Effects of Childhood Stuttering on Attention Regulation in Emotionally Arousing Situations

Alison Bush Peabody College of Vanderbilt University

The purpose of this study was to examine the relation between children's attention regulation and stuttering in three different emotionally arousing situations. Participants were 15 monolingual, Standard American English speaking, preschool children who stutter (CWS) and 17 monolingual Standard American English speaking, preschool children who do not stutter (CWNS) between the ages of 3; 0 (years; months) and 5; 7. All participants had speech, language, and hearing development within normal limits, with the exception of stuttering for CWS. Measures included two indices of attention regulation (i.e., looks away from the computer monitor and off-topic statements), that were observed during the first three minutes of a "book reading" narrative production task. This task occurred immediately after listening to a pre-recorded emotionally arousing background conversation (negative, positive, and neutral). It was predicted that children who stutter would less efficiently regulate their attention in a negative emotionally arousing situation. Main findings indicated that CWS take fewer looks away from the computer monitor than CWNS during the narrative task and that it initially takes CWS longer to first look away from the computer monitor than CWNS. Findings were taken to suggest that CWS fixate their attention on a stimulus and are less able to disengage when required and/or appropriate while CWNS have the ability to flexibly shift their attention away from the same stimulus, especially in a negative arousing situation.

Emotional reactivity and emotion regulation have recently been main topics of interest in developmental psychology, but not until recently have they been linked with stuttering in young children. Children who stutter (CWS) when compared to children who do not stutter (CWNS) have been shown to be significantly more reactive, significantly less able to regulate their emotions, and have significantly poorer attention regulation (Conture, Walden, Graham, Arnold, Hartfield, Karrass, and Schwenk in press; Karrass, Walden, Conture, Graham, Arnold, Hartfield, and Schwenk in press). These results suggest that when preschool children who stutter experience their daily situational requirements, they display greater emotional reactivity along with an inability to flexibly control their attention and regulate their emotions. These challenges to the maintenance and regulation of emotional reactivity may exacerbate difficulties CWS have in establishing fluent speech and language, especially when they experience mistakes, disruptions or hesitations during their conversational speech and language.

Vanderbilt Undergraduate Research Journal, Volume 2, Number 1, Spring 2006

Stuttering has been defined as, "a disruption in the rhythm or fluency of speech" (Conture 2001, 264). Nearly 5 percent of adults report having stuttered at some point in their lives, although 70-80 percent of those affected discontinue without treatment. Only 1 percent of children continue to stutter after six years of age but the academic, emotional, social, and vocational consequences are often severe in the short-, medium- as well as long-term aspects of the child's life, which is why it is important to determine which variables might cause or perpetuate stuttering. For the purposes of this discussion, Pellowski and Conture's (2002) description of CWS will be employed as any child who exhibits three or more stuttering-like disfluencies per 100 words of conversational speech.

Although one can find many anecdotal as well as clinical observations that early childhood stuttering relates to emotion, only recently has this relation been empirically explored (Karrass et al. in press) as well as theoretically described (Conture et al. in press). Cole (2004, 319) defines emotions as, "biologically prepared capabilities that evolved and endured in humans because of their extraordinary value for survival. Emotions are a kind of radar and rapid response system, constructing and carrying meaning across the flow of experience." Emotions are considered by some to be the tools by which we appraise experience and prepare to act on situations. In order to express emotion, a person needs to appreciate the significance of a situation or perception/representation of a situation (Cole 2004). The word "stance" implies that emotions involve being poised, oriented, ready, or inclined toward a course of action (Cole 2004, 320). The term stance connotes that the individual is evaluating a situation (appraising) and inclining toward a particular class of actions (action readiness). Furthermore, although emotions have an overt or external component (e.g., facial gestures), they are often unseen and unfelt. Thus, emotions must frequently be inferred from evidence of the individual's relation to surrounding events.

When considering emotions, their nature and level, one must also consider emotional regulation. There are several ways to regulate emotion, such as modifying, eliminating, minimizing, switching, amplifying, or redirecting (Cole 2004, 320). Another regulatory strategy involved with emotion is the allocation of attention and other resources to solve a problem or dealing with a challenge. Attention regulation typically involves shifting one's attention away from something that is emotionally arousing in order to limit the emotional effects of the stimulus (Ahadi and Rothbart 1994).

Specifically, with regard to the possible relation between emotions and stuttering, it is predicted that two emotion variables reactivity and regulation may intensify the occurrence of stuttering in young children. Emotional reactivity is the experience of frequent and intense emotional arousal. Aspects of emotional reactivity are the threshold and ease with which individuals become emotionally aroused and the intensity of those emotional experiences (Spinrad, Eisenberg, Harris, Hanish, Fabes, Kupanoff, Ringwald, and Holmes 2004).

Empirical findings appear to suggest that children who stutter are sensitive, may react strongly, or fail to regulate their reactions to various communicative, emotional, and other environmental stressors

(i.e. meeting or talking with unfamiliar people). These responses reflect both the reactivity a child experiences in various situations as well as the child's ability to regulate this reactivity (Anderson, Pellowski, Conture, and Kelly 2003).

Emotional regulation entails the process of initiating, maintaining, or modulating the occurrence, intensity, or duration of internal feelings and emotion-related physiological processes (Thompson 1994). One way people are thought to be able to efficiently regulate their emotional reactivity is through allocating attentional resources. Such allocation of resources allows a person to re-define or re-direct their emotion when faced with a highly arousing situation. In essence, emotion regulation refers to changes associated with activated emotions. These include changes in the emotion itself (changes in intensity, duration) or in other psychological processes (memory, social interaction). One particularly salient aspect of emotion regulation is the regulation of attention (attention shifting and focusing) (Eisenberg 2000). Attentional control, especially attention shifting, is thought to be used to modulate internal emotion-related processing, while attention focusing sometimes may be used to manage overt behavior associated with emotion when the emotion itself is not efficiently regulated.

Specifically, children who can modulate the intensity and duration of their experience of negative emotion through processes such as attention shifting and focusing may be better able to manage the emotion internally so that they are relatively unlikely to express negative emotion in their behavior. Children who can flexibly regulate their attention tend to be relatively low in observed or other-rated negative emotionality as well (Eisenberg 2000).

Given the above, it was hypothesized that emotional reactivity and regulation can exacerbate ongoing stuttering as well as contribute to future instances of stuttering. It is not unreasonable to suggest that all communicative events resulting from speech-language planning and production could potentially be influenced by emotional arousal and coping. For example, disruptions in speech language planning and production may not only be detected by peripheral as well as central monitoring of communication, but may also be filtered through dispositional and situationally emotional reactions and regulation. This filtering may aggravate or maintain instances of stuttering, maybe even making them more severe in duration, physical tension, and/or changing their type. For example, this could occur when making reiterative-type (repetitions) and speech disfluencies more prolonged.

It is hypothesized that children who stutter experience several shortfalls in attention regulation. During the preschool years, children are developing the skills necessary in controlling attention, such that they are learning to choose which stimuli to attend to (Ruff and Rothbart 1996). Attentional control is a primary method of emotion regulation, such that shifting attention away from a distressing stimulus toward a more soothing stimulus is a powerful and advanced emotion regulation technique. Conversely, shifting attention away too often from stimulus to stimulus is a less mature emotion regulation technique, along with fixating attention on one stimulus for a lengthened period of

time. If CWS experience difficulties managing their attentional resources, such difficulties might have direct effects on their speech disfluencies. For example, these children might fixate on the speech errors that they make, rather than shift their attention to less challenging or distressing aspects of their conversation, and by so doing contribute to increases in their negative reactivity.

Such speculation suggests the importance of empirical study of attention regulation, emotional reactivity and regulation in relation to childhood stuttering because of the numerous communicative difficulties CWS deal with on a daily basis. Indeed, there are already some data that support this speculation. First, children who stutter, as compared to children who do not stutter, are less successful in effectively maintaining attention and adapting to their environment (Embrechts et al. 1998). Second, CWS are less adaptable to change, differences and novelty, less rhythmic in their daily life activities, and less distractible (Anderson, Pellowski, Conture, and Kelly 2003). Third, CWS are more emotionally reactive to environmental stimuli (Wakaba 1998). Last, CWS are more anxious, sensitive, introverted, and withdrawn (Fowlie and Cooper 1978). These difficulties contribute to dysfunctional behavior. For instance, children who are easily over-aroused by the negative emotion have difficulty coping with emotionally evocative situations, even in situations that are less evocative for others. The preceding brief literature review plus the speculation of the author and that of others (Conture et al. in press) suggests the importance of considering the possible role that emotions play with childhood stuttering. Specifically, the role that emotional reactivity and regulation play in the exacerbation or maintenance of childhood stuttering, in particular the role of attentional regulation. Therefore, the present study examined relations between children's attention regulation and stuttering in three different emotionally arousing situations. It was predicted that children who stutter will be less able to efficiently regulate their attention in emotionally arousing situations. Specifically, it was hypothesized that children who stutter will be less successful in focusing their attention when placed in a highly negative arousing situation than children who do not stutter and exhibit more instances of attention shifting in the negative emotionally arousing situation than children who do not stutter.

Method

Participants

Participants were 15 monolingual, Standard American English speaking, 3- to 5-year-old (3; 0 5; 5) children who stutter (CWS) and 17 monolingual, Standard American English speaking, 3- to 5-year-old (3; 2 5; 7) children who do not stutter (CWNS). The mean age of the CWS and CWNS was 48 months (4; 0).

Participants were paid volunteers unaware of the purposes and specific methods of the study. Besides stuttering exhibited by the CWS, no participant, either CWS or CWNS, exhibited any other reported speech or language problems, based on the criteria described below.

Children who stutter were identified for participation in this study by their parents through (a) an advertisement in a free, widely-read, monthly parent-oriented magazine circulated throughout Middle Tennessee (i.e., *The Nashville Parent*); or (b) Middle Tennessee area speech-language pathologists, health care providers, daycare centers, and related entities; or (c) self or professional referral to the Vanderbilt Bill Wilkerson Center for an initial assessment of childhood stuttering. The study protocol was approved by the Institutional Review Board at Vanderbilt University in Nashville, Tennessee. For each of the 32 participants, parents signed an informed consent, and their children assented.

Classification and Inclusion Criteria

Participants were assigned to the CWS group if they (a) exhibited three or more stuttering-like disfluencies (part-word repetitions, sound prolongations, blocks, tense pauses, and single-syllable word repetitions) per 100 words of conversational speech (Yairi and Ambrose 1992) and (b) received a total overall score of 11 or above on the Stuttering Severity Instrument-3 (SSI-3) (Riley 1994).

To be classified as a CWNS, participants (a) exhibited two or fewer stuttering-like disfluencies per 100 words of conversational speech (Yairi and Ambrose 1992) and (b) received a total overall score of 10 or below on the SSI-3 (Riley 1994).

Procedure

During a laboratory visit, participants listened to three 1-minute background conversations and gave narrative descriptions afterwards of three of the series of Mercer Mayer's *Frog, Where Are You?* (Mayer 1967; 1969) children's picture books (without text). Each background conversation involved two adult female speakers that were previously audiotaped and presented at a comfortable listening level through free-field loudspeakers in the next room. The scripted text of the background conversations were about one minute in length and the content of the conversations had nothing to do with the child, the child's behavior, the child's family, or the room the child was in. The emotion expressed by the two adult female speakers, however, was different for the three conversations.

Background emotions associated with the three conversations were predicted to increase arousal in the children and, as a result, change the emotional expression, emotion regulation, and most importantly degree of attention regulation displayed during the first three minutes of the narrative task. In one conversation the two adult speakers conversed in a neutral, affectively flat, manner, in another a happy (positive) manner and in another an angry (negative) manner. The emotion of each conversation had been previously judged by both preschool children themselves (by pointing to happy, frowning, and neutral faces) and independent adult listeners to be consistent with happy, angry, and flat affect. The flat affective conversation was judged least arousing, the positive affect conversation judged most happy, and the negative affect conversation judged most angry. The order of the three conversations was counterbalanced across children. Immediately after each child listened to the con-

versation, he or she provided a narrative describing a series of content- and length-matched pictures from one of the randomly assigned picture books.

Measures

During the child's narrative production, attention regulation was observed during the first three minutes of the narrative (story-telling) task that immediately followed each (flat, positive, and negative) background stimulation condition. One coder observed and coded all 32 participants. Reliability of the four measures was assessed by randomly selecting 3 of the 32 (10% of sample) participants and having a second observer independently code the attention regulation behaviors. Intra-rater reliability was 93%.

Total Number of Looks Away. After listening to one of three, more or less emotionally arousing background conversations, children looked at a computer monitor with pictures from the Mercer Mayer story on it. The title page of the story was first presented, followed by the first page of the actual story. From the time the first page of the actual story appeared on the screen until exactly three minutes later, the number of looks away from the computer monitor for each participant was recorded by the present writer. Looks were tallied separately for each of the three minutes. A look away from the computer monitor was any look where the child's eyes stray away from the monitor which lasted for at least one-half second (i.e. look at the clinician, out the window, above at the ceiling, at shoes, to the side, etc.) and when the coder could not see the whites of the eyes on the opposite side of the eyeball. A look away did not include instances when a child's eyeballs were not visible. Elicited looks away from the computer monitor that involve one of the following were excluded: looking away as a response to the clinician saying something, making noise, or noises in another room. Looks could take place at any time during the three minutes of observation and the total number of looks away from the computer monitor was calculated.

Latency to First Look Away. Beginning from the second when the first page of the story appears on the screen to the second when the child first looks away from the computer monitor was recorded.

Total Number of Off-Topic Statements (OTS). As mentioned above, the title page of the story was first presented, followed by the first page of the actual story. From the time the first page of the actual story appeared on the screen until exactly three minutes later, the number of off-topic statements was recorded. OTS were tallied separately by minute as well as totaled together from all three minutes. If the coder could not understand a child's utterance, a second coder listened to it to decipher the meaning. Any utterance made by a child that both the first and second coder could not understand was not further assessed and/or included in the final data corpus.

An OTS was an utterance regarding anything not related to the story in front of the child. Two OTSs in a row only counted as one (i.e. "What is that sound I hear? Is that a helicopter?"). When two off-topic statements in a row were less related it still only counted as one (i.e. "What is that sound I hear?

I see a bug on the floor."). Instances OTS which were counted as two OTS: If the child made an OTS followed by a clinician response and then another OTS; or at least three seconds elapsed between the first OTS and a second OTS. A reference to any of the objects on the page of the story did not count as a topic diverting statement, even if they were used in a context by the child not relating to the story they were telling. Requests for another activity were also included as an OTS, which involved a verbalization of the child which was intended to physically do something else besides telling the story. For example, such requests were, "I want to go play in the other room," or "Can I go see my mommy now?"

Latency to First OTS. Beginning from the second when the first page of the story appears on the screen to the second when the child first begins his or her topic diverting sentence was recorded.

Method

For the purpose of data analysis, four dependent variable measures were used to quantify attention regulation in children who do and do not stutter: (1) total number of looks away, (2) latency (in seconds) to first look away, (3) total number of off-topic statements (OTS), and (4) latency (in seconds) to first OTS. The independent variables in the study include group (CWS and CWNS) and emotion condition (positive, negative, and neutral). Means and standard deviations for each dependent variable are shown in Tables 1 to 4. The data for the 4 dependent measures were analyzed in a 2 (group: CWS and CWNS) x 3 (emotion condition: positive, negative, and neutral) repeated-measures ANOVA.

Descriptive Analyses

As a general trend, CWNS had more looks away across all three emotion conditions than did CWS, with CWNS having an average of 6.16 more looks away than CWS. CWS also waited longer to first look away across all three emotion conditions than CWNS, with CWNS initially looking away at an average of 8.0 seconds faster than CWS.

TABLE 1 Means and Std. Deviations for Total Looks Away During Emotion Condition

Emotion Condition	CWS (n=15)		CWNS (n=17)		Both Groups (n=32)	
	M	SD	M	SD	M	SD
Positive	11.733	2.434	18.706	4.089	15.437*	4.879
Negative	12.533	2.850	19.118	3.839	16.031*	4.735
Neutral	12.067	3.173	17.000	4.402	14.688*	4.561
All Conditions	12.111	.402	18.275	1.122	15.385*	4.672

*$p \leq 0.05$

TABLE 2 Means and Std. Deviations for Time to First Look Away During Emotion Condition

Emotion Condition	CWS (n=15)		CWNS (n=17)		Both Groups (n=32)	
	M	SD	M	SD	M	SD
Positive	13.800	4.554	7.294	4.298	10.344*	5.457
Negative	18.800	5.003	6.118	2.342	12.063*	7.448
Neutral	13.400	6.379	8.558	5.789	10.844*	6.451
All Conditions	15.333	2.835	7.333	1.236	11.084*	6.452

*$p \leq 0.05$

TABLE 3 Means and Std. Deviations for Total Off-Topic Statements During Emotion Condition

Emotion Condition	CWS (n=15)		CWNS (n=17)		Both Groups (n=32)	
	M	SD	M	SD	M	SD
Positive	1.467	1.407	1.824	2.157	1.656	1.825
Negative	1.133	1.506	1.294	1.532	1.219	1.497
Neutral	1.667	2.380	1.294	1.359	1.469	1.883
All Conditions	1.422	1.764	1.471	1.683	1.448	1.735

*$p \leq 0.05$

TABLE 4 Means and Std. Deviations for Time to First Off-Topic Statement During Emotion Condition

Emotion Condition	CWS (n=15)		CWNS (n=17)		Both Groups (n=32)	
	M	SD	M	SD	M	SD
Positive	109.467	66.601	114.647	70.358	112.219	67.565
Negative	116.067	71.322	126.059	63.780	121.375	66.502
Neutral	134.667	65.983	113.294	62.702	123.313	64.132
All Conditions	120.067	67.969	118.000	65.613	118.969	66.066

*$p \leq 0.05$

Inferential Analyses

Analysis of Variance (ANOVA) was used to test whether the two talker groups (CWS and CWNS) differed on the attention regulation dependent variables. Talker group and emotion condition were the independent variables. The four dependent variables (total looks away, latency to first look away, total off-topic statements, and latency to off-topic statement) were tested simultaneously in order to control the experiment-wise alpha level. Although the two talker groups differ in gender, with males more common in the CWS group than one would expect by chance, this gender difference was not predicted to influence the relation between the talker groups and dependent variables.

Total Number of Looks Away. (Table 1) The test for group (2) by emotion condition (3) in total number of looks away was significant, $F(2, 29) = 32.59$, $p < .0001$. However, there was no significant interaction found in group by emotion condition in total number of looks away, $F(2, 29) = 1.563$, $p < .227$. A main effect of emotion condition within group was found to be marginally significant, $F(2, 29) = 3.135$, $p < .059$.

Follow-up tests of between-subjects effects examined group differences within the independent variable of total number of looks away. For CWS, there was no significant difference in total number of looks away between the positive and negative conditions, $F(1, 30) = .385$, $p < .254$, no significant difference between the positive and neutral conditions, $F(1, 30) = 1.129$, $p < .296$, and no significant difference between the negative and neutral conditions, $F(1, 30) = .4.970$, $p < .133$. For CWNS, there was no significant difference in total number of looks away between the positive and negative conditions, $F(1, 30) = .458$, $p < .337$, no significant difference between the positive and neutral conditions, $F(1, 30) = 2.492$, $p < .125$, and no significant difference between the negative and neutral conditions, $F(1, 30) = .549$, $p < .464$.

Results indicate that CWS significantly differ from CWNS across each emotion condition with the largest between-group difference in the negative emotion condition where CWS exhibited an average of 7.59 less looks away than CWNS. Within group, the largest difference for CWS was between the positive and negative emotion condition, where CWS took an average of 0.8 more looks away from the computer monitor in the negative than in the positive emotion condition. For CWNS, the largest difference was between the neutral and negative emotion condition, where CWNS took an average of 2.12 more looks away in the negative emotion condition than in the neutral emotion condition.

Latency to First Look Away. (Table 2) The test for group by emotion condition in latency to first look away was significant, $F(2, 29) = 44.13$, $p < .0001$. A significant group by emotion condition interaction was found, $F(2, 29) = 10.686$, $p < .0001$. A main effect of emotion condition within subjects was not found to be significant, $F(2, 29) = 2.2573$, $p < .123$, indicating that emotion did not significantly vary within groups.

These results show that CWS significantly differ from CWNS in terms of latency to first look away across all three emotion conditions. The largest difference can be found in the negative emotion condition, with CWS taking an average of 12.782 seconds longer to first look away than CWNS.
Follow-up tests of between-subjects effects examined group differences within the dependent variable of latency to first look away. For CWS, there was a significant difference between the positive and negative conditions, $F(1, 30) = 10.529$, $p < .003$, a significant difference between the negative and neutral conditions, $F(1, 30) = 16.406$, $p < .0001$, but no significant difference found between the positive and neutral conditions, $F(1, 30) = .0514$, $p < .822$. For CWNS, there was a marginal significant difference between the negative and neutral condition, $F(1, 30) = 3.892$, $p < .058$, and no significant differences found between positive and negative, $F(1, 30) = .6607$, $p < .423$, and positive and neutral, $F(1, 30) = .6096$, $p < .441$

Total Number of Off-Topic Statements. (Table 3) The test for group by condition in total number of off-topic statements was not found to be significant, $F(2, 29) = .01$, $p < .924$, indicating that CWS and CWNS do not differ between groups on each emotionally arousing condition. There was no significant interaction of group by emotion condition, $F(2, 29) = .4731$, $p < .628$. No main effect of condition within subjects was found, $F(2, 29) = 1.412$, $p < .260$, indicating that emotion did not significantly vary within groups. These results imply that CWS do not significantly differ from CWNS in total off-topic statements and thus is not a clear indicator of variations in attention regulation.

Latency to First Off-Topic Statement. (Table 4) The test for group by condition in latency to first off-topic statement was not found to be significant, $F(2, 29) = .01$, $p < .911$, indicating that CWS and CWNS do not differ between groups on each emotionally arousing condition. There was no significant group by emotion condition interaction found in latency, $F(2, 29) = .6873$, $p < .511$. There was no main effect of emotion condition within group, $F(2, 29) = .4591$, $p < .636$, indicating that emotion did not significantly vary within groups. Again, these results show that CWS and CWNS do not significantly differ in latency to first OTS in any emotion condition.

Discussion

There were essentially two main findings resulting from the present study. The first main finding was that CWS produced significantly less looks away from the stimulus (computer monitor) than CWNS across all three emotion conditions, especially in the negative emotionally arousing situation. The second main finding was that preschool CWS took longer to first look away from the target stimulus across all three emotion conditions than it did for CWNS, again, especially in the negative emotionally arousing situation. In other words, CWS have a tendency to fixate their attention on a stimulus while CWNS have the ability to flexibly shift their attention, which is a more mature regulation strategy (Jankowski, Rose, and Feldman 2001). The general discussion to follow will focus on these two main findings.

Main Finding: CWS are Slower to Look Away and Do So Less Often

Based on the min findings above, it is concluded that CWS have poorer attention regulation than CWNS. Specifically, in order to have flexible attention regulation, especially when emotionally aroused, children need to have the ability to allocate their attentional resources to a variety of outlets. If, as these findings seem to suggest, CWS have fewer attentional resources to devote to telling the narrative stories (after perceptually/conceptually processing the emotional context of the two adult speakers), this may cause them to be slower to look away, both initially and continuously throughout the three minute story-telling period. Conversely, CWNS, with apparently more attentional resources, hear the same emotional background conversations but can look around the room to regulate and allocate their attention other places instead of putting it all in one place.

In other words, CWS seem to have an inability to readily disengage from a look. CWS seem to more often become stuck in one spot and thus not sampling their environment with the same manner and flexibility as do CWNS. Studies have shown that children who examine stimuli with many brief looks such as CWNS process cognitive information more efficiently as compared to others who use fewer but longer looks as displayed by CWS (Jankowski, Rose, and Feldman 2001; Frick, Colombo, and Saxon 1999). Similarly, Jankowski et al. (1999) found that young children who examine a stimulus with relatively short looks (CWNS) appear to process information faster than long lookers (CWS). The lengthier looks of CWS may result from their inability to inhibit looking and disengage fixation when two or more targets (background conversation, telling the story, stuttering, etc.) compete for their attention (Richards and Cronise 2000).

Jankowski, Rose, and Feldman (2001) collected evidence indicating that short lookers, such as CWNS in the present study, scan more broadly, resulting in an appreciation of global information, while long lookers such as the CWS in the present study restrict their gaze to a smaller area and appreciate changes only in local information. Jankowski et al (1999) have also shown that young children who scan a stimulus more broadly tend to have briefer fixations and spend less time inspecting any one element of the stimulus before switching to another element. Moreover, children who inspect a stimulus with briefer, more broadly distributed fixations showed faster encoding.

Other Findings: No Between-Group Differences in Number and Latency of Off-Topic Statements

Although the dependent measures of total number of looks away and latency to first look away were successful measures of attention regulation, the same was not true for the other two dependent measures of total number of off-topic statements and latency to first off-topic statement. Future studies should include a larger variety of measures of attention regulation to improve reliability. Also, future studies could be improved with a larger sample size. Variability in measures of visual attention may prove to be important for understanding the status of early attentional and cognitive processes; this remains to be addressed in future work.

Broader Implications of Main Findings

The deficits that CWS display in attention regulation could potentially impact multiple domains of development other than speech development, such as social, emotional, and academic development. Short-comings in attention regulation in preschool have been found to be associated with internalizing behavior problems, poorer academic performance and social competence in elementary school (Nelson, Martin, Hodge, Havill, and Kamphaus 1999), and poorer academic competence in adolescence (Shoda, Mischel, and Peake 1990).

Conclusion

In conclusion, having a deeper understanding of the cognitive/emotional processes of children who stutter may improve our fundamental understanding of this perplexing childhood disorder and eventually lead to improvements in the assessment and treatment of childhood stuttering. By knowing the relation between childhood stuttering and attention regulation in different levels of emotional arousal, future work can be done to prevent the severity of stuttering. Numerous studies have been conducted with infants and their looking durations to measure cognitive processing abilities and these early processing abilities can predict later cognitive development (Jankowski, Rose, and Feldman 2001; Frick, Colombo, and Saxon 1999; Colombo, Shaddy, Richman, Maikranz, and Blaga 2004; Richards and Cronise 2000). Although some early indicators of childhood stuttering are known today, present findings suggest that acquiring more objective knowledge of the cognitive processing characteristics of children who stutter should enhance our ability to identify, assess, prevent, and treat early childhood stuttering.

References

Ahadi, S., and Rothbart, M. 1994. Temperament, development, and the Big Five. In *The developing structure of temperament and personality from infancy to adulthood*, ed. G.A. Kohnstamm and C.F. Halverson, Jr. Hillsdale, NJ: Erlbaum.

Anderson, J., Pellowski, M., Conture, E., and Kelly, E. 2003. Temperamental characteristics of young children who stutter. *Journal of Speech, Language, and Hearing Research* 46: 1221-1233.

Brutten, E. and Shoemaker, D. 1967. *The modification of stuttering*. Englewood Cliffs, NJ: Prentice-Hall.

Cole, P., Martin, S., and Dennis, T. 2004. Emotion regulation as a scientific construct: methodological challenges and directions for child development research. *Child Development* 75: 317-333.

Colombo, J., Shaddy, D., Richman, W., Maikranz, J., and Blaga, O. 2004. The developmental course of habituation in infancy and preschool outcome. *Infancy* 5: 1-38.

Conture, E. 2001. *Stuttering: Its nature, diagnosis and treatment*. Needham Heights, MA: Allyn & Bacon.

Conture, E., Walden, T., Graham, C., Arnold, H., Hartfield, K., Karrass, J., and Schwenk, K. In press. Communicative-emotional model of developmental stuttering. In *Stuttering research and practice: Contemporary issues and approaches*, ed. N. Bernstein Ratner and J. Tetnowski. Vol. 2. Mahwah, NJ: Lawrence Erlbaum.

Conture, E., Zackheim, C., Anderson, J., Pellowski, M., and Ohde, R. 2003. Linguistic processes and childhood stuttering: many's a slip between intension and lip. In *Speech motor control in normal and disordered speech*. New York: Harper Collins.

Eisenberg, N., Guthrie, I., Fabes, R., Shepard, S., Losoya, S., Murphy, B., Jones, S., Poulin, R., and Reiser, M. 2000. Prediction of elementary school children's externalizing problem behaviors from attentional and behavioral regulation and negative emotionality. *Child Development* 71: 1367-1382.

Embrechts, M., Ebben, H., Franke, P., and van de Poel, C. 1998. Temperament: A comparison between children who stutter and children who do not stutter. In *Stuttering: Proceedings of the second world congress on fluency disorders*, ed. E.C. Healy and H.F.M. Peters. Nijmegen, The Netherlands: University Press Nijmegen.

Fabes, R., Eisenberg, N., Jones, S., Smith, M., Guthrie, I., Poulin, R., Shepard, S., and Friedman, J. 1999. Regulation, emotionality, and preschoolers' socially competent peer interactions. *Child Development* 70: 432-442.

Fowlie, G., and Cooper, E. 1978. Traits attributed to stuttering and nonstuttering children by their mothers. *Journal of Fluency Disorders* 3: 233-246.

Frick, J., Colombo, J., and Saxon, T. 1999. Individual and developmental differences in disengagement of fixation in early infancy. *Child Development* 70: 537-548.

Jankowski, J., Rose, S., and Feldman, J. 2001. Modifying the distribution of attention in infants. *Child Development* 72: 339-351.

Karrass, J., Walden, T., Conture, E., Graham, C., Arnold, H., Hartfield, K., and Schwenk, K. In press. Relation of emotional reactivity and regulation to childhood stuttering. *Journal of Communication Disorders* 53: 1-22.

Mayer, M. 1967. *A boy, a dog, and a frog*. New York: Dial Books for Young Readers.

Mayer, M. 1969. *Frog where are you?* New York: Dial Books for Young Readers.

Nelson, B., Martin, R.P., Hodge, S., Havill, V., and Kamphaus, R. 1999. Modeling the prediction of elementary school adjustment from preschool temperament. *Personality and Individual Differences* 26(4): 687-700.

Pellowski, M., and Conture, E. 2002. Characteristics of speech disfluency and stuttering behaviors in 3- and 4-year-old children. *Journal of Speech, Language, and Hearing Research* 45: 20-34.

Richards, J., and Cronise, K. 2000. Extended visual fixation in the early preschool years: look duration, heart rate changes, and attentional inertia. *Child Development* 71: 602-620.

Riley, G.D. 1994. Stuttering Severity Instrument for Children and Adults-3 (SSI-3). 3rd ed. Austin, TX: Pro-Ed.

Ruff, H.A., and Rothbart, M.K. 1996. *Attention in early development: Themes and variations*. London, UK: Oxford University Press.

Schoda, Y., Mischel, W., and Peake, P.K. 1990. Predicting adolescent cognitive and self-regulatory competencies from preschool delay of gratification: Identifying diagnostic conditions. *Developmental Psychology* 26: 978-986.

Spinrad, T.L., Eisenberg,N., Harris, E., Hanish, L., Fabes, R.A., Kupanoff, K., Ringwald, S., and Holmes, J. 2004. The relation of children's everyday nonsocial peer play behavior to their emotionality, regulation, and social functioning. *Child Development* 40: 67-80.

Thompson, R. 1994. Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development* 59: 25-52.

Wakaba, Y. 1998. Research on temperament of children who stutter with early onset. In *Stuttering: Proceedings of the second world congress on fluency disorders*, ed. E.C. Healy and H.F.M. Peters. Nijmegen, The Netherlands: University Press Nijmegen.

Yairi, E., and Ambrose, N. 1992. Onset of stuttering in preschool children: Selected factors. *Journal of Speech and Hearing Research* 35: 782-788.

Yairi, E. and Ambrose, N. 2005. *Early childhood stuttering*. Austin, TX: Pro-Ed, Inc.

Alison L. Bush is a fourth-year student majoring in Child Development and Cognitive Studies in the Peabody College of Education and Human Development. A native of Elmhurst, Illinois, she is a member of the Psi Chi Psychology Honor Society and the Kappa Delta Epsilon Education Honor Society as well as being consistently honored on the Dean's List. She graduated Magna Cum Laude with a Bachelor's of Science and High Honors in Child Development this May. In the fall, she will pursue a master's degree in Speech-Language Pathology at Northwestern University.