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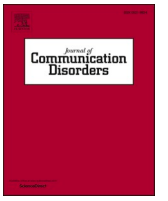

Temperament is Linked to Avoidant Responses to Stuttering Anticipation

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ABSTRACT

Purpose: The purpose of the present study was to examine the degree to which certain temperament constructs predict individual differences in three types of behavioral responses to anticipation among children and adults who stutter (CWS and AWS, respectively): avoidance, physical change, and approach.
Methods: Participants included 64 CWS (9- to 17-years-old) and 54 AWS (18- to 50-years-old) who completed an online survey package including a temperament questionnaire (*Early Adolescent Temperament Questionnaire–Revised* for the CWS; *Adult Temperament Questionnaire* for the AWS) and the *Stuttering Anticipation Scale*. The data were analyzed separately for CWS and AWS using multivariate multiple regressions to assess how each temperament construct predicted avoidance, physical change, and approach responses to anticipation.
Results: CWS who reported higher levels of shyness were more likely to engage in avoidant behavioral responses when they anticipate an upcoming moment of stuttering. AWS who reported higher levels of orienting sensitivity were more likely to engage in avoidant behavioral responses when they anticipate an upcoming moment of stuttering. No temperament constructs predicted physical change or approach responses to anticipation among either age group.
Conclusion: Specific aspects of temperament appear to be linked to the degree that CWS and AWS engage in avoidant behavioral responses to stuttering anticipation. These findings support the continued study of how individual differences impact the internal experience and outward manifestation of stuttering behaviors.

1. Introduction

Temperament can be conceptualized as a lens through which an individual sees and subsequently interacts with the world. Extended to the experience of stuttering, temperament can serve as a filter through which stuttering experiences are shaped, particularly experiences related to moments of stuttering, the anticipation of them, and ensuing responses. Although anticipation is common to people who stutter, there is individual variation in how they choose to respond to anticipation (Jackson et al., 2015, 2019). That is, prior to an overt moment of stuttering, speakers have the opportunity to alter how stuttering behaviors manifest. These responses to anticipation are necessarily individualized considering how speakers uniquely manage the internal (e.g., speech-language

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planning) and external (e.g., listener reactions) characteristics associated with the interaction. Individuals' capacity for reactivity and self-regulation could very well contribute to what they choose to do with that anticipation. While some people who stutter may avoid the upcoming word they anticipate stuttering on, others may physically change some aspect of the speech mechanism, while others may approach the word without any compensatory strategy (Jackson et al., 2019). What propels speakers to respond to stuttering anticipation in these different ways? One possibility is that their unique temperaments contribute to individual differences in how they maneuver moments of anticipating upcoming difficulty (Compas et al., 2004). Because stuttering anticipation subsumes both reactive and self-regulatory processes, temperament may be particularly salient to our understanding of the anticipation phenomenon.

1.1. Temperament

1.1.1. Constructs

Temperament is an umbrella term that reflects a collection of traits. Globally, it refers to individual differences in reactivity and self-regulation in emotional, attentional, and motor domains (Rothbart & Bates, 1998; Rothbart & Derryberry, 1981). *Reactivity* refers to how easily one's emotions, attention, and motor activity are aroused, including proclivities toward, away from, or against unfamiliar or challenging stimuli (Rothbart, 2011). Reactivity can be measured by the onset, duration, and intensity of emotional reactions, as well as variability in how aroused and distressed one becomes to overstimulation, activity, and attention (Rothbart & Derryberry, 1981). *Self-regulation* modulates reactivity; it reflects how one initiates, maintains, or moderates the occurrence, intensity, and duration of their arousal (Rothbart & Bates, 1998). While temperament is part of one's biological makeup (particularly reactive tendencies that are present in infancy), it is also influenced over time by heredity, maturation, and experience (Laceulle et al., 2012; Rothbart & Ahadi, 1994; Rothbart & Bates, 1998; Rothbart & Derryberry, 1981; Snyder et al., 2015). As such, temperament does not exert unidirectional and constant influence on how an individual reacts and regulates; it is also influenced by an individual's experiences (Rothbart et al., 2000).

Questionnaire-based methods are one of the most common approaches for studying temperament. These questionnaires are based on prominent models of temperament—most notably are those that originated from the works of Thomas and Chess (1977) and Rothbart and colleagues (2006). Factor analytic studies have revealed that the structure of temperament is comprised of several constructs related to reactivity and self-regulation that tend to be relatively stable across development. In the present study, we utilized Rothbart's questionnaires and, as such, will focus our discussion on the factor structure of her model. The three temperament "superfactors" in Rothbart's model include surgency, negative affect, and effortful control. *Surgency* reflects a tendency to react to situations with positive emotional states, rapidly approach potential rewards, and demonstrate high activity level. *Negative affect* is the tendency to react to situations with negative emotional states such as discomfort, anger/frustration, fear, and sadness. *Effortful control* is the ability to detect errors, plan, and inhibit a dominant response in lieu of performing a subdominant response (Rothbart, 2007). In adolescence, a fourth factor of *affiliativeness* emerges as a primary temperament construct which involves concern for others including warmth and closeness with others, perceptual sensitivity, and pleasure sensitivity (Rothbart et al., 2004). In adulthood, evidence supports reformulation of the affiliativeness subscale into a factor called *orienting sensitivity*, referring to the degree to which an individual is sensitive to low intensity neutral or emotional cues, and aware of spontaneous ideas not directly related to the present environment (Evans & Rothbart, 2007). While the processes that underlie temperament are common to everyone, variation in how these processes function and are elicited under specific conditions reflect individual differences in temperament (Rothbart, 2011).

There is considerable evidence that temperament traits are at least moderately stable from early childhood into adulthood (Roberts & Delvecchio, 2000). For instance, young children with high levels of negative affect tend to continue exhibiting high levels of negative affect in adolescence and adulthood. However, it is a great challenge, if not impossible, to separate out the cascading effects that these early temperament traits can have on events throughout the person's life that in turn influence their behavioral outcomes. For example, young children with high levels of negative affect might elicit harsh parenting which, in turn, promotes poor mental health outcomes (Martin et al., 2020). And while temperament traits are typically conceptualized as stable traits that influence behavior across situations, it is of functional importance in helping us understand individuals' responses to stress (Strelau, 2001), making it applicable to stuttering which can be considered a stressor. There are automatic and controlled responses to stress, and temperament traits influence both. Automatic responses to stress include physiological arousal, emotional arousal, intrusive thoughts, attentional biases, impulsive responses, and involuntary escape behaviors (Compas et al., 2001). These involuntary reactions emerge from bottom-up, reactive components of temperament, such as negative affect, extraversion, and orienting sensitivity. In contrast, controlled responses to stress are volitional efforts to regulate one's thoughts, emotions, behaviors, physiology, and the environment and tend to be influenced by top-down, self-regulatory component of temperament (i.e., effortful control; Fickova, 2001; Gomez et al., 1999; Lengua et al., 1999).

1.1.2. Temperament and Stuttering

In the past two decades, there has been growing momentum in linking temperament and stuttering—both in state and trait domains that affect how individuals interact with the world around them in a singular moment as well as over time. Most studies have focused on young children near the age of onset of stuttering to investigate how temperament relates to children's stuttering severity (reflecting the child's state) (Arnold et al., 2011; Choi et al., 2013; K. N. Johnson et al., 2010; Kefalianos et al., 2017; Kraft et al., 2014; Ntourou et al., 2013, 2020; Tumanova et al., 2011), as well as how it relates to children's overall disposition and recovery/persistence of stuttering (reflecting the speaker's trait) (Ambrose et al., 2015; Kefalianos et al., 2014; Singer et al., 2019; Zengin-Bolatkale et al., 2018). As a group, when compared to children who do not stutter, young children who stutter (CWS) have shown heightened negative affect (Ambrose et al., 2015; Eggers et al., 2010; Ntourou et al., 2013), decreased adaptability to environmental change (Anderson

et al., 2003; Schwenk et al., 2007), and lowered capacity for attentional and emotional self-regulation (Eggers et al., 2010, 2012, 2013; Felsenfeld et al., 2010; K. N. Johnson et al., 2010). However, there are several reports of comparable tendencies in reactivity (Kefalianos et al., 2012) and regulation (Eggers et al., 2018; K. N. Johnson et al., 2012; Kefalianos et al., 2012) between CWS and their typically fluent peers. There have been equivocal findings regarding group differences in behavioral inhibition between CWS and typically fluent children (Choi et al., 2013; Ntourou et al., 2020; Tumanova et al., 2020), which is a temperamental tendency to react to novel or unfamiliar people and situations with cautiousness and fear (Kagan et al., 1984). Interestingly, greater behavioral inhibition (Choi et al., 2013; Ntourou et al., 2020) and lower self-regulatory abilities (Arnold et al., 2011; Kraft et al., 2014, 2019) have been associated with greater stuttering frequency in some young children who stutter, but greater behavioral inhibition has been linked to lower stuttering frequency in others (Tumanova et al., 2020).

While most of the empirical attention has focused on characterizing the link between temperament and stuttering in early childhood, it remains relevant and valuable to study the relationship beyond the bounds of early childhood. In particular, the study of temperament has critical implications for the social-emotional adjustment and personality development of older CWS and adults who stutter (AWS) who cope with chronic stuttering. However, this research on temperament among older CWS and AWS is limited. One study among 6- to 12-year-olds found no between-group differences on any temperament construct (Nicholas, 2015), while another study found increased reactivity among older CWS aged 10- to 12-years but not among younger CWS aged 7- to 9-years old (Rocha et al., 2019). Preliminary comparisons between AWS and typically fluent adults have revealed no group differences on self-reported temperament (Beita-Zuk, 2013; Guitar, 2003; Lucey et al., 2019) or physiological measures of reactivity through acoustic startle responses (Alm & Risberg, 2007; J. B. Ellis et al., 2008) (cf. Guitar, 2003).

Although there appear to be no systematic group differences in temperament among older CWS and AWS, within-group trends of the effect of temperament on the stuttering experience among older CWS and AWS have emerged. Among eight- to 14-year-olds who stutter, those who are more extraverted and less fearful/shy tend to be less impacted by their stuttering, while those who are prone to irritability and frustration are impacted more (Eggers et al., 2021). Among AWS, temperament has been identified as an important moderator of repetitive negative thinking and adverse impact of stuttering. Repetitive negative thinking refers to recurrent thoughts about one's self, concerns, and experiences (Watkins, 2008). Tichenor and Yaruss (2020) suggest that when put into the context of the stuttering experience, anticipation may be conceived as one form of repetitive negative thinking: "If anticipation is experienced repeatedly, then it may become habitual, thereby making it a stuttering-specific example of [repetitive negative thinking]" (p. 202). Importantly, AWS with high levels of negative affect and low levels of effortful control are more likely to report higher levels of repetitive negative thinking and greater adverse impact of stuttering (Tichenor & Yaruss, 2020).

Taken together, the equivocal between-group findings and interesting within-group findings suggest that there is not just merit in investigating group differences in temperament between speakers who do and do not stutter, but rather, how individual differences in temperament influence how people who stutter maneuver stuttering in everyday interactions and in the long-term. This is particularly relevant in the context of anticipation because most speakers who stutter experience anticipation to a significant degree throughout their daily lives (Jackson et al., 2018). The many momentary decisions that a stutterer is faced with therefore would plausibly be impacted by their reactivity and regulatory tendencies. This work can help us understand how temperament contributes to the experience of stuttering later in development to elucidate the myriad and unique ways that people who stutter cope with stuttering and its anticipation, once they have cumulative experience with it. This has important implications for understanding the heterogeneity of the stuttering experience as well as individualizing the therapeutic approach for clients who stutter.

1.2. Anticipation

While sound/syllable repetitions, prolongations, and blocks are the defining *overt* characteristics of stuttering, anticipation is one of the core *covert* features of stuttering. Anticipation can occur on a variety of timescales. People who stutter might have a general, looming expectation that they will stutter in an upcoming speaking situation or that listeners will react negatively to their stuttering during a future interaction (Boyle & Blood, 2015; Plexico et al., 2009; Tichenor & Yaruss, 2018). The nature of this anticipation is not specific to discrete sounds or words. Anticipation can also occur on a much shorter, more immediate timescale, such as when people who stutter sense that they will stutter on a specific upcoming sound or word should they continue their utterance as planned (Jackson et al., 2015, 2018). In the present study, we are concerned with the latter.

Anticipation has long been of interest in the field of stuttering, and it is central to several foundational theories of stuttering related to the anticipatory struggle hypothesis such as Johnson's view on anticipatory avoidance (1938), Sheehan's approach-avoidance conflict (1953), and Van Riper's preparatory set (1937). This is inextricably linked to the fact that one's ability to anticipate moments of stuttering is a precursor to common behavioral approaches to stuttering therapy, particularly those that focus on behavioral changes such as stuttering modification and fluency shaping. For example, a client's ability to use easy onset of phonation, light articulatory contact, or preparatory sets to minimize overt stuttering relies on their ability to anticipate the stuttering moment in the first place. Only once they are aware of impending overt stuttering are they able to adjust their muscular tension so they can approach that sound or word in an easier way.

Contemporary models of stuttering integrate aspects of speech, language, emotional, and physiological factors. These models frame how individual differences in these domains feed into the development and variability of stuttering. Of particular relevance to the present study are Conture and Walden's dual diathesis-stressor model (Conture & Walden, 2012; Walden et al., 2012) and Garcia-Barrera and Davidow's model of anticipation (2015). Conture and Walden propose that environmental stressors activate underlying vulnerabilities in emotion and speech-language and emotion which contributes to the variability of stuttering across situations (Walden et al., 2012). In this dual diathesis-stressor model of stuttering, these two vulnerabilities in emotion and speech-language

are likely epigenetic in that they are inherited traits but responsive to environmental interaction and influence (Conture & Walden, 2012). Central to this model is the influence of temperament on stuttering—that is, individuals' unique proclivities for emotional reactivity and regulation play a critical role in the development and variability of stuttering.

In their recent theoretical account of anticipation, Garcia-Barrera and Davidow (2015) assert that anticipation emerges from a complex interaction between previous experiences and error monitoring. Through associative learning processes, speakers develop memories of sounds or words that they have previously stuttered on which, when coupled with perceived negative consequences for stuttering, makes the speaker highly sensitive to upcoming moments of stuttering via their speech monitoring system (Garcia-Barrera & Davidow, 2015). In fact, many studies have shown that speakers of all ages tend to stutter on the same sounds or words on repeated occasions, a phenomenon known as the consistency effect (Bloodstein, 1960; Johnson & Knott, 1937; Williams, Silverman, & Kools, 1969). As a result of repeated difficulty with certain sounds and words, speakers come to anticipate future struggle on those same sounds or words which can result in "anticipatory anxiety"—increased levels of anxiety based on previous negative experiences with those sounds or words (Alm, 2004; Bowers et al., 2012).

We propose that the current study paves a preliminary bridge between these two contemporary theories of how stuttering and associated reactions develop over time. For some people who stutter who are highly emotionally reactive, anticipating an upcoming moment of stuttering and potential negative listener reactions may serve as a stressor that activates their emotional diathesis—that is, their underlying proclivity for high emotional reactivity. The anticipation of stuttering triggers an emotional response whereby the upcoming moment of stuttering is assumed to occur at high risk of a negative outcome. As such, people who stutter with high levels of negative affect (i.e., negative emotional reactivity) may be prone to avoid upcoming moments of stuttering in attempt to circumvent the uncomfortable social repercussions for stuttering. For other people who stutter who have greater capacity for emotional regulation, anticipating an upcoming moment of stuttering may allow them to activate adaptive ways of approaching it—whether it be making a physical change to say the word with greater ease or approaching the target word head-on. As such, people who stutter with high levels of effortful control (i.e., capacity for self-regulation) may be prone to approach moments of stuttering because they have adequate emotional regulation to move through it. These possible connections between temperament (as informed by Conture and Walden's dual diathesis-stressor model) and anticipation (as informed by Garcia-Barrera and Davidow's anticipation model) serve as the bases for our study hypotheses, which are outlined in Section 1.3.

Although there have been equivocal findings on psycho-physiological markers associated with real-time anticipation (Alm, 2004; Baumgartner & Brutten, 1983; Bowers et al., 2012; Dietrich & Roaman, 2001), people who stutter have described anticipation making them feel anxious, fearful, and frustrated (Plexico et al., 2009). As such, collecting self-report experiences with anticipation offers a clinically relevant approach to studying this elusive phenomenon. Survey-based research on anticipation allows clinicians and researchers to not only glean information about how often a speaker anticipates stuttering and the associated physiological sensations (Cholin et al., 2016), but also how they choose to respond behaviorally. Both CWS and AWS anticipate stuttering, though AWS have reported anticipating stuttering to a greater degree. In a recent study by Jackson et al. (2018), nearly 80 percent of 9-12 year-old CWS and more than 90 percent of 13-17 year-old CWS reported anticipating at least "sometimes." In another study by Jackson et al. (2015), all AWS ($n = 30$) reported anticipating at least "sometimes," and nearly 80 percent reported anticipating stuttering at least "often."

Despite the universality of anticipation across CWS and AWS, speakers respond to anticipation in myriad ways. In the time between a speaker's cognitive sense that they will stutter on an upcoming word and arrival at that word, the speaker can choose to do a variety of things. Jackson et al. (2015) qualitatively analyzed AWS' reported experiences with behavioral responses to anticipation and reduced them to 25 non-overlapping items. These 25 items comprise the *Stuttering Anticipation Scale* (SAS; Jackson et al., 2018) on which respondents rate how frequently they respond to anticipation in each of those ways. The SAS has been used with both CWS and AWS (Jackson et al., 2018, 2019). In a recent exploratory factor analysis of the SAS, a three-factor structure emerged suggesting that people who stutter respond to anticipation in three distinct ways: avoidance, physical change, and approach (Jackson et al., 2019). Seventeen items on the SAS contribute to the avoidance factor; these items focus on a speaker's attempts to *not* stutter such as switching words, stalling, changing the topic, using interjections, letting someone else speak for them, and avoiding speaking altogether. Four items on the SAS contribute to the physical change factor; these items reflect a speaker's attempts to adjust the speech mechanism in some way including slowing down one's speech rate, employing a speech strategy, and taking a breath. The remaining four items on the SAS contribute to the approach factor; these items relate to a speaker's decision to stutter overtly without avoiding such aspseudostuttering, disclosing, and stuttering openly. These three factors emerged from a sample of 121 people who stutter ranging in age from nine to 63 years of age, which suggests that these factors are relevant to both CWS and AWS. These findings suggest that with the awareness of upcoming difficulty, speakers have a choice as to how they can proceed— whether they choose to avoid, make a physical change, or approach. As such, the rapid decision-making process that occurs after the speaker anticipates stuttering on an upcoming word yet before they arrive at that target word advertently impacts how the moment of stuttering overtly manifests.

There are several extrinsic and intrinsic factors that may contribute to how speakers choose to respond to anticipation. For instance, extrinsic factors would be related to real or perceived demands of the situations such as time pressure and listener reactions. Intrinsic factors may be related to the speakers' learned responses that stem from experiences in speech therapy. These could be productive responses, such as learning to move through a moment of stuttering with greater ease or approaching stuttering head-on; alternatively, these could be maladaptive responses where stuttering may be avoided to maintain an overt semblance of fluency. Another intrinsic factor could be speakers' unique reactive and self-regulatory tendencies, which is what we examine in the current study.

1.3. Purpose of the Present Study

The purpose of the present study was to determine which, if any, temperament construct(s) predict how often CWS and AWS engage

in avoidance, physical change, and approach responses to anticipation. We predicted that among both CWS and AWS, negative affect would be associated with avoidant responses to anticipation, and effortful control would be associated with physical change and approach responses to anticipation. Because negative affect is the tendency to react to situations with negative emotional states such as discomfort and fear, we hypothesized that individuals with high levels of negative affect would engage in a high degree of avoidance behaviors as those speakers try to prevent the discomfort that could arise from overt stuttering. Further, because effortful control is the tendency to detect errors, plan, and perform an action when there is a strong tendency to avoid it (Evans & Rothbart, 2007), we hypothesized that individuals with high levels of effortful control would override initial desires to avoid moments of stuttering in favor of making a physical change or approaching moments of stuttering.

2. Methods

This study was approved by the Institutional Review Board at the second author's institution.

2.1. Participants

Participants included 64 CWS (46 males, 18 female) between nine- and 17-years of age ($M = 13.2$, $SD = 2.2$) and 54 AWS (36 males, 18 female) between 18- and 50- years of age ($M = 30.7$, $SD = 10.0$). Participants were recruited through the second author's database of people who stutter, referrals from stuttering specialists, and emails through Friends: The National Association of Young People Who Stutter.

2.2. Measures

Participants provided consent and completed a temperament questionnaire and the *Stuttering Anticipation Scale* (SAS; Jackson et al., 2018) online using Qualtrics software (Provo, UT). To assess temperament, the CWS completed the *Early Adolescent Temperament Questionnaire-Revised* (EATQ-R; L. K. Ellis & Rothbart, 2001), and the AWS completed the *Adult Temperament Questionnaire* (ATQ; Evans et al., 2007). The EATQ-R is a 65-item scale that assesses temperament and self-regulation in 9- to 15-year-olds, yielding four superfactor scores for surgency, negative affect, effortful control, and affiliativeness. Surgency is calculated by averaging the subscale means for high intensity pleasure, fear (reverse scored), and shyness (reverse scored). Negative affect is calculated by averaging the subscale means for frustration, depressive mood, and aggression. Effortful control is calculated by averaging the subscale means for attention, inhibitory control, and activation control. Affiliativeness is calculated by averaging the subscale means for affiliation, perceptual sensitivity, and pleasure sensitivity. In our sample, internal consistency of the EATQ-R superfactors were $\alpha = .55$ for surgency, $\alpha = .62$ for negative affect, $\alpha = .70$ for effortful control, and $\alpha = .52$ for affiliativeness. The ATQ is a 77-item questionnaire for adults over 18 years of age, yielding four superfactor scores for surgency, negative affect, effortful control, and orienting sensitivity. For adults, surgency is calculated by averaging the subscale means for high intensity pleasure, sociability, and positive affect. Negative affect is calculated by averaging subscale means for fear, sadness, discomfort, and frustration. Effortful control is calculated by averaging subscale means for attentional control, inhibitory control, and activation control. Orienting sensitivity is calculated by averaging subscale scores for neutral perceptual sensitivity, affective perceptual sensitivity, and associative sensitivity. As reported by the scale developers, internal consistency of the ATQ superfactors were $\alpha = .71$ for surgency, $\alpha = .81$ for negative affect, $\alpha = .78$ for effortful control, and $\alpha = .85$ for orienting sensitivity. Neither the EATQ-R nor ATQ is norm-referenced for 16- and 17-year-olds. In consultation with an expert colleague of the scale developers, we used the EATQ-R for the 16- and 17-year-olds in this study because the questions in the EATQ-R were deemed more relevant to adolescents (Putnam, personal correspondence). For example, the EATQ-R includes questions about school and adolescence (e.g., "It is easy for me to really concentrate on homework problems," "I do something fun for a while before starting my homework, even when I'm not supposed to"), whereas the ATQ includes questions more related to adulthood (e.g., "I would not enjoy a job that involves socializing with the public," "I am often late for appointments"). On both the EATQ-R and ATQ, respondents rate each statement on a 7-point Likert scale where higher scores on individual statements, subscales, and superfactors reflect a greater degree of that trait.

Participants also completed the SAS, which contains 25 statements regarding common behavioral responses to anticipation. These statements represent the most commonly reported, action-based responses to anticipation from a qualitative analysis of AWS (Jackson et al., 2015), speaking to the face validity of the scale. For example, 80 percent of participants from that study contributed to the category for *switching words*. This response was captured in the SAS with the question, "How often do you switch words that you think you will stutter on?" Age-appropriateness of the SAS questions for 9-12 year-olds was determined via informal interviews with five CWS (Jackson et al., 2018). The following instructions were provided in the SAS to each participant: *In this survey, you will find a series of statements related to what you do when you think you are about to stutter.* Participants then responded to each statement by dragging a cursor along a visual analog scale that was labeled, from left to right: *never, sometimes, about half the time, most of the time, always.* The distance from the left anchor to the cursor for each item was recorded on a scale of 0-100, indicating percent of time. Previous work demonstrated that the SAS is comprised of three factors: avoidance, physical change, and approach behaviors (Jackson et al., 2019). Corresponding items for each of the three factors were averaged to yield a rating for each factor for each participant. For the CWS in our sample, internal consistency of the avoidance factor was $\alpha = .88$, physical change factor was $\alpha = .65$, and approach factor was $\alpha = .40$. For the AWS in our sample, internal consistency of the avoidance factor was $\alpha = .91$, physical change factor was $\alpha = .71$, and approach factor was $\alpha = .62$.

2.3. Data Analysis

The data were analyzed using R version 4.0.2 (R Core Team, 2020). Our primary aim was to identify how temperament predicted behavioral responses to anticipation among CWS and AWS. To do so, two multivariate multiple regressions were conducted—one for the CWS and one for the AWS. Multivariate multiple regressions allowed us to estimate multiple models simultaneously while accounting for the correlated errors due to the fact that the models involved the same observations. For the CWS, ratings from the four EATQ-R superfactors (surgency, effortful control, negative affect, and affiliativeness) served as the independent variables to predict variance in ratings from the three SAS factors which served as the dependent variables (avoidance, physical change, approach behaviors). For the AWS, ratings from the four ATQ superfactors (surgency, effortful control, negative affect, orienting sensitivity) served as the independent variables to predict variance in ratings from the three SAS factors which served as the dependent variables. Sex was included as a co-variate in both models to account for non-negligible sex effects on temperament (e.g., Else-Quest et al., 2006; Gaias et al., 2012; Kim et al., 2003; Muris & Meesters, 2009). Age was subsequently included as an additional covariate for the CWS group because of the cognitive development that is subsumed under the neurobiological changes of adolescence. Post-hoc analyses were conducted on significant models to explore which, if any, specific temperament subscale(s) (independent variables) contributed meaningfully to variation in a particular SAS factor rating (dependent variable).

Shapiro-Wilk tests indicated that the ratings for the temperament superfactors were normally distributed across both age groups, indicating that parametric analyses were appropriate. For the EATQ-R (children): surgency, $W = .99$, $p = .87$; effortful control, $W = .97$, $p = .09$; negative affect, $W = .98$, $p = .61$; affiliativeness, $W = .98$, $p = .38$. For the ATQ (adults): surgency, $W = .97$, $p = .14$; effortful control, $W = .98$, $p = .51$; negative affect, $W = .97$, $p = .29$; orienting sensitivity, $W = .99$, $p = .96$.

3. Results

Correlation matrices of the four temperament superfactors and three SAS factors for the CWS can be found in Table 1, and for the AWS in Table 2.

The mean SAS ratings for each of the three SAS factors (100-point visual analogue scale) for the CWS and AWS are provided in Table 3. Of note in Table 3 is that the mean ratings for avoidant responses to anticipation were lower for the CWS than for the AWS, suggesting that as a group, the AWS engaged in avoidance behaviors more than CWS. However, physical change and approach responses to anticipation were similar across the CWS and AWS.

3.1. CWS

The model that predicted avoidance ratings was significant, $F(5, 58) = 3.24$, $p = .01$, adjusted $R^2 = .15$. The models that predicted physical change and approach ratings were not significant, $F(5, 58) = 0.34$, $p = .89$, adjusted $R^2 = -.06$ and $F(5, 58) = 0.95$, $p = .46$, adjusted $R^2 = -.004$, respectively. The relationship between temperament and avoidance for the CWS was driven by a significant effect of surgency on avoidance, $t(58) = -2.24$, $p = .02$; a one-unit increase in surgency was associated with an 9.13 unit decrease in avoidance ratings. No other temperament superfactors predicted avoidance, physical change, or approach ratings for the CWS. Table 4 displays the results of the primary model for the CWS. When age was added as a covariate in addition to sex, the original results held where surgency significantly predicted avoidance ratings, $F(6, 57) = 3.73$, $p = .003$, adjusted $R^2 = .21$. In fact, age significantly influenced avoidance ratings itself, $t(57) = 2.24$, $p = .03$; a one-year increase in age was associated with a 2.13 unit increase in avoidance ratings.

A post-hoc linear regression was conducted to examine which EATQ-R surgency subscale(s) meaningfully contributed to variance in avoidance ratings. The three subscales of surgency are high intensity pleasure, fear, and shyness. It should be noted that fear and shyness are reverse scored in their contribution to surgency. For this post-hoc regression, the alpha level was Bonferroni corrected at .05 / 3 = .02 to correct for multiple comparisons. Age was retained in the post-hoc model, but sex was eliminated, because of their influence in the primary model. Table 5 displays the results of the post-hoc model for the CWS. Shyness was the only surgency subscale that significantly predicted avoidance ratings, $t(60) = 2.79$, $p = .007$. A one-unit increase in shyness was associated with a 5.99 unit

Table 1
Correlations Between the Four Temperament (EATQ-R) Superfactors and the Three Stuttering Anticipation Scale Factors for the Children Who Stutter

	1	2	3	4	5	6	7
Temperament Superfactor							
1. Surgency	—						
2. Negative Affect	**-.56****	—					
3. Effortful Control	.24	**-.41****	—				
4. Affiliativeness	**-.27***	**.37****	.10	—			
Stuttering Anticipation Scale Factor							
5. Avoidance	**-.41****	**.31***	**-.27***	.18	—		
6. Physical Change	.04	-.01	.04	.06	.08	—	
7. Approach	.05	-.16	.21	.11	-.17	**.28***	—

* $p < .05$. ** $p < .01$.

Table 2
Correlations Between the Four Temperatment (ATQ) Superfactors and the Three Stuttering Anticipation Scale Factors for the Adults Who Stutter

	1	2	3	4	5	6	7
Temperament Superfactor							
1. Surgency	—						
2. Negative Affect	**-.56****	—					
3. Effortful Control	.03	-.23	—				
4. Orienting Sensitivity	-.12	.21	.08	—			
Stuttering Anticipation Scale Factor							
5. Avoidance	**-.29***	.13	.01	**.43****	—		
6. Physical Change	.02	.04	-.14	.16	**.53****	—	
7. Approach	.11	.03	-.02	.05	-.17	-.01	—

* $p < .05$. ** $p < .01$.

Table 3
Descriptive Statistics for Stuttering Anticipation Scale Factor Scores for Children and Adults Who Stutter

Stuttering Anticipation Scale Factor	Children Who Stutter		Adults Who Stutter	
	M (SD)	*Range*	*M (SD)*	*Range*
Avoidance	33.00 (16.92)	1.89-74.18	41.32 (18.78)	4.30-84.64
Physical Change	49.69 (21.83)	3.94-100	46.26 (19.56)	14.15-92.29
Approach	33.25 (16.00)	0.85-74.58	31.47 (18.71)	0.21-73.33

Note. Scores represent the extent, in percentage of the time, to which participants reported responding to stuttering anticipation in the specified way. Scores range from 0-100 where *0* = never and *100* = always.

Table 4
Effects of Temperament (EATQ-R) Superfactors, Sex, and Age on Stuttering Anticipation Scale (SAS) Scores for the Children Who Stutter

Stuttering Anticipation Scale Factor	Temperament Superfactor	*β*	SE	*t*	*p*
Avoidance	**Surgency**	**-9.13**	**3.77**	**-2.42**	**.02***
	Negative Affect	0.99	4.65	0.21	.83
	Effortful Control	-7.45	4.07	-1.83	.07
	Affiliativeness	0.23	4.25	0.05	.96
	Sex	1.60	4.62	0.35	.73
	Age	**2.13**	**0.95**	**2.24**	**.03***
Physical change	Surgency	2.95	5.64	0.52	.60
	Negative Affect	0.64	6.97	0.09	.93
	Effortful Control	0.16	6.11	0.03	.98
	Affiliativeness	1.96	6.36	0.31	.76
	Sex	8.08	6.92	1.17	.25
	Age	-0.64	1.42	-0.45	.65
Approach	Surgency	-1.45	4.04	-0.36	.72
	Negative Affect	-5.59	4.99	-1.12	.27
	Effortful Control	4.11	4.38	0.94	.35
	Affiliativeness	4.95	4.56	1.09	.28
	Sex	-1.65	4.95	-0.33	.74
	Age	-0.04	1.02	-0.04	0.97

* $p < .05$.

increase in avoidance ratings. Of note, shyness ratings had greater variation among CWS ($M = 2.28$, $SD = 0.97$) when compared to high intensity pleasure ($M = 2.99$, $SD = 0.76$) and fear ($M = 2.13$, $SD = 0.84$), speaking to potentially greater individual variation in that temperament trait. It is also important to note that age approached significance, which suggests a potential role of age in avoidance; as children get older, they may tend to avoid more often. This is in line with previous results that show that the extent to which people

Table 5
Post-Hoc Effects of Surgency Subscales and Age on Avoidance Ratings for the Children Who Stutter

Stuttering Anticipation Scale Factor	Surgency Subscale	*β*	SE	*t*	*p*
Avoidance	High intensity pleasure	0.13	2.65	0.05	.96
	Fear	4.34	2.59	1.68	.10
	Shyness	**5.99**	**2.15**	**2.79**	**.007***
	Age	1.81	0.91	1.99	0.05

* Bonferroni-corrected $\alpha = .02$

who stutter anticipate increases with age (Jackson et al., 2018).

3.2. AWS

Similar to the CWS outcome, only the model that predicted avoidance ratings was significant, $F(5, 48) = 4.19$, $p = .003$, adjusted $R^2 = .23$. The models that predicted physical change and approach ratings were not significant, $F(5, 48) = 0.78$, $p = .57$, adjusted $R^2 =$ -.02 and $F(5, 48) = 0.79$, $p = .56$, adjusted $R^2 =$ -.02, respectively. The relationship between temperament and avoidance for the AWS was driven by a significant effect of orienting sensitivity on avoidance, $t(48) = 3.83$, $p = .0004$; a one-unit increase in orienting sensitivity was associated with a 13.01 unit increase in avoidance ratings. No other temperament constructs predicted avoidance, physical change, or approach ratings. Table 6 displays the results of the primary model for the AWS.

A post-hoc linear regression was conducted to examine which ATQ orienting sensitivity subscale(s) meaningfully contributed to variance in avoidance ratings. The three subscales of orienting sensitivity are neutral perceptual sensitivity, affective perceptual sensitivity, and associated sensitivity. For this post-hoc regression, the alpha level was Bonferroni corrected at .05 / 3= .02 to correct for multiple comparisons. Because sex did not have a significant effect in the primary model, it was not included in the post-hoc model. None of the orienting sensitivity subscales significantly predicted avoidance ratings. Table 7 displays the results of the post-hoc model for the AWS.

4. Discussion

The aim of the present study was to determine which temperament construct(s) predicted specific behavioral responses to stuttering anticipation among CWS and AWS. The three categories of behavioral responses to anticipation included avoidance, physical change, and approach, which align with the three factors of the *Stuttering Anticipation Scale* (Jackson et al., 2019). There were two main findings. For the CWS, lower surgency predicted avoidant responses to anticipation; this relationship was be driven by the shyness subscale of surgency. For the AWS, orienting sensitivity predicted avoidant responses to anticipation. These findings challenged our apriori predictions in which we expected negative affect to predict avoidant responses to anticipation and effortful control to predict physical change and approach responses to anticipation across both CWS and AWS.

4.1. Shyness Predicts Avoidant Responses to Anticipation Among CWS

The temperament superfactor of surgency was negatively associated with avoidant responses to anticipation among CWS. Surgency is comprised of three subscales on the EATQ-R: high intensity pleasure, fear, and shyness. In general, individuals who score high on surgency are more likely to glean pleasure from high intensity experiences (e.g., skiing fast down a steep slope, going places with big crowds), have low levels of fear, and have low levels of shyness. The post-hoc analysis revealed that the inverse relationship between surgency and avoidance was driven by the shyness subscale, such that higher levels of shyness predicted higher levels of avoidant behavioral responses to anticipation.

Shyness is a trait that is characterized by fear and inhibition in response to social novelty and/or situations of perceived social threat (Melchior & Cheek, 1990). It is associated with physiological and behavioral stress reactivity, as well as enhanced ability to detect threat (LoBue & Pérez-Edgar, 2014). Longitudinal work has indicated that shyness likely emerges from epigenetic influences—that is, environmental stress that acts upon an original temperamental disposition present at birth (Kagan et al., 1988; Schmidt & Fox, 2002). Environmental stress refers to the physiological changes and behavioral responses (e.g., anxiety, distress) that result when environmental demands exceed a person's coping resources (Frumkin, 2016). Experiencing chronic adversity may alter stress response systems and the expression of behavioral inhibition, negative affect, and threat-based hypervigilance, which has been proposed to lay

Table 6
Effects of Temperament (ATQ) Superfactors and Sex on Stuttering Anticipation Scale Scores for the Adults Who Stutter

Stuttering Anticipation Scale Factor	Temperament Superfactor	β	SE	t	p
Avoidance	Surgency	-6.25	3.66	-1.71	.09
	Negative affect	-4.74	4.46	-1.06	.29
	Effortful control	-2.14	3.03	-0.71	.48
	Orienting sensitivity	**13.01**	**3.39**	**3.83**	**.0004*****
	Sex	7.86	5.24	1.50	.14
Physical change	Surgency	1.91	4.39	0.44	.67
	Negative affect	-1.05	5.35	-0.20	.85
	Effortful control	-4.65	3.63	-1.28	.21
	Orienting sensitivity	6.45	4.07	1.58	.12
	Sex	6.04	6.29	0.96	.34
Approach	Surgency	6.16	4.20	1.47	.15
	Negative affect	2.49	5.12	0.49	.63
	Effortful control	-0.98	3.48	-0.28	.78
	Orienting sensitivity	2.95	3.89	0.76	.45
	Sex	9.72	6.01	1.62	.11

*** $p < .001$.

Table 7
Post-Hoc Effects of Orienting Sensitivity Subscales on Avoidance Ratings for the Adults Who Stutter

Stuttering Anticipation Scale Factor	Orienting Sensitivity Subscale	β	SE	t	p
Avoidance	Neutral perceptual sensitivity	4.38	2.96	1.48	.15
	Affective perceptual sensitivity	2.96	3.03	0.98	.33
	Associative sensitivity	4.58	2.70	1.70	.10

the developmental foundation for prospective shyness (Gartstein & Skinner, 2018; Poole et al., 2020). Negative experiences related to stuttering, particularly those associated with specific moments of stuttering, can be thought of as one form of environmental stress or chronic adversity. Knowing that CWS tend to demonstrate heightened sensitivity to environmental stimuli and diminished ability for self-regulation (review in R. Jones et al., 2014), young people who stutter may be particularly susceptible to environmental stress resulting from negative social consequences of stuttering thus contributing to their avoidant responses to anticipation.

While shyness is rooted in discomfort in social situations, behavioral inhibition is a temperamental disposition rooted in discomfort with novelty across both social *and* nonsocial situations. Recent investigations into behavioral inhibition among young CWS have yielded important implications. Of note, CWS do not appear to be more behaviorally inhibited than young children who do not stutter (Choi et al., 2013; Tumanova et al., 2020) (cf. Ntourou et al., 2020), although they do tend to be rated as shyer than children who do not stutter by their parents and teachers (Fowlie & Cooper, 1978; Lass et al., 1992; Tumanova et al., 2020; Yeakle & Cooper, 1986). These perceptions of CWS may very well reflect the documented stereotypes towards people who stutter (Craig et al., 2003; Mackinnon et al., 2007), which may be internalized by people who stutter and become self-stigmatizing attributes as well (Boyle, 2013). However, other studies of parent-reported temperament of young CWS and CWNS indicate no meaningful between-group differences (see review in Alm, 2014), and some studies have even reported trends of *lower* levels of shyness among CWS than typically fluent controls (Eggers et al., 2010; Embrechts et al., 2000). These equivocal findings highlight the importance of investigating individual differences *within* groups of people who stutter, as we did in the present study. Indeed, the current findings suggest that there is substantial within-group variation in levels of shyness as evidenced by the larger standard deviation for the shyness subscale compared to the high intensity pleasure and fear subscales.

Shyness in early childhood, and behavioral inhibition more broadly, have been implicated in the development of inter- and intrapersonal adjustment difficulties, including social anxiety, in adolescents and adulthood (Grose & Coplan, 2015; Kagan et al., 1988; Rapee & Spence, 2004; Spence & Rapee, 2016). At times, shyness and social anxiety can be difficult constructs to disentangle (Hofmann et al., 2006; Turner et al., 1990). This is likely due to the fact that both are associated with the use of avoidance or safety behaviors (Asendorpf, 1990; W. H. Jones et al., 1986), which are used in an attempt to prevent negative social consequences (Clark, 1999). This has direct implications for stuttering, as people who stutter have reported using a wide range of safety behaviors, most commonly avoiding difficult words and syllables, keeping their answers short, choosing safe or easy people to talk to in socially threatening situations, and mentally rehearsing sentences before saying them (Lowe et al., 2017). Safety behaviors are theorized to perpetuate fear related to those situations that are avoided and thus maintain anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997). In the context of the present study, CWS who engage in avoidant behavioral responses to anticipation could be perpetuating their fear of impending stuttering thus reinforcing the salience of their anticipation and increasing the likelihood that they will engage in those avoidant responses in the future.

4.2. Orienting Sensitivity Predicted Avoidant Responses to Anticipation Among AWS

The temperament superfactor of orienting sensitivity was positively associated with avoidant behaviors in response to anticipation among AWS. Orienting sensitivity, also known as "cognitive sensitivity," refers to automatic attention to both internal events and external sensory events. It may be the case that AWS who are particularly attentive to internal events (e.g., knowing that overt stuttering is about to occur) or external events (e.g., perceived negative reactions or the potential for negative reactions), are more likely to avoid because they are quicker or better able to implement an alternative response (in this case, avoidance) than AWS who are not as sensitive in this regard. The ability to detect upcoming stuttering may be closely related to interoception, or the ability to perceive bodily changes (e.g., cardiovascular and other physiological changes), which likely vary across individuals (Jones, G., 1994). This heightened sense of internal events may contribute to the speaker's ability to implement avoidant responses. Garcia-Barrera and Davidow (2015) proposed that this heightened awareness may be impacted by one's somatic state (e.g., sweating, higher heart rate), such that memory traces of somatic experiences are associated with problematic words or sounds. The neuronal populations associated with these somatic markers, in turn, may fire at the same time as the neuronal populations associated with the memory traces of the problematic phonemes or lemmas, "wiring together into a full interoceptive experience" (p. 8). Whether this ability is adaptive or maladaptive for the speaker is a discussion to pursue with a speech-language pathologist knowledgeable of the temperament-anticipation link. The speech-language pathologist could facilitate a discussion about orienting sensitivity, or temperament more broadly, serving as the lens through which an individual responds to anticipation. Discussion in therapy could focus on these temperamental traits and how they shape the manifestation of overt stuttering events (e.g., "Because you're really good at sensing upcoming stuttering, you may also feel an urge to avoid. Let's try to play with how you respond to that anticipation, which ultimately, is going to determine how stuttering manifests itself on the surface").

Because orienting sensitivity is grounded in attentional processing (Evans & Rothbart, 2008), the current findings offer preliminary extensions to the growing literature base on attentional processes among people who stutter. Most relevant to the present study is the

attentional processing of social-emotional information. In particular, there are certain attentional processes that are associated with anxiety among those in the general population, and its empirical application to people who stutter is beginning to emerge. The *vigilance-avoidance* hypothesis posits that anxious individuals are efficient at detecting threatening cues in their environment (vigilance) and then quickly shifting their attention away from that stimulus (avoidance) (Eysenck, 1992; Mogg & Bradley, 1998). This attentional avoidance is believed to be a defensive reaction whereby the person minimizes detailed processing of the potential threat which reduces their subjective discomfort. Preliminary evidence has shown that people who stutter who have heightened levels of anxiety tend to prioritize attentional processing of negative stimuli (Beita-Zuk, 2013; Hennessey et al., 2014; Lowe et al., 2012, 2016), although this attentional bias towards negativity may reflect experience with stuttering beyond the confines of anxiety (Rodgers et al., 2020). Although our methodology precludes assumptions about speakers' experience with anxiety, we can speculate that AWS with high orienting sensitivity may be acutely aware of the anticipation that they are either (a) about to stutter or (b) receive even subtle listener reactions to their speech and in turn might be more inclined to avoid the upcoming moment of stuttering. Future studies could assess this hypothesis by examining the relationship between attentional hypervigilance and stuttering avoidance behaviors.

4.3. Clinical Implications

When clinicians develop temperament-based treatments for their clients, they maximize the goodness-of-fit between their client's unique proclivities with their therapeutic plans and activities thereby creating a powerful vehicle for change (McClowry et al., 2008). Viewing behavioral responses to anticipation through the lens of temperament offers tentative clinical implications. By mapping certain temperamental profiles to specific types of behavioral responses to anticipation, clinicians are granted insight into how their clients' internal dispositions may promote their use of maladaptive responses (e.g., avoidance) versus productive responses (e.g., physical change, approach) to anticipation. The current findings indicate that CWS who are more shy and AWS who are highly sensitive to sensory stimuli are more inclined to avoid upcoming moments of stuttering. Thus, clinicians may choose to help these clients become more assertive and comfortable being in a moment of stuttering through desensitization activities (e.g., pseudostuttering, open stuttering, self-disclosure) to increase their productive behavioral responses to anticipation.

Mindfulness-based approaches might be particularly useful to help pay attention intentionally, in the present moment and without judgement (Kabat-Zinn, 2009), to their thoughts, feelings, and behaviors that (a) precipitate an overt moment of stuttering, and (b) occur when in the midst of an overt moment of stuttering (Boyle, 2011; Emge & Pellowski, 2019; Harley, 2018). This could promote desensitization to the moment of stuttering, thereby increasing the likelihood that they would feel comfortable approaching a moment of stuttering once they anticipate one coming up. Clinicians may also utilize cognitive-behavioral discussions (Harley, 2018; Klein & Amster, 2018; Menzies et al., 2009) to help clients understand the link between their thoughts, feelings, physiological reactions, and behaviors during moments of anticipation. For example, clinicians might ask, "what thoughts were going through your mind, and how did your body feel, when you anticipated that moment of stuttering?" followed by "what did you do after you had that thought?" To help the client start to consider alternative ways of responding to anticipation, the clinician could pose, "what's another way you could have responded to that anticipation?" and "how would that alternative make you feel?" These cognitive strategies could facilitate the implementation of physical changes such as altering articulatory tension to move through stuttering events in easier and potentially more efficient ways. That is, if negative emotional responses such as fear or embarrassment are mitigated, it could be easier for an individual who stutters, when anticipating overt stuttering, to approach the moment of stuttering by, for example, committing to saying what they want to say or making a physical adjustment to produce the target word in a more efficient way. Taken together, clinicians can tailor their therapy approach to provide a better goodness-of-fit between the client's temperamental proclivities and behavioral outcomes to improve their functional and psychosocial outcomes.

4.4. Limitations

A limitation of the present study is our inability to speak to the biological influences of temperament on how people who stutter respond to anticipation. Because this study investigated temperament beyond early childhood (in speakers aged 9 years and older), it is not feasible to isolate temperament characteristics that are biologically innate from those that have been influenced over time by experiences with stuttering (Alm, 2014). However, it is important to highlight that we were interested in understanding within-group, individual differences, rather than comparing temperament traits across groups of people who stutter and typically fluent controls. As such, the need to isolate innate temperament differences (as opposed to those that are influenced by experience) was less important; we were merely interested in understanding how participants' temperaments at the time of data collection (which would be a blend of innate and experiential factors) influenced their responses to anticipation at that point in time. And while this is a critical consideration for the empirical questions we sought to answer, it also speaks to the clinical utility of the findings: in real-world clinical situations, clinicians need to address their clients as they are at that moment in the clinical relationship—altered or not by their prior experiences—rather than what their temperaments were in their innate, biological forms as young children. To study the influence of biological disposition on behavioral responses to anticipation more pointedly, researchers could develop methodologies to study these constructs in early childhood near the onset of stuttering. However, an inherent challenge of studying behavioral responses to anticipation in young children is their developing capacity for metacognition that likely limits their capacity for self-awareness of anticipation and how they respond to it.

Another limitation of the present study is that the avoidance factor of the SAS is likely a more robust factor than the physical change and approach factors. While the avoidance factor is comprised of 17 SAS items, the physical change and approach factors are each comprised of four SAS items. Therefore, it is possible that temperament was less likely to be linked to physical change and approach

because the items that measure those two factors are less comprehensive. Future scale development work can focus on expanding the SAS to round out the physical change and approach factors to make them more comparable in robustness to the avoidance factor.

We also cannot speak to the potential influence of therapy experiences on how people who stutter choose to respond to anticipation. Addressing avoidance behaviors is likely to be a component of intervention for clients who work with clinicians who take a cognitive-behavioral approach to stuttering therapy. As such, future studies of anticipation and avoidance would benefit from collecting not only information regarding participants' history with stuttering therapy, but also the therapeutic approach, their therapy goals, and their perceived progress on those goals. It would also be beneficial to collect information on speaker's stuttering severity to continue investigating potential links between temperament traits and stuttering severity.

5. Conclusions

The present study broadly examined individual differences in stuttering anticipation among CWS and AWS, with a focus on identifying temperament constructs that predicted different types of behavioral responses to anticipation (i.e., avoidance, physical change, approach). The primary findings indicated that (a) shyness predicted avoidant behavioral responses to anticipation among CWS, and (b) orienting sensitivity predicted avoidance responses to anticipation among AWS. Taken together, the results suggest that specific temperament dimensions play an important role in how often people who stutter engage in avoidant behaviors in response to anticipation. Future research can extend this work by continuing to examine how individual differences impact the internal experience and outward manifestation of stuttering behaviors.

Declaration of Competing Interest

We have no conflicts of interest to disclose.

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References

Alm, P. A. (2004). Stuttering, emotions, and heart rate during anticipatory anxiety: A critical review. *Journal of Fluency Disorders, 29*, 123–133. https://doi.org/10.1016/j.jfludis.2004.02.001. https://doi.org/.

Alm, P. A. (2014). Stuttering in relation to anxiety, temperament, and personality: Review and analysis with focus on causality. *Journal of Fluency Disorders, 40*, 5–21. https://doi.org/10.1016/j.jfludis.2014.01.004. https://doi.org/.

Alm, P. A., & Risberg, J. (2007). Stuttering in adults: The acoustic startle response, temperamental traits, and biological factors. *Journal of Communication Disorders, 40* (1), 1–41. https://doi.org/10.1016/j.jcomdis.2006.04.001. https://doi.org/.

Ambrose, N. G., Yairi, E., Loucks, T. M., Seery, C. H., & Throneburg, R. (2015). Relation of motor, linguistic and temperament factors in epidemiologic subtypes of persistent and recovered stuttering: Initial findings. *Journal of Fluency Disorders, 45*, 12–26. https://doi.org/10.1016/j.jfludis.2015.05.004. https://doi.org/.

Anderson, J. D., Pellowski, M. W., Conture, E. G., & Kelly, E. M. (2003). Temperamental characteristics of children who stutter. *Journal of Speech, Language, and Hearing Research, 46*, 1211–1233. https://content.ebscohost.com/ContentServer.asp?T=P&P=AN&K=507855933&S=R&D=eue&EbscoContent=dGJyMMvl7ESep7U40dvuOLCmr1Cep7NSs6i4TLKWxWXS&ContentCustomer=dGJyMPGpsEiuprZKuePfgeyx44Dt6fIA.

Arnold, H. S., Conture, E. G., Key, A. P. F., & Walden, T (2011). Emotional reactivity, regulation and childhood stuttering: A behavioral and electrophysiological study. *Journal of Communication Disorders, 44*(3), 276–293. https://doi.org/10.1016/j.jcomdis.2010.12.003. https://doi.org/.

Asendorpf, J. B. (1990). Beyond social withdrawal: Shyness, unsociability, and peer avoidance. In *Human Development, 33*.

Baumgartner, J. M., & Brutten, G. J. (1983). Expectancy and heart rate as predictors of the speech performance of stutterers. *Journal of Speech and Hearing Research, 26*, 383–388.

Beita-Zuk, C. (2013). *A preliminary investigation into the influence of temperament and anxiety on attention when processing emotional information in adults who do and do not stutter*. William Paterson University of New Jersey.

Bloodstein, O. (1960). The development of stuttering: I. Changes in nine basic features. *Journal of Speech and Hearing Disorders, 25*, 366–376.

Bowers, A., Saltuklaroglu, T., & Kalinowski, J. (2012). Autonomic arousal in adults who stutter prior to various reading tasks in order to elicit changes in stuttering frequency. *International Journal of Psychophysiology, 83*, 45–55. https://doi.org/10.1016/j.ijpsycho.2011.09.021. https://doi.org/.

Boyle, M. P. (2011). Mindfulness training in stuttering therapy: A tutorial for speech-language pathologists. *Journal of Fluency Disorders, 36*, 122–129. https://doi.org/10.1016/j.jfludis.2011.04.005. https://doi.org/.

Boyle, M. P. (2013). Assessment of stigma associated with stuttering: Development and evaluation of the Self-Stigma of Stuttering Scale (4S). *Journal of Speech, Language, and Hearing Research, 56*, 1517–1529. https://doi.org/10.1044/1092-4388(2013/12-0280. https://doi.org/.

Boyle, M. P., & Blood, G. W. (2015). Stigma and stuttering: Conceptualizations, applications, and coping. In K. O. St. Louis (Ed.), *Stuttering meets stereotype, stigma, and discimination: An overview of attitude research* (pp. 43–70). West Virginia University Press.

Choi, D., Conture, E. G., Walden, T. A., Lambert, W. E., & Tumanova, V. (2013). Behavioral inhibition and childhood stuttering. *Journal of Fluency Disorders, 38*, 171–183. https://doi.org/10.1016/j.jfludis.2013.03.001. https://doi.org/.

Cholin, J., Heiler, S., Whillier, A., & Sommer, M. (2016). Premonitory Awareness in Stuttering Scale (PAiS). *Journal of Fluency Disorders, 49*, 40–50. https://doi.org/10.1016/j.jfludis.2016.07.001. https://doi.org/.

Clark, D. M. (1999). Anxiety disorders: Why they persist and how to treat them. *Behaviour Research and Therapy1, 37*, S5–S27.

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneider (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). The Guilford Press.

Compas, B. E., Connor-Smith, J., & Jaser, S. S. (2004). Temperament, stress reactivity, and coping: Implications for depression in childhood and adolescence. *Journal of Clinical Child and Adolescent Psychology, 33*(1), 21–31. https://doi.org/10.1207/S15374424JCCP3301_3. https://doi.org/.

Conture, E. G., & Walden, T. A. (2012). A dual diathesis-stressor model of stuttering. In L. Bellakova, & Y. Filatova (Eds.), *Theoretical issues of fluency disorders* (pp. 95–127). Vlados.
Craig, A., Tran, Y., & Craig, M. (2003). Stereotypes towards stuttering for those who have never had direct contact with people who stutter: A randomized and stratified study. *Perceptual and Motor Skills, 97*.
Dietrich, S., & Roaman, M. H. (2001). Physiologic arousal and predictions of anxiety by people who stutter. *Journal of Fluency Disorders, 26*, 207–225.
Eggers, K., De Nil, L. F., & Van Den Bergh, B. R. H (2010). Temperament dimensions in stuttering and typically developing children. *Journal of Fluency Disorders, 35*, 355–372. https://doi.org/10.1016/j.jfludis.2010.10.004. https://doi.org/.
Eggers, K., De Nil, L. F., & Van Den Bergh, B. R. H (2012). The efficiency of attentional networks in children who stutter. *Journal of Speech, Language, and Hearing Research, 55*, 946–959. https://doi.org/10.1044/1092-4388(2011/10-0208. https://doi.org/.
Eggers, K., De Nil, L. F., & Van Den Bergh, B. R. H (2013). Inhibitory control in childhood stuttering. *Journal of Fluency Disorders, 38*, 1–13. https://doi.org/10.1016/j.jfludis.2012.10.001. https://doi.org/.
Eggers, K., De Nil, L. F., & Van Den Bergh, B. R. H (2018). Exogenously triggered response inhibition in developmental stuttering. *Journal of Fluency Disorders, 56*, 33–44. https://doi.org/10.1016/j.jfludis.2018.02.001. https://doi.org/.
Eggers, K., Millard, S., & Kelman, E. (2021). Temperament and the impact of stuttering in children aged 8-14 years. *Journal of Speech, Language, and Hearing Research, 64*, 417–432. https://doi.org/10.1044/2020_JSLHR-20-00095. https://doi.org/.
Ellis, J. B., Finan, D. S., & Ramig, P. R. (2008). The influence of stuttering severity on acoustic startle responses. *Journal of Speech, Language, and Hearing Researech, 51*, 836–850. https://content.ebscohost.com/ContentServer.asp?T=P&P=AN&K=507992241&S=R&D=eue&EbscoContent=dGJyMNXb4kSep7c40dvuOLCmr1Cep69Ssaa4SLGWxWXS&ContentCustomer=dGJyMPGpsEiuprZKuePfgeyx44Dt6fIA.
Ellis, L. K., & Rothbart, M. K. (2001). Revision of the Early Adolescent Temperament Questionnaire. *Biennial Meeting of the Society for Research in Child Development*.
Else-Quest, N. M., Hyde, J. S., Goldsmith, H. H., & Van Hulle, C. A. (2006). Gender differences in temperament: A meta-analysis. *Psychological Bulletin, 132*(1), 33–72. https://doi.org/10.1037/0033-2909.132.1.33. https://doi.org/.
Embrechts, M., Ebben, H., Franke, P., & Van de Poel, C. (2000). Temperament: A comparison between children who stutter and children who do not stutter. In *Proceedings of the Third World Congress on Fluency Disorders: Theory, Research, Treatment, and Self-Help* (pp. 557–562).
Emge, G., & Pellowski, M. W. (2019). Incorporating a mindfulness meditation exercise into a stuttering treatment program. *Communication Disorders Quarterly, 40*(2), 125–128. https://doi.org/10.1177/1525740118783516. https://doi.org/.
Evans, D. E., & Rothbart, M. K. (2007). Developing a model for adult temperament. *Journal of Research in Personality, 41*, 868–888. https://doi.org/10.1016/j.jrp.2006.11.002. https://doi.org/.
Evans, D. E., & Rothbart, M. K. (2008). Temperamental sensitivity: Two constructs or one? *Personality and Individual Differences*, 44, 108–118. https://doi.org/10.1016/j.paid.2007.07.016.
Eysenck, M. W. (1992). *Anxiety: The cognitive perspective*. Erlbaum.
Felsenfeld, S., van Beijsterveldt, C. E. M., & Boomsma, D. I. (2010). Attentional regulation in young twins with probable stuttering, high nonfluency, and typical fluency. *Journal of Speech, Language, and Hearing Research, 53*, 1147–1166.
Fowlie, G. M., & Cooper, E. B. G (1978). Traits attributed to stuttering and nonstuttering children by their mothers. *Journal of Fluency Disorders, 3*, 233–246.
Frumkin, H. (2016). *Environmental health: From global to local* (3rd ed.). John Wiley & Sons, Inc.
Gaias, L. M., Gartstein, M. A., Fisher, P. A., Putnam, S. P., Räikkönen, K., & Komsi, N. (2012). Cross-cultural temperamental differences in infants, children, and adults in the United States of America and Finland. *Scandinavian Journal of Psychology, 53*(2), 119–128. https://doi.org/10.1111/j.1467-9450.2012.00937.x. https://doi.org/.
Garcia-Barrera, M. A., & Davidow, J. H. (2015). Anticipation in stuttering: A theoretical model of the nature of stutter prediction. *Journal of Fluency Disorders, 44*, 1–15. https://doi.org/10.1016/j.jfludis.2015.03.002. https://doi.org/.
Gartstein, M. A., & Skinner, M. K. (2018). Prenatal influences on temperament development: The role of environmental epigenetics. *Development and Psychopathology, 30*, 1269–1303. https://doi.org/10.1017/S0954579417001730. https://doi.org/.
Grose, J., & Coplan, R. J. (2015). Longitudinal outcomes of shyness from childhood to emerging adulthood. *Journal of Genetic Psychology, 176*(6), 408–413. https://doi.org/10.1080/00221325.2015.1084988. https://doi.org/.
Guitar, B. (2003). Acoustic startle responses and temperament in individuals who stutter. *Journal of Speech, Language, and Hearing Research, 46*, 233–240.
Harley, J. (2018). The role of attention in therapy for children and adolescents who stutter: Cognitive behavioral therapy and mindfulness-based interventions. *American Journal of Speech-Language Pathology, 27*(3(S)), 1139–1151. https://doi.org/10.1044/2018_AJSLP-ODC11-17-0196. https://doi.org/.
Hennessey, N. W., Dourado, E., & Beilby, J. M. (2014). Anxiety and speaking in people who stutter: An investigation using the emotional Stroop task. *Journal of Fluency Disorders, 40*, 44–57. https://doi.org/10.1016/j.jfludis.2013.11.001. https://doi.org/.
Hofmann, S. G., Moscovitch, D. A., & Kim, H.-J. (2006). Autonomic correlates of social anxiety and embarrassment in shy and non-shy individuals. *International Journal of Psychophysiology, 61*, 134–142. https://doi.org/10.1016/j.ijpsycho.2005.09.003. https://doi.org/.
Jackson, E. S., Gerlach, H., Rodgers, N. H., & Zebrowski, P. M. (2018). My client knows that he's about to stutter: How can we address stuttering anticipation during therapy with young people who stutter? *Seminars in Speech and Language, 39*(4), 356–370. https://doi.org/10.1055/s-0038-1667164. https://doi.org/.
Jackson, E. S., Rodgers, N. H., & Rodgers, D. B. (2019). An exploratory factor analysis of action responses to stuttering anticipation. *Journal of Fluency Disorders, 60*, 1–10. https://doi.org/10.1016/j.jfludis.2019.03.001. https://doi.org/.
Jackson, E. S., Yaruss, J. S., Quesal, R. W., Terranova, V., & Whalen, D. H. (2015). Responses of adults who stutter to the anticipation of stuttering. *Journal of Fluency Disorders, 45*, 38–51. https://doi.org/10.1016/j.jfludis.2015.05.002. https://doi.org/.
Johnson, K. N., Conture, E. G., Walden, T. A., & Johnson, K. N. (2012). Efficacy of attention regulation in preschool-age children who stutter: A preliminary investigation. *Journal of Communication Disorders, 45*, 263–278. https://doi.org/10.1016/j.jcomdis.2012.04.001. https://doi.org/.
Johnson, K. N., Walden, T. A., Conture, E. G., & Karrass, J. (2010). Spontaneous regulation of emotions in preschool children who stutter: Preliminary findings. *Journal of Speech, Language, and Hearing Research, 53*, 1478–1495.
Johnson, W., & Knott, J. R. (1937). Studies in the psychology of stuttering: I. The distribution of moments of stuttering in successive readings of the same material. *Journal of Speech Disorders, 2*, 17–19.
Jones, R., Choi, D., Conture, E., Walden, T., & Jones, R. M. (2014). Temperament, emotion, and childhood stuttering. *Seminars in Speech and Language, 35*(2), 114–131. https://doi.org/10.1055/s-0034-1371755. https://doi.org/.
Jones, W. H., Briggs, S. R., & Smith, T. G. (1986). Shyness: Conceptualization and measurement. *Journal of Personality and Social Psychology, 51*(3).
Kabat-Zinn, J. (2009). *Wherever you go, there you are: Mindfulness meditation in everyday life*. Hyperion.
Kagan, J., Reznick, J. S., Clarke, C., Snidman, N., & Garcia-Coll, C. (1984). Behavioral inhibition to the unfamiliar. *Child Development, 55*(6), 2212–2225. https://www-jstor-org.proxy.lib.uiowa.edu/stable/pdf/1129793.pdf?refreqid=excelsior%3A330d766fe01c0d325a742c2c163eed6b.
Kagan, J., Reznick, J. S., & Snidman, N. (1988). Biological bases of childhood shyness. *Source: Science, New Series, 240*(4849).
Kefalianos, E., Onslow, M., Block, S., Menzies, R., & Reilly, S. (2012). Early stuttering, temperament and anxiety: Two hypotheses. *Journal of Fluency Disorders, 37*(3), 151–163. https://doi.org/10.1016/j.jfludis.2012.03.002. https://doi.org/.
Kefalianos, E., Onslow, M., Ukoumunne, O. C., Block, S., & Reilly, S. (2014). Stuttering, temperament, and anxiety: Data from a community cohort ages 2-4 years. *Journal of Speech, Language, and Hearing Research, 57*, 1314–1322. https://doi.org/10.1044/2014. Augusthttps://doi.org/.
Kefalianos, E., Onslow, M., Ukoumunne, O. C., Block, S., & Reilly, S. (2017). Temperament and early stuttering development: Cross-sectional findings from a community cohort. *Journal of Speech Language and Hearing Research, 60*(4), 772. https://doi.org/10.1044/2016_JSLHR-S-15-0196. https://doi.org/.
Kim, S., Brody, G. H., & Murry, V. M. (2003). Factor structure of the Early Adolescent Temperament Questionnaire and measurement invariance across gender. *Journal of Early Adolescence, 23*(3), 268–294. https://doi.org/10.1177/0272431603254178. https://doi.org/.
Kraft, S. J., Ambrose, N., & Chon, H. (2014). Temperament and environmental contributions to stuttering severity in children: The role of effortful control. *Seminars in Speech & Language*, 35(2), 80–94. https://doi.org/ 10.1055/s-0034-1371753.

Kraft, S. J., Lowther, E., & Beilby, J. (2019). The role of effortful control in stuttering severity in children: Replication study. *American Journal of Speech-Language-Hearing Research, 28*, 14–28. https://doi.org/10.1044/2018_AJSLP-17-0097. https://doi.org/.

Laceulle, O. M., Nederhof, E., Karreman, A., Ormel, J., & Van Aken, M. A. G (2012). Stressful events and temperament change during early and middle adolescence: The TRAILS study. *European Journal of Personality, 26*, 276–284. https://doi.org/10.1002/per.832. https://doi.org/.

Lass, N. J., Ruscello, D. M., Schmitt, J. F., Pannbacker, M. D., Orlando, M. B., Dean, K. A., Ruziska, J. C., & Harkins Bradshaw, K. (1992). Teachers' perceptions of stutterers. *Language, Speech, and Hearing Services in Schools, 23*. https://doi.org/10.1044/0161-1461.2301.73. https://doi.org/.

LoBue, V., & Pérez-Edgar, K. (2014). Sensitivity to social and non-social threats in temperamentally shy children at-risk for anxiety. *Developmental Science, 17*(2), 239–247. https://doi.org/10.1111/desc.12110. https://doi.org/.

Lowe, R., Guastella, A. J., Chen, N. T. M., Menzies, R. G., Packman, A., O'brian, S., & Onslow, M (2012). Avoidance of eye gaze by adults who stutter. *Journal of Fluency Disorders, 37*, 263–274. https://doi.org/10.1016/j.jfludis.2012.04.004. https://doi.org/.

Lowe, R., Helgadottir, F., Menzies, R., Heard, R., O'Brian, S., Packman, A., & Onslow, M. (2017). Safety Behaviors and Stuttering. *Journal of Speech, Language, and Hearing Research, 60*(5), 1246–1253. https://doi.org/10.1044/2016_jslhr-s-16-0055. https://doi.org/.

Lowe, R., Menzies, R., Packman, A., O'Brian, S., Jones, M., & Onslow, M. (2016). Assessing attentional biases with stuttering. *International Journal of Language and Communication Disorders, 51*(1), 84–94. https://doi.org/10.1111/1460-6984.12187. https://doi.org/.

Lucey, J., Evans, D., & Maxfield, N. D. (2019). Temperament in Adults Who Stutter and Its Association With Stuttering Frequency and Quality-of-Life Impacts. *Journal of Speech, Language, and Hearing Research*, 1–12. https://doi.org/10.1044/2019_JSLHR-S-18-0225. https://doi.org/.

Mackinnon, S. P., Hall, S., & Macintyre, P. D. (2007). Origins of the stuttering stereotype: Stereotype formation through anchoring-adjustment. *Journal of Fluency Disorders, 32*, 297–309. https://doi.org/10.1016/j.jfludis.2007.03.003. https://doi.org/.

McClowry, S. G., Rodriguez, E. T., & Koslowitz, R. (2008). Temperament-based intervention: Re-examining goodness of fit. *European Journal of Developmental Science, 2*(2), 120–135.

Melchior, L. A., & Cheek, J. M. (1990). Shyness and anxious self-preoccupation during a social interaction. *Journal of Social Behavior and Personality, 5*(2), 117–130. https://www.researchgate.net/profile/Jonathan_Cheek/publication/235418712_Shyness_and_anxious_self-preoccupation_during_social_interaction/links/00463523ddbf28dbf1000000.pdf.

Menzies, R. G., Onslow, M., Packman, A., & O'Brian, S (2009). Cognitive behavior therapy for adults who stutter: A tutorial for speech-language pathologists. *Journal of Fluency Disorders, 34*, 187–200. https://doi.org/10.1016/j.jfludis.2009.09.002. https://doi.org/.

Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy, 36*, 809–848.

Muris, P., & Meesters, C. (2009). Reactive and regulative temperament in youths: Psychometric evaluation of the Early Adolescent Temperament Questionnaire-Revised. *Journal of Psychopathology and Behavioral Assessment, 31*, 7–19. https://doi.org/10.1007/s10862-008-9089-x. https://doi.org/.

Nicholas, A. (2015). Solution Focused Brief Therapy with Children Who Stutter. *Procedia - Social and Behavioral Sciences, 193*, 209–216. https://doi.org/10.1016/j.sbspro.2015.03.261. https://doi.org/.

Ntourou, K., Conture, E. G., & Walden, T. A. (2013). Emotional reactivity and regulation in preschool-age children who stutter. *Journal of Fluency Disorders, 38*(3), 260–274. https://doi.org/10.1016/j.jfludis.2013.06.002. https://doi.org/.

Ntourou, K., Defranco, E. O., Conture, E. G., Walden, T. A., & Mushtaq, N. (2020). A parent-report scale of behavioral inhibition: Validation and application to preschool-age children who do and do not stutter. *Journal of Fluency Disorders, 63*, Article 105748. https://doi.org/10.1016/j.jfludis.2020.105748. https://doi.org/.

Plexico, L. W., Manning, W. H., & Levitt, H. (2009). Coping responses by adults who stutter: Part I. Protecting the self and others. *Journal of Fluency Disorders, 34*, 87–107. https://doi.org/10.1016/j.jfludis.2009.06.001. https://doi.org/.

Poole, K. L., Saigal, S., Van Lieshout, R. J., & Schmidt, L. A. (2020). Developmental programming of shyness: A longitudinal, prospective study across four decades. *Development and Psychopathology, 32*(2), 455–464. https://doi.org/10.1017/S0954579419000208. https://doi.org/.

R Core Team. (2020). *R: A language and environment for statistical computing* (4.0.2 ("Taking Off Again")). R Foundation for Statistical Computing. https://www.r-project.org.

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy, 35*(8), 741–756.

Rapee, R. M., & Spence, S. H. (2004). The etiology of social phobia: Empirical evidence and an initial model. *Clinical Psychology Review, 24*(7), 737–767. https://doi.org/10.1016/j.cpr.2004.06.004. https://doi.org/.

Roberts, B. W., & Delvecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126*(1), 3–25. https://doi.org/10.1037/0033-2909.126.1.3. https://doi.org/.

Rocha, M. S., Yaruss, J. S., & Rato, J. R. (2019). Temperament, Executive Functioning, and Anxiety in School-Age Children Who Stutter. *Frontiers in Psychology, 10*, 1–14. https://doi.org/10.3389/fpsyg.2019.02244. Octoberhttps://doi.org/.

Rodgers, N. H., Lau, J. Y. F., & Zebrowski, P. M (2020). Attentional bias among adolescents who stutter: Evidence for a vigilance-avoidance effect. *Journal of Speech, Language, &andHearing Research*. https://doi.org/10.1044/2020_JSLHR-20-00090. https://doi.org/.

Rothbart, M. K. (2007). Temperament, development, and personality. *Current Directions in Psychological Science, 16*(4), 207–212. https://journals-sagepub-com.proxy.lib.uiowa.edu/doi/pdf/10.1111/j.1467-8721.2007.00505.x.

Rothbart, M. K. (2011). *Becoming who we are: Temperament and personality in development*. The Guilford Press.

Rothbart, M. K., & Ahadi, S. A. (1994). Temperament and the development of personality. *Journal of Abnormal Psychology, 103*(1), 55–66.

Rothbart, M. K., Ahadi, S. A., & Evans, D. (2000). Temperament and personality: Origins and Outcomes Genetic and Behavioral interaction for lung cancer View project. *Journal of Personality and Social Psychology, 78*(1), 122–135. https://doi.org/10.1037/0022-3514.78.1.122. https://doi.org/.

Rothbart, M. K., & Bates, J. E. (1998). Temperament. W. Damon & N. Eisenberg. In *Handbook of child psychology: Social, emotional, and personality development, 3* pp. 105–176). Wiley. https://uiowa-illiad-oclc-org.proxy.lib.uiowa.edu/illiad/illiad.dll?Action=10&Form=75&Value=1346761.

Rothbart, M. K., & Derryberry, D. (1981). Development of individual differences in temperament. In M. E. Lamb, & A. L. Brown (Eds.), *Advances in developmental psychology* (pp. 37–86). Lawrence Erlbaum Associates.

Rothbart, M. K., Ellis, L. K., & Posner, M. I. (2004). Temperament and self-regulation. In R. F. Baumeister, & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 357–370). The Guilford Press.

Schmidt, L. A., & Fox, N. A. (2002). Individual differences in childhood shyness: Origins, malleability, and developmental course. In D. Cervone, & W. Mischel (Eds.), *Advances in personality science* (pp. 83–105). Guilford Press.

Schwenk, K. A., Conture, E. G., & Walden, T. A. (2007). Reaction to background stimulation of preschool children who do and do not stutter. *Journal of Communication Disorders, 40*, 129–141. https://doi.org/10.1016/j.jcomdis.2006.06.003. https://doi.org/.

Singer, C. M., Walden, T. A., & Jones, R. M. (2019). Differences in the relation between temperament and vocabulary based on children's stuttering trajectories. *Journal of Communication Disorders, 78*, 57–68. https://doi.org/10.1016/j.jcomdis.2019.01.004. https://doi.org/.

Snyder, H. R., Gulley, L. D., Bijttebier, P., Hartman, C. A., Oldehinkel, A. J., Mezulis, A., Young, J. F., & Hankin, B. L. (2015). Adolescent emotionality and effortful control: Core latent constructs and links to psychopathology and functioning. *Journal of Personality and Social Psychology, 109*(6), 1132–1149. https://doi.org/10.1037/pspp0000047. https://doi.org/.

Spence, S. H., & Rapee, R. M. (2016). The etiology of social anxiety disorder: An evidence-based model. *Behaviour Research and Therapy, 86*, 50–67. https://doi.org/10.1016/j.brat.2016.06.007. https://doi.org/.

Thomas, A., & Chess, S. (1977). *Temperament and development*. Brunner/Mazel. https://psycnet.apa.org/record/1978-03178-000.

Tichenor, S., & Yaruss, J. S. (2018). A phenomenological analysis of the experience of stuttering. *American Journal of Speech-Language Pathology, 27*(3(S)), 1180–1194. https://doi.org/10.1044/2018_AJSLP-ODC11-17-0192. https://doi.org/.

Tichenor, S., & Yaruss, J. S. (2020). Repetitive negative thinking, temperament, and adverse impact in adults who stutter. *American Journal of Speech-Language Pathology, 29*(1), 201–215. https://doi.org/10.1044/2019_AJSLP-19-00077. https://doi.org/.

Tumanova, V., Woods, C., & Razza, R. (2020). The role of behavioral inhibition for conversational speech and language characteristics of preschool-age children who stutter. *American Journal of Speech-Language Pathology, 29*(2), 638–651. https://doi.org/10.1044/2019_AJSLP-19-00026. https://doi.org/.

Tumanova, V., Zebrowski, P. M., Throneburg, R. N., & Kulak Kayikci, M. E. (2011). Articulation rate and its relationship to disfluency type, duration, and temperament in preschool children who stutter. *Journal of Communication Disorders, 44*, 116–129. https://doi.org/10.1016/j.jcomdis.2010.09.001. https://doi.org/.

Turner, S. M., Beidel, D. C., & Townsley, R. M. (1990). Social phobia: Relationship to shyness. *Behaviour Research and Therapy, 28*(6), 497–505.

Walden, T. A., Frankel, C. B., Buhr, A. P., Johnson, K. N., Conture, E. G., & Karrass, J. M. (2012). Dual diathesis-stressor model of emotional and linguistic contributions to developmental stuttering. *Journal of Abnormal Child Psychology, 40*(4), 633–644. https://doi.org/10.1007/s10802-011-9581-8. https://doi.org/.

Williams, D. E., Silverman, F. H., & Kools, J. A. (1969). Disfluency behavior of elementary-school stutterers and nonstutterers: The consistency effect. *Journal of Speech and Hearing Research, 12*, 308–318.

Yeakle, M. K., & Cooper, E. B. (1986). Teacher perceptions of stuttering. *Journal of Fluency Disorders, 11*, 345–359.

Zengin-Bolatkale, H., Conture, E. G., Walden, T. A., & Jones, R. M. (2018). Sympathetic arousal as a marker of chronicity in childhood stuttering Sympathetic arousal as a marker of chronicity in childhood stuttering. *Developmental Neuropsychology, 43*(2), 135–151. https://doi.org/10.1080/87565641.2018.1432621. https://doi.org/.