied to 5=Very Satisfied).

Procedure

Participants completed the study online through the online survey software Qualtrics®. Upon clicking the link participants were directed to read a welcome script (Appendix Q), which then directed them to the informed consent (Appendix R). After reading and agreeing to the informed consent, participants completed a brief screener survey to determine eligibility if they met inclusion or exclusion criteria (Appendix S). Participants who self-reported meeting the inclusion criteria and none of the exclusion criteria were eligible to continue with the study.

Individuals who did not meet the inclusion criteria or endorsed one or more of the exclusion criteria were dismissed from the study.

Stuttering Group. Enrollment in the AWS group was determined via responses during the screening survey. Individuals who met inclusion/exclusion criteria, self-reported a diagnosis of stuttering, and reported current stuttering were placed into the AWS group. Participants completed the PDC, CPI, OASES-A, SAD-D, OASIS, SSS, LSURS, GSE-6, ASRS-v1.1, BIS-11, and demographic information in a randomized order. Individuals who endorsed alcohol, nicotine, or illicit substance use within the past year also completed substance use measures. Upon completion of the assigned measures, participants were enrolled in a drawing for one of ten $25 Amazon Gift Cards.

Individuals who reported a diagnosis of stuttering but denied currently stuttering were temporarily placed into the AWS group as the lack of stuttering currently could be related to developing secondary responses that help the individual avoid moments of stuttering. Upon completion of their participation, individuals temporarily assigned to the AWS group remained in the AWS group if their OASES-A scores fell into the mild-to-moderate range or higher (1.50+). This score was selected as the cut-off as it is indicative of individuals whose overall functioning in communicative situations is not greatly impacted but still report concerns about how stuttering will impact their daily functioning or communication (Yaruss & Quesal, 2010). If scores fell below 1.50, the participant was placed into the AWNS group. All participants who were temporarily assigned to the AWS group remained in the group.

SSI-4 Removal. Originally, participants placed in the AWS group were to schedule a second session to complete the SSI-4 via Zoom® to obtain an objective measure of overt

stuttering behavior. However, difficulties with participants signing up to complete the session or downloading the conferencing software led to this portion of the study to be dropped.

Non-Stuttering Group. Individuals who met the inclusion/exclusion criteria and denied a past or present stuttering diagnosis were placed into the AWNS group. Participants completed the PDC, CPI, SAD-D, OASIS, SSS, LSURS, GSE-6, ASRS-v1.1, BIS-11, substance use measures, and demographic information in a randomized order. Upon completion of the assigned measures, participants were enrolled in a drawing for one of ten $25 Amazon gift cards. These procedures were reviewed and approved by the Idaho State University Humans Subjects Committee.

Data analysis

The data were analyzed using IBM SPSS v26 and GraphPad Prism v9. To determine PD discounting values for participants, their responses on the visual analog scales of the PDC represented their indifference points. Then each participant's indifference points were plotted as a function of odds of stuttering ($p/1-p$; p=probability of stuttering) as opposed to odds against stuttering as it would be expected that communication value would decrease with increasing dysfluency risk. Then, equation 1, the hyperbolic discounting equation (Mazur, 1987) was fit to the data to determine *h*-values. In addition, the hyperboloid equation (Green et al., 1994; Myerson & Green, 1995; equation 2) was also fit to the data:

$$V=A/1+h\Theta, \quad (1)$$

$$V=A/(1+h\Theta)^s. \quad (2)$$

In these equations, *V* is the subjective value of communicating (i.e., indifference point), *A* is the larger, uncertain amount of communication., Θ is the odds of stuttering, and *h* is a free parameter that indexes one's rate of discounting. Higher *h* values indicate a greater preference for the smaller, certain outcome or a higher sensitivity to probabilities (i.e., "risk-aversion"), whereas lower *h* values indicate less sensitivity to probabilities and a greater preference for the larger, uncertain outcome (i.e., "risk-taking" behavior).

In the hyperboloid equation, *s* refers to a nonlinear scaling parameter that is proposed to characterize an individual's sensitivity to the differences between odds. The inclusion of *s* alters the shape of the hyperbola leading to a "leveling off" of values at higher odds. An *s* value of 1 indicates that differences between odds are perceived similarly, where as an *s* values closer to 0 indicates individual's subjective values may show little sensitivity across higher odds compared to lower odds. An *s* value larger than one indicates relatively more sensitivity to higher odds and less sensitivity to lower odds.

Discounting values are often non-normally distributed within a sample, so an alternative analytic approach to using the *h* and *s* free parameters to characterizing PD is often used—area under the curve (AUC; Myerson, Green, & Warusawitharana, 2001). To calculate AUC, the area beneath the discounting curve is determined by creating trapezoids formed by the area between each successive subjective value and the corresponding odds. The following equation is used to calculate the area of each trapezoid:

$$AUC=\Sigma(x_2-x_1)[(y_2+y_1)/2], \quad (3)$$

where *x* refers to the successive odds and *y* refers to the corresponding subjective values. The discounting rate is the sum of the trapezoid areas and is bound between 0 (steepest discounting possible) and 1.0 (no discounting). AUC values offer an atheoretical characterization of PD (Myerson et al., 2001) with lower AUC values representing greater risk aversion/increased discounting and higher AUC values representing lower risk aversion/decreased discounting.

Attention Check. To ensure participants attended to instructions, three "attention check" questions added to demographics and OASIS (e.g., "What was the amount of your last paycheck? Please enter "NONE" if you are paying attention."). Participants who responded incorrectly to two of the three questions were excluded from the analysis. None of the participants failed the attention check.

Covariate Analysis. Prior research indicated that factors such as age, education, years stuttering, years of treatment, and speech usage can function as covariates for communication participation (Boyle et al., 2018). In addition, alcohol, nicotine, and illicit substance use have been shown to influence discounting rates (MacKillop et al., 2011). However, the extent to which these variables functioned as covariates for communication outcomes in discounting was not clear. Therefore, to determine if these variables needed to be included as covariates, Spearman's rho correlations were conducted across all participants between the three conditions of the PDC (*h* values and AUC), the CPI *T*-scores, age, gender, education, and endorsement of alcohol, nicotine, illicit substance use within the past year. Similarly, Spearman's rho correlations were conducted between the PDC, the CPI T-scores, number of years stuttering, and number of treatment attempts among AWS group only. Variables that significantly correlated with the CPI T-score and all three PDC conditions were considered significant covariates.

Significant correlations between three PDC conditions and other variables would suggest a robust relation with discounting (Rodriguez et al., in press).

Main Analyses. Independent samples t-tests and chi-square analyses were utilized to determine differences in demographic variables between the two groups (AWS vs. AWNS). Criteria outlined by Johnson and Bickel, (2008) were used to determine the percentage of individuals who showed systematic or non-systematic responding. Briefly, nonsystematic responding contained either an indifference point that was greater than 20% of the previous indifference point or the final indifference point was not less than 10% of the first indifference point. Chi square analyses were used to determine if there were significant differences in percentage of systematic responders between AWS and AWNS. A 2x3 mixed design ANOVA was used to determine the main effects of group (AWS vs. AWNS as the between-subjects factor) and negative reaction (10%, 50%, and 90% as the within-subjects factor), and interactions on AUC values from the PDC.

To examine other relations among variables, Spearman's rho correlations were conducted to determine associations between the PDC, CPI, and other measures of stuttering, anxiety, and relevant treatment and demographic factors. Four sequential multiple regression equations were used to determine the extent to which GSE-6 and OASES-A scores accounted for significantly more variance in across the three AUC scores of the PDC and the CPI when controlling for relevant covariates. LSURS, SAD-D, and OASIS total scores were entered in the first step and GSE-6, OASES-A, and SSS scores were entered in the second step.

To compare model fit, residual sum of squares (RSS) were calculated and compared between the two equations (hyperbolic and hyperboloid). Lower scores indicated better fit. RSS, as opposed to R^2 values, may be more appropriate for discounting data as R^2 can sometimes

result in uninterpretable negative values and is based on the assumption of a linear—not a nonlinear—relationship between variables (Johnson & Bickel, 2008; Lawyer & Schoepflin, 2013; Spiess & Neumeyer, 2010). In addition, 2x2 repeated measures ANOVAs were used to examine differences in model fit using RSS across the three different negative reaction conditions of the PDC with group as the between-subjects factor and equation (hyperbolic vs. hyperboloid) as the within-subject factor.

Results

Demographic Information

AWS and AWNS groups showed significant differences across several demographic, physical and mental health, and communication related variables (Table 1). The variables of education and employment were dichotomized given the small numbers across group in a manner similar to Boyle et al., (2018). Education was split between no degree in higher education (coded as 0) and obtained a degree in higher education (coded as 1). Employment was split based on employed for wages (coded as 0) and not employed for wages (coded as 1). Endorsement of alcohol-, illicit substance-, and nicotine use within the past year were also dichotomized (0=No, 1=Yes).

Table 1

Demographics Table of Total Sample

Variable	Total Sample *N*=160 M(S.E.)	AWS *n*=67 M(S.E.)	AWNS *n*=93 M(S.E.)	*p*
Age	38.24(1.04)	43.28(1.89)	34.60(1.03)	<0.001*
Gender				0.03*
Female	51.9%	41.8%	59.1%	
Male	48.1%	58.2%	40.9%	
%White[#]	75.6%	77.6%	74.2%	0.62
Income	$61581.26(5666.85)	$61328.22(5857.23)	$61765.53(8845.39)	0.97

%Higher Education Degree	67.5%	76.1%	61.3%	0.05*
%Employed for Wages	81.3%	77.6%	83.9%	0.32
100% Communication Likelihood	66.3%	77.6%	58.1%	0.01*
CPI T-Scores	54.19(0.86)	49.40(0.94)	57.64(1.20)	<0.001*
SSS Total	41.90(2.70)	58.04(3.79)	30.02(3.27)	<0.001*
LSURS				0.87
Undemanding	7.5%	7.5%	7.5%	
Intermittent	36.3%	38.8%	34.4%	
Routine	33.8%	34.3%	33.3%	
Extensive	18.8%	14.9%	21.5%	
Extraordinary	3.8%	4.5%	3.2%	
SAD-D	11.10(0.75)	10.71(1.07)	11.37(1.03)	0.92
OASIS	5.85(0.33)	5.71(0.41)	5.94(0.48)	0.72
GSE-6	18.35(0.25)	18.36(0.33)	18.35(0.35)	0.98
BIS	59.32(0.95)	56.42(1.10)	61.43(1.39)	0.005*
% used alcohol in the past year	75%	73.1%	76.3%	0.64
% used illicit substances in the past year	24.4%	19.4%	28.0%	0.23
% used cigarettes in the past year	26.3%	9%	38.7%	<0.001*
% used e-cigarettes in the past year	16.3%	7.5%	22.8%	0.01*
Positive ASRSv1.1	38%	16.4%	29%	0.06
Endorsed mental health diagnosis	30%	31.3%	29%	0.75

Note. *$p \leq 0.05$; [#]largest group by percentage; AWS=Adults Who Stutter; AWNS=Adults Who Do Not Stutter; CPI=Communicative Participation Item Bank; SSS=Subjective Stuttering Scales; LSURS=Level of Speech Use Rating Scale; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; GSE-6=General Self-Efficacy Scale; BIS-11=Barrett Impulsivity Scale-11; ASRS-v1.1=Adult ADHD Self-Report Scale

Individuals in the AWS group were significantly older than individuals in the AWNS group [$t(104.31)=-4.04$, $p<0.001$, 95%CI[-12.94,-4.42], $d=0.67$]. Chi-square analyses revealed there were significant differences between the number of males and females across AWS and

AWNS groups [$\chi^2(1)=4.70$, $p=0.03$]. Based on the odds ratio, the odds of identifying as male in the AWS group was 2.02 times as high than identifying as female. In addition, significantly more individuals in the AWS group obtained a degree in higher education relative to the AWNS group [$\chi^2(1)=3.90$, $p=0.05$]. AWS were 100% likely to engage in a communicative situation with 0% stuttering and NR risk at a greater frequency than AWNS [$\chi^2(1)=6.66$, $p=0.01$]; indeed, the odds ratio of 100% likelihood was 2.61 times higher in the for AWS relative to AWNS. T-tests showed that the AWS group scored significantly lower on the CPI [$t(157.16)=157.16$, $p<0.001$, 95%CI[5.23,11.24], $d=0.84$] and significantly higher on the SSS [$t(155)=-5.84$, $p<0.001$, 95%CI[-38.86,-19.22], $d=0.95$] compared to the AWNS group, which indicates the AWS group were less likely to participate in communication situations and perceived their dysfluencies as more impactful on their daily life.

In addition, the AWNS group showed significantly higher scores on the BIS compared to the AWS group [$t(156.32)=2.83$, $p=0.005$, 95%CI[1.52,8.52], $d=0.44$], indicating higher rates of self-reported impulsivity in the AWNS group. Between the AWS and AWNS groups, chi-square analyses revealed that the frequencies between smokers and non-smokers [$\chi^2(1)=17.81$, $p<0.001$] and e-cigarette and non-e-cigarette users [$\chi^2(1)=6.69$, $p=0.01$] significantly differed with the odds being lower for individuals in the AWNS group. Odds ratios indicated that the odds of being a smoker was 6.3 times as high and the odds of being an e-cigarette user was 3.75 times as high for participants in the AWNS group than those in the AWS group. No significant differences between the AWS and AWNS groups were observed on income, employment, LSURS, SAD-D, OASIS, GSE-6, alcohol use, illicit substance use, positive ADHD screen, or endorsed a mental health diagnosis. When examining the severity of alcohol, illicit substance, and nicotine use among individuals in both groups who endorsed using these substances in the past year, no

significant differences were observed on the DAST-10, PSCDI, or PSECDI (Table 2). However, the AWNS group reported significantly higher scores on the AUDIT-C compared to the AWS group [$t(116.98)=2.08$, $p=0.04$, 95%CI[0.01,0.41], $d=0.38$].

Table 2

Alcohol and substance use symptom severity

Measure	Total M(S.E.)	Stuttering M(S.E.)	Control M(S.E.)	*p*
AUDIT-C	*n*=120 3.56(0.20)	*n*=49 3.02(0.23)	*n*=71 3.93(0.30)	0.04*
DAST-10	*n*=39 2.77(0.31)	*n*=13 2.08(0.35)	*n*=26 3.12(0.42)	0.08
PSCDI	*n*=42 8.24(0.71)	*n*=6 6.83(1.78)	*n*=36 8.47(0.78)	0.43
PSECDI	*n*=26 6.42(0.85)	*n*=5 4.80(1.66)	*n*=21 6.81(0.97)	0.36

Note. *$p \leq 0.05$; AUDIT-C=Alcohol Use Disorders Identification Test—Version C; DAST-10=Drug and Abuse Screening Test—10; PSCDI=Penn State Cigarette Dependence Index; PSECDI=Penn State Electronic Cigarette Dependence Test

Specific Stuttering Group Demographics. Specific demographic and treatment characteristics of the AWS group are presented in Table 3.

Table 3

Specific Demographic and Treatment Characteristics of Stuttering Sample

Variable	M(S.E.)
Age of Stuttering Onset	4.63(0.22)
Years Stuttering	38.66 (1.91)
Diagnosing Provider	
Speech Language Pathologist	88.1%
Medical Provider	1.5%
Psychologist	4.5%
Other	1.5%
OASES-A Total Scores	3.35(0.09)
OASES-A Specifiers	
Mild/Moderate	9.0%
Moderate	19.4%

Moderate/Severe	34.3%
Severe	37.3%
Currently Experiencing Stuttering	94%
Number of Treatment Attempts	2.64(0.16)
Previously Attended Treatment for Stuttering	92.6%
Past Stuttering Treatment Provider	
Speech Language Pathologist	90%
Medical Provider	2.0%
Psychologist	4.0%
Other	4.0%
Noticed Improvement in Dysfluencies from Past Stuttering Treatment	64%
Satisfaction with Past Treatment	3.36(0.17)
Currently Attending Treatment for Stuttering	14.9%
Current Stuttering Treatment Provider	
Speech Language Pathologist	100%
Medical Provider	0%
Psychologist	0%
Other	0%
Noticed Improvement in Dysfluencies from Current Treatment	11.9%
Satisfaction with Current Treatment	4.3(0.21)
Currently have prescription for stutter	4.5%

Note. OASES-A=Overall Assessment of the Speaker's Experience of Stuttering—Adult; Satisfaction for stuttering treatment rated on a 5-pt Likert scale (1=Very Unsatisfied to 5=Very Satisfied)

Participants reported they had been stuttering for over 38 years on average and currently reported the severity and impact on daily functioning fell within the moderate/severe range (OASES-A *M*=3.35). A large portion of the sample reported current stuttering and had experienced approximately 2-3 treatment attempts in the past. Over half of the participants who had experienced treatment in the past noted an improvement in their dysfluencies but less than 12% of those currently enrolled in treatment noticed an improvement. Many of the professionals providing diagnosis and treatment were speech language pathologists. Less than 5% of the sample reported a medication prescribed specifically for their stutter

Table 4

Spearman's rho correlations between discounting values and other possible covariates across all participants (N=160)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11,	12.	13.	14.
1. *h* value 10% NR	-													
2. *h* value 50% NR	.78**	-												
3. *h* value 90% NR	.71**	.86**	-											
4. AUC 10% NR	-.94**	-.72**	-.64**	-										
5. AUC 50% NR	-.77**	-.96**	-.83**	.76**	-									
6. AUC 90% NR	-.70**	-.86**	-.97**	.66**	.87**	-								
7. CPI T-Score	-.19*	-.08	-.10	.26**	.15	.14	-							
8. Age	.08	.04	.02	-.04	.03	.01	.07	-						
9. Gender	.05	.18*	.05	-.04	-.18*	-.04	.08	.02	-					
10. Education	-.13	-.18*	-.15	.16*	.21**	.14	.16	.23**	-.11	-				
11. Alcohol Use	.04	.06	-.003	-.02	-.03	.04	-.08	.13	.07	-.06	-			
12. Illicit Substance Use	.01	.04	.03	-.03	-.02	-.01	-.07	-.20*	.03	-.17*	-.19*	-		
13. Nicotine Use	.01	.07	.05	.07	-.004	-.05	.10	.13	.02	.19*	.02	-.32*	-	
14. Vaporizer Use	.06	.05	.08	-.10	-.08	-.07	-.05	-.23**	-.02	-.24**	-.18*	.22**	-.39**	-
15. BIS-11	.05	-.02	-.02	-.11	-.07	-.04	-.36**	-.19*	-.07	.01	-.18*	.20*	-.24**	.20*

Note. *p<0.05 **p<0.01 NR=Negative Reaction; AUC=Area under the curve; CPI=Communicative Participation Item Bank; BIS-11=Barrett Impulsivity Scale-11

Covariate Analyses.

Due to skewness, total scores from the SAD-D were normalized using square root transformation. Analyses revealed that none of the expected covariates were significantly correlated with all three conditions of the PDC and the CPI (Table 4). In addition, analyses of demographic variables revealed a difference of BIS scores between the AWS and AWNS groups. However, the BIS did not significantly correlate with any condition of the PDC or the CPI. Years stuttering and number of treatment attempts were not significantly correlated with the PDC or the CPI among the AWS group only (Table 5).

In addition, Spearman's correlations were conducted examining the relations among alcohol, illicit substance, and nicotine use severity measures among individuals who endorsed use of such substances. Results revealed no significant associations between *h* and AUC values of the PDC, CPI, AUDIT-C, DAST-10, PSCDI, and PESCDI across the total sample or associations are examined between groups with one exception. The DAST-10 and CPI showed a significant negative association across the total sample (r_s=-0.41, p=0.01) and when only the AWNS group was examined (r_s=-0.54, p=0.006); there was no significant association among the AWS group only. Results from one-way and repeated-measure ANOVA revealed no significant differences between the CPI and PDC values by gender. Therefore, no additional covariates were included in the main analyses.

Table 5

Spearman's rho correlations AWS only (n=67)

Variable	1.	2.	3.	4.	5.	6.	7.	8.
1. *h* value 10% NR	-							
2. *h* value 50% NR	.80**	-						
3. *h* value 90% NR	.65**	.86**	-					
4. AUC 10% NR	-.97**	-.79**	-.66**	-				
5. AUC 50% NR	-.81**	-.98**	-.85**	.80**	-			
6. AUC 90% NR	-.70**	-.88**	-.98**	.72**	.89**	-		
7. CPI T-Score	-.42**	-.44**	-.45**	.45**	.46**	.52**	-	
8. # of years stuttering	.02	-.03	-.05	-.06	.06	.06	.09	-
9. #of tx attempts	-.05	-.16	-.19	.06	.13	.14	-.05	.07

Note. **p<0.01 AWS=adults who stutter; NR=Negative Reaction; AUC=Area Under the Curve; CPI=Communicative Participation Item Bank; tx=treatment

Probability Discounting

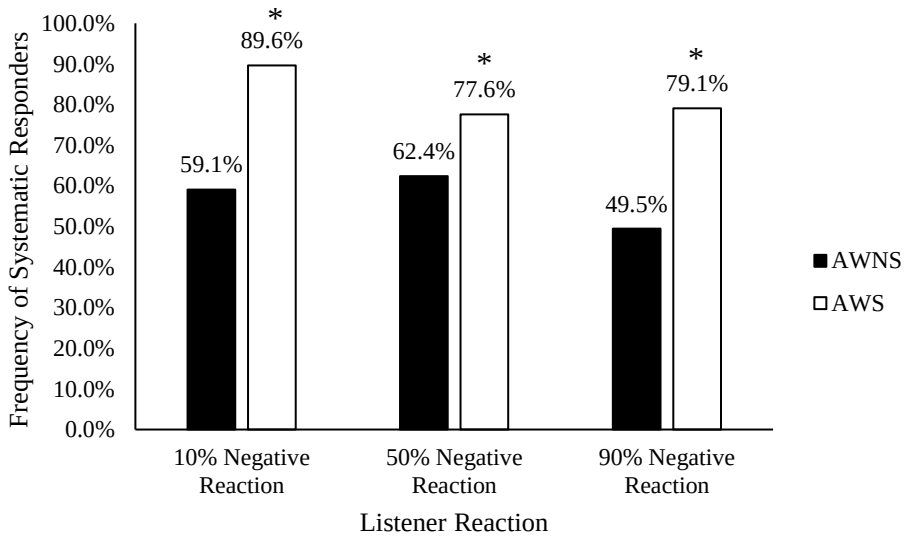
Systematic vs. Non-systematic responding. The percentage of systematic and non-systematic responders across groups and the three levels of negative reaction (NR) are presented in Figure 3. Indifference points across both groups were classified as systematic or non-systematic utilizing criteria described in Johnson and Bickel (2008). Between 49-90% of the data were systematic, depending on NR condition. Importantly, there were differences in systematic data between the AWS and AWNS groups. AWS showed significantly higher systematic data (between 79-90%) than the AWNS group (between 49-63%). Chi-square analyses revealed that frequency of systematic vs. non-systematic responders between AWS and AWNS groups were significantly different across 10% [$\chi^2(1)=17.81$, $p<0.001$], 50% [$\chi^2(1)=4.21$, $p=0.04$], and 90% NR [$\chi^2(1)=14.51$, $p<0.001$].

Odds ratios for systematic responding between groups varied across the three NR conditions. For the 10% NR condition, the odds of being a systematic responder was 5.91 times higher for the AWS group than those in the AWNS group. For the 50% NR condition, the odds

of being systematic were 2.09 higher and for the 90% negative reaction group the odds of being systematic 3.87 times higher for the AWS group than the AWNS group.

Figure 3

Frequencies of systematic responders



Note. *p<0.05 AWNS=adults who do not stutter; AWS=adults who do stutter

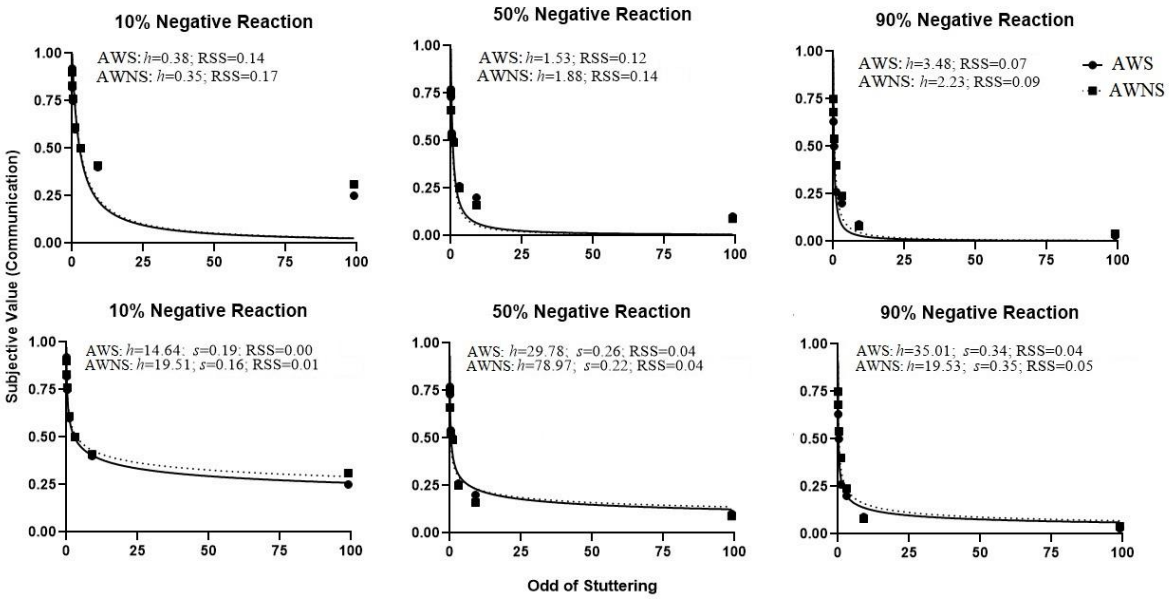
***H*-values and area under the curve.** *H*-values derived from both the hyperbolic or hyperboloid equation demonstrated significant skewness prior and post-transformation across all three NR conditions of the PDC, therefore non-parametric analyses were used to examine association with *h* values from the hyperbolic equation. AUC values demonstrated a normal distribution and were utilized to examine differences between groups using parametric analyses.

Discounting curves for each condition and group for both discounting models (top: hyperbolic; bottom: hyperboloid) are presented in Figure 4. Across all conditions, both AWS (circles) and AWNS groups (squares) demonstrated a hyperbolic decay in communication likelihood as the odds of stuttering increased. This hyperbolic decay was observed across all NR conditions. For the hyperbolic model, RSS values ranged from 0.07-0.14 among the AWS group and 0.09-0.17 AWNS group. Hyperbolic *h*-values ranged from 0.38-3.48 among the AWS group

and from 0.35-2.23 among the AWNS group. RSS of the hyperboloid equation ranged from 0.00-0.04 among the AWS group and 0.01-0.05 among the AWNS group. Hyperboloid *h*-values ranged from 14.64-35.01 for the AWS group and from 19.51-78.97 for the AWNS group.

Figure 4

Goodness-of-fit lines and discounting values of median indifference points



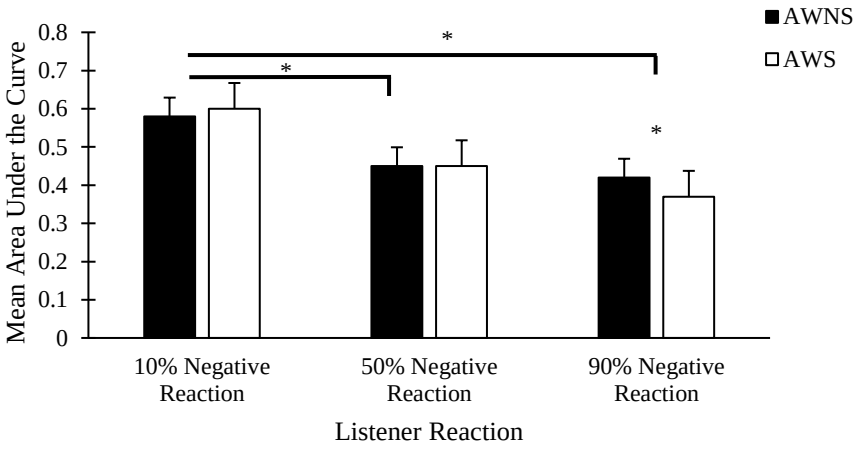
Note. AWS=adults who stutter; AWNS=adults who do not stutter; Subjective value (median indifference points) of communicating as a function of the odds of stuttering across three different probabilities of a negative reaction. Goodness of fit lines using the hyperbolic equation (equation 1) are presented in the top three graphs those for the hyperboloid equation (equation 2) are in the bottom three graphs.

Mean AUC values that reflect discounting are presented in Figure 5 as a function of NR condition. A mixed ANOVA revealed a significant main effect of magnitude [$F(2,316)=103.15$, $p<0.001$, $\eta_p^2=0.40$]. Simple contrast analyses revealed that the 50% negative reaction condition [$F(1,158)=101.08$, $p<0.001$, $\eta_p^2=0.39$] and the 90% negative reaction condition [$F(1,158)=130.06$, $p<0.001$, $\eta_p^2=0.45$] were significantly lower than the 10% negative reaction condition when controlling for the main effect of group. There was no significant main effect of group, however, there was a significant interaction of magnitude X group [$F(2,316)=3.45$,

p=0.03, η_p^2=0.02]. The interaction was primarily driven by the significantly lower AUC scores in the AWS group (M=0.37, $S.E.$=0.04) compared to the AWNS group (M=0.42, $S.E.$=0.03) in the 90% negative reaction condition. Analyses with systematic responders only continued to show main effect of magnitude; however, neither the main effect of group or the interaction were significant (see Appendix T for more detailed analysis of systematic responders).

Figure 5

Area under the curve values between AWS and AWNS groups



Note. *p<0.05; AWNS=adults who do not stutter; AWS=adults who stutter

Stuttering group only. To determine if relations among stuttering and communication measures and the PDC were dependent upon AWS or AWNS status, correlations were conducted separately for each group. Correlations between the PDC and other measures among the AWS group only are presented in Table 6. Spearman's rho correlations revealed statistically

Table 6

Spearman's rho correlations between discounting, communication, and anxiety measures AWS only (n=67)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. *h* value 10% NR	-													
2. *h* value 50% NR	.80**	-												
3. *h* value 90% NR	.65**	.86**	-											
4. AUC 10% NR	-.97**	-.79**	-.66**	-										
5. AUC 50% NR	-.81**	-.98**	-.85**	.80**	-									
6. AUC 90% NR	-.70**	-.88**	-.98**	.72**	.89**	-								
7. CPI T-Score	-.42**	-.44**	-.45**	.45**	.46**	.52**	-							
8. OASES-A Total	.38**	.41**	.44**	-.42**	-.44**	-.50**	-.84**	-						
9. SSS Total	.31*	.36**	.42**	-.32**	-.37**	-.47**	-.71**	.78**	-					
10. SAD-D [sqrt]	.29*	.39**	.42**	-.29*	-.40**	-.45**	-.64**	.78**	.68**	-				
11. OASIS	.21	.25*	.26*	-.20	-.24*	-.26*	-.63**	.63**	.59**	.73**	-			
12. GSE-6	-.27*	-.24*	-.26*	.34*	.26*	.30*	.59*	-.51*	-.37*	-.33*	-.40**	-		
13. LSUR	-.30*	-.32**	-.31*	.31**	.33**	.31**	.32**	-.41**	-.24	-.30*	-.17	.41**	-	
14. # of years stuttering	.02	-.03	-.05	-.06	.06	.06	.09	-.17	-.17	-.25*	-.19	-.05	-.04	-
15. # of tx attempts	-.05	-.16	-.19	.06	.13	.14	-.05	.10	.02	.09	-.03	-.13	-.18	.07

Note. *$p \leq 0.05$; ** $p < 0.01$; AWS=adults who stutter; NR=Negative Reaction; AUC=Area Under the Curve; CPI=Communicative Participation Item Bank; OASES-A=Overall Assessment of the Speaker's Experience of Stuttering-Adult; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; GSE-6=General Self-Efficacy Scale; LSUR=Level of Speech Use Rating Scale; tx=treatment

significant, positive associations (rs=0.65-0.86, p<0.01) between the h-values across the three NR conditions. H-values examined were those derived from the hyperbolic equation. Similarly, AUC values showed significant, positive associations with each other across the three NR conditions (rs=0.72-0.89, p<0.01). In addition, h and AUC values showed significant, negative relations with each other (rs= -0.72 to -0.96, p<0.01). Among the AWS group, h-values of the PDC showed significant, negative, associations with the CPI across the NR conditions (rs=-0.42-0.45, p<0.001). In addition, the CPI showed significant, positive associations with AUC values across those conditions (rs=0.45-0.52, p<0.001).

Among the AWS group, self-reported measures of stuttering severity were significantly associated with all three conditions of the PDC. The OASES-A was positively associated with PDC h-values (rs=0.38-0.44, p<0.05) and negatively associated with AUC values (-0.42 to -0.50, p<0.05). SSS total scores were significantly positively related to h-values (rs=0.31-0.42, p<0.01) and negatively related to AUC values (rs=-0.32 to -0.47, p<0.05).

The GSE-6 also showed significant, negative associations with h-values across all three NR conditions (rs=-0.24 to -0.27, $p\leq$0.05) and significant, positive associations with AUC values across all three NR conditions (rs=0.26-0.34, p<0.01). The SAD-D showed significant positive associations with h-values (rs=0.29-0.42, p<0.05) and AUC values (rs=-0.29 to -0.45, p<0.05). The OASIS showed significant, positive relations with h-values of the 50% and 90% condition (rs=0.25-0.26), p=0.04), but not the 10% condition. The OASIS showed significant, negative associations with AUC values of the 50% and 90% conditions (rs=-0.24-0.-26, p=0.04), but not the 10% condition.

With systematic responders only (Appendix T), subjective measures of stuttering showed different associations with the PDC. The SSS was no longer associated with the 10% NR h-

values and AUC values or the 50% AUC values. The OASES-A, however, remained significantly associated with discounting values except for the 10%NR *h* value. Similarly, self-efficacy (GSE-6) was not significantly associated with all *h* or AUC values but showed only significant associations for the 90%NR *h*-values and the 10% and 90% AUC values. Measures of anxiety (OASIS and SAD-D) and speech use (LSUR) were no longer significant with *h* values or AUC values across any NR condition.

To determine the extent to which measures of self-efficacy and measures of the internal stuttering experience predicted significantly more variance in PDC and CPI scores than measures of anxiety, four separate sequential multiple regressions were conducted. All four models had speech usage and anxiety (LSURS, SAD-D, OASIS) entered into the first step and subjective stuttering severity and self-efficacy (OASES-A, SSS, and GSE-6) entered into the second step but differed in terms of the criterion variable. The first three models regressed variables onto the 10%, 50%, and 90% NR AUC values whereas the fourth model regressed variables onto communicative participation (CPI).

Regression Analysis. For the first regression analysis—the 10% NR condition (Table 7)—the first full model was not significant. When the SSS, OASES-A, and GSE-6 entered the model, the model trended towards significance and the OASES-A was revealed to be a significant, negative predictor of 10% NR AUC ($r_{12.3}$=-0.26). However, the change in R^2 with the inclusion of the two additional parameters did not significantly account for more variance.

Table 7

Regression Summary Predicting PDC AUC values of the 10% NR Condition

Variable	*b* (SE)	β	*t*	R^2	ΔR^2	*p*
			Step One			
				0.11		0.08
(Constant)	0.59(0.12)		5.04			<0.001*

LSURS	0.04(0.03)	0.18	1.46			0.15
SAD-D [sqrt]	-0.04(0.03)	-0.26	-1.42			0.16
OASIS	0.003(0.01)	0.05	0.29			0.77
		Step Two				
				0.18	0.08	0.06
(Constant)	0.95(0.34)		2.79			0.007*
LSURS	0.03(0.03)	0.11	0.78			0.44
SAD-D [sqrt]	0.001(0.04)	0.01	0.04			0.97
OASIS	0.007(0.01)	0.11	0.61			0.55
SSS	0.001(0.001)	0.11	0.53			0.60
OASES-A	-0.16(0.08)	-0.51	-2.08			0.04*
GSE-6	0.001(0.01)	0.02	0.10			0.92

Note. *$p \leq 0.05$; LSUR=Level of Speech Use Rating Scale; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; OASES-A=Overall Assessment of the Speaker's Experience of Stuttering-Adult; GSE-6=General Self-Efficacy Scale

For the second regression analysis—50% NR condition (Table 8)—the first model was statistically significant [$F(3,64) = 5.62$, $p = 0.002$] and SAD-D was a significant, negative predictor ($r_{12.3} = -0.33$). When the SSS, GSE-6 and OASES-A entered the model, the model remained significant, [$F(6,64) = 3.64$, $p = 0.004$]; however, the inclusion of the additional parameters did not account for significantly more variance nor were there any significant predictors.

Table 8

Regression Summary Predicting PDC AUC values of the 50% NR Condition

Variable	*b* (SE)	β	*t*	R^2	ΔR^2	*p*
		Step One				
				0.22		0.002*
(Constant)	0.53(0.12)		4.47			<0.001*
LSURS	0.04(0.03)	0.17	1.41			0.16
SAD-D [sqrt]	-0.08(0.03)	-0.47	-2.80			0.007*
OASIS	0.01(0.01)	0.13	0.77			0.44
		Step Two				
				0.27	0.06	0.004*
(Constant)	1.01(0.35)		2.91			0.005*
LSURS	0.04(0.03)	0.14	1.08			0.29
SAD-D [sqrt]	-0.04(0.04)	-0.21	-1.00			0.32
OASIS	0.01(0.01)	0.15	0.88			0.39

SSS	0.000(0.001)	-0.05	-0.26		0.79
OASES-A	-0.13(0.08)	-0.38	-1.62		0.11
GSE-6	-0.01(0.01)	-0.10	-0.69		0.49

Note. *$p \leq 0.05$; LSUR=Level of Speech Use Rating Scale; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; OASES-A=Overall Assessment of the Speaker's Experience of Stuttering-Adult; GSE-6=General Self-Efficacy Scale

For the third regression analysis—the 90% NR condition—AUC values are presented in Table 9. The first model was statistically significant [$F(3,64=6.61$. $p=0.001$] with SAD-D total score ($r_{12.3}$=-0.37) as a significant predictor. With the inclusion of the SSS, OASES-A and GSE-6, the model still remained significant [$F(6,64)=4.40$, $p=0.001$); however, no single predictor was statistically significant. Further, the inclusion of the additional parameters did not account for significantly more variance.

Table 9

Regression Summary Predicting PDC AUC values of the 90% NR Condition

Variable	*b* (SE)	β	*t*	R^2	ΔR^2	*P*
		Step One				
				0.25		0.001*
(Constant)	0.49(0.13)		3.89			<0.001*
LSURS	0.04(0.03)	0.14	1.25			0.22
SAD-D [sqrt]	-0.10(0.03)	-0.52	-3.13			0.003*
OASIS	0.01(0.01)	0.13	0.80			0.43
		Step Two				
				0.31	0.07	0.001*
(Constant)	0.76(0.37)		2.09			0.04*
LSURS	0.02(0.04)	0.08	0.67			0.51
SAD-D [sqrt]	-0.05(0.04)	-0.26	-1.29			0.20
OASIS	0.02(0.01)	0.21	1.23			0.23
SSS	-0.001(0.002)	-0.16	-0.87			0.39
OASES-A	-0.10(0.08)	-0.29	-1.27			0.21
GSE-6	0.001(0.01)	0.01	0.08			0.93

Note. *$p \leq 0.05$; LSUR=Level of Speech Use Rating Scale; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; OASES-A=Overall Assessment of the Speaker's Experience of Stuttering-Adult; GSE-6=General Self-Efficacy Scale

The final regression analysis—for the CPI—revealed that the first model was statistically significant [Table 10; $F(3,64)=20.04$, $p<0.001$] with the SAD-D ($r_{12.3}$=-0.36) and OASIS ($r_{12.3}$=-0.29) as significant, negative predictors of CPI T scores. When the SSS, GSE-6 and OASES-A were entered into the model, the model remained statistically significant [$F(6,64)=31.14$, $p<0.001$] and both GSE-6 ($r_{12.3}$=0.32) and OASES-A total score ($r_{12.3}$=-0.51) were significant predictors. In addition, the inclusion of the additional parameters accounted for significantly more variance [$F(3,58)=21.78$, $p<0.001$]. When conducting these four regressions with systematic responders only, no model or variable was a significant predictor of 10%, 50%, or 90% NR AUC values. However, predictors for the CPI remained similar with the exception of the SAD-D, which was not significant in either the first or second step.

Table 10

Regression Summary Predicting CPI T-Scores

Variable	*b* (SE)	β	*t*	R^2	ΔR^2	*P*
		Step One				
				0.50		<0.001*
(Constant)	57.10(2.83)		20.15			<0.001*
LSURS	0.89(0.74)	0.11	1.20			0.24
SAD-D [sqrt]	-2.10(0.71)	-0.41	-2.98			0.004*
OASIS	-0.66(0.28)	-0.32	-2.39			0.02*
		Step Two				
				0.76	0.27	<0.001*
(Constant)	63.40(5.94)		10.67			<0.001*
LSURS	-0.51(0.57)	-0.07	-0.90			0.37
SAD-D [sqrt]	0.21(0.62)	0.04	0.33			0.74
OASIS	-0.24(0.21)	-0.12	-1.18			0.24
SSS	-0.04(0.03)	-0.16	-1.51			0.14
OASES-A	-5.93(1.32)	-0.59	-4.49			<0.001*
GSE-6	0.56(0.22)	0.20	2.52			0.01*

Note. *$p\leq0.05$; LSUR=Level of Speech Use Rating Scale; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; OASES-A=Overall Assessment of the Speaker's Experience of Stuttering-Adult; GSE-6=General Self-Efficacy Scale

Non-stuttering group only. Correlations between the PDC and other measures in the AWNS group are presented in Table 11. Correlations between *h* and AUC values maintained similar, significant associations as the total sample. The GSE-6 showed a significant, negative association with the 10% negative reaction *h* value (*r*s=-0.27) but no significant associations

Table 11

Spearman's rho correlations between discounting, communication, and anxiety measures among AWNS only (n=93)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. *h* value 10% NR	-										
2. *h* value 50% NR	.77**	-									
3. *h* value 90% NR	.74**	.86**	-								
4. AUC 10% NR	-.92**	-.70**	-.64**	-							
5. AUC 50% NR	-.74**	-.95**	-.83**	.74**	-						
6. AUC 90% NR	-.70**	-.84**	-.96**	.64**	.86**	-					
7. CPI T-Score	-.09	.08	.09	.20	.03	-.06	-				
8. SSS Total	.08	-.15	-.18	-.12	.11	.18	-.66**	-			
9. SAD-D [sqrt]	.09	-.04	-.02	-.18	-.09	-.04	-.76**	.61**	-		
10. OASIS	.18	.10	.15	-.23*	-.15	-.15	-.45**	.34**	.65**	-	
11. GSE-6	-.27*	-.20	-.17	.36**	.31**	.21*	.49**	-.26*	-.37**	-.30**	-
12. LSUR	-.04	.02	.07	.10	.01	-.09	.33**	-.28**	-.31**	-.23*	.15

Note. *p<0.05; ** p<0.01; AWNS=adults who do not stutter; NR=Negative Reaction; AUC=Area Under the Curve; CPI=Communicative Participation Item Bank; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; GSE-6=General Self-Efficacy Scale; LSUR=Level of Speech Use Rating Scale

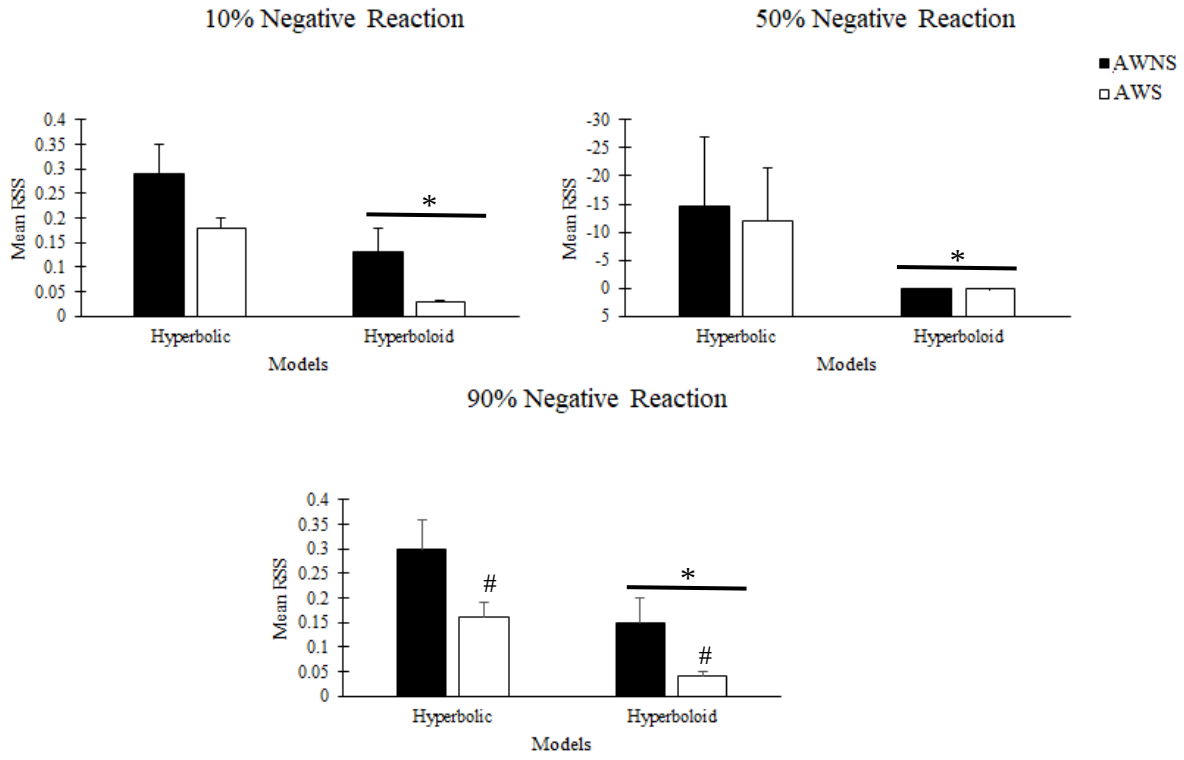
were observed with *h* values from the 50% or 90% NR condition. However, the GSE-6 showed significant, positive association with AUC across the three NR conditions (*r*s=0.21-0.36). There was a significant, negative relation between the AUC value of the 10% NR condition and the

OASIS, but no other significant associations were observed with AUC across the 50% and 90% NR conditions. Further, *h*-values were not associated with the OASIS, and *h* and AUC values were not related to the CPI, SSS, and SAD-D total scores. The OASIS and GSE-6 were not significantly associated with the PDC when examined with systematic responders only.

Model fit. To evaluate model fit, mean RSS values are presented against model type and stuttering status in Figure 6. To determine the extent to which the hyperbolic (equation 1) versus the hyperboloid (equation 2), three 2x2 repeated measure of ANOVAs—one for each NR condition—were conducted with group (AWS vs. AWNS) as the between subject

Figure 6

Mean residual sum of squares across NR conditions



Note. *,#p<0.05; AWS=adults who stutter; AWNS=adults who do not stutter; Error bars for the hyperboloid equation of the 50% NR are present but are covered by the bars

factors and equation model (hyperbolic vs. hyperboloid) as the within subject factors. For the 10% NR conditions, there was a significant main effect of model type [$F(1,154)=60.301$, $p<0.001$, $\eta_p^2=0.28$] with the hyperboloid equation accounting for less residual error than the hyperbolic; there was no main effect of group or interaction.

Results of the 50% negative reaction condition revealed a significant main effect of model type [$F(1,149)=11.25$, $p=0.001$, $\eta_p^2=0.07$], in which the hyperboloid had significantly lower RSS compared to the hyperbolic equation ($p=0.001$). There was no significant main effect of group or an interaction.

For the 90% negative reaction group, there was a significant main effect of model [$F(1,143)=45.37$, $p<0.001$, $\eta_p^2=0.24$], with the hyperboloid equation accounting for less residual error than the hyperbolic. There was a significant main effect of group [$F(1,143)=4.04$, $p=0.04$, $\eta_p^2=0.03$] with AWS showing lower RSS than AWNS. There was not a significant interaction.

Exploratory Analyses. The first item of the PDC, which does not factor into the calculation of discounting scores, asks individuals to rate their likelihood of engaging in a communicative situation under ideal circumstances (i.e., when the risk of dysfluency was 0% and the risk of a negative reaction was also 0%). Exploratory analyses examining differences based on selection of this item can be found in Appendix U.

Discussion

The purpose of the present study was to develop and validate a PD task for communication among a stuttering population that incorporated the odds of a dysfluency and the likelihood of a negative social reaction. Discounting patterns and values were compared between AWS and AWNS to determine if there were significant differences in systematic data and risk sensitivity between populations. In addition, variables were compared between AWS

and AWNS to assist in its validation with the hypotheses that only certain demographic variables (e.g., communication participation, self-efficacy, stuttering) would be significantly correlated with the discounting task among a stuttering population. Finally, measures of self-efficacy and stuttering were assessed to determine if they accounted for significantly more variance in discounting scores among AWS.

Characterization of AWS and AWNS

In this sample, AWS and AWNS differed on several demographic variables. AWS were significantly older, more likely to identify as male, endorsed higher education, reported less impulsivity, less nicotine use, and lower alcohol severity use compared to AWNS. In addition, AWS reported less communication participation, higher subjective stuttering scores, and levels of speech usage. These scores were comparable to those found in other AWS samples (e.g., Boyle et al., 2018). Differences between gender among AWS is expected given that stuttering has been found in males relatively more frequently than females (Bloodstein & Ratner, 2008; Guitar, 2014; Neumann et al., 2017; Yairi & Ambrose, 2013).

There is no research to date on age-related differences in PD, though previous research has revealed age-related differences in sensitivity to delayed outcomes (i.e., less discounting), with younger individuals as more impulsive (Green et al., 1994). Indeed, substance use and problematic gambling tend to predict lower PD (risky choice) and steeper delay discounting than non-users (e.g., Bickel et al., 1999; Madden et al., 2009; Petry, 2012), though this is with the outcome of money. Although differences in group demographics factors may have influenced responses on the PDC, analyses indicated that these variables were not significantly correlated with communication discounting.

Probability Discounting of Communication

For both groups, the odds of stuttering led to a hyperbolic decrease in the subjective value of communication. This was the case across all three NR conditions. Moreover, as NR probability increased, steeper discounting was observed regardless of group condition, suggesting a magnitude effect. Magnitude effects have been previously demonstrated across other commodities such as money (Myerson et al., 2011), illicit substances (Kirby et al., 1999), and food (Hendrickson et al., 2015). This novel finding from this study, then, expands the literature on magnitude effects in discounting to include communication as an outcome.

AWS demonstrated significantly steeper discounting (i.e., lower AUC values) compared to AWNS under conditions of highest risk of NR from the listener. However, the effect for the interaction was small—only accounting for 2% of the variance—and was not significant when examined with systematic responders only. Moreover, there were no group differences with the other NR conditions. This lack of a robust between-group discounting finding was unexpected, given the greater history of negative communicative experiences among AWS (Boyle, 2017; Bricker-Katz et al., 2010, 2013; Klein & Hood, 2004; Logan & O'Connor, 2012; Zeigler-Hill et al., 2019).

There are potential reasons for this lack of difference. First, it may be that the negative communication experiences associated specifically with stuttering may not be associated with differences in communication on the PDC. Second, recruitment practices differed between the two groups. All but three AWS were recruited through the National Stuttering Association (NSA) list serv. The NSA is a non-profit organization for adults and adolescents who stutter, their families, and professionals whose mission is focused on instilling positive self-identity and providing a sense of community among individuals who stutter through education, advocacy,

outreach, and research (NSA, 2020). Through the annual national conference and a strong online presence that includes access to support groups and a digital library, members can be among a community of individuals with shared experiences as they express their struggles in communicative situations and receive positive, affirming support. Research on marginalized communities (e.g., LGBTQ+) shows that therapeutic environments focused on the affirmation of a marginalized identity decreases psychiatric symptoms (Ellis, 2020; Ellis et al., 2020; Pachankis et al., 2020). Therefore, it may be possible that among this sample, exposure to NSA-contingencies focused on the reinforcement of community-building behaviors and communication *as opposed to decreasing dysfluencies* attenuated the participants' sensitivity to aversive variables. This may explain the similarity in discounting to participants who do not stutter.

Despite the lack of robust differences in discounting between AWS and AWNS groups, examination of the percent of systematic data between groups produces a potentially meaningful effect. Between 77.6-89.6% (depending on NR condition) were systematic for those who stutter, while only 49.5-62.4% were systematic for those who do not stutter. This means that AWS have between 2.09-5.91 greater odds of producing systematic PD data than AWNS. The frequency of systematic responders in this current study was comparable to percentages found in other discounting studies using monetary or non-monetary outcomes (e.g., Hendrickson et al., 2015; Rasmussen et al., 2010; Smith et al., 2018; Weatherly, 2014). These results may suggest that AWS, relative to AWNS, demonstrate a relatively stronger sensitivity to the communication outcome of the discounting task, which may be due to differences in learning history or valuing of a particular outcome (Lawyer, 2008; Smith et al., 2018). Individuals who stutter are more likely to receive feedback from others about their communication compared to those who do not

stutter (Boyle, 2017; Bricker-Katz et al., 2010; Plexico et al., 2009; Zeigler-Hill et al., 2019). Therefore, the percent of systematic data one produces on the PDC may be a more sensitive measure of consequences to stuttering, as opposed to the discounting values themselves.

Relations Between Communication, Stuttering, and Psychological Measures

Importantly, the newly developed PDC was significantly related to measures of speech usage (CPI and LSURS) among AWS, but not among AWNS. That is, higher discounting values (i.e., lower AUC values) was linked to lower communicative participation. When examining these relations with only systematic responders, the association between the PDC and CPI remained significant, though not as strong; the association between the PDC and LSURS was not significant. Nonetheless, the PDC's significant associations with the CPI and LSURS suggests that the PDC is related to aspects of communication participation, but the extent to which the three measures are measuring the same construct has yet to be determined and is an area of future research.

We found partial support for the hypothesis that the PDC would be related to measures of stuttering among AWS. Indeed, the SSS and OASES both showed significant, positive associations with *h*-values and significant, negative associations with AUC values across the three NR conditions of the PDC. Further, these associations increased in strength as NR probability increased. This suggests that one's sensitivity to dysfluency risk and negative social responses are also associated with increased stuttering severity. There were no significant associations between the discounting values and self-reported stuttering among AWNS. Due to recruitment difficulties, we were unable to examine associations with the SSI-4, therefore associations with the PDC and this measure of stuttering are unknown.

Significant associations between self-efficacy and measures of anxiety with the PDC were observed among AWS but not among AWNS, which is consistent with our hypothesis. Lower self-efficacy was associated with higher communication discounting. Generalized and social anxiety symptoms were associated with higher rates of discounting. The magnitude of associations with the PDC was relatively weak among both generalized anxiety symptoms and self-efficacy. Symptoms of social anxiety showed relatively stronger associations with the PDC, with effect sizes increasing across negative reaction condition. AWS have shown higher rates of anxiety relative to those who do not stutter (Craig & Tran, 2014; Iverach et al., 2018; Messenger et al., 2004); however, within this sample neither generalized or social anxiety significantly differ between the two samples. Anxiety was only significantly related to risky communication in the stuttering sample only, suggesting that anxiety symptoms may interact with communication decision-making for AWS more so than for an AWNS. However, these associations should be interpreted with caution as they disappear when examining systematic responders only.

The extent to which measures of self-efficacy and impact of stuttering experience accounted for significantly more variance among the PDC and CPI yielded mixed results. When controlling for anxiety and levels of speech usage, stuttering severity and self-efficacy did not significantly predict discounting values. However, both self-efficacy and impact of stuttering were significant predictors and accounted for significantly more variance in CPI scores when controlling for speech usage and anxiety, which extends prior research (Boyle et al., 2018). Boyle and colleagues (2018) found that self-efficacy, in addition to measures of self-esteem and social support accounted for significantly greater variance in communicative participation scores after controlling for self-reported dysfluencies, levels of speech usage, treatment history, years

stuttering, and demographic factors (i.e., sex, living situation, education, and employment). These results are similar in that self-efficacy was a significantly greater predictor of communicative participation than measures of anxiety and speech usage. In addition, the results from the current study extend the findings from Boyle et al. by demonstrating that communication participation decreases as the impact of stuttering on an individual's life increases (as measured by the OASES-A) when controlling for symptoms of anxiety and speech usage. These results, in conjunction with the findings from Boyle et al. (2018), suggest that a person's perception of their stuttering experience may be a better treatment target for enhancing communicative participation compared to reducing dysfluencies. The generalizability of these results beyond the current sample, however, should be interpreted with caution given that the sample size for the stuttering group was relatively smaller than the numbers indicated by the power analysis for correlation.

Hyperbolic vs. Hyperboloid Model

Consistent with our hypothesis, the hyperboloid model, which includes the additional scaling parameter (i.e., *s*; Green et al., 1994; Myerson & Green, 1995), demonstrated a significantly better fit to the data than the hyperbolic equation (Mazur, 1987). Indeed, the hyperboloid equation accounted for 24-28% more of the variance RSS values in the 10% and 90% NR conditions compared to the hyperbolic; for the 50% NR condition, it accounted for 7% more than the hyperbolic.

In terms of groups differences and model fit, there were not robust differences between groups. In the 90% NR condition, AWS showed significantly better fit regardless of model when compared to AWNS, but the main effect of group was not observed in other two NR conditions. The findings are similar to Bruce et al. (2016) who found that the hyperboloid equation provided

a better fit to discounting of medication adherence as a function of side effect and medication efficacy. Like health-decision making, communication-related decision-making may also be influenced by these individual sensitivities in the over- or underestimation of differences in odds as measured by the scaling parameter (i.e., *s*), which is a critical added feature of the hyperboloid model. However, further research is warranted to determine if the hyperboloid model continues to show a significantly better fit to communication-related decision making as the differences in model fit between hyperbolic and hyperboloid equation for medical decision-making are not always observed across differing samples from the same population (Jarmolowicz et al., 2017).

Limitations and Future Directions

A notable limitation of the current study is the lack of an objective clinician-administered measure of stuttering that captures overt dysfluency occurrence (i.e., SSI-4; Riley, 2009). It is possible that the increased frequency and severity of overt dysfluencies may lead to notable differences in communication discounting. Indeed, the association between increasing overt dysfluency frequency and lower communication participation has been noted in the literature via self-report (Boyle et al., 2018), but to our knowledge an objective measure to examine this relation as not been utilized in the literature thus far. Future research would benefit from the inclusion of clinician administered measures such as the SSI-4, which would provide data on overt dysfluency stuttering and its severity. Given the difficulties in the current study of recruiting participants in an online format, however, future researchers may benefit from conducting this type of research in-person or develop strategies to ensure adequate online participation with the SSI-4 (e.g., increased compensation, alternate video conferencing software).

Another notable limitation of the current study is lack of an established PD measure for comparison. Prior research focused on the development and validation of new discounting measures typically include a previously established discounting measure with either a similar or differing commodity (e.g., food vs. money; Hendrickson et al., 2015; Rodriguez et al., 2018). The data from an additional discounting measures could be compared with those from the new measure to determine the extent to which similar impulsive and risk-taking decision-making processes are similar to other discounting tasks (Odum, 2011a, 2011b). Furthermore, while the PDC showed significant associations with the CPI and LSURS, the extent to which these three measures are different facets of the same communication construct is unclear. Future research using statistics such as a factor analysis could help to elucidate overlap and differences in construct validity between the PDC and communication-related measures (Białaszek et al., 2019).

Future research studying the PDC between AWS and AWNS would benefit from examining match-controlled samples between groups, in addition to attempting to recruit a bulk of stuttering participants from multiple sources in addition to the NSA. Indeed, such efforts could determine the extent to which there are differences in communication discounting between members and non-members of the NSA or exposure to affirming treatments.

Implications

The extent to which an individual's sensitivity to risk of dysfluency or a negative social reaction could have utility in guiding treatment and prevention efforts among AWS; this has been shown with discounting with other health-related problems (e.g., Bruce et al., 2018; Yoon et al., 2007). Discounting values for medication adherence have shown associations with self-reported motivation to adherence to treatment (Jarmolowicz et al., 2017) and have been in

predictive in classifying adherent and non-adherent patients (Bruce et al., 2016). This suggests that the extent to which an AWS is sensitive to dysfluency and negative reaction risk could impact their likelihood of engaging in stuttering treatment. Indeed, higher discounting values could indicate not only is the individual particularly sensitive to risk of dysfluency or a negative listener reaction but may also struggle in engaging in stuttering treatment where exposure to communication with others is an essential part of treatment (Beilby et al., 2012a; Guitar, 2014; Yates et al., 2018).

Further, an individual's discounting pattern's sensitivity to either dysfluency risk or negative reaction risk could be an indicator of where to focus treatment goals. For instance, an individual who demonstrated steep communication discounting as a function dysfluency risk but failed to show a magnitude effect may indicate that the individual is more sensitive to their stutter relative to others. Treatment goals could focus on developing an understanding of their individual stutter through psychoeducation and awareness building techniques (e.g., mindfulness, tallying, mirror work, video/audio recordings, etc.) or focus on the development of positive self-identity as a person who stutters. Another scenario would be if the individual demonstrated a magnitude effect as a function of negative reaction risk, which would be indicative of greater sensitivity to the interpersonal aspects of speech. Treatment goals may focus more on assertive communication skills, use of disclosure statements, how to form relationships, make small talk, or decrease social anxiety for example. Sensitivity to this variable could also indicate a more in depth understanding of close interpersonal relationships and that treatment may need to involve friends and family members more readily from the individual's life and provide them with psychoeducation on stuttering, as well as information on how to be an ally and create an affirming environment for AWS. Notably, these types of treatment goals would warrant an

interdisciplinary approach between both speech language pathology and mental health professionals (e.g., clinical psychologists, counselors, licensed clinical social workers) to provide a more holistic approach to stuttering treatment (Yates et al., 2018). Integrating the PDC as part of a pre- post-treatment assessment battery would be a way to examine its clinical utility as well as begin the process of establishing normative data to indicate which specific discounting values and patterns are associated with specific stuttering characteristics and treatment outcomes.

The development of a communication measure that incorporates decision-making is critical to better understand underlying mechanisms involved in communication for AWS. The results of the current study suggest that the newly developed PDC may be such a measure, especially given its relations with other communication and stuttering measures and differential associations between stuttering and non-stuttering samples. Furthermore, given that struggles with communication is not unique to a stuttering diagnosis, the PDC may have utility in characterizing decision-making among other communication disorders. Future research could focus on altering the event occurring from a dysfluency to an event associated with a different communication disorder and see if communication is discounted in a similar fashion and demonstrates differential associations been a control sample.

Overall, the current findings uniquely show that communication value can be discounted; that is, the subjective value of communication decreases hyperbolically as odds for dysfluency increase and the odds of a negative outcome. Notably, the extent to which communication is discounted shows associations with stuttering measures in a stuttering population but not in a non-stuttering population. Further, AWS demonstrated more systematic responding—suggesting increased sensitivity to communication outcomes—when compared to their non-stuttering

counterparts. Therefore, the PDC appears to be an internally and externally valid measure of communication PD for AWS and has clinical utility for this population.

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Appendix A

Probability Discounting Task for Stuttering

The following questions will refer to the most severe moment of stuttering you have ever experienced in your lifetime. Please answer the following questions as accurately as you can.

Where were you when it occurred?_____

How old were you when it occurred?_____

In minutes, how long did the severe stuttering event last? _____(e.g., less than a minute, 1 minute, 10 minutes)

Please check the following overt stuttering behavior(s) that occurred during the most severe event.

( ) Repetitions (e.g., I-I-I-I-I; k-k-k-k-k)
( ) Prolongation (e.g., aaaaaaaaapple)
( ) Blocks (e.g., b_ _ _lock)
( ) Other [please describe] _____

Not counting yourself, how many other people were present?_____

Please indicate the relationship of the individual(s) present to you (e.g., spouse, partner, family member, friend, stranger, co-worker, etc.)

_____

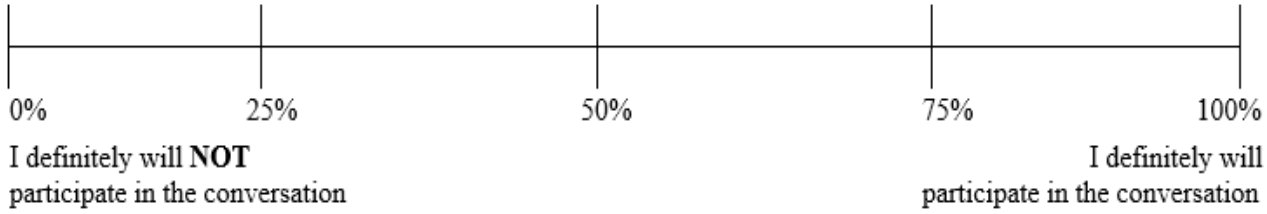
Use the following scale to answer the following question.
1=Unsupportive (e.g., laughing, mocking, appeared frustrated, talking over me, etc.) to 5=Supportive (e.g., appeared patient, waited for me to speak, maintained appropriate eye contact, etc.)

In general, how you would rate the reaction(s) of the individual(s) present? 1 2 3 4 5

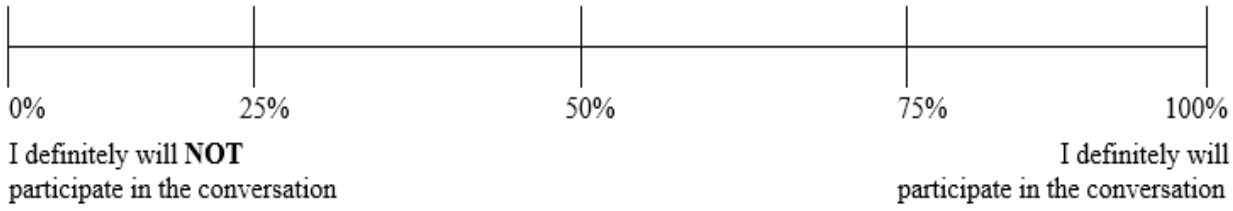
For the following questions, you will be asked to imagine yourself in different speaking scenarios between you and one other person. During each conversation, you may or may not experience the severe moment of stuttering you previously described. The moment of stuttering may include repetitions (e.g., I-I-I-I-I; k-k-k-k-k), prolongations (e.g., aaaapple), and/or blocks (e.g., b_ _ _ _lock). Even if you attempt to modify or prevent the stutter during the conversation,

it will still occur. In addition, the person you are conversing with may or may not have a negative reaction (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.). After each scenario, you will be asked to rate the likelihood you would participate in the conversation on a scale of 0=I definitely will **NOT** participate in the conversation to 100=I definitely will participate in the conversation.

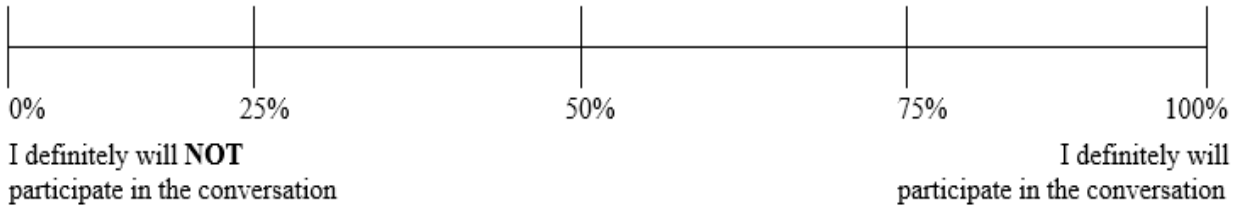
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **0% chance you will experience a severe moment of stuttering**. In addition, there is a **0% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **1% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

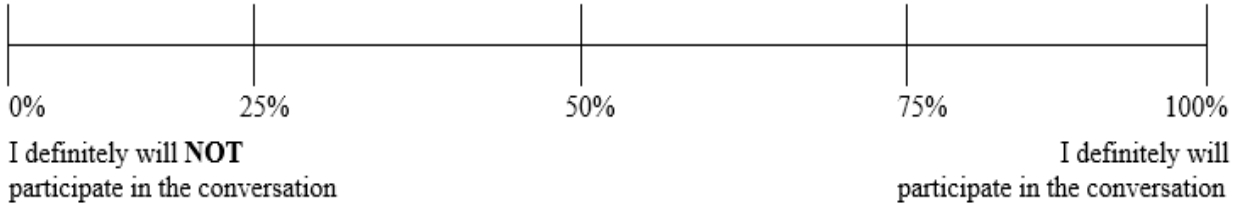


Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **10% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

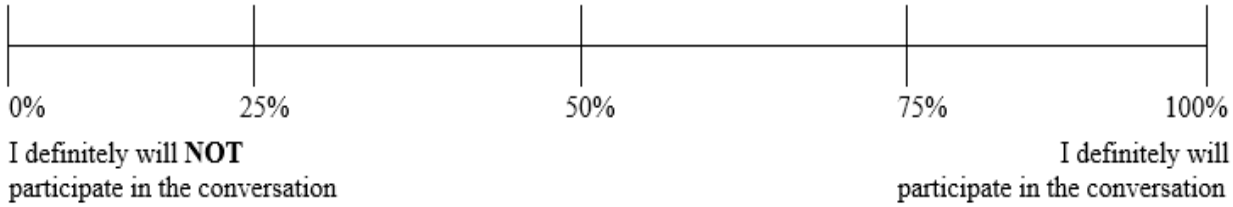


Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is

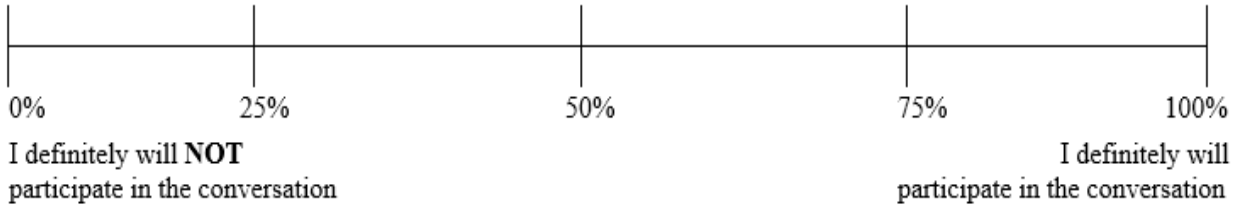
a **25% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



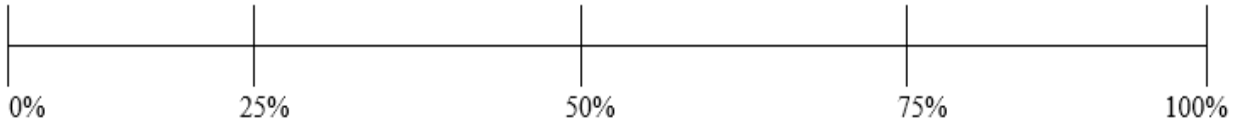
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **50% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



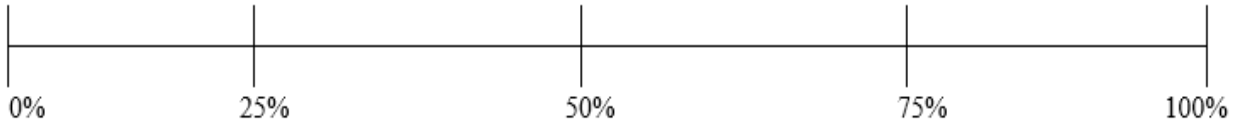
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **75% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



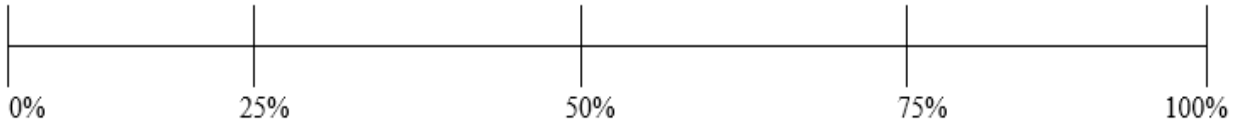
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **90% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



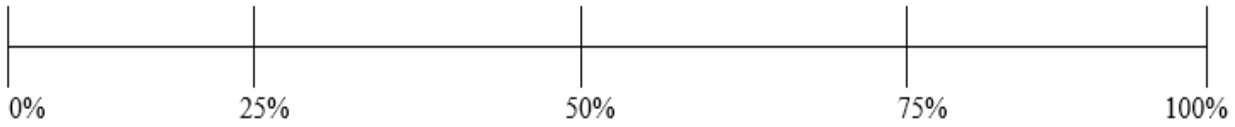
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **99% chance you will experience a severe moment of stuttering**. In addition, there is a **10% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **1% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

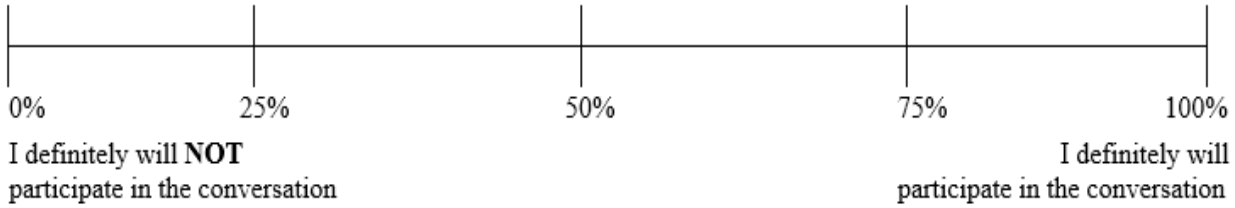


Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **10% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).

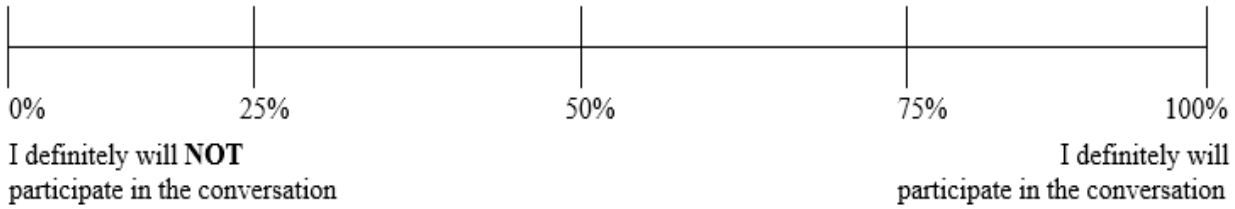


Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **25% chance you will experience a severe moment of stuttering**. In addition, there is a **50%**

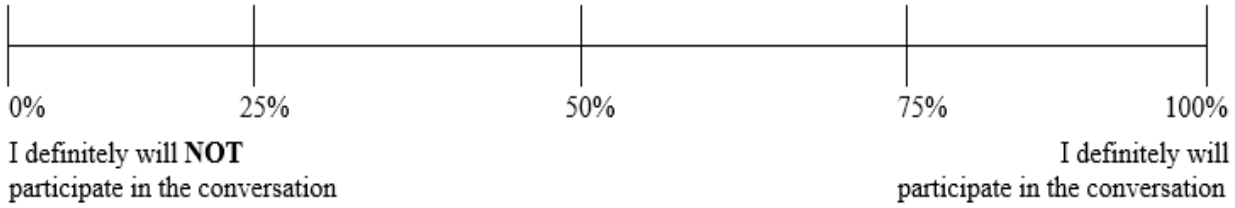
chance the person will respond negatively (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



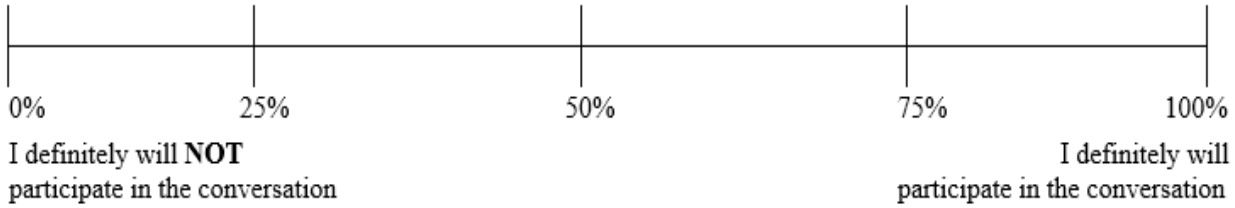
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **50% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



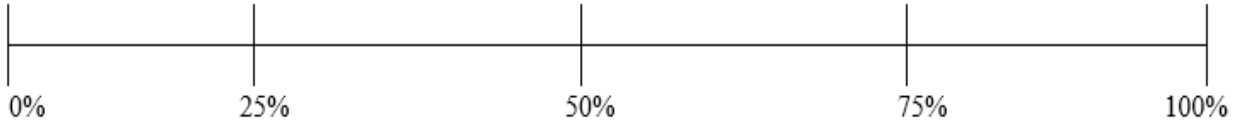
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **75% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



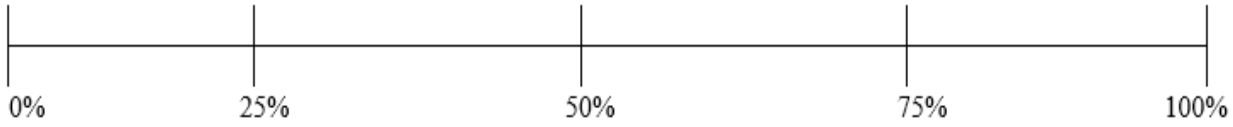
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **90% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



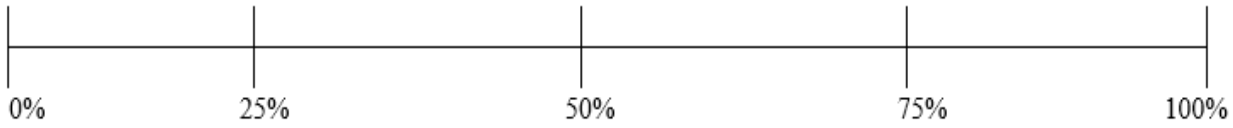
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **99% chance you will experience a severe moment of stuttering**. In addition, there is a **50% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



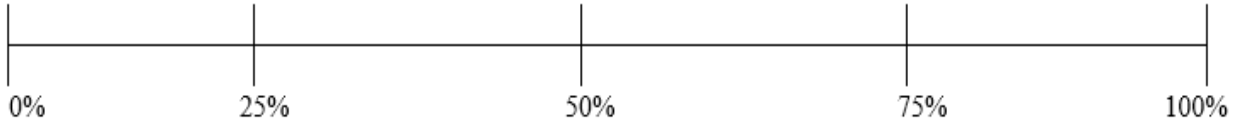
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **1% chance you will experience a severe moment of stuttering**. In addition, there is a **90% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



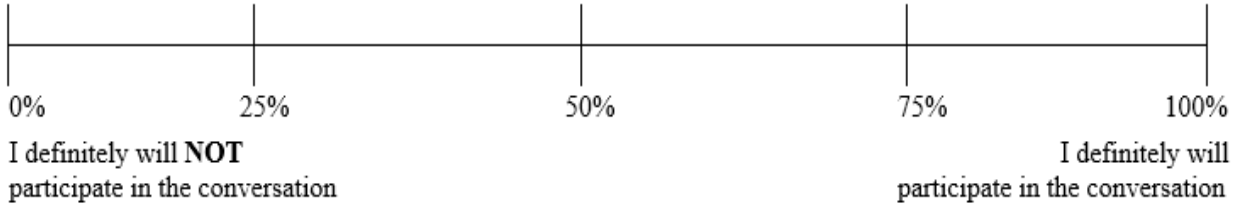
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **10% chance you will experience a severe moment of stuttering**. In addition, there is a **90% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



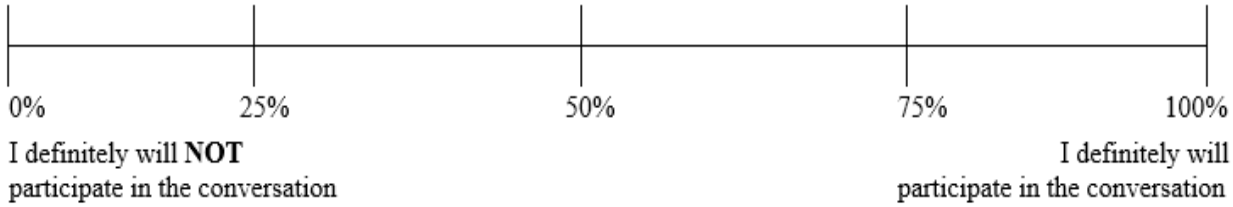
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **25% chance you will experience a severe moment of stuttering**. In addition, there is a **90% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



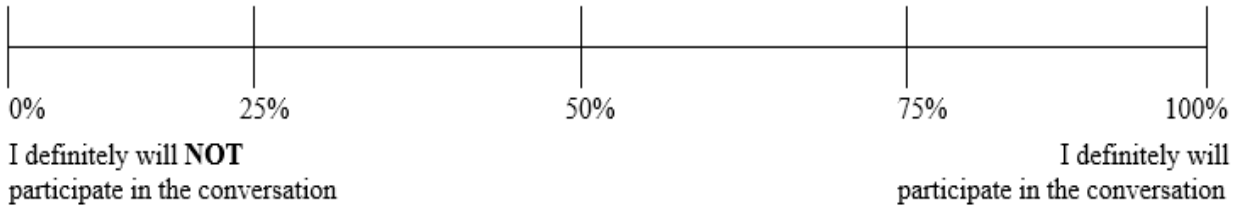
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **50% chance you will experience a severe moment of stuttering**. In addition, there is a **90% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



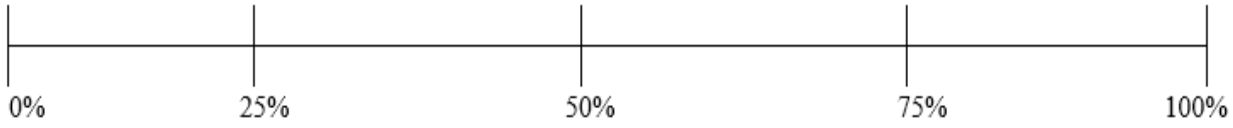
Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **75% chance you will experience a severe moment of stuttering**. In addition, there is a **90% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **90% chance you will experience a severe moment of stuttering**. In addition, there is a **90% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



Imagine that you are about to engage in a conversation with another person with each of you expected to contribute approximately equally to the conversation. During the interaction, there is a **99% chance you will experience a severe moment of stuttering**. In addition, there is a **90% chance the person will respond negatively** (e.g., laugh/make fun, cut you off, look uncomfortable or frustrated, etc.).



I definitely will **NOT** participate in the conversation

I definitely will participate in the conversation

Appendix B

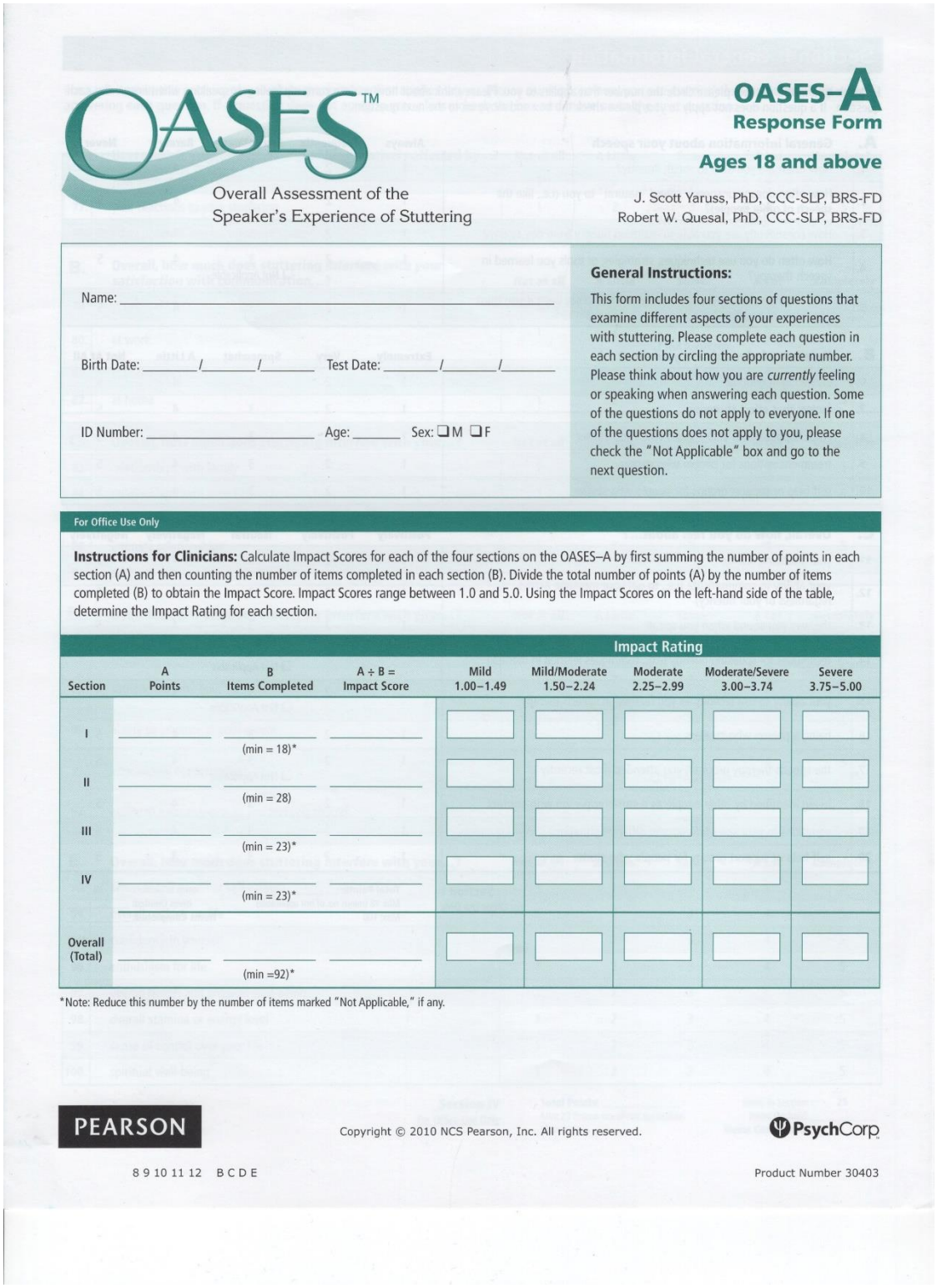
The Communicative Participation Item Bank – General Short Form

Instructions: The following questions describe a variety of situations in which you might need to speak to others. For each question, please mark how much your condition interferes with your participation in that situation. By "condition" we mean ALL issues that may affect how you communicate in these situations including speech conditions, any other health conditions, or features of the environment. If your speech varies, think about an AVERAGE day for your speech—not your best or your worst days.

	Not at all	**A little**	**Quite a bit**	**Very much**
1. Does your condition interfere with… …**talking with people you know?**				
2. Does your condition interfere with… …**communicating when you need to say something quickly?**				
3. Does your condition interfere with… **…talking with people you do NOT know?**				
4. Does your condition interfere with… **…communicating when you are out in your community (e.g., errands; appointments)?**				
5. Does your condition interfere with… …**asking questions in a conversation?**				
6. Does your condition interfere with… …**communicating in a small group of people?**				
7. Does your condition interfere with… …**having a long conversation with someone you know about a book, movie, show or sport event?**				
8. Does your condition interfere with… …**giving someone DETAILED information?**				
9. Does your condition interfere with… …**getting your turn in a fast-moving conversation?**				
10. Does your condition interfere with… …**trying to persuade a friend or family member to see a different point of view?**				

Appendix C

Overall Assessment of the Speaker's Experience of Stuttering



OASES™

Overall Assessment of the Speaker's Experience of Stuttering

OASES–A
Response Form
Ages 18 and above

J. Scott Yaruss, PhD, CCC-SLP, BRS-FD
Robert W. Quesal, PhD, CCC-SLP, BRS-FD

Name: _____

Birth Date: ____/____/____ Test Date: ____/____/____

ID Number: _____ Age: _____ Sex: ❑ M ❑ F

General Instructions:

This form includes four sections of questions that examine different aspects of your experiences with stuttering. Please complete each question in each section by circling the appropriate number. Please think about how you are *currently* feeling or speaking when answering each question. Some of the questions do not apply to everyone. If one of the questions does not apply to you, please check the "Not Applicable" box and go to the next question.

For Office Use Only

Instructions for Clinicians: Calculate Impact Scores for each of the four sections on the OASES–A by first summing the number of points in each section (A) and then counting the number of items completed in each section (B). Divide the total number of points (A) by the number of items completed (B) to obtain the Impact Score. Impact Scores range between 1.0 and 5.0. Using the Impact Scores on the left-hand side of the table, determine the Impact Rating for each section.

Section	A Points	B Items Completed	A ÷ B = Impact Score	Impact Rating: Mild 1.00–1.49	Mild/Moderate 1.50–2.24	Moderate 2.25–2.99	Moderate/Severe 3.00–3.74	Severe 3.75–5.00
I		(min = 18)*						
II		(min = 28)						
III		(min = 23)*						
IV		(min = 23)*						
Overall (Total)		(min =92)*						

*Note: Reduce this number by the number of items marked "Not Applicable," if any.

PEARSON

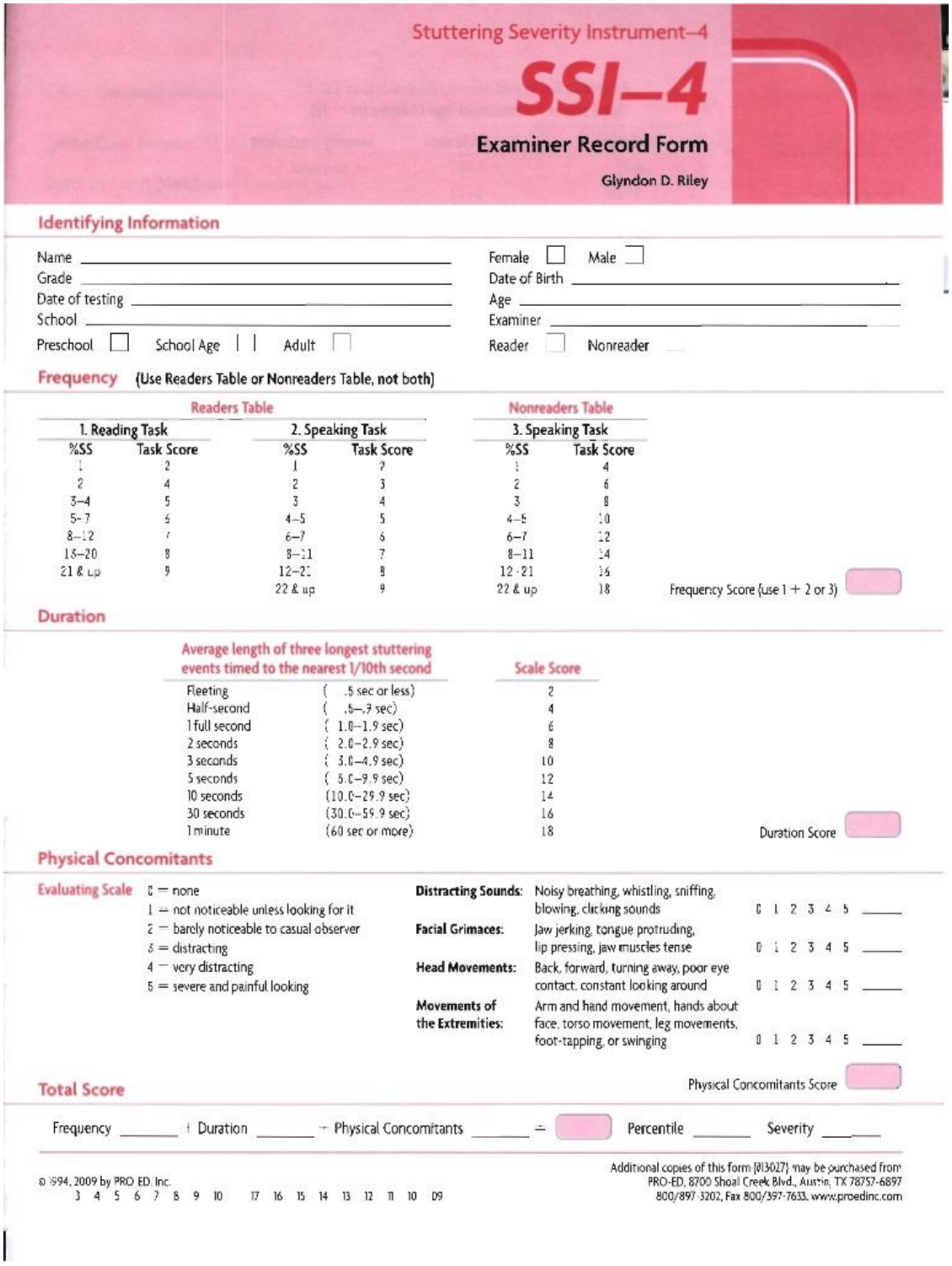
PsychCorp

8 9 10 11 12 B C D E

Product Number 30403

Appendix D

Stuttering Severity Instrument, Fourth Edition



Stuttering Severity Instrument–4

SSI–4

Examiner Record Form

Glyndon D. Riley

Identifying Information

Name _____ Female ☐ Male ☐

Grade _____ Date of Birth _____

Date of testing _____ Age _____

School _____ Examiner _____

Preschool ☐ School Age ☐ Adult ☐ Reader ☐ Nonreader

Frequency (Use Readers Table or Nonreaders Table, not both)

Readers Table

1. Reading Task		2. Speaking Task	
%SS	Task Score	%SS	Task Score
1	2	1	2
2	4	2	3
3–4	5	3	4
5–7	6	4–5	5
8–12	7	6–7	6
13–20	8	8–11	7
21 & up	9	12–21	8
		22 & up	9

Nonreaders Table

3. Speaking Task	
%SS	Task Score
1	4
2	6
3	8
4–5	10
6–7	12
8–11	14
12–21	16
22 & up	18

Frequency Score (use 1 + 2 or 3) ____

Duration

Average length of three longest stuttering events timed to the nearest 1/10th second		Scale Score
Fleeting	(.5 sec or less)	2
Half-second	(.5–.9 sec)	4
1 full second	(1.0–1.9 sec)	6
2 seconds	(2.0–2.9 sec)	8
3 seconds	(3.0–4.9 sec)	10
5 seconds	(5.0–9.9 sec)	12
10 seconds	(10.0–29.9 sec)	14
30 seconds	(30.0–59.9 sec)	16
1 minute	(60 sec or more)	18

Duration Score ____

Physical Concomitants

Evaluating Scale

0 = none
1 = not noticeable unless looking for it
2 = barely noticeable to casual observer
3 = distracting
4 = very distracting
5 = severe and painful looking

Distracting Sounds:	Noisy breathing, whistling, sniffing, blowing, clicking sounds	0 1 2 3 4 5 ____
Facial Grimaces:	Jaw jerking, tongue protruding, lip pressing, jaw muscles tense	0 1 2 3 4 5 ____
Head Movements:	Back, forward, turning away, poor eye contact, constant looking around	0 1 2 3 4 5 ____
Movements of the Extremities:	Arm and hand movement, hands about face, torso movement, leg movements, foot-tapping, or swinging	0 1 2 3 4 5 ____

Physical Concomitants Score ____

Total Score

Frequency _____ + Duration _____ + Physical Concomitants _____ = ____ Percentile _____ Severity _____

3 4 5 6 7 8 9 10 17 16 15 14 13 12 11 10 09

Additional copies of this form (#13027) may be purchased from PRO-ED, 8700 Shoal Creek Blvd., Austin, TX 78757-6897 800/897-3202, Fax 800/397-7633, www.proedinc.com

Appendix E

Subjective Stuttering Scale—Research Edition

1. How would you score your fluency during the session today?
   Relatively fluent 1 2 3 4 5 6 7 8 9 Severe stuttering

2. How would you score your speech with the following audiences during the last week?

	Relatively fluent								Severe stuttering
Close friend	1	2	3	4	5	6	7	8	9
Authority figure	1	2	3	4	5	6	7	8	9
Telephone	1	2	3	4	5	6	7	8	9

3. How much time during conversation during the last week did you think about stuttering with the following audiences?

	Never								Constantly
Close friend	1	2	3	4	5	6	7	8	9
Authority figure	1	2	3	4	5	6	7	8	9
Telephone	1	2	3	4	5	6	7	8	9

4. How often did you change words during the last week when you thought you might get stuck with the following audiences?

	Never								Constantly
Close friend	1	2	3	4	5	6	7	8	9
Authority figure	1	2	3	4	5	6	7	8	9
Telephone	1	2	3	4	5	6	7	8	9

5. To what extent did you feel internally hurried during conversations during this past week with the following audiences?

	Never								Constantly
Close friend	1	2	3	4	5	6	7	8	9
Authority figure	1	2	3	4	5	6	7	8	9
Telephone	1	2	3	4	5	6	7	8	9

6. How much energy did you expend this week on how you speak rather than on what you wanted to say with the following audiences?

	0%								100%
Close friend	1	2	3	4	5	6	7	8	9
Authority figure	1	2	3	4	5	6	7	8	9
Telephone	1	2	3	4	5	6	7	8	9

7. During the past week how often did you refrain from a conversation because of fear of stuttering with the following audiences?

	Seldom								Frequently
Close friend	1	2	3	4	5	6	7	8	9
Authority figure	1	2	3	4	5	6	7	8	9

Telephone 1 2 3 4 5 6 7 8 9

8. During the past week how much choice did you feel you had to take part in a conversation with the following audiences?

	A great deal								Very little
Close friend	1	2	3	4	5	6	7	8	9
Authority figure	1	2	3	4	5	6	7	8	9
Telephone	1	2	3	4	5	6	7	8	9

Appendix F

Levels of Speech Usage Scale

Levels of Speech Usage Scale

While communication is important to everyone, different people use their speech in different ways. Think of how you typically need to use your speech day to day. Mark the category below that best describes you.

___ **Undemanding:**
Quiet for long periods of time **almost every day**
Almost never:
- talk for long periods
- raise your voice above a conversational level,
- participate in group discussions, give a speech or other presentation

___ **Intermittent:**
Quiet for long periods of time on **many days**
Most talking is **typical conversational speech**
Occasionally:
- talk for longer periods
- raise voice above conversational level
- participate in group discussions, give a speech or other presentation

___ **Routine:**
Frequent periods of talking on **most days**
Most talking is **typical conversational speech**
Occasionally:
- talk for longer periods
- raise voice above conversational level
- participate in group discussions, give a speech or other presentation

___ **Extensive:**
Speech needs **consistently go beyond everyday conversational speech.**
Regularly:
- talk for long periods
- talk in a loud voice
- participate in group discussions, give presentations or performances

Although the demands on your speech are often high, you are able to continue with most work or social activities even if your speech is not perfect.

___ **Extraordinary:**
Very high speech demands
Regularly:
- talk for long periods of time
- talk with loud or expressive speech or
- give presentations or performances.

The success of your work or personal goals depends almost entirely on the quality of your speech and voice.

Appendix G

Social Anxiety Disorder Dimensional Scale

Social Anxiety Disorder Dimensional Scale (SAD-D)

The following questions ask about thoughts, feelings, and behaviors that you may have had about *social situations*. Usual social situations include: public speaking, speaking in meetings, attending social events or parties, introducing yourself to others, having conversations, giving and receiving compliments, making requests of others, and eating and writing in public. Please rate how often the following states are true for you.

During *the past month*, I have…

	Never	**Occasionally**	**Half of the time**	**Most of the time**	**All of the time**
…felt moments of sudden terror, fear, or fright in social situations	0	1	2	3	4
…felt anxious, worried, or nervous about social situations	0	1	2	3	4
…had thoughts of being rejected, humiliated, embarrassed, ridiculed or offending others	0	1	2	3	4
…felt a racing heart, sweaty, trouble breathing, faint, or shaky in social situations	0	1	2	3	4
…felt tense muscles, on edge or restless, or trouble relaxing in social situations	0	1	2	3	4
…avoided, or did not approach or enter, social situations	0	1	2	3	4
…left social situations early or participated only minimally (e.g., said little, avoided eye contact)	0	1	2	3	4
…spent a lot of time preparing what to say or how to act in social situations	0	1	2	3	4
…distracted myself to avoid thinking about social situations	0	1	2	3	4
…needed help to cope with social situations (e.g., alcohol or medications, superstitious objects)	0	1	2	3	4

Appendix H

Overall Anxiety Severity and Impairment Scale

The following items ask about anxiety and fear. For each item, circle the number for the answer that best describes your experience *over the past week*.

1. In the past week, <u>how often</u> have you felt anxious?

0. *No* anxiety in the past week.
1. *Infrequent* anxiety. Felt anxious a few times.
2. *Occasional* anxiety. Felt anxious as much of the time as not. It was hard to relax
3. *Frequent* anxiety. Felt anxious most of the time. It was very difficult to relax.
4. *Constant* anxiety. Felt anxious all of the time and never really relaxed.

2. In the past week, when you have felt anxious, <u>how intense or severe was your anxiety?</u>

0. *Little* or *none*: Anxiety was absent or barely noticeable.
1. *Mild*: Anxiety was at a low level. It was possible to relax when I tried. Physical symptoms were only slightly uncomfortable.
2. *Moderate*: Anxiety was distressing at times. It was hard to relax or concentrate, but I could do it if I tried. Physical symptoms were uncomfortable.
3. *Severe*: Anxiety was intense much of the time. It was very difficult to relax or focus on anything else.
4. *Extreme*: Anxiety was overwhelming. It was impossible to relax at all. Physical symptoms were unbearable.

3. In the past week, how often did you <u>avoid situations, places, objects, or activities</u> because of anxiety or fear?

0. *None*: I do not avoid places, situations, activities, or things because of fear.
1. *Infrequent*: I avoid something once in a while, but will usually face the situation or confront the object. My lifestyle is not affected.
2. *Occasional*: I have some fear of certain situations, places, or objects, but it is still manageable. My lifestyle has only changed in minor ways. I always or almost always avoid the things I fear when I'm alone, but can handle them if someone comes with me.
3. *Frequent*: I have considerable fear and really try to avoid the things that frighten me. I have made significant changes in my lifestyle to the avoid object, situation, activity, or place.
4. *All the time*: Avoiding objects, situations, activities, or places has taken over my life. My lifestyle has been extensively affected and I no longer do things that I used to enjoy.

4. In the past week, how much did your anxiety <u>interfere with your ability to do the things you needed to do</u> at work, at school, or at home?

0. *None*: No interference at work/home/school from anxiety

1. *Mild*: My anxiety has caused some interference at work/home/school. Things are more difficult, but everything that needs to be done is still getting done.
2. *Moderate*: My anxiety definitely interferes with tasks. Most things are still getting done, but few things are being done as well as in the past.
3. *Severe*: My anxiety has really changed my ability to get things done. Some tasks are still being done, but many things are not. My performance has definitely suffered.
4. *Extreme*: My anxiety has become incapacitating. I am unable to complete tasks and have had to leave school, have quit or been fired from my job, or have been unable to complete tasks at home and have faced consequences like bill collectors, evictions, etc.

5. In the past week, how much has anxiety <u>interfered with your social life and relationships?</u>

0. *None*: My anxiety doesn't affect my relationships.
1. *Mild*: My anxiety slightly interferes with my relationships. Some of my friendships and other relationships have suffered, but, overall, my social life is still fulfilling.
2. *Moderate*: I have experienced some interference with my social life, but I still have a few close relationships. I don't spend as much time with others as in the past, but I still socialize sometimes.
3. *Severe*: My friendships and other relationships have suffered a lot because of anxiety. I do not enjoy social activities. I socialize very little.
4. *Extreme*: My anxiety has completely disrupted my social activities. All of my relationships have suffered or ended. My family life is extremely strained.

Check: I experience extreme anxiety. Select "false" if you are paying attention.

0. True
1. False

Appendix I

General Self-Efficacy Scale – 6-item Version

	Not all true	Barely true	Moderately true	Exactly true
1. If someone opposes me, I can find means and ways to get what I want.	**1**	**2**	**3**	**4**
2. It is easy for me to stick to my aims and accomplish my goals.	**1**	**2**	**3**	**4**
3. I am confident that I could deal efficiently with unexpected events.	**1**	**2**	**3**	**4**
4. Thanks to my resourcefulness, I know how to handle unforeseen situations.	**1**	**2**	**3**	**4**
5. I can remain calm when facing difficulties because I can rely on my coping abilities.	**1**	**2**	**3**	**4**
6. No matter what comes my way, I'm usually able to handle it.	**1**	**2**	**3**	**4**

Appendix J

Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist, Part A

Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist

Patient Name		Today's Date					
Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, place an X in the box that best describes how you have felt and conducted yourself over the past 6 months. Please give this completed checklist to your healthcare professional to discuss during today's appointment.			Never	Rarely	Sometimes	Often	Very Often
1. How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?							
2. How often do you have difficulty getting things in order when you have to do a task that requires organization?							
3. How often do you have problems remembering appointments or obligations?							
4. When you have a task that requires a lot of thought, how often do you avoid or delay getting started?							
5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?							
6. How often do you feel overly active and compelled to do things, like you were driven by a motor?							
							Part A

Appendix K

Barrett Impulsivity Scale—11

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

① Rarely/Never ② Occasionally ③ Often ④ Almost Always/Always

1	I plan tasks carefully.	①	②	③	④
2	I do things without thinking.	①	②	③	④
3	I make-up my mind quickly.	①	②	③	④
4	I am happy-go-lucky.	①	②	③	④
5	I don't "pay attention."	①	②	③	④
6	I have "racing" thoughts.	①	②	③	④
7	I plan trips well ahead of time.	①	②	③	④
8	I am self controlled.	①	②	③	④
9	I concentrate easily.	①	②	③	④
10	I save regularly.	①	②	③	④
11	I "squirm" at plays or lectures.	①	②	③	④
12	I am a careful thinker.	①	②	③	④
13	I plan for job security.	①	②	③	④
14	I say things without thinking.	①	②	③	④
15	I like to think about complex problems.	①	②	③	④
16	I change jobs.	①	②	③	④
17	I act "on impulse."	①	②	③	④
18	I get easily bored when solving thought problems.	①	②	③	④
19	I act on the spur of the moment.	①	②	③	④
20	I am a steady thinker.	①	②	③	④
21	I change residences.	①	②	③	④
22	I buy things on impulse.	①	②	③	④
23	I can only think about one thing at a time.	①	②	③	④
24	I change hobbies.	①	②	③	④
25	I spend or charge more than I earn.	①	②	③	④
26	I often have extraneous thoughts when thinking.	①	②	③	④
27	I am more interested in the present than the future.	①	②	③	④
28	I am restless at the theater or lectures.	①	②	③	④
29	I like puzzles.	①	②	③	④
30	I am future oriented.	①	②	③	④

Appendix L

Alcohol Use Disorders Identification Test—Version C

Screening Question: Have you consumed drinks containing alcohol in the past year? Yes or No

Instructions: For each question, please check the answer that is correct for you.

ONE (1) standard drink =

1. **How often do you have a drink containing alcohol?**
   - ☐ Never
   - ☐ Monthly or less
   - ☐ Two to four times a month
   - ☐ Two to three times per week
   - ☐ Four or more times a week

2. **How many drinks containing alcohol do you have on a typical day when you are drinking?**
   - ☐ 1 or 2
   - ☐ 3 or 4
   - ☐ 5 or 6
   - ☐ 7 to 9
   - ☐ 10 or more

3. **How often do you have six or more drinks on one occasion?**
   - ☐ Never
   - ☐ Less than Monthly
   - ☐ Monthly
   - ☐ Weekly
   - ☐ Daily or almost daily

Appendix M

Drug Abuse Screening Test—10

Screening Question: Have you used illicit substances (e.g., non-prescription abuse, opioids, marijuana, etc.) in the past year? Yes or No

Code_____

Drug Abuse Screening Test, DAST-10

The following questions concern information about your possible involvement with drugs *not including alcoholic beverages* during the past 12 months.

"Drug abuse" refers to (1) the use of prescribed or over-the-counter drugs in excess of the directions, and (2) any nonmedical use of drugs.

The various classes of drugs may include cannabis (marijuana, hashish), solvents (e.g., paint thinner), tranquilizers (e.g., Valium), barbiturates, cocaine, stimulants (e.g., speed), hallucinogens (e.g., LSD) or narcotics (e.g., heroin). Remember that the questions *do not* include alcoholic beverages.

Please answer every question. If you have difficulty with a statement, then choose the response that is mostly right.

In the past 12 months...		**Circle**	
1.	Have you used drugs other than those required for medical reasons?	Yes	No
2.	Do you abuse more than one drug at a time?	Yes	No
3.	Are you unable to stop abusing drugs when you want to?	Yes	No
4.	Have you ever had blackouts or flashbacks as a result of drug use?	Yes	No
5.	Do you ever feel bad or guilty about your drug use?	Yes	No
6.	Does your spouse (or parents) ever complain about your involvement with drugs?	Yes	No
7.	Have you neglected your family because of your use of drugs?	Yes	No
8.	Have you engaged in illegal activities in order to obtain drugs?	Yes	No
9.	Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs?	Yes	No
10.	Have you had medical problems as a result of your drug use (e.g. memory loss, hepatitis, convulsions, bleeding)?	Yes	No

Drug Abuse Screening Test (DAST-10). (Copyright 1982 by the Addiction Research Foundation.)

Appendix N

Penn State Cigarette Dependence Test

Screening Question: Have you smoked cigarettes in the past year? Yes or No

1. How many cigarettes per day do you usually smoke?
    a. 0-4 times/day
    b. 5-9 times/day
    c. 10-14 times/day
    d. 15-19 times/day
    e. 20-29 times/day
2. On days that you can smoke freely, how soon after you wake up do you smoke your first cigarette of the day?
    a. 0-5 minutes
    b. 6-15 minutes
    c. 16-30 minutes
    d. 31-60 minutes
    e. 61-120 minutes
    f. 121+ minutes
3. Do you sometimes awaken at night to have a cigarette?
    a. Yes
    b. No
4. If yes, how many nights per week do you typically awaken to smoke?
    a. 0-1 nights
    b. 2-3 nights
    c. 4+ nights
5. Do you smoke now because it is really hard to quit?
    a. Yes
    b. No
6. Do you have strong cravings to smoke?
    a. Yes
    b. No
7. Over the past week, how strong have the urges to smoke been?
    a. None/slight
    b. Moderate/Strong
    c. Very strong/Extremely strong
8. Is it hard to keep from smoking in places where you are not supposed to?
    a. Yes
    b. No

When you haven't used tobacco for a while or when you have tried to stop smoking…

9. Did you feel more irritable because you couldn't smoke?
    a. Yes

b. No

10. Did you feel nervous, restless, or anxious because you couldn't smoke?
    a. Yes
    b. No

Appendix O

Penn State Electronic Cigarette Dependence Test

Screening Question: Have you used a nicotine vaporizer (i.e., vape) in the past year? Yes or No

1. How many times per day do you usually use your electronic cigarette? (Assume that one "time" consists of around 15 puffs or lasts around 10 minutes.)
    a. 0-4 times/day
    b. 5-9 times/day
    c. 10-14 times/day
    d. 15-19 times/day
    e. 20-29 times/day
2. On days that you can use your electronic cigarette freely, how soon after you wake up do you first use your electronic cigarette?
    a. 0-5 minutes
    b. 6-15 minutes
    c. 16-30 minutes
    d. 31-60 minutes
    e. 61-120 minutes
    f. 121+ minutes
3. Do you sometimes awaken at night to use your electronic cigarette?
    a. Yes
    b. No
4. If yes, how many nights per week do you typically awaken to use your electronic cigarette?
    a. 0-1 nights
    b. 2-3 nights
    c. 4+ nights
5. Do you use an electronic cigarette now because it is really hard to quit?
    a. Yes
    b. No
6. Do you have strong cravings to use an electronic cigarette?
    a. Yes
    b. No
7. Over the past week, how strong have the urges to use an electronic cigarette been?
    a. None/slight
    b. Moderate/Strong
    c. Very strong/Extremely strong
8. Is it hard to keep from using an electronic cigarette in places where you are not supposed to?
    a. Yes
    b. No

When you haven't used an electronic cigarette for a while or when you tried to stop using…

9. Did you feel more irritable because you couldn't use an electronic cigarette?
    a. Yes
    b. No
10. Did you feel nervous, restless, or anxious because you couldn't use an electronic cigarette?
    a. Yes
    b. No

Appendix P
Demographics Questionnaire

Please answer the following questions.

1. What is your gender?
    a. Man
    b. Woman
    c. Transgender
    d. Other_____

2. What is your current age? _____

3. When is your birthday? (Please answer in mm/dd/yyyy)_____

4. What is your ethnicity?
    a. White/Caucasian
    b. Black/ African-American
    c. Hispanic/ Latino
    d. Asian
    e. Native-American
    f. Mixed _____
    g. Other _____

5. What is your annual income? _____

Check: What was the amount of your last paycheck? Please enter "NONE" if you are paying attention. _____

6. What is your religious affiliation? _____

7. What is your highest level of education?
    a. High school/GED
    b. Some College
    c. Associates Degree
    d. Bachelor's degree
    e. Master's degree
    f. Doctorate/PhD
    g. Other_____

8. Are you currently employed?
    a. Yes (continue 8a)
    b. No (continue 8b)

    8a. How would you classify your employment?

a) Full-time
b) Part-time
c) Temporary

8b. Are you retired?

a) Yes
b) No

9. Have you *ever* been diagnosed with childhood-onset fluency disorder (i.e., stuttering, persistent/developmental stuttering)?
   a. Yes (continue to 9a)
   b. No (continue to 10)

   9a. Who diagnosed you with stuttering?
   a) Speech Language Pathologist/Therapist
   b) Psychiatrist
   c) Psychologist
   d) Medical doctor
   e) Other_____

   9b. How old were you when you first began stuttering? _____

   9c. Do you currently still experience stuttering?
   a) Yes
   b) No

   9d. Are you currently enrolled in treatment for stuttering?
   a) Yes (continue 9e)
   b) No (continue 9j)

   9e. Currently, who of the following is your main provider for your stuttering treatment?
   a) Speech Language Pathologist/Therapist
   b) Psychiatrist
   c) Psychologist
   d) Medical doctor
   e) Other_____

   9f. How long have you been enrolled in your current treatment for stuttering?
   _____

   9g. Could you please describe what your stuttering treatment consists of?_____
   _____
   _____
   _____
   _____
   _____

9h. Have you noticed an improvement in the frequency of your dysfluencies due to treatment?

a) Yes
b) No

9i. How satisfied are you with your current stuttering treatment?

a) Very Satisfied
b) Satisfied
c) Neutral
d) Unsatisfied
e) Very Unsatisfied

9j. If not currently enrolled in stuttering treatment, have you ever been enrolled in stuttering treatment?

a) Yes (continue to 9aa)
b) No (Skip to question 9m)

9aa. How long has it been since you have received treatment for your stuttering?

_____

9bb. Who of the following is your main provider for your stuttering treatment?

a) Speech Language Pathologist/Therapist
b) Psychiatrist
c) Psychologist
d) Medical doctor
e) Other_____

9cc. Could you please describe what your stuttering treatment consists of?

_____
_____
_____
_____
_____
_____

9dd. Did you notice an improvement in the frequency of your dysfluencies following treatment?

a) Yes
b) No

9ee. How satisfied were you with your past stuttering treatment?

a) Very Satisfied
b) Satisfied
c) Neutral

d) Unsatisfied
e) Very Unsatisfied

9k. How many times have you attempted treatment for stuttering? _____

9l. How many times have you attended self-help groups for stuttering? _____

9m. Are you currently taking medication for your stutter?
a) Yes (continue to question 9ee)
b) No (skip to question 9n)

9ee. What medication are you taking for your stutter?
_____
_____
_____
_____
_____

9n. Have you ever received counseling, therapy, or mental health services for difficulties you attribute to your stutter?
a) Yes
b) No

10. Have you ever received a diagnosis for a psychological condition from a mental health professional or medical provider?
a. Yes (continue 11a)
b. No (skip to question 12)

10a. What was the diagnosis? _____

CHECK: Should the researcher use my data? Yes No

Appendix Q
Welcome Script

Thank you for your interest in our research! This principal investigator for this study is Luis R. Rodriguez, M.S. under the supervision of Dr. Erin Rasmussen as a part of the Health Decision-Making Lab in the Department of Psychology at Idaho State University.
The purpose of this study is to understand the relationship between decision-making behavior and communication. Prior to participating, you will first take a brief screening survey to see if you are eligible. If you are eligible you will be directed to read over the consent form. If you agree to participate you will complete questionnaires about your communication patterns and lifestyle, a decision-making task, and provide demographic information.
Select participants will be asked to complete the second part of the study which involves a brief video interview where you will read a reading passage provided by the researcher as well as answer questions about your communication experiences. These interviews be recorded but will not be shared with or used for any other purposes unrelated to the study. All information you provide will be kept confidential and be assigned a random number to increase privacy. None of the information you provide will be judged or scrutinized by the researcher.
Individuals who complete all assigned portions of the study will be enrolled in a drawing for one of ten $25 Amazon Gift Cards!

The survey may take approximately 40-60 minutes.

Your participation is VOLUNTARY, and you are free to withdraw your participation at any time. If you have any questions prior to participating, please contact the researchers at commstdy@isu.edu
If you are interested in participating, click the next arrow! Otherwise you may exit your browser to close the survey.

Appendix R

Consent Form
Idaho State University
Human Subjects Committee
Informed Consent Form for Non-Medical Research

CONSENT TO PARTICIPATE IN RESEARCH

Communication Decision-Making Study

You have been asked to volunteer for a research study conducted by Luis R Rodriguez, M.S. and Erin B. Rasmussen, Ph.D. (208-282-5651), from the Department of Psychology at Idaho State University. You have been asked to participate in this research because you are at least 18 years old, have access to an internet connection, and reported proficiency in speaking and reading English. Your participation in this research is voluntary. You should read the information below and email any question about anything you do not understand to **commstdy@isu.edu** before deciding whether or not to participate.

1. PURPOSE OF THIS STUDY
The purpose of this study is to examine decision-making patterns in communication engagement among adults who do and do not stutter, and to validate new measures concerning communication. The goal of this research is to better understand decision-making patterns regarding communication in addition to developing new measures of communication that can be used in both research and treatment settings.

2. PROCEDURES
- This study consists of 1 online session that takes approximately 15-30 minutes to complete.
- For this study you will be asked to agree to this consent form and complete several questionnaires via Qualtrics®, an online survey software.
    - You may be asked to rate your fluency over the past week and how you feel it may have impacted your ability to communicate with different individuals in your life.
    - You may be asked to complete questions regarding your overall experience and knowledge with stuttering and to describe your most severe moment of stuttering.
    - You may be asked to make choices on the likelihood of your participation in a social interaction based on the likelihood of stuttering or negative social interaction occurring.
    - You may be asked about your use of speech over the past year, your engagement in communication within the community, and different treatment experiences you have encountered.
    - You may be asked questions about different beliefs about yourself and experiences you have had regarding anxiety, ability to concentrate, and substance

use. In addition, you will be asked demographic information about yourself (e.g., age, gender, income, etc.)

3. POTENTIAL RISKS AND DISCOMFORTS
Because you will be asked some questions regarding your experience of communication, anxiety, substance use, and life experiences, you may experience very slight emotional discomfort from answering these questions. There may also be a risk of an accidental breach of confidentiality.

4. ANTICIPATED BENEFITS TO SUBJECT
There are no tangible benefits to you for participating in this study.

5. ANTICIPATED BENEFITS TO SOCIETY
Results of this research will be used to increase our understanding of decision-making behavior and communication.

6. ALTERNATIVE TO PARTICIPATION
An alternative is to not participate in this study

7. PAYMENT FOR PARTICIPATION
Participants who complete the study according to their assigned condition (e.g., complete both sessions if assigned to so or only complete one session if assigned to do so) will be entered into a drawing for one of ten $25 Amazon Gift Cards. Participants will be provided with a link that will take them to a separate survey where they will provide their contact information. This information will be deleted once the selected individuals have claimed their compensation.

8. FINANCIAL OBLIGATIONS
There are no financial obligations to you for participating in this study.

9. EMERGENCY CARE AND COMPENSATION FOR INJURY
Idaho State University does not provide any other form of compensation for injury. No other compensation is available

10. PRIVACY AND CONFIDENTIALITY
If you volunteer to participate in this research, you will be provided a link to complete the survey on Qualtrics and be assigned an ID code to all study material upon completion of the study.

No information about you, or provided by you during the research, will be disclosed to others without your written permission, except (a) if necessary to protect your rights or welfare (for example, if you are injured), or (b) if required by law.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity. Any paper containing your name will be stored in a

locked cabinet in the Principle Investigator's laboratory separate from data collected during the study. Raw data will be stored for seven years, after which it will be deleted or destroyed.

11. PARTICIPATION AND WITHDRAWAL

Your participation in this study is VOLUNTARY. If you choose not to participate in the study, this will not affect your relationship with anyone at Idaho State University, current or future medical care, or any benefits to which you are entitled. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time. You should inform the investigator in charge of this study if you decide to do this.

12. WITHDRAWAL OF PARTICIPATION BY THE INVESTIGATOR

The investigators and/or the sponsor may stop your participation in this study at any time. The investigator, Luis R. Rodriguez, M.S., will make the decision and let you know if it is not possible for you to continue. The decision may be made either to enhance safety or because it is part of the research plan. You may also be required to withdraw if you do not follow the investigator's instructions.

If you must drop out because the investigator(s) ask you to (rather than because you decided on your own to withdraw) for any reason other than not complying with the investigator's instructions, you will still receive compensation.

13. IDENTIFICATION OF INVESTIGATORS

In the event of a research related injury or if you experience an adverse reaction, please immediately contact the investigators listed below. If you have any questions about the research or your participation in the study, please feel free to contact Luis R. Rodriguez, M.S. (commstdy@isu.edu) or Erin B Rasmussen, PhD., (rasmerin@isu.edu) Garrison Hall, Campus Box 8112, Idaho State University, Pocatello, ID 833209-8112; (208) 282-5651

14. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have any questions regarding your rights as a research subject, you may contact the Idaho State University Institutional Review Board for Human Research at (208) 282-2179.

If you would like an electronic copy of the consent form, please email commstdy@isu.edu with a written request prior to participating.

SIGNATURE OF RESEARCH PARTICIPANT OR LEGAL REPRESENTATIVE

I have read (or someone has read to me) the information provided above. I have been given an opportunity to ask questions, and all of my questions have been answered to my satisfaction. If requested, I have been given an electronic copy of the informed consent form.

BY CHECKING "AGREE" ON THIS FORM, I WILLINGLY AGREE TO

PARTICIPATE IN THE RESEARCH IT DESCRIBES.

( ) Agree ( ) Disagree

Appendix S
Screening Survey

1. Are you at least 18 years of age?
    a. Yes
    b. No

2. Do you have access to a reliable internet connection?
    a. Yes
    b. No

3. Are you willing to download or have access to the video conferencing software Zoom®? (https://zoom.us/) The free version of this video conferencing software will be necessary to facilitate the second session of the study which involves a brief in person interview for select participants.
    a. Yes
    b. No

4. Have you *ever* been diagnosed with a speech/language or communication disorder?
    a. Yes (proceed to item 4a)
    b. No (proceed to item 5)

    4a. Please select *all* speech/language or communication disorder diagnoses you have received.

    ____ Alalia (i.e., speech delay)
    ____ Aphasia
    ____ Apraxia
    ____ Cleft lip or cleft palate
    ____ Cluttering
    ____ Developmental verbal dyspraxia
    ____ Dysarthria
    ____ Expressive or receptive language delay or disorder
    ____ Orofacial myofunctional disorder
    ____ Selective mutism
    ____ Speech sound disorder
    ____ Stuttering (i.e., developmental stuttering, persistent stuttering, child-onset fluency disorder)
    ____ Voice disorder (i.e., dysphonia, aphonia)
    ____ Other _____

    4aa. If you selected stuttering, do you currently stutter? Yes OR No

5. Please select if you have been diagnosed with any of the following by a medical or mental health professional:

    ____ Alzheimer's Disease
    ____ Autism Spectrum Disorder
    ____ Dementia
    ____ Hearing loss
    ____ Intellectual disability
    ____ Laryngeal or oral cancer
    ____ Social Pragmatic Communication Disorder
    ____ Stroke
    ____ Traumatic Brain Injury
    ____ Other/Unspecified Neurodevelopmental Disorder

    ____ I have not been diagnosed with any of the disorders, disabilities, or difficulties listed.

Appendix T
Systematic Responders Only

Systematic Responders Only. To determine the robustness of the observed effects, identical analyses were conducted using systematic responders only (Johnson & Bickel, 2008).When examining differences between AUC as a function of negative reaction (10%, 50%, or 90% negative reaction) and group (stuttering vs. non-stuttering), repeated measure ANOVA continued to show a significant main effect of negative reaction [$F(2,160)=117.25$, $p<0.001$, $\eta_p^2=0.59$]. When controlling for group, the 50% negative reaction condition [$F(1,80)=116.97$, $p<0.001$, $\eta_p^2=0.59$] and the 90% negative reaction [$F(1,80)=159.13$, $p<0.001$, $\eta_p^2=0.67$] had significantly lower AUC values than the 10% negative reaction condition. However, there was no significant main effect of group, nor was there a significant interaction.

For AWS spearman's rho correlations revealed significant, positive relations among *h* values (rs=0.59-0.82, $p<0.01$) and AUC values (rs=0.69-0.78, $p<0.01$) across the three negative reaction conditions (Table 12). In addition, AUC and *h* values were significantly and negatively associated with each other across the three magnitudes (rs=-0.76 to -0.99, $p<0.01$). The CPI was significantly and negatively correlated with *h* values and positively correlated with AUC values. The OASES-A showed significant, positive associations with the 50% and 90% NR conditions and was negatively associated with the AUC values across the three NR conditions. The SSS showed significant, positive correlations with the *h* value of the 50% and 90% NR conditions and a significant, negative association with the AUC value of the 90% NR. The GSE-6 showed a significant, negative association with the *h* value of the 90% NR and a positive association with the 10% and 90% NR AUC (rs=0.34, p=0.02). With systematic responders only, *h* values and AUC values of the PDC were no longer significantly correlated with measures

Table 12

Spearman's rho correlations among discounting, communication, and anxiety measures among AWS systematic responders only (n=37)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. *h* value 10% NR	-													
2. *h* value 50% NR	.73**	-												
3. *h* value 90% NR	.59**	.82**	-											
4. AUC 10% NR	-.98**	-.75**	-.65**	-										
5. AUC 50% NR	-.76**	-.97**	-.81**	.78**	-									
6. AUC 90% NR	-.63**	-.82**	-.99**	.69**	.83**	-								
7. CPI T-Score	-.30*	-.34*	-.47**	.30*	.36*	.52**	-							
8. OASES-A Total	.28	.32*	.38**	-.30*	-.35*	-.44**	-.78**	-						
9. SSS Total	.23	.30*	.34*	-.22	-.28	-.35*	-.64**	.72**	-					
10. SAD-D [sqrt]	.15	.25	.22	-.14	-.26	-.27	-.62**	.79**	.57**	-				
11. OASIS	.06	.16	.14	-.05	-.15	-.16	-.57**	.59**	.58**	.72**	-			
12. GSE-6	-.29	-.22	-.33*	.33*	.25	.34*	.51**	-.45**	-.34*	-.28	-.30	-		
13. LSUR	-.27	-.28	-.27	.27	.30*	.27	.37*	-.46**	-.30*	-.40**	-.17	.52**	-	
14. # of years stuttering	.22	.18	.16	-.22	-.13	-.14	-.09	-.11	-.05	-.27	-.12	-.20	-.02	-
15. # of tx attempts	.06	-.11	-.05	-.05	.07	.01	-.13	.16	.00	.21	.06	-.35*	-.30*	-.00

Note. *$p \leq 0.05$; ** $p < 0.01$; AWS=adults who stutter; NR=Negative Reaction; AUC=Area Under the Curve; CPI=Communicative Participation Item Bank; OASES-A=Overall Assessment of the Speaker's Experience of Stuttering-Adult; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; GSE-6=General Self-Efficacy Scale; LSUR=Level of Speech Use Rating Scale; tx=treatment

of anxiety (i.e., OASIS or SAD-D); however, the CPI was significantly and negatively correlated with the SAD-D (rs=-0.62, p<0.001) and the OASIS (rs=-0.57, p<0.001).

Using only AWS systematic responders, neither the first regression model or the second model with the SSS, GSE-6, and OASES-A were statistically significant. Further, no individual variable significantly predicted AUC values of the 10% negative reaction condition. Similar results were observed for the 50 % and 90% negative reaction conditions. Neither the first or second regression equation were statistically significant, nor were individual variables significant predictors. Further, across all three negative reaction conditions, the inclusion of the additional parameters did not account for significantly more variance in AUC values.

For the CPI, the first regression model was statistically significant [F(3,44)=9.59, p<0.001; Table 15] with the OASIS being a significant, negative predictor ($r_{12.3}$=-0.32). The model continued to remain statistically significant [F(6,44)=13.33, p<0.001] and accounted for significantly more variance when the SSS, OASES-A, and GSE-6 entered the model [ΔR^2=0.27; F(3,38)=10.45, p<0.001]. Within the second model, when controlling for all other variables, the OASES-A ($r_{12.3}$=-0.41) and the GSE-6 ($r_{12.3}$=0.34) significantly predicted CPI T-scores.

Table 13

Regression Summary Predicting CPI T-Scores with Systematic Responders Only

Variable	*b* (SE)	β	*t*	R^2	ΔR^2	*p*
		Step One				
				0.41		<0.001*
(Constant)	51.26(3.72)		13.80			<0.001*
LSURS	1.68(0.87)	0.25	1.93			0.06
SAD-D [sqrt]	-0.90(0.92)	-0.18	-0.97			0.34
OASIS	-0.68(0.31)	-0.38	-2.18			0.04*
		Step Two				
				0.68	0.27	<0.001*
(Constant)	57.33(7.21)		7.96			<0.001*
LSURS	-0.36(0.80)	-0.06	-0.45			0.65
SAD-D [sqrt]	0.19(0.81)	0.04	0.23			0.82

OASIS	-0.18(0.27)	-0.10	-0.67	0.51
SSS	-0.04(0.03)	-0.17	-1.12	0.27
OASES-A	-4.75(1.70)	-0.51	-2.80	0.008*
GSE-6	0.63(0.28)	0.26	2.22	0.03*

Note. *$p \leq 0.05$; LSUR=Level of Speech Use Rating Scale; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; OASES-A=Overall Assessment of the Speaker's Experience of Stuttering-Adult; GSE-6=General Self-Efficacy Scale

Table 14

Spearman's rho correlations between discounting, communication, and anxiety measures among AWNS systematic responders (n=45)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
13. *h* value 10% NR	-										
14. *h* value 50% NR	.59**	-									
15. *h* value 90% NR	.55**	.73**	-								
16. AUC 10% NR	-.97**	-.61**	-.56**	-							
17. AUC 50% NR	-.62**	-.99**	-.74**	.63**	-						
18. AUC 90% NR	-.57**	-.74**	-.99**	.57**	.74**	-					
19. CPI T-Score	-.11	-.19	-.15	.13	.20	.17	-				
20. SSS Total	.22	-.01	-.10	-.23	.02	.07	-.44**	-			
21. SAD-D [sqrt]	.14	.26	.27	-.14	-.28	-.28	-.60**	.46**	-		
22. OASIS	.14	.26	.27	-.14	-.28	-.28	-.60*	.46*	.48**	-	
23. GSE-6	-.27	-.24	-.31	.28	.27	.32	.47**	-.07	-.20	-.17	-
24. LSUR	-.17	-.07	.07	.16	.07	-.05	.18	-.20	-.17	-.22	.05

Note. *$p<0.05$; ** $p<0.01$; AWNS=adults who do not stutter; NR=Negative Reaction; AUC=Area Under the Curve; CPI=Communicative Participation Item Bank; SSS=Subjective Stuttering Scales; SAD-D=Social Anxiety Disorder Dimensional Scale; OASIS=Overall Anxiety Severity and Impairment Scale; GSE-6=General Self-Efficacy Scale; LSUR=Level of Speech Use Rating Scale

Among the AWNS, the three negative reaction condition *h* values were significantly and positively associated with each other (*r*s=0.55-0.73, *p*<0.01) as well as AUC values (*r*s=0.57-0.74, *p*<0.01; table 17). Further, *h* and AUC values among the AWNS showed significant, negative associations with each other across the three negative conditions (*r*s= -0.56 to -0.99, *p*<0.01). Neither *h* or AUC values across any negative reaction condition correlated with the CPI, SSS, SAD-D, OASIS, GSE-6 or the LSUR.

Appendix U

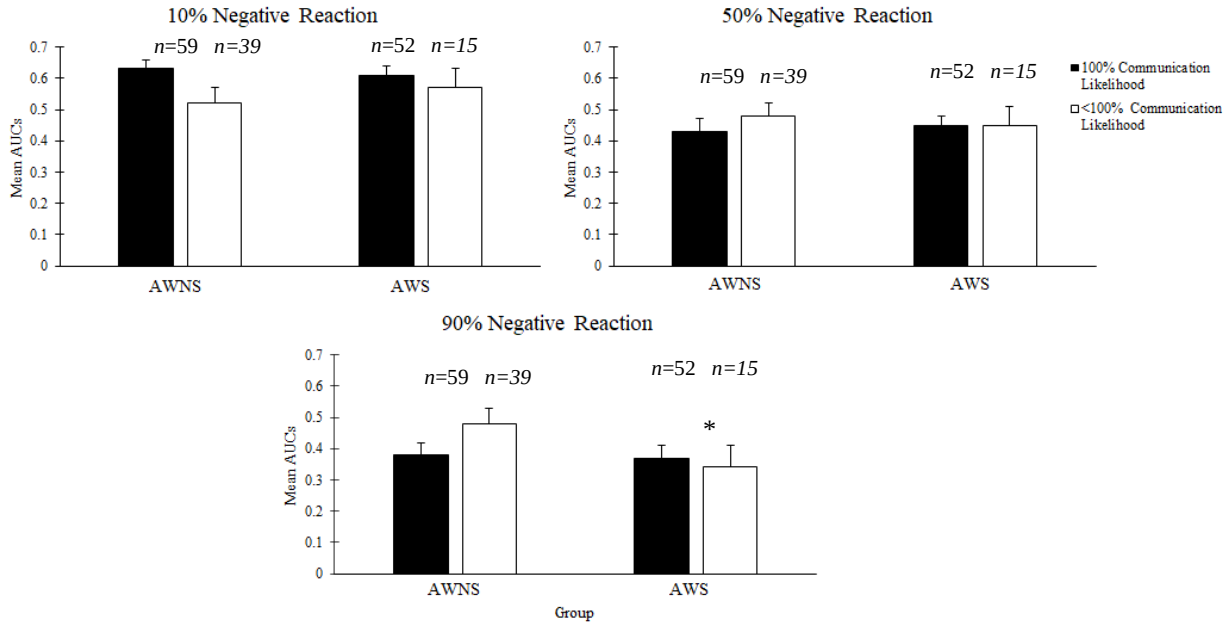
Exploratory Analysis

Exploratory Analysis: Ideal Condition

To determine sensitivity of the measure, the first item of the PDC assessed the likelihood an individual would engage in a communicative situation under ideal circumstances (i.e., when the risk of dysfluency was 0% and the risk of a negative reaction was also 0%). We compared the frequency of individuals who were 100% likely to engage a communicative situation with 0% stuttering and NR risk. Chi square revealed a significant difference between AWS (77.6%) and AWNS [58.1%; $\chi^2(1)=6.66$, $p=0.01$]; indeed, the odds ratio of 100% likelihood was 2.61 times higher in the for AWS relative to AWNS.

Figure 7

Area under the curve values



Note. *$p<0.05$; AWNS=adults who do not stutter; AWS=adults who stutter

Given this significant difference, a 2x2x3 mixed repeated measures ANOVA with group (stuttering vs. non-stuttering) and communication likelihood (100% vs <100%) as between subject factors and negative reaction condition (10%, 50%, and 90%) as the-within subject factor was conducted (see Figure 8). Results revealed a significant main effect of NR [$F(2,312)=81.69$, $p<0.001$, $\eta_p^2=0.34$]. The AUC values of the 10% NR were significantly higher from the 50% NR condition [$F(1,156)=76.294$, $p<0.001$, $\eta_p^2=0.33$], and the 50% condition AUC values were significantly higher than the 90% NR condition [$F(1,156)=26.93$, $p<0.001$, $\eta_p^2=0.15$]. There was a significant interaction between group and NR condition [$F(2,312)=4.60$, $p=0.01$, $\eta_p^2=0.03$]. Contrasts indicated that within the 90% NR condition, AUC values were significantly lower among the stuttering condition compared to non-stuttering and stuttering AUCs in other NR conditions [$F(1,156)=8.01$, $p=0.005$, $\eta_p^2=0.05$]. There was a significant interaction between NR and communication likelihood [$F(2,312)=7.50$, $p=0.001$, $\eta_p^2=0.05$]. Individuals who selected 100% communication likelihood showed significantly higher AUC values in the 10% NR condition compare to the 50% condition [$F(1,156)=10.79$, $p=0.001$, $\eta_p^2=0.07$]. No difference in AUC values were observed between the 50% and 90% NR as a function of communication likelihood. There was a significant 3-way interaction between magnitude, group, and communication likelihood [$F(2,312)=5.97$, $p=0.003$, $\eta_p^2=0.04$]. AWS showed significantly higher AUC values for the 10% NR condition compared to the 50% NR condition regardless of communication likelihood. However, AWNS showed a significant differences between 10% NR and 50% NR condition only if they endorsed 100% communication likelihood as opposed to less than 100% communication likelihood when dysfluency and negative reaction risk were both 0% [$F(1,156=4.59$, $p=0.03$, $\eta_p^2=0.03$]. No significant differences were observed between the 50% and 90% negative reaction conditions. There were no significant main effects of group,

communication likelihood, nor was there a significant interaction between the two variables. When conducting analyses with systematic responders only, results remained similar except the interaction between magnitude and communication likelihood was no longer significant.

Additional exploratory analyses were conducted to determine if other differences were observed between individuals who selected 100% vs. less than 100% likelihood of communicating under ideal conditions. Independent samples t-tests revealed that AWNS who selected less than 100% scored significantly higher on the SSS [$M_{<100\%}$=47.18, *S.E.*=5.70; $t(55.69)=4.62$, $p<0.001$, $d=1.02$) Similarly, they reported significantly lower scores on the CPI [$M_{100\%}$=53.19, *S.E.*=1.88; $t(91)=3.33$, $p=0.001$, $d=0.69$). No significant differences were observed between the two groups on either measure of anxiety, although differences in social anxiety scores on the SAD-D trended towards significance [$M_{<100\%}$=3.31, *S.E.*=0.28; $M_{100\%}$=2.68, *S.E.*=0.21; $t(91)=1.81$, $p=0.07$, $d=0.38$]. However, the groups did not differ on GSE-6, ASRS or BIS-11 scores, nor was there a significant difference in endorsements of a mental health diagnosis.

Among AWS only, those who selected <100% likelihood of communicating showed significantly lower CPI scores [$M_{<100\%}$=45.53, *S.E.*=1.96) than those who endorsed 100% likelihood [$M_{100\%}$=50.52, *S.E.*=1.03; $t(65)=-2.28$, $p=0.03$, $d=0.93$]. The less 100% subgroup within the stuttering sample also showed significantly lower scores on the GSE-6 [$M_{<100\%}$=16.73, *S.E.*=0.75] than those on those who endorsed 100% [$M_{100\%}$=18.82; *S.E.*=0.34; $t(65)=2.78$, $p=0.007$, $d=0.78$]. There were no significant differences on SAD-D, OASIS, ASRS, or BIS scores.

Exploratory Analysis Discussion

Interestingly, exploratory analyses revealed one's initial valuation of speech under ideal conditions can impact the magnitude effect of communication. For instance, all adults who stutter and those adults who do not stutter who selected 100% likelihood of communicating under ideal conditions (i.e., 0% risk of dysfluency and 0% risk of negative reaction) showed similar patterns of discounting across all three negative reaction conditions with significantly less discounting at 10% negative risk compared to 50% and 90%. However, for adults who do not stutter who indicated less than 100% likelihood of communicating under ideal conditions, they showed significantly steeper discounting in the 10% negative reaction conditions.

The results from the exploratory analysis highlight the importance of examining initial valuation larger outcomes under ideal conditions (i.e., 0% risk; "no delay") in both probability and delay discounting literature as this could lead to increased variability in the data. Indeed, this examination may be especially important for non-monetary outcomes given that receipt of a larger amount of particular outcome may be a punisher (e.g., sex; Lawyer, 2008; Lawyer et al., 2010). In addition, examination of responses at 0-delay or 0-risk condition may reveal differences between group that have important clinical implications. For instance, multiple sclerosis patients who discounted adherence to medication with 99% efficacy showed significantly poorer performance on cognitive performance suggesting additional intervention may be necessary (Bruce et al., 2018).