Research Article

Temperament in Adults Who Stutter and Its Association With Stuttering Frequency and Quality-of-Life Impacts

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Purpose: The study aim was to determine whether self-reported temperament traits differentiate adults who stutter (AWS) from adults who do not stutter (AWNS). Additionally, associations between temperament and stuttering frequency, and between temperament and quality of life impacts of stuttering, were investigated in AWS.

Method: Self-reported temperament traits were documented for 33 AWS and 43 AWNS using the Adult Temperament Questionnaire (ATQ; Evans & Rothbart, 2007). Quality-of-life impacts of stuttering were assessed using the Overall Assessment of the Speaker's Experience with Stuttering (Yaruss & Quesal, 2010). Stuttering frequency was calculated from 100-word monologue and reading samples.

Results: A between-groups difference in scores on the ATQ Positive Affect subscale was nominally significant (i.e., before correcting for multiple tests) and also approached statistical significance after Bonferroni correction. Positive

Affect scores were lower for AWS, and the size of this trending effect was moderate. Within AWS, a statistically significant positive correlation was found between impact scores on the General Information section of the Overall Assessment of the Speaker's Experience with Stuttering and ATQ Frustration subscale scores after Bonferroni correction. No associations were detected between temperament traits and stuttering frequency.

Conclusions: Results reveal a nontrivial tendency for AWS to experience decreased positive affect compared to AWNS. In addition, increased frustration was found to be associated with reduced general knowledge about stuttering in AWS. Neither effect has been previously reported for adults or children who stutter. Finally, self-reported temperament traits were not found to vary with stuttering frequency in adults, consistent with previous results for AWS.

Stuttering is estimated to affect 5%–8% of individuals at some point in their lifetime, although most will recover (Yairi & Ambrose, 2013). Early theories proposed that stuttering is caused by personality conflict (see Ambrose, 2004). While those theories have been abandoned, there has been renewed interest in psychosocial aspects of stuttering. For example, the notion that basic emotional processes may interact with environmental factors to perpetuate or exacerbate stuttering is a current focus of research (e.g., Choi, Conture, Walden, Jones, & Kim, 2016;

Walden et al., 2012). Investigations of emotional and psychosocial effects of experience with stuttering have also intensified in recent years (e.g., Beilby, Byrnes, Meagher, & Yaruss, 2013; Boyle, 2018; Bricker-Katz, Lincoln, & Cumming, 2013; Carter, Breen, Yaruss, & Beilby, 2017; Craig, Blumgart, & Tran, 2009; Daniels, Gabel, & Hughes, 2012; Koedoot, Bouwmans, Franken, & Stolk, 2011).

One focus of modern-day research related to emotional functioning in people who stutter has been that of temperament. Temperament refers to individual differences in activity, emotionality, attention, and self-regulation that may be shaped by genetic, biological, and environmental factors (Shiner et al., 2012). Temperament research in stuttering has focused largely on children who stutter (CWS) with the aim of isolating contributions of genetically and biologically driven aspects of temperament to stuttering development (Walden et al., 2012). As outlined later, existing evidence suggests that at least some CWS have increased negative affect and reduced self-regulation. It has been proposed that both effects can influence the frequency of stuttering in children and may also result in CWS becoming preoccupied

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Editor-in-Chief: Julie Liss

Editor: J. Scott Yaruss

Received June 4, 2018

Revision received October 14, 2018

Accepted May 2, 2019

https://doi.org/10.1044/2019_JSLHR-S-18-0225

Disclosure: The authors have declared that no competing interests existed at the time of publication.

with their disfluent speech (Conture et al., 2006; Karrass et al., 2006).

In addition to studying temperament in CWS, Guitar (2003) proposed that a focus on temperament in adults who stutter (AWS) is warranted because temperament traits related to persistent stuttering (if any) would be most likely to manifest in adulthood. To date, however, few studies have explicitly investigated temperament in AWS (e.g., Alm & Risberg, 2007; Guitar, 2003). Furthermore, despite the proposed relationship between temperament, stuttering, and reactions to stuttering in CWS (Conture et al., 2006; Karrass et al., 2006), there is limited evidence as to whether temperament in AWS is associated with stuttering behaviors or perceived adverse impacts of stuttering. The current study addresses these questions by comparing temperament traits in AWS and adults who do not stutter (AWNS) using a comprehensive assessment rooted in modern-day temperament theory, in addition to exploring whether temperament traits in AWS are associated with stuttering frequency and with self-perceived impacts of stuttering on quality of life.

Temperament and Temperament Constructs

Temperament generally refers to early-developing differences in emotional and attentional dispositions, including reactive and regulatory processes (Rothbart, 2012). Some aspects of temperament are genetically influenced and present at birth, while other aspects of temperament develop with maturation and experience (Rothbart, Ahadi, & Evans, 2000). Existing evidence suggests that experience interacts with temperament even from an early age (Rothbart et al., 2000), including evidence that specific gene variations in children can interact with the quality of parenting they receive to influence temperament traits (Sheese, Voelker, Rothbart, & Posner, 2007). Additionally, evidence suggests that temperament and personality traits become increasingly consistent over time until reaching peak consistency between the ages of 50 and 59 years (Roberts & DelVecchio, 2000). Although more studies are needed to understand the changeability of temperament traits, Roberts and DelVecchio (2000) note that trait consistency is not so high as to eliminate the possibility of continued interaction with experience across the life span.

There have been multiple approaches to the study of temperament in adults (reviewed in Zuckerman, 2012). One of the broadest among these, and the one adopted here, is Mary Rothbart's approach. Evans and Rothbart (2007) define temperament in adults as a subdomain of personality, which includes individual differences in emotional and attentional capacities. This approach builds on Rothbart et al.'s developmental model of temperament (Rothbart, 2012), which further defines temperament as

...constitutionally based individual differences in reactivity and self-regulation, influenced over time by genes, maturation and experience. The term *constitutional* refers to the biological bases of temperament. By *reactivity*, we mean dispositions

toward emotional, motor, and orienting reactions (these are sometimes referred to as the three A's: affect, activity, and attention). By temperamental *self-regulation*, we refer to processes that regulate our reactivity. Self-regulatory dispositions include our motivational tendencies to approach or withdraw from a stimulus, to direct our attention toward or away from it, and the effortful attentional control that serves to regulate our thoughts or emotions. (p. 9)

Rothbart and colleagues have discovered that, in adults, temperament includes (a) negative affect, (b) extraversion/surgency, (c) effortful control, and (d) orienting sensitivity (Evans & Rothbart, 2007). The first two constructs are emotional in nature: *Negative affect* refers to negative emotionality and responses to aversive stimuli, while *extraversion/surgency* refers to positive emotionality and responses to appealing stimuli. The latter two constructs are attentional in nature: *Orienting sensitivity* refers to awareness of stimuli, and *effortful control* refers to self-regulation, including attentional control (e.g., capacity to shift and focus attention as desired). Negative affect, extraversion/surgency, and orienting sensitivity are all reactive aspects of temperament (i.e., automatic, bottom-up, emergent), while effortful control may be applied in a top-down manner to regulate reactive aspects of temperament.

As noted above, the constructs comprising temperament appear to form the foundations for constructs comprising the adult personality, although personality extends beyond temperament to include aspects such as individuals' thoughts and values (Evans & Rothbart, 2007). Moreover, the constructs in Rothbart's model have shown associations with constructs of the prominent Five-Factor Model (FFM) of personality (Evans & Rothbart, 2007). Specifically, Rothbart's constructs of negative affect, extraversion/surgency, orienting sensitivity, and effortful control have shown convergence with the FFM's neuroticism, extraversion, intellect/openness, and conscientiousness constructs, respectively (Evans & Rothbart, 2007). As mentioned later, the FFM has been used in personality research with adolescents and adults who stutter (Bleek, Montag, Faber, & Reuter, 2011; Iverach et al., 2010; Jafari, Baziar, Bleek, Reuter, & Montag, 2015), potentially providing clues about aspects of temperament in AWS.

Psychology researchers have been investigating associations between temperament and mental health in adults (e.g., Chaves, Lopez-Gomez, Hervas, & Vazquez, 2017; Claes, Norré, Van Assche, & Bijttebier, 2014; Gomez, Kyriakides, & Devlin, 2014; Kaye et al., 2015; Rettew & McKee, 2005; Voth et al., 2014). For example, temperament traits in adults have been studied to gain a better understanding of emotional and self-regulatory processes in potential subtypes of attention-deficit/hyperactivity disorder (Gomez et al., 2014), in anorexia nervosa before and after recovery (Wagner et al., 2006), and in self-injury in individuals with eating disorders (Claes et al., 2014). Although not the focus here, the study of temperament in AWS may also shed light on emotional and self-regulatory aspects of mental health functioning in this speaker group.

Temperament in CWS

There have been quite a number of studies examining temperament among CWS. Some have investigated temperament structure in CWS (i.e., factor analytic derived factors of temperament; Eggers, De Nil, & Van den Bergh, 2009), while other studies have focused on specific temperament traits in CWS. Different measures of temperament have been employed including parent report scales (Ambrose, Yairi, Loucks, Seery, & Throneburg, 2015; Anderson, Pellowski, Conture, & Kelly, 2003; Eggers, De Nil, & Van den Bergh, 2010; Karrass et al., 2006; Kefalianos, Onslow, Packman, et al., 2017; Kefalianos, Onslow, Ukoumunne, Block, & Reilly, 2014, 2017; Kraft, Ambrose, & Chon, 2014; Lewis & Goldberg, 1997; Reilly et al., 2013, 2009), physiological measures (Arnold, Conture, Key, & Walden, 2011; Choi et al., 2016; Gregg & Scott, 2015; Ortega & Ambrose, 2011; van der Merwe, Robb, Lewis, & Ormond, 2011; Zengin-Bolatkale, Conture, Key, Walden, & Jones, 2018), and behavioral measures (Choi, Conture, Walden, Lambert, & Tumanova, 2013; Eggers, De Nil, & Van den Bergh, 2013; Johnson, Walden, Conture, & Karrass, 2010; Ntourou, Conture, & Walden, 2013; Schwenk, Conture, & Walden, 2007; Walden et al., 2012).

As reviewed in detail elsewhere (Alm, 2014; Conture, Kelly, & Walden, 2013; Kefalianos, Onslow, Block, Menzies, & Reilly, 2012), overall, the findings point to greater negative affect (e.g., Eggers et al., 2010; Karrass et al., 2006; Ntourou et al., 2013) and reduced self-regulation (e.g., Eggers et al., 2010; Johnson et al., 2010; Karrass et al., 2006) in CWS. Moreover, parent report findings from Ambrose et al. (2015) suggest that children who persist in their stuttering have a greater negative temperament than both CWNS and CWS who eventually recover. As mentioned previously, it has been proposed that both increased negative affect and reduced self-regulation may influence the frequency of stuttering in children, and they may also result in CWS becoming preoccupied with their disfluent speech (Conture et al., 2006; Karrass et al., 2006). Unknown are whether similar differences (e.g., increased negative affect, reduced self-regulation) are seen in AWS and whether the temperament profiles of AWS are associated in any way with stuttering frequency and/or perceived impacts of stuttering on quality of life.

Temperament in AWS

To date, only a handful of studies have investigated temperament, indirectly or directly, in AWS. For example, in a study exploring levels of the stress hormone cortisol, AWS demonstrated higher cortisol levels compared to AWNS during a high-stress condition (Blood, Blood, Bennett, Simpson, & Susman, 1994). Higher blood cortisol levels have been associated with negative affect (Smyth et al., 1998). Thus, one interpretation of the Blood et al. (1994) findings is that stress-inducing conditions lead to a physiological response related to negative affect in AWS. With that said, the same result was not replicated in a later study (Blood, Blood, Frederick, Wertz, & Simpson, 1997).

Using the Taylor–Johnson Temperament Analysis (Taylor & Morrison, 1996), which was based on a temperament model predating Rothbart, Guitar (2003) found higher scores of the trait “nervous” in AWS versus AWNS. Guitar also found that acoustic startle responses, a physiological measure of negative affect, were larger in AWS compared to AWNS. In contrast, later studies found no differences in acoustic startle responses in AWS versus AWNS (Alm & Risberg, 2007; Ellis, Finan, & Ramig, 2008).

As mentioned previously, the FFM of personality, which relates to Rothbart’s temperament model, has been used to study personality in adolescents and adults who stutter. Some studies found higher neuroticism in AWS (Bleek et al., 2011; Iverach et al., 2010), possibly indicating increased negative affect. Iverach et al. (2010) also found lower agreeableness and conscientiousness in AWS, possibly indicating reduced effortful control. In contrast, higher agreeableness was seen in adolescents and adults who stutter (Bleek et al., 2011; Jafari et al., 2015) and higher conscientiousness in AWS (Bleek et al., 2011). As the studies reviewed so far in this section reveal, temperament in AWS has been studied partially and often indirectly, providing an incomplete and contradictory picture.

Similarly, there is an incomplete picture as to whether temperament is associated with stuttering frequency in AWS. A significant relationship was not observed between acoustic startle responses and stuttering frequency or stuttering severity in AWS (Alm & Risberg, 2007; Guitar, 2003; Ellis et al., 2008). As noted previously, acoustical startle responses provide a physiological correlate of negative affect. Unknown is whether other aspects of temperament are associated with stuttering frequency in AWS.

Finally, associations between temperament and self-perceived adverse impacts of stuttering have not been comprehensively explored. Results of one study, using the FFM of personality, suggest that reduced extraversion and increased neuroticism are related to greater self-perceived adverse impacts of stuttering in AWS (Bleek et al., 2012). Other findings suggest that lower extraversion is associated with poorer communication attitudes in AWS (Stipdonk, Liefstink, Bouwen, & Wijnen, 2014).

Stuttering behaviors and self-perceived quality of life are important factors in clinical management of stuttering in adults (Yaruss, 2010). As noted previously, temperament has also been hypothesized to have associations with stuttering frequency and emotional reactions to stuttering in children. Therefore, the current study also probed for associations between temperament and stuttering frequency, as well as self-perceived quality-of-life impacts in AWS.

Current Study

The primary aim of this study was to investigate whether self-reported temperament traits differentiate AWS and AWNS. A secondary aim was to explore whether associations exist between temperament, stuttering frequency, and self-perceived adverse impacts of stuttering in AWS. Based on findings reviewed previously, we tentatively

predicted that AWS would demonstrate increased negative affect compared to AWNS. Based on findings from Alm and Risberg (2007) and Ellis et al. (2008), we tentatively predicted that increased negative affect would not be associated with increased stuttering frequency in AWS. Finally, based on findings from Bleek et al. (2012) and Stipdonk et al. (2014), we tentatively predicted that increased negative affect and/or reduced extraversion in AWS would be associated with greater perceived adverse impacts of stuttering. It is important to emphasize that correlations were explored only to probe for associations (not causal relationships) between temperament, stuttering frequency, and reactions to stuttering. Investigating temperament in AWS may have implications for informing theory and management of stuttering in adults.

Method

Participants

All participants were between the ages of 18 and 40 years. Participants were a convenience sample of 33 AWS (nine women; $M_{\text{age}} = 24;10$ [years;months]) and 43 AWNS (14 women; $M_{\text{age}} = 23;9$). The difference in age months between groups was not statistically significant, $t(74) = 1.18$, $p = .24$. Presence of stuttering in AWS was established using participant self-report and was verified through observation by the third author, a speech-language pathologist with expertise in stuttering. Participants completed a health and communication status questionnaire, which included questions related to general health, language background, and speech/language/hearing function. All participants reported being in good neurological health, speaking English as a native language, having normal or corrected-to-normal vision, and having normal hearing. Although participants were not asked to report a history of psychological or psychiatric conditions, they did report that they were not using psychiatric medications at the time of testing. Additionally, participants were not asked to report a history of stuttering therapy or participation in stuttering self-help groups. The AWS reported having no history of speech or language impairment aside from stuttering. The AWNS reported having no history of speech or language impairment or family history of stuttering. Among the AWNS, the self-reported highest obtained education levels of participants and their respective frequencies included high school/GED ($n = 21$), vocational college ($n = 1$), high school/vocational college ($n = 1$), college undergraduate ($n = 17$), and college graduate ($n = 3$). The AWS self-reported education levels of high school/GED ($n = 13$), vocational college ($n = 3$), college undergraduate ($n = 12$), and college graduate ($n = 5$). Participants gave written informed consent before participating. Study procedures were approved and monitored by the University of South Florida Institutional Review Board.

Procedures

All participants were assessed at the University of South Florida Stuttering Intervention and Research Lab or

at a National Stuttering Association conference. Most of the AWS were recruited to participate in laboratory experiments. All questionnaires and speech samples were completed prior to any laboratory tasks. Each participant completed the Adult Temperament Questionnaire (ATQ) short form. In addition, AWS provided speech samples that were digitally video-recorded. Participating AWS also completed the Overall Assessment of the Speaker's Experience with Stuttering (OASES; Yaruss & Quesal, 2010).

ATQ

Temperament was assessed using the short form of the ATQ, which is a 77-item self-report questionnaire derived from the long form of the ATQ (Evans & Rothbart, 2007), with statements rated using a 7-point Likert scale. The factor scales of the ATQ short form and the subscales probed within them are as follows: (a) Negative Affect (Fear, Sadness, Discomfort, Frustration), (b) Extraversion/Surgency (Sociability, Positive Affect, High Intensity Pleasure), (c) Effortful Control (Attentional Control, Inhibitory Control, Activation Control), and (d) Orienting Sensitivity (Neutral Perceptual Sensitivity, Affective Perceptual Sensitivity, Associative Sensitivity). Each participant receives a score for each of the four factor scales and for each of the subscales within each factor, for a total of 17 different scores. Higher versus lower scores relate to the degree of a given trait in an individual, such as higher Fear compared to lower Fear, respectively. Alpha reliability coefficients for the ATQ short form, derived from the longer form reported in Evans and Rothbart (2007), range from .60 to .79 for the subscales and from .75 to .85 for the factor scales. The broader ATQ constructs (i.e., factor level scales) show high levels of correspondence with other temperament and personality models, including the temperament and character inventory (Goldberg, 2003), the multi-language seven factor model, and the FFM (Evans & Rothbart, 2007).

Stuttering Frequency

Stuttering frequency was calculated as the percentage of syllables stuttered (%SS) in two videotaped speech samples obtained from each AWS. The analyzed speech samples were a 100-word segment of a monologue and a 100-word segment of a reading passage. For the monologue, participants were instructed to talk freely for 5–7 min about topics of personal interest and current events. The midpoint was determined (in minutes and seconds), and 100 words approximately surrounding the midpoint were analyzed for the presence of stuttering (i.e., approximately 50 words before and after the midpoint were sampled). For the reading sample, participants read aloud the entire 300-word Rainbow Passage (Fairbanks, 1960), and stuttering frequency was assessed for the middle 100 words.

The speech samples were transcribed and coded by a team of speech-language pathologists (the first and third authors) and trained research assistants. Each syllable was scored for the presence of sound repetitions, syllable repetitions, audible prolongations, silent blocks, or mixed

stuttering (i.e., a combination of sound/syllable repetitions, audible prolongations, and/or silent blocks). Before scoring, team members met to operationally define and discuss specific examples of each stuttering type. Two raters (always the third author and one other team member) scored each transcript to 100% agreement after exclusions. That is, syllables on which the presence versus absence of stuttering was not agreed upon by both raters were discarded from the analysis of stuttering frequency. Disagreements were rare (averaging less than one per transcript) and related to uncertainty about whether monosyllabic word repetitions were themselves stuttering or whether they were retrials used by some participants as secondary behaviors (verbal stalling) in anticipation of stuttering.

OASES

The OASES (Yaruss & Quesal, 2010) was administered to AWS to assess the self-perceived impact of stuttering on quality of life. The OASES is a 100-item questionnaire in which individuals rate statements using a 5-point Likert scale. Impact scores obtained from the OASES correspond to four sections including General Information, Reactions to Stuttering, Communication in Daily Situations, and Quality of Life, as well as an overall impact score. From these impact scores, both section and overall impact ratings are determined. Impact ratings and their corresponding impact score ranges are as follows: mild (1.00–1.49), mild–moderate (1.50–2.24), moderate (2.25–2.99), moderate to severe (3.00–3.74), and severe (3.75–5.00). The OASES was developed based on a review of other quality-of-life measures, focus groups, pilot studies, and item analysis, and it has high test–retest reliability for impact scores and impact ratings (Yaruss & Quesal, 2006).

Data Analysis

All analyses were conducted using SPSS 24 (IBM Corp., 2016). The Shapiro–Wilk test was applied to test for normality in the participant samples. Two-tailed independent-samples *t* tests were used to determine whether differences in temperament traits between AWS and AWNS were statistically significant in normally distributed variables. Mann–Whitney *U* tests were used to determine whether differences in temperament traits between AWS and AWNS were statistically significant in nonnormally distributed variables. Effect sizes for statistically significant differences in temperament traits between groups were determined using Cohen's *d*.

Between-groups comparisons were approached as follows. First, *t* tests were computed for the four factor scales of the ATQ (Negative Affect, Extraversion/Surgency, Orienting Sensitivity, and Effortful Control). To control for Type 1 error, the alpha level for declaring statistical significance was adjusted to $.05 / 4$ factor scales = .0125 using Bonferroni correction. Next, *t* tests (or, for two subscales, Mann–Whitney *U* tests) were computed for subscales associated with each scale. For the subscales under Negative Affect, the alpha level was adjusted to $.05 / 4$ subscales = .0125.

For the subscales under Extraversion/Surgency, Orienting Sensitivity, and Effortful Control, respectively, the alpha level was adjusted to $.05 / 3$ subscales = .0166.

Correlations between temperament scores and OASES scores in AWS were determined using Pearson *r* coefficients for normally distributed variables and Spearman rank coefficients for nonnormally distributed variables. First, Pearson *r* correlation coefficients were calculated between each of the four factor scales of the ATQ (Negative Affect, Extraversion/Surgency, Orienting Sensitivity, and Effortful Control) and each of the five scores obtained for the OASES (General Information, Reactions to Stuttering, Communication in Daily Situations, Quality of Life, and Overall Impact). To control for Type 1 error, the alpha level was adjusted to $.05 / 20$ = .0025 using Bonferroni correction. Next, Pearson *r* coefficients (or, for two ATQ subscales, Spearman rank coefficients) were calculated between each set of subscores and each of the five OASES scores. For the subscales under Negative Affect, the alpha level was adjusted to $.05 / 20$ = .0025. For the subscales under Extraversion/Surgency, Orienting Sensitivity, and Effort Control, respectively, the alpha level was adjusted to $.05 / 15$ = .0033.

Finally, correlations between temperament scores and stuttering frequency in AWS were approached as follows. First, Spearman rank coefficients were calculated between each of the four factor scales of the ATQ (Negative Affect, Extraversion/Surgency, Orienting Sensitivity, and Effortful Control) and each of the two stuttering frequency scores (Monologue and Read Aloud). To control for Type 1 error, the alpha level was adjusted to $.05 / 8$ = .0063. Next, Spearman rank coefficients were calculated between each set of subscores and each of the two stuttering frequency scores (Monologue and Read Aloud). For the subscales under Negative Affect, the alpha level was adjusted to $.05 / 8$ = .0063. For the subscales under Extraversion/Surgency, Orienting Sensitivity, and Effortful Control, respectively, the alpha level was adjusted to $.05 / 6$ = .0083.

Results

Stuttering frequency in monologue ranged from 2% to 36% of syllables stuttered. According to Healey's (2010) proposed stuttering severity ratings (i.e., 5%SS, mild; 10% SS, moderate; 15%SS, severe), 24 AWS in the current study might be characterized as having mild stuttering, six participants might be characterized as having moderate stuttering, and three participants might be characterized as having severe stuttering based on their monologue samples. In reading, stuttering frequency ranged from < 1% to 20% of syllables stuttered. The range of stuttering frequencies observed in our AWS is consistent with the range of stuttering frequencies seen in other recent investigations of AWS (e.g., Manning & Beck, 2013). Our AWS also presented with a fairly broad range of OASES scores. Based on OASES overall impact ratings, one participant was rated mild, 14 were mild–moderate, 17 were moderate, and one was severe.

Normality Testing

The Shapiro–Wilk test revealed that the Associative Sensitivity subscale data were not normally distributed for both AWS ($p = .006$) and AWNS ($p = .04$). In addition, the Affective Perceptual Sensitivity subscale data were not normally distributed for AWS ($p = .04$). Thus, Mann–Whitney U tests were used when comparing groups on these two subscales. In addition, Spearman rank coefficients were computed to determine associations between these two subscales and OASES scores. The Shapiro–Wilk test also revealed that %SS data were not normally distributed for Monologue ($p < .001$) and Read Aloud ($p = .004$). Thus, Spearman rank coefficients were used to determine associations between ATQ scores and %SS.

ATQ Factor Scale Comparisons

Table 1 shows ATQ factor scores for each group and results of between-groups comparisons. No between-groups differences were detected in the ATQ factor scales at the adjusted alpha threshold.

ATQ Subscale Comparisons

Table 2 shows mean ATQ subscale scores for each group and results of between-groups comparisons. No between-groups differences were detected in the ATQ subscale scores at the adjusted alpha thresholds, with one exception. The difference between groups on the Positive Affect subscale approached statistical significance at the $p = .016$ threshold ($t = 2.31$, $p = .02$). As shown in Table 2, AWS had lower Positive Affect subscale scores than AWNS. The size of this effect was moderate ($d = 0.53$). This effect suggests a nontrivial tendency for AWS to experience positive emotionality and pleasure less frequently, at a lower intensity, and for a shorter period, than AWNS.

Correlations Between ATQ and OASES Scores

No statistically significant correlations were detected between ATQ factor scale scores and OASES scores in AWS at the adjusted alpha threshold (see Table 3 for

correlation coefficients). Similarly, no correlations between ATQ subscale scores and OASES scores reached statistical significance, with one exception (see Table 4 for correlation coefficients). As shown in Figure 1, the subscale Frustration showed a statistically significant, positive correlation with scores on the General Information section of the OASES at the $p = .0025$ threshold ($r = .54$, $p = .001$). This suggests that AWS who exhibit increased negative emotionality when a task is interrupted tend to be less knowledgeable about stuttering management or factors that influence stuttering.

Correlations Between ATQ Scores and %SS

No statistically significant correlations were detected between any ATQ factor scale or subscale scores and %SS in monologue or reading (see Table 5).

Discussion

We compared temperament traits between AWS and AWNS using a modern-day self-report scale designed to assess four different constructs in adult temperament. We also probed for associations between temperament traits and stuttering frequency, and between temperament traits and self-perceived impacts of stuttering on quality of life, in AWS. Comparison of temperament traits between groups detected lower positive affect in AWS versus AWNS. This difference just fell shy of reaching statistical significance with Type 1 error control. Thus, we are interpreting it as a trend toward lower positive affect in AWS. The moderate size of this effect suggests that it should be treated as nontrivial. In addition, a statistically significant positive correlation was detected between the temperament trait frustration and general knowledge about stuttering in AWS. In contrast, no statistically significant correlations were detected between temperament and stuttering frequency in AWS. These findings, particularly trending results, should be considered with caution. At the very least, they suggest areas for further study.

Differences in Temperament Between Groups

A nontrivial trend toward lower scores on the Positive Affect subscale reflects a lower “latency, threshold, intensity, duration, and frequency of experiencing pleasure” (Evans & Rothbart, 2007, p. 884) in AWS versus AWNS. To our knowledge, reduced positive affect in AWS or CWS has not been previously reported. If lower positive affect in AWS is shown to be replicable, one question is whether there is a shift from higher to lower positive affect in people who stutter from childhood to adulthood as a result of reduced positive reinforcement associated with speaking due to stuttering. Alternatively, it is possible that, in some individuals who stutter, lower positive affect is relatively innate and becomes more consistent over time until adulthood. As previously noted, the current study did not probe for causal relationships, and longitudinal studies are needed to

Table 1. Means, standard deviations, and between-groups comparisons of Adult Temperament Questionnaire (ATQ) factor scale scores.

ATQ factor scale	Group				<i>t</i>	<i>p</i>	<i>d</i>
	AWNS		AWS				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Negative affect	3.61	0.66	3.82	0.57	−1.45	.15	0.34
Extraversion/surgency	5.06	0.65	4.74	0.66	2.08	.04	0.49
Effortful control	4.58	0.77	4.38	0.65	1.20	.23	0.28
Orienting sensitivity	4.76	0.79	4.76	0.60	1.95	.06	0.00

Note. AWNS = adults who do not stutter; AWS = adults who stutter.

Table 2. Means, standard deviations, and between-groups comparisons of Adult Temperament Questionnaire (ATQ) subscale scores.

ATQ subscale	Group				<i>t</i> or <i>U</i> ^a	<i>p</i>	<i>d</i>
	AWNS		AWS				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Fear	3.31	0.90	3.74	0.87	−2.10	.04	0.49
Sadness	3.88	0.88	3.91	0.68	−0.14	.89	0.04
Discomfort	3.67	0.94	3.95	0.88	−1.34	.19	0.31
Frustration	3.58	0.93	3.66	1.06	−0.35	.73	0.08
Sociability	5.38	0.96	4.93	1.07	1.90	.06	0.44
Positive affect	5.36	0.78	4.91	0.92	2.31	.02	0.53
High-intensity pleasure	4.61	0.90	4.48	1.10	0.54	.59	0.13
Attentional control	4.30	1.07	4.11	1.07	0.76	.45	0.18
Inhibitory control	4.25	0.88	4.18	0.71	0.35	.73	0.09
Activation control	5.11	0.93	4.77	0.84	1.66	.10	0.38
Neutral perceptual sensitivity	5.21	0.85	4.81	0.89	1.98	.06	0.46
Affective perceptual sensitivity	4.59	1.03	4.59	1.00	638.5 ^a	.46	0.00
Associative sensitivity	5.27	0.94	4.89	1.00	570	.14	0.39

Note. AWNS = adults who do not stutter; AWS = adults who stutter.

^aResults obtained using Mann-Whitney U tests.

fully understand the development and maturation of temperament traits in people who stutter.

As mentioned in the introduction, the study of temperament may shed light on the emotional and self-regulatory aspects of mental health function. There is mounting evidence that AWS are at an elevated risk for social anxiety disorder (e.g., Blood, Blood, Maloney, Meyer, & Qualls, 2007; Iverach et al., 2016; Iverach, Rapee, Wong, & Lowe, 2017), and reduced positive affect has been associated with symptoms and diagnoses of anxiety disorders, as well as depression (Brown, Chorpita, & Barlow, 1998; Eisner, Johnson, & Carver, 2009; Watson, Clark, & Carey, 1988). Thus, if lower positive affect is shown to be replicable in AWS, one question is whether decreased pleasurable engagement is associated with increased risk of anxiety and depression in AWS.

Although we predicted that AWS would exhibit greater negative affect than AWNS, our findings did not support this prediction. This stands in contrast to previous discoveries of higher “nervous” trait scores in AWS (Guitar, 2003) and increased neuroticism in AWS (Bleek et al., 2011; Iverach et al., 2010). Instead, the current results are more consistent with the Jafari et al. (2015) finding of no difference in

neuroticism (a correlate of negative affect) in people who stutter. It also seems worth emphasizing that we failed to find differences in temperament constructs related to attention in AWS, despite previous findings of reduced self-regulation in CWS mentioned in the introduction. This contrast underscores the need for longitudinal research investigating the development and maturation of emotional and attentional temperament constructs in people who stutter.

Reasons for disparities between our findings and previously published studies comparing temperament traits in people who stutter versus peers who do not stutter are not immediately clear. The current study had fewer participants than some previous studies (e.g., Bleek et al., 2011; Iverach et al., 2010; Jafari et al., 2015) but more participants than other previous studies (e.g., Guitar, 2003), making it unclear what effect sample size may have on power for detecting differences in temperament in people who stutter. Also unclear is the effect of variation in participant factors. For example, the stuttering treatment and self-help group history of participants in the current study was unknown, while in other studies, all of the participants who stutter had a positive history of treatment seeking and/or self-help participation

Table 3. Pearson correlation coefficients between Adult Temperament Questionnaire (ATQ) factor scale scores and Overall Assessment of the Speaker's Experience with Stuttering (OASES) impact scores in adults who stutter.

ATQ factor scale	OASES section				
	Section 1	Section 2	Section 3	Section 4	Total impact
Negative affect	.34	−.05	.12	−.04	.09
Extraversion/surgency	−.20	−.18	−.16	−.14	−.20
Effortful control	−.23	−.15	−.17	.05	−.15
Orienting sensitivity	−.17	.12	−.11	.05	.07

Note. Section 1: General Information; Section 2: Reactions to Stuttering; Section 3: Communication in Daily Situations; Section 4: Quality of Life.

Table 4. Pearson or Spearman^a correlation coefficients between Adult Temperament Questionnaire (ATQ) subscale scores and Overall Assessment of the Speaker's Experience with Stuttering (OASES) impact scores in adults who stutter.

ATQ subscale	OASES section				
	Section 1	Section 2	Section 3	Section 4	Total impact
Fear	.18	-.06	.23	.08	.11
Sadness	-.05	-.15	-.08	-.15	-.13
Discomfort	.13	-.22	-.13	-.22	-.15
Frustration	.54*	.23	.24	.13	.32
Sociability	-.20	-.24	-.17	-.17	-.24
Positive affect	-.32	-.46	-.39	-.43	-.49
High-intensity pleasure	.04	.19	.12	.18	.17
Attentional control	-.10	-.13	-.13	-.07	-.13
Inhibitory control	-.21	.04	-.13	.20	-.02
Activation control	-.20	-.22	-.13	-.00	-.17
Neutral perceptual sensitivity	.06	.16	-.11	.11	.07
Affective perceptual sensitivity	.08 ^a	-.05 ^a	.07 ^a	.16 ^a	.05 ^a
Associative sensitivity	-.08 ^a	-.09 ^a	-.16 ^a	-.22 ^a	-.15 ^a

Note. Section 1: General Information; Section 2: Reactions to Stuttering; Section 3: Communication in Daily Situations; Section 4: Quality of Life.

^aResults obtained using Spearman rank coefficients.

* $p < .0025$.

(Bleek et al., 2011; Guitar, 2003; Iverach et al., 2010; Jafari et al., 2015). However, as mentioned previously, not all of those studies found the same temperament effects in people who stutter. Another possibility to consider is that different approaches to operationalizing temperament and temperament constructs on different assessments may contribute to divergent findings related to temperament in AWS. Investigated through the lens of Rothbart's temperament model, the current results point toward reduced positive affect in AWS versus AWNS but no differences in negative affect or any other temperament traits in AWS versus AWNS.

Figure 1. Correlation between Adult Temperament Questionnaire (ATQ) Frustration scores and Overall Assessment of the Speaker's Experience with Stuttering (OASES) General Information impact scores in adults who stutter.

Associations Between Temperament and Self-Perceived Quality-of-Life Impacts of Stuttering

A statistically significant, positive correlation was detected between frustration and reduced general knowledge about stuttering and how to manage stuttering. Frustration is operationalized on the ATQ as negative affect associated with the interruption of tasks and behavior (Evans & Rothbart, 2007). Thus, AWS who exhibit increased negative emotionality when a task is interrupted tend to be less knowledgeable about stuttering management or factors that influence stuttering. Since stuttering is inherently a disruption of speech, stuttering itself may be especially likely to amplify

Table 5. Spearman correlation coefficients between Adult Temperament Questionnaire (ATQ) scores and percentage of syllables stuttered (%SS) in adults who stutter.

ATQ scales and subscales	%SS	
	Monologue	Reading
Negative affect	-.24	.06
Fear	-.11	.07
Sadness	-.29	.01
Discomfort	-.06	.11
Frustration	-.03	.13
Extraversion/surgency	-.12	-.24
Sociability	-.08	-.18
Positive affect	-.18	-.18
High-intensity pleasure	.06	-.13
Effortful control	-.18	-.16
Attentional control	-.18	-.25
Inhibitory control	-.17	.09
Activation control	-.12	-.17
Orienting sensitivity	.20	.18
Neutral perceptual sensitivity	.12	.10
Affective perceptual sensitivity	.19	.25
Associative sensitivity	.10	.08

negative emotionality in AWS who exhibit higher frustration, even though they may not present with significantly higher overall negative affect. If so, this may help to explain why some AWS use avoidance to cope with stuttering and why more knowledge about speech production and stuttering in AWS is related to greater self-confidence (e.g., Crichton-Smith, 2002; Plexico, Manning, & Levitt, 2009a, 2009b).

It is interesting to note that, although Bleek et al. (2012) found that increased neuroticism was related to greater self-perceived adverse impacts of stuttering in AWS across all domains of the OASES, we did not find any statistically significant correlations between negative affect and OASES scores in AWS. Furthermore, we found no support for the prediction that lower extraversion/surgency would be related to greater perceived negative impacts of stuttering, which was based on studies of personality among AWS from Bleek et al. (2012) and Stipdonk et al. (2014). However, it is possible that the conservative Type 1 error control in this study resulted in meaningful correlations going undetected. In particular, it may be valuable to further investigate correlations between positive affect and OASES scores, which in this study, approached statistical significance even with Bonferroni correction applied.

As mentioned previously, different approaches to temperament assessment may operationalize temperament differently. The personality measures used by Bleek et al. (2012) and Stipdonk et al. (2014) are probably sensitive to individuals' cognitions, beliefs, and values, which are not included as aspects of temperament (Evans & Rothbart, 2007). Since the OASES explicitly includes the assessment of cognitive reactions to stuttering (Yaruss, 2010), it is possible that personality traits may show stronger correlations to impacts of stuttering than temperament traits alone.

Temperament and Stuttering Frequency

Associations were not detected between temperament and stuttering frequency. This is consistent with other work, mentioned in the introduction, that failed to find correlations between physiological measures of temperament (e.g., cortisol levels, acoustic startle responses) and stuttering frequency or severity in AWS (e.g., Alm & Risberg, 2007; Ellis et al., 2008; Guitar, 2003) or in CWS (e.g., Arnold et al., 2011). In contrast, research using behavioral and parent report measures has detected associations between temperament and stuttering frequency in CWS (e.g., Johnson et al., 2010), providing at least speculative support for the interaction between these variables proposed by Conture et al. (2006). As mentioned in the introduction, unknown is whether associations between temperament and stuttering frequency in AWS might also be revealed using behavioral observations.

Implications, Limitations, and Future Directions

Although limited implications can be derived from the current study, the current findings tentatively suggest that continued exploration of temperament traits in AWS

may inform the clinical management of persistent stuttering. For example, if reduced positive affect is detected consistently in AWS, then associations between low positive affect and mental health disorders suggest that routine assessment of anxiety and depression may be warranted in AWS. Furthermore, if a positive association between frustration and reduced general knowledge about stuttering is detected consistently in AWS, another potential implication is that treatments that help AWS cope with frustration may help to reduce their perceived negative impacts of stuttering on quality of life.

This study was limited in that behavioral and physiological correlates of temperament were not measured. In addition, although the sample size was larger than in some previous studies of temperament in AWS, the high level of variable findings across all studies examining temperament or personality and stuttering indicates that much larger sample sizes will be needed to validate the effects observed in this and previous studies. Furthermore, the speech samples collected were relatively short and may not have been fully representative of the participants' stuttering. Regarding the participants, the age range was limited to relatively young adults and did not consider temperament in aging AWS. In addition, this study was potentially limited by a lack of participant data related to treatment history, self-help group attendance, and the presence or absence of a mental health disorder. Finally, although temperament traits have been shown to fluctuate and increase in consistency over time (Roberts & DelVecchio, 2000) and appear to interact with experience in young children (Rothbart et al., 2000), longitudinal studies will be necessary to discern cause and effect related to temperament and stuttering.

Summary and Conclusions

This study expands upon previous findings regarding temperament in AWS and its relationship to stuttering frequency and self-perceived quality-of-life impacts of stuttering. Results demonstrate, alongside previous research, that AWS may differ from AWNS on certain aspects of temperament, with different studies detecting differences in different temperament traits between groups. Results of this study also demonstrate that aspects of temperament may be associated with perceived negative impacts of stuttering in AWS. Such findings may be useful in developing interventions aimed at improving quality of life in AWS. In contrast, temperament traits were not found to correlate with the frequency of stuttering in AWS, suggesting that temperament has no relationship with observable stuttering behavior in adults.

Acknowledgments

This research was supported by the National Institute on Deafness and Other Communication Disorders under Grant R03DC011144 awarded to Nathan Maxfield. We are grateful to Justine Van Dyke, Kalie Morris, Caitlin Kellar, and Alissa Belmont for their efforts in data collection. We are also grateful for the adults who stutter who participated in this research. Finally,

we thank the National Stuttering Association for allowing us to conduct research at their national conference.

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