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Relation of emotional reactivity and regulation to childhood stuttering

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Abstract

The purpose of the present study was to examine relations between children's emotional reactivity, emotion regulation and stuttering. Participants were 65 preschool children who stutter (CWS) and 56 preschool children who do not stutter (CWNS). Parents completed the Behavior Style Questionnaire (BSQ) [McDevitt S. C., & Carey, W. B. (1978). A measure of temperament in 3–7 year old children. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 19, 245–253]. Three groups of BSQ items measuring emotional reactivity, emotion regulation, and attention regulation were identified by experts in children's emotions. Findings indicated that when compared to their normally fluent peers, CWS were significantly more reactive, significantly less able to regulate their emotions, and had significantly poorer attention regulation, even after controlling for gender, age, and language abilities. Findings suggest that the relatively greater emotional reactivity experienced by preschool children who stutter, together with their relative inability to flexibly control their attention and regulate the emotions they experience, may contribute to the difficulties these children have establishing reasonably fluent speech and language.

Learning outcomes—The reader should be able to (1) define emotional reactivity and emotion regulation, (2) explain how emotional reactivity and emotion regulation relate to preschool stuttering, and (3) understand recent empirical evidence linking reactivity and regulation to preschool stuttering.

Despite an extensive literature in psychology regarding emotional reactivity and regulation (see Eisenberg & Fabes, 1992, for a review) and an equally extensive literature in speech–language pathology regarding stuttering (e.g., Bloodstein, 1995; Conture, 2001; Guitar, 1998), in recent years there has been relatively little intersection between speech–language pathology approaches to stuttering and psychological approaches to emotion, stress and coping (for early, notable exceptions, see Murphy & Fitzsimons, 1960, and Brutten & Shoemaker, 1967). This is unfortunate given that emotional reactivity and regulation have been shown to influence a wide range of developmentally important outcomes such as communication (Dixon & Shore, 1997; Dixon & Smith, 2000; Karrass & Braungart-Rieker, 2003; Paul & Kellogg, 1997), school performance (Ialongo, Edelsohn, & Kellam, 2001), and psychopathology (Eisenberg et al., 1993; Eisenberg, Fabes et al., 1997) in children who do not stutter.

Given the relations among emotional reactivity and regulation and communicative development, there is reason to expect that reactivity and regulation may influence childhood stuttering, or at least possibly exacerbate or maintain the problem. This expectation is consistent with recent reviews and findings from empirical studies regarding the emotional development and behavior of children who stutter (e.g., Anderson, Pellowski, Conture & Kelly, 2003; Embrechts, Ebben, Franke & van de Poel, 1998; Wakaba, 1998; Wakaba, Iizawa, Gondo,

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Inque, & Fujino, 2003; Yairi & Williams, 1970), as well as adults who stutter (e.g., Alm, 2004; Craig, Hancock, Tran, & Craig, 2003; Ezrati-Vinacour & Levin, 2004; Guitar, 2003; Messenger, Onslow, Packman, & Menzies, 2004). Such speculation and empirical findings are also consistent with parent reports and clinical observations that children who stutter are “high-strung,” “excitable,” “timid,” and “restless,” with “exaggerated fears” (Glasner, 1949).

Likewise, these observations are also consistent with some recent models of stuttering (e.g., Conture et al., in press; Riley & Riley, 2000) that include temperamental/emotional characteristics as one of several components in a multi-dimensional or broad perspective on stuttering (see Smith & Kelly, 1997 for review). There is a developing body of knowledge suggesting that aspects of temperament may play a role in speech–language development and disorders in general (e.g., Dixon & Shore, 1997; Dixon & Smith, 2000; Karrass & Braungart-Rieker, 2003; Paul & Kellogg, 1997). Evidence has linked aspects of emotional reactivity to “late talking” (Paul & Kellogg, 1997), as well as stuttering in young children (e.g., Embrechts et al., 1998).

Emotional reactivity refers to the tendency to experience frequent and intense emotional arousal. Both the threshold and ease with which individuals become emotionally aroused and the intensity of emotional experiences are aspects of emotional reactivity. Although emotional reactivity is often thought of in terms of negative emotions, there are important individual differences in reactivity of positive emotions as well (Spinrad et al., 2004). *Emotion regulation* involves the process of initiating, maintaining, or modulating the occurrence, intensity, or duration of internal feelings and emotion-related physiological processes (Thompson, 1994). Emotion regulation is generally defined in terms of modulating internal emotional reactivity, whether positive or negative in valence (Ahadi & Rothbart, 1994). There are several strategies that people are thought to use to regulate their emotional reactivity. One regulatory strategy involves the allocation of attention and other resources to solve a problem or deal with 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 & Rothbart, 1994).

We have developed a model, the Emotional Reactivity, Regulation and Stuttering (ERRS) Model (see Fig. 1) that links emotion with stuttering, focusing on two aspects of emotion: reactivity (or arousal) and regulation (or coping). In this model, characteristics of the child and the environment (communicative, motoric, linguistic, and situational requirements) are portrayed as contributing to the fluency of the present speech act. Reactivity and regulation also influence whether the present speech act will be fluent and/or influence the “quality” (i.e., duration, physical tension, etc.) of any disfluent productions. These two variables (reactivity and regulation) may have a stable, dispositional component, as well as a variable component that is situationally responsive (i.e., some situations are more arousing, and some situations permit better coping). We conjecture that these two variables – reactivity and regulation – and their joint effects (path 8 in the model) may exacerbate the frequency, duration and severity of stuttering in children.

Based on this model, it is hypothesized that when the present speech act is disfluent, a more reactive child might be more aware and concerned, and if the child is poorly able to regulate those emotions, the heightened, unregulated emotion is thought to contribute to a greater likelihood of a subsequent disfluency. Thus, over time, an emotionally reactive and/or poorly regulated child with a predisposition to display speech disfluencies (due to communicative, motoric, linguistic, or situational factors) would be more likely to experience a disfluency problem that persists, than a similarly predisposed child with less reactivity and/or better regulatory abilities. Although at present there is little empirical evidence linking emotional reactivity and regulatory skills to childhood stuttering, there is a substantial body of knowledge

linking reactivity and regulation to other socially competent behaviors in children. For example, Eisenberg et al. have articulated a conceptual model of the impact of emotion reactivity and emotion regulation on children's functioning (Eisenberg & Fabes, 1992; Eisenberg et al., 2000) based on earlier models proposed by Rothbart and Derryberry (1981) and others. Empirical support for the Eisenberg et al. model has been reported in several studies (e.g., Ialongo et al., 2001; Eisenberg et al., 1993; Eisenberg, Fabes et al., 1997).

In brief, the Eisenberg model posits two categories of variables that influence children's adaptive behavior: emotional arousal (reactivity) and regulatory (coping) ability. Individuals who cannot maintain their emotional reactions within a tolerable range are predicted to behave in dysfunctional ways. This model puts special emphasis on *negative* emotional reactivity and its regulation. It is conjectured that individuals who are easily over-aroused by negative emotion will have particular difficulty coping with emotionally evocative situations, perhaps even with situations that are less evocative for others. Because children who are low in emotional reactivity experience emotions less intensely, measures of regulation may be less strongly related to their behavior (e.g., speech–language output, social emotional competence) than for children who are highly emotionally reactive.

Numerous empirical studies have shown that both emotional reactivity and regulation impact children's functioning. For example, preschool children who are less apt to experience negative emotion (low emotional reactivity) have more competent peer interactions (Fabes et al., 1999). Furthermore, even when social interactions are emotionally intense, well-regulated children have more socially competent responses. Indeed, results of several empirical studies indicate that emotional reactivity and regulation *act jointly* (e.g., Eisenberg et al., 2001, 1993; Eisenberg, Guthrie et al., 1997; Eisenberg, Fabes et al., 1997; Fabes et al., 1999; Rothbart, Ahadi, & Hershey, 1994). For example, Eisenberg et al. (1996) reported that first to third grade children who were high in negative emotionality and low in regulation were prone to externalizing behavior problems, with the effect of regulation being stronger for those high in negative emotionality. Likewise, Eisenberg et al. (1993) found that high emotional intensity and low (attention) regulation were associated with low social skills and low sociometric (peer) status in preschool children.

To the present authors' knowledge, to date there has been no empirical test of the links among emotional reactivity, regulation, and childhood stuttering. There are studies linking temperamental characteristics to stuttering in preschool and school-age children, however. Results of these studies, based on several methodologies, have indicated that young children who stutter (CWS), when compared to children who do not stutter (CWNS), are (a) less successful in maintaining attention and adapting to their environment (Embrechts et al., 1998), (b) less adaptable to change, differences and novelty, less rhythmic in their daily life activities, and less distractible (Anderson et al., 2003), (c) more reactive to environmental stimuli (Wakaba, 1998), and (d) more sensitive, anxious, introverted, and withdrawn (Fowlie & Cooper, 1978; Glasner, 1949). One contradictory finding was that of Lewis and Goldberg (1997), who found that children "at-risk for stuttering" exhibited temperamental profiles consistent with high adaptability to change and a positive approach to new stimuli. Taken together, results of these empirical studies indicate that CWS, when compared to CWNS, are more emotionally reactive to their environments and to change or novelty.

Of special note, there are no known empirical studies of the relation between emotional regulation and stuttering. Interestingly, however, speech–language pathologists have long noted that "coping skills" of individuals who stutter influence stuttering and/or recovery; however, no systematic empirical study of these skills has been undertaken, particularly in young children at or near the onset of stuttering. Personal and clinical anecdotes abound regarding how some people who stutter, when faced with a particular speaking situation (e.g.,

answering the door, ordering in a restaurant, speaking to one person as opposed to many), avoid talking in whole or in part, attempt to get others to speak for them, or try to physically force out sounds, syllables or words. Although these “strategies” exhibited by (typically older) people who stutter during conversational discourse are not the same as the emotional regulatory behaviors described in this study, they appear to be methods that people devise for coping with their speech disfluencies. Thus, for the purposes of this study, reactivity and regulation are conceptualized as contributing to stuttering in young children.

This study was designed to assess naturally occurring differences between CWS and CWNS in emotional reactivity and regulation, as rated by parents. Reactivity and regulation were measured by sets of items from the Behavior Style Questionnaire (McDevitt & Carey, 1978) that were selected by experts in children’s emotions and speech–language pathology to measure reactivity, emotion regulation, and attention regulation. CWS were predicted to be more emotionally reactive to environmental demands and less able to regulate their emotions, and to have particular deficits in attention regulation. Furthermore, because our model predicts that experiences with disfluencies contribute to the persistence of stuttering behaviors in a reactive child with a predisposition to speech disfluencies, tests were conducted to ascertain whether experience with stuttering (e.g., time since the onset of stuttering), in preschool children who stutter relatively close to the onset of stuttering, would account for the relations between stuttering, reactivity and regulation.

1. Method

1.1. Participants

Participants were 65 monolingual, Standard American English speaking, 3–5-year-old (3;0–5;11) children who stutter and 56 monolingual, Standard American English speaking, 3–5-year-old children who do not stutter. The mean age of the CWS children was 48.9 months (S.D. = 9.56), and 22% were female. The mean age of the CWNS children was 48.9 (S.D. = 8.58), and 41% were female. Each participant’s socioeconomic status (SES) was determined using the Hollingshead Two-Factor Index of Social Position (Myers & Bean, 1968), which assigns a numerical score based on the occupation and education level of the “head of household” of each participant’s family (in dual-parent families, 86% of sample, the father’s occupation and education level were used; in single-parent families, 14% of sample, the mother’s occupation and education level were used). Sixteen families elected not to provide SES information. The mean scores for social position did not significantly differ between the groups (CWS $n = 50$, $M = 24.82$, S.D. = 14.10, CWNS, $n = 55$, $M = 24.87$, S.D. = 15.23). The CWS participating in this study had not received any prescribed speech–language treatment prior to their participation. All parents signed an informed consent, and all children assented.

Participants were paid volunteers naïve to the purposes and methods of the study and had no known or reported hearing, neurological, developmental, academic, intellectual, or emotional problems. Besides stuttering exhibited by the CWS, no participant in either group exhibited any other known or reported speech and/or language problems, based on the criteria described below.

All participants were part of an ongoing series of studies concerning the relation between stuttering and speech–language planning and production (e.g., Anderson & Conture, 2000, 2004; Melnick, Conture, & Ohde, 2003; Pellowski & Conture, 2005; Zackheim & Conture, 2003). Approximately 36% (24/65) of the CWS and 48% (27/56) of the CWNS participants had also participated in a previous study (Anderson et al., 2003) of temperamental differences between preschool children who do and do not stutter.

Children who stutter were identified for participation by their parents who were informed about it through (a) an advertisement in a free, widely-read, monthly parent-oriented magazine circulated throughout Middle Tennessee (i.e., the “Nashville Parent,” with estimated monthly readership of 230,000); or (b) Middle Tennessee area speech–language pathologists, health care providers, daycare centers, and so forth; or (c) self or professional referral to the Vanderbilt Bill Wilkerson Center for an initial assessment of childhood stuttering.

1.2. Classification and inclusion criteria

1.2.1. Children who stutter—Participants were assigned to the CWS group if they (a) exhibited three or more stuttering-like disfluencies (part-word repetitions, single-syllable word repetitions, sound prolongations, blocks, and tense pauses) per 100 words of conversational speech (Yairi & Ambrose, 1992a) and (b) received a total overall score of 11 or above (a severity equivalent of at least “mild”) on the Stuttering Severity Instrument-3 (SSI-3) (Riley, 1994; CWS had a mean SSI-3 score of 19.60, S.D. = 5.92). Similar indices of stuttering have been reported elsewhere (e.g., Yairi, 1981; Yairi & Ambrose, 1992b; Yairi & Lewis, 1984). As part of this assessment of stuttering, the time since onset (TSO) of stuttering for each child who stuttered was determined. Using a time “bracketing” procedure (Anderson et al., 2003; Yairi & Ambrose, 1992a), the average time since parental-reported onset of stuttering (TSO) for the 58 CWS participants with TSO data was determined to be 16.47 months (S.D. = 9.41 months, range = 3–38 months).

1.2.2. Children who do not stutter—To be classified as CWNS, participants (a) exhibited two or fewer stuttering-like disfluencies per 100 words of conversational speech (Yairi & Ambrose, 1992b) and (b) received a total overall score of 10 or below (a severity equivalent of less than “mild” for preschool children) on the SSI-3 (CWNS had a mean SSI-3 score of 5.68, S.D. = 3.77).

1.2.3. Speech, language, and hearing abilities—During a visit to the child’s home, all participants were administered the Peabody Picture Vocabulary Test-R or III (PPVT-R or PPVT-III; Dunn & Dunn, 1981, 1997), the Test of Early Language Development-2 or 3 (TELD-2 or TELD-3; Hresko, Reid, & Hamill, 1991, 1999), and the Sounds in Words subtest of the Goldman–Fristoe Test of Articulation (GFTA or GFTA-2; Goldman & Fristoe, 1986, 2000) to assess receptive vocabulary, receptive and expressive language skills, and articulation abilities, respectively. In addition to scoring above the 16th percentile rank for their chronological age, all participants were judged to be easily intelligible in connected speech by the test administrator. Each participant passed pure tone and tympanometric screening (ASHA, 1990).

1.2.4. Screening—One hundred and fifty-nine children were screened for participation and 121 met all the criteria. Reasons for removing a child from the sample were: scoring below the 16th percentile on one or more of the language tests (23 children), profiles of speech disfluencies that were not consistent with either a CWS or CWNS classification (12 children), and having had prior speech therapy (3 children).

1.3. Measure

The Behavior Style Questionnaire (BSQ; McDevitt & Carey, 1978), a 100-item measure using a six-point scale of nine temperament dimensions, was completed by the parents. The BSQ has excellent test–retest ($\alpha = .89$) and split-half reliability ($\alpha = .84$), based on samples of 53 and 350 children, respectively (McDevitt & Carey, 1978).

Although the BSQ was not designed to specifically assess factors representing reactivity and regulation, BSQ items reflecting emotional reactivity and emotion regulation were identified

and rated independently by two experts in children's emotions (scholars whose research programs focus on emotion and its regulation) and one speech–language pathologist. None of these three professionals were aware of the hypotheses of the present study. The raters were given definitions of reactivity and emotion regulation and some examples of each. Emotional *reactivity* was defined as degree of emotional responses. Examples included frequency and intensity of emotion, threshold of arousal, negative response to challenge, and autonomic reactivity. Emotion *regulation* was defined as management of emotional responses to situations. Examples were modulation (redirection, control, or modification) of emotional expressions, behaviors that manage emotional action tendencies, duration of emotion, and control of emotion. The raters then reviewed each item on the BSQ and identified whether it measured reactivity, regulation, or neither. For the items that were identified as measuring either reactivity or regulation, the raters reported how well the item exemplified the construct on a 1–5 scale (1 = best example, 3 = mediocre example, 5 = poor example).

Twenty-four items were selected by at least two of the raters as exemplars of emotional reactivity, and 13 of those items were rated as good examples of reactivity (i.e., ratings of <2.0). Two of the 13 reactivity items were deleted in order to achieve the highest agreement (11 items, $\alpha = .76$). Examples of reactivity items included “child cries intensely when hurt” and “child protests when denied a request by the parents.” Higher scores represented greater reactivity.

Thirty-four items were selected by at least two raters as exemplars of emotion regulation. The authors reviewed these regulation items and identified two subsets: those measuring emotion regulation ($n = 11$) and those measuring attention regulation ($n = 11$). The 11 exemplars of emotion regulation and attention regulation with the best ratings (i.e., ratings of $< \text{or} = 2.5$) were identified ($\alpha = .75$). Examples of emotion regulation items were “child cries for more than a few minutes when hurt” and reverse-scored “child adjusts easily to changes in his/her routine.” Higher scores reflected better emotion regulation. Two of the 11 attention regulation items were deleted in order to improve reliability (resulting $\alpha = .65$). The remaining nine items measuring attention regulation included such statements as “child pays attention when the parent explains something” and “child becomes engrossed in an interesting activity.” Higher scores represented better attention regulation.

1.3.1. Comparison of derived measures of reaction/regulation to another standardized test of emotional reaction/regulation in children—In order to determine whether the BSQ reactivity, emotion regulation and attention regulation variables were valid measures, a small validity sample (16 CWS, 7.3 males to 1 female, and 17 CWNS, . 7 males to 1 female; mean age = 47.7 months, S.D. = 10.5 months) was identified, and their parents completed the Child Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001). The CBQ was developed to measure aspects of reactivity and regulation, based on a theory of temperament articulated by Rothbart et al., and has been found to be reliable and valid (Rothbart et al., 2001). Statistically significant correlations were found between each construct from the BSQ and similar constructs from the CBQ. Specifically, BSQ emotional reactivity related to CBQ negative affect, $r(34) = .42, p < .05$; BSQ emotion regulation correlated with CBQ falling reactivity, $r(33) = .37, p < .05$; and BSQ attention regulation was associated with CBQ attention shifting, $r(34) = .67, p < .001$ (Karrass et al., 2005). As in other studies of reactivity and regulation (e.g., Rydell, Berlin, & Bohlin, 2003), reactivity was inversely related to both emotional and attention regulation, and the two regulation variables were positively correlated (Table 2).

1.4. Procedure

Parents were interviewed and children were tested twice, once in the home and 1–2 weeks later in the laboratory, a procedure used and reported in several previous empirical studies of

developmental stuttering in early childhood (e.g., Melnick et al., 2003). The home visit involved speech and language screening. The campus visit included further assessments of speech and hearing screening. Each assessment lasted between 1 and 1.5 h on average. Parents were given a copy of the BSQ during the home visit and were asked to work together in completing the questionnaire and bring it with them to the laboratory visit. Parents received information about their children's performance on the speech, language, and temperament assessments at the end of each visit.

1.5. Data analysis

Several data analytic techniques were employed. In order to better describe the sample, group differences in SES, chronological age, and gender were performed. To assess possible between-group demographic (i.e., SES and chronological age) differences, *t*-tests were employed. A Chi-square test was used to investigate relations between gender and talker group. The purpose of these analyses was to describe the sample.

Next, tests of the hypotheses of the study were conducted. To evaluate whether emotional reactivity and regulation differed between the groups, Multiple Analysis of Variance (MANOVA) was employed. The independent variable was talker group (CWS versus CWNS), and the dependent variables were emotional reactivity, emotion regulation, and attention regulation. Demographic characteristics that were significantly related to the dependent variables were included as covariates. Similarly, a second MANOVA was performed. Again, talker group was the independent variable and emotional reactivity, emotion regulation, and attention regulation were the dependent variables. In this second MANOVA, scores on standardized speech–language tests were used as covariates, to determine whether language abilities influenced the relations between talker group and reactivity and regulation.

Furthermore, given the possibility that chronological age and time since onset of stuttering might influence between-group differences in reactivity and regulation, several tests were conducted. First, the effects of age on relations between talker group and reactivity and regulation (i.e., the interaction between age and talker group) was explored using regression analyses. Procedures described by Aiken and West (1991) were used to test the effects of the interaction of talker group and age on the three dependent variables. The advantage of this technique is that it allows the use of a continuous variable (i.e., age, measured in months) as part of an interaction. This statistical technique involves two steps. First, the talker group and age variables were centered (i.e., the mean of each variable was subtracted from each value, creating two new, centered variables, with means of zero). Centering the variables assures that the interaction term is not too highly correlated with the talker group and age variables (i.e., multicollinearity, see Aiken & West, 1991). Next, an interaction term was created by multiplying the centered talker group variable with the centered age group variable. A significant interaction would indicate that age impacted the relation between talker group and the dependent variables, in other words, that the relation between talker group and reactivity and regulation was different depending on the child's age.

A second approach was utilized to test whether age interacted with talker group in predicting reactivity and regulation. Using this approach, chronological age was converted to a grouping variable, creating three groups: ages 3, 4, and 5 years. ANOVA tested whether the relation between talker group and reactivity and regulation differed depending on the age of the child.

Finally, to test whether time since onset of stuttering related to reactivity and regulation, correlations between TSO and reactivity and regulation were tested for the CWS group. A significant correlation would indicate that children who have been stuttering longer are more reactive and/or less well regulated.

2. Results

2.1. Descriptive analyses

Means and standard deviations for the three temperament subscales for each group are presented in Table 1. For descriptive purposes, talker group differences were tested for three demographic/background variables (gender and age of the child and family SES). Consistent with previous research (e.g., Fosnot, 1993), gender was significantly related to talker group, $\chi^2(1) = 5.41, p < .05$, with boys more likely to be CWS and girls more likely to be CWNS. As will be subsequently shown, although the gender ratio differed between the two talker groups (CWS 3.6 males to 1 female and CWNS 1.4 males to 1 female) gender did not affect the relations between talker group and reactivity, emotion regulation, or attention regulation.

There was no age difference between the two talker groups, $t(119) = 1.60, p = .11$. Parents of 16 participants (15 CWS and 1 CWNS) declined to provide SES information. The two talker groups did not differ on SES, $t(103) = .02, p = .99$. All analyses were conducted twice, once with only the participants with complete SES data and second with the missing data replaced with the common mean. The findings were virtually identical whether the smaller sample or the larger sample with mean replacement was used. The analyses presented are with the more comprehensive, larger sample with mean replacement for participants with missing SES data.

2.2. Between-group differences in emotional reactivity and regulation

Multiple analysis of variance was used to test whether the two talker groups differed in levels of reactivity and regulation. Talker group was the independent variable. The three dependent variables (reactivity, emotion regulation, and attention regulation) were tested simultaneously in order to control the experiment-wise alpha level. Furthermore, of the three demographic/background variables tested (gender and age of the child and SES) only SES was related to the dependent variables. (Children from higher SES families were less reactive, with better emotional and attention regulation.) Therefore, only SES was included in subsequent statistical models to control for possible effects on the dependent variables and on the relations between talker group and the dependent variables. Although the two talker groups differed in gender, with males more common in the CWS group than one would expect by chance, this between-group difference in gender did not influence the relation between the talker groups and the dependent variables. Moreover, gender $\times$ talker group interactions were tested in each model and were not statistically significant. In other words, the gender of the child did not significantly affect the relations between talker group and reactivity, emotion regulation, and attention regulation. Thus, any significant talker group differences in reactivity or regulation cannot be readily attributed to the effects of gender or its interaction with talker group. Therefore, results are presented for models without gender $\times$ talker group interaction terms.

The overall MANOVA was significant, $F(3, 116) = 3.96, p < .01$, indicating that CWS and CWNS differed on the three dependent variables as a group. Tests of the specific hypotheses of the study were then conducted. Follow-up tests of between-subjects effects examined group differences within each specific dependent variable. All three statistical models, predicting reactivity, emotion regulation, and attention regulation, were significant (see Table 1 and Fig. 2). In brief, CWS were reported to be significantly more reactive, significantly less able to regulate their emotions, and had significantly poorer attention regulation than their normally fluent peers. Thus, controlling for SES, the two talker groups differed in levels of emotional reactivity, emotion regulation, and attention regulation.

2.3. Influence of speech-language abilities on relations between talker group and emotional variables

Although all CWS and CWNS participants in the present study had language scores within normal limits, some past research indicates that CWS have significantly or marginally lower scores on some standardized language-screening tests (e.g., Anderson, Pellowski, & Conture, 2005; Blood, Ridenour, Qualls & Hammer, 2003; Pellowski & Conture, 2005; Pellowski, Conture, Anderson & Ohde, 2001), although other studies have not reported such differences (e.g., Miles & Ratner, 2001; Watkins & Johnson, 2004; Watkins & Yairi, 1997; Watkins, Yairi, & Ambrose, 1999). In order to determine whether language abilities might influence the relation between talker group and emotional reactivity, emotion regulation, or attention regulation, the MANOVA procedure was repeated, controlling for the five speech-language tests. The sample size decreased slightly because not all of the children completed all of the language tests. Only three of the five speech-language tests were significantly related to the dependent variables. Controlling for the three speech-language tests that were related to the dependent variables, the statistically significant group differences remained. Thus, results indicated that scores on standardized tests of speech-language abilities did not influence the relations between talker group and emotional reactivity, emotion regulation, and attention regulation.

2.4. Relation of emotional reactivity and regulation to chronological age

If chronological age influences emotional reactivity and regulatory abilities, one would predict a different relation between reactivity, regulation, and stuttering for older preschoolers than for younger preschoolers. Typically developing children generally decrease in reactivity and increase in regulation over this age period (Rothbart, 1989; Ruff & Rothbart, 1996).

To test whether between-group differences were equally strong for older and younger participants, two procedures were employed: (1) regression analyses (a procedure described by Aiken and West, 1991) to test the effects of the interaction of talker group and age on the three dependent variables (i.e., emotional reactivity, emotion regulation, and attention regulation) and (2) ANOVA for the two groups grouped by age (i.e., 3-year-old versus 4-year-old versus 5-year-old).

2.5. Regression analyses

Regression analyses tested whether the group differences in emotional reactivity and emotion regulation were similar across the preschool period. SES was included in the regression models to control for its possible effects on the relations between age, talker group, and the dependent variables. Each dependent variable was tested separately. None of the beta weights for the age $\times$ talker group interaction was statistically different from zero: reactivity $\beta = .02$, $p = .87$, emotion regulation $\beta = .01$, $p = .92$, and attention regulation, $\beta = -.03$, $p = .70$. These analyses indicate that the relation between talker group and reactivity and regulation did not change with age (e.g., did not get stronger with age).

2.5.1. ANOVA analyses—To further investigate the possible effects of chronological age on the relation between talker group and the dependent variables, the interaction between group and age in predicting reactivity, emotion regulation, and attention regulation was tested using ANOVA. Age was converted to a grouping variable, creating three groups: ages 3, 4, and 5 years. Descriptive information about each group is presented in Tables 2 and 3. Although all three models (i.e., the one for 3, 4, and 5-year-olds) were statistically significant, none of the interactions was significant, indicating that the chronological age of the child did not affect the relation between talker group and emotional reactivity, emotion regulation, or attention regulation, $ps = .11$, $.98$, and $.94$, respectively. The non-significant interaction between talker group and chronological age predicting reactivity is graphed in Fig. 3. As can be seen in Fig.

3, CWS and CWNS showed different patterns of reactivity across the three ages. CWS increased reactivity between ages 3 and 4 years and then decreased between ages 4 and 5 years whereas CWNS displayed the opposite pattern, decreasing reactivity between 3 and 4 years and then increasing between 4 and 5 years.

2.6. Within-group (CWS) assessment of the relation of time since onset to emotional variables

2.6.1. Time since onset of stuttering—To assess the possible relations of experience with stuttering to our variables of interest, emotional reactivity and regulation, correlations between time since onset of stuttering (TSO) and reactivity, emotion regulation, and attention regulation were calculated for the CWS group only (since, by definition, CWNS do not have a time since onset of stuttering).

TSO was significantly and positively correlated with chronological age (see Table 2), a finding similar to that reported by Pellowski and Conture (2002) and Yaruss, LaSalle, and Conture (1998). Despite this significant, positive correlation, substantial variance in TSO remained after controlling for chronological age (i.e., 60% of the variance remained). In other words, TSO was not completely redundant with chronological age. Seven children were missing TSO information; therefore, analyses were conducted with the 58 CWS children with TSO data. Correlations between TSO and reactivity, emotion regulation, and attention regulation were all non-significant, r s between $-.01$ and $-.16$, p s between $.24$ and $.97$. Therefore, these tests suggest that experience with stuttering, that is, length of time since onset of stuttering, does not appear to influence reactivity or regulation during the preschool years. In summary, neither chronological age nor experience with stuttering (i.e., time since onset) appears to appreciably influence emotional reactivity and regulation in preschool CWS.

3. Discussion

The primary purpose of the present study was to compare naturally occurring differences in parent-reported emotional reactivity and emotion regulation between children who do and do not stutter. This study resulted in three main findings. First, preschool CWS were more emotionally reactive to situational requirements than their normally fluent peers. In other words, when faced with everyday stressful, challenging, or exciting situations, CWS were more intensely aroused than CWNS. Second, preschool CWS were less able to regulate their emotions than CWNS. Once CWS children became upset or excited, they were less skillful and slower in returning to a baseline, calm emotional state. Third, preschool children who stutter were less able to flexibly control their attention than their normally fluent peers. This third finding suggests that CWNS were better able to shift their focus of attention when necessary, whereas CWS tended to become fixated and were less able to disengage when required and/or appropriate. The general implications of these findings will be discussed below.

3.1. Theoretical implications of the main findings

Preschool CWS were found to be more emotionally reactive and less well regulated in this study, as compared to preschool CWNS. Our model postulates a bi-directional relation between reactivity and regulation with stuttering, such that for reactive, poorly regulated children, experiences with speech errors and disfluencies are more negatively arousing than for less reactive, better regulated children. Such negative arousal results in a reverberant interaction of errors, disfluencies and emotional reactions, a situation that is believed to exacerbate the child's frequency, duration and severity of stuttering (see Brutten & Shoemaker, 1967 for related speculation). Furthermore, reactive children with poor attention control might become preoccupied with their disfluent speech, whereas less reactive children with better attention

control (i.e., the ability to appropriately shift attention) might be better able to ignore their disfluent speech and “move on.”

We would argue that the relation between reactivity, regulation, and stuttering is not completely explained by the hypothesis that mere experience with stuttering causes children to become more reactive and less well regulated. Instead, we are arguing that the inherently more reactive, poorly regulated disposition of the child who is at risk for stuttering, perhaps due to difficulties developing efficient, fluent speech planning and/or production abilities, is more likely to develop a clinically significant stuttering problem than a child with equal risk (due to similar speech planning and/or production difficulties) who is less reactive and better regulated. In addition to this *dispositional* (i.e., trait) component of reactivity, there is also a *situational* (i.e., state) component, such that certain situations, particularly those eliciting heightened positive or negative emotions, will increase the probability that CWS exhibit more speech disfluencies (a conjecture not unlike that of Brutten & Shoemaker, 1967). Furthermore, once a child has developed a clinically significant stuttering problem, greater reactivity and poorer regulation may be engendered, in a bi-directional, perhaps reverbant manner, thus exacerbating and/or maintaining the child’s communicative difficulties.

Furthermore, CWS, when compared to their CWNS peers, were found to be less proficient with their attention regulation. During the preschool years, children are developing skills in executive control of attention, such that they are learning to choose to which stimuli they will attend (Ruff & Rothbart, 1996). Preschool children develop voluntary control of their attention, resulting in the ability to attend to something that is not inherently rewarding, such as shifting their attention away from a fun game and toward a parent’s request to get ready for bed. Furthermore, 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 sophisticated emotion regulation technique (Buss & Goldsmith, 1998). The apparently lower abilities CWS exhibit in managing their attention might have direct effects on their speech disfluencies, such that these children might fixate on the speech errors that they make (and/or what they are having difficulty saying quickly, efficiently, and fluently), which might contribute to increases in negative reactivity. Furthermore, the difficulties CWS display in attention regulation could potentially impact multiple domains of development, not only speech development, but also social, emotional, and academic development. Deficits in attention regulation in preschool have been found to be associated with internalizing and externalizing behavior problems (Eisenberg et al., 2001, 2004; Zahn-Waxler, Schmitz, Fulker, Robinson, & Emde, 1996), poorer academic performance and social competence in elementary school (Nelson, Martin, Hodge, Havill, & Kamphaus, 1999), and poorer academic competence in adolescence (Shoda, Mischel, & Peake, 1990). Perhaps, correlations among these various academic, behavioral, and social problems and stuttering might be a fruitful avenue of research, and help explain, at least for some children, one possible core contributor to their stuttering, that is, inability to change or shift attention from more to less arousing/negative stimuli.

3.2. Influence of chronological age and experience with stuttering on emotional reactivity and regulation

It was conjectured that preschool CWS may become more emotionally reactive and less well regulated as a consequence of the experience of stuttering and perhaps from related negative social feedback from others. However, the present findings suggest that preschool CWS, as a group, might not have had enough experience with stuttering for such experience to affect their reactivity and regulation. In our analyses, the interaction between age and talker group did not predict reactivity, emotion regulation, or attention regulation. This finding was taken to suggest that older CWS did not experience more reactivity or poorer regulation relative to younger CWS as a result of their generally longer exposure to the experience and consequences of

stuttering. Likewise, analyses of time since onset of stuttering – where experience with stuttering was directly assessed – were consistent with this interpretation. That is, TSO was not significantly related to reactivity, emotion regulation, or attention regulation. Thus, these results suggest that the relatively brief experience with stuttering, typical of preschool children, did not lead them to become more reactive or less well regulated.

3.3. Relation of emotional reactivity and regulation to social functioning

The between-group differences between reactivity and regulation for CWS and CWNS suggest that at least some CWS may be at risk for problems in social development. Young children who are highly reactive and poorly regulated may easily become over-aroused by negative emotion and experience difficulty coping with emotionally evocative situations. They may therefore experience difficulties in separating from their parents, adjusting to school, and making friends (Chess & Thomas, 1991). One could suggest, therefore, that difficulties entering potentially arousing social situations are more common for CWS than CWNS. Thus, CWS may interact less frequently and for shorter durations with their social partners, preferring to maintain ongoing behavior rather than venturing into new or different contexts or interactions (speculation consistent with the empirical findings of Anderson et al., 2003). Such responses might result in less frequent communication, which, in turn, may lead to fewer opportunities for communicative practice, feedback, and development, particularly outside the family.

As suggested by Paul and Kellogg (1997) in an empirical study of language-delayed preschoolers, such emotional response styles may impact the entirety of children's speech and language development. Although further empirical research is needed to explore these relations, it is not unreasonable to suggest that reactivity to arousing situations as well as difficulties regulating that arousal may decrease the quantity of a child's verbal output and/or even disturb the quality of that output. For example, the child may be less likely to enter into new, different communicative situations and/or attempt to modify the quantity and quality of his or her communicative output, changes in output that may, in turn, impact the child's speech fluency and/or speech language development. Furthermore, greater reactivity and/or poorer regulation might contribute to the often-reported co-occurrence of stuttering and speech and language delays/disorders (e.g., Blood et al., 2003). For example, some studies find that children who stutter exhibit less well-developed receptive vocabulary skills (e.g., Anderson & Conture, 2000; Meyers & Freeman, 1985; Ryan, 1992), although other studies do not find the language skills of CWS to be different from those of CWNS (e.g., Miles & Ratner, 2001; Watkins & Johnson, 2004; Watkins & Yairi, 1997; Watkins et al., 1999).

3.4. Caveats

3.4.1. Nature of testing instrument—The present study had several limitations. First, the BSQ was not specially designed to test emotion constructs, even though several items on the BSQ, according to experts on the emotional behavior and development of children, measured these constructs. Future research should use measures specifically designed to assess reactivity and regulation in young children, such as the Child Behavior Questionnaire (Rothbart et al., 2001) or the How My Child Feels (Walden, Harris, & Catron, 2003). Moreover, these findings were based on a single reporter (parent) and a single instrument, or portion of that instrument (i.e., 31 items from the 100-item BSQ). In future research, multiple reports from multiple sources using multiple instruments would strengthen both the reliability and validity of these findings (e.g., parent, clinician, and preschool teacher reports; observations in the laboratory, at home, and in the preschool classroom; physiological data, such as cortisol levels or EEG/ERP measures).

3.4.2. Study of dispositional/trait versus situational reactivity—The present study examined *trait-like* or *dispositional* individual differences in children's temperament, because parents reported on their children's behaviors over an extended time period, not specific to individual situations, during the previous 3 months. Future studies should attempt to examine the relation between *state-like* or *situational* reactivity and stuttering within the CWS group. Specifically, laboratory procedures that are arousing to children could be performed during various speech/conversational tasks and comparisons could be made of number, duration, and type of speech disfluencies exhibited by CWS in arousing versus non-arousing situations. These studies would lend further support to the hypotheses supported in the present study, that children who stutter are more emotionally reactive and less well regulated than children who do not stutter and that these differences might have important implications in multiple areas of their behavioral, communicative, and social development, especially their speech (disfluencies).

4. Conclusions

The present findings indicate that children who stutter differ from their normally fluent peers in terms of emotional reactivity and regulation. These differences suggest that CWS might experience a reverberant interaction between their speech errors, disfluencies and emotions, a situation, that if not mitigated over time with maturation and/or treatment, may exacerbate the frequency, duration and severity of stuttering. Therefore, results of the present study appear to be an important step in understanding the role that emotional reactivity and regulation plays in the development and maintenance of stuttering in early childhood.

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Appendix A. CE self-study questions

1. *Emotion regulation* refers to:
2. The tendency to experience frequent and intense emotional arousal.
3. The process of initiating, maintaining, or modulating the occurrence, intensity, or duration of internal feelings and emotion-related physiological processes.
4. Shifting one's attention away from something that is emotionally arousing in order to limit the emotional effects of the stimulus.
5. *Emotional reactivity* refers to:
6. The tendency to experience frequent and intense emotional arousal.
7. The process of initiating, maintaining, or modulating the occurrence, intensity, or duration of internal feelings and emotion-related physiological processes.
8. Shifting one's attention away from something that is emotionally arousing in order to limit the emotional effects of the stimulus.
9. *Attention regulation* refers to:
10. The tendency to experience frequent and intense emotional arousal.
11. The process of initiating, maintaining, or modulating the occurrence, intensity, or duration of internal feelings and emotion-related physiological processes.
12. Shifting one's attention away from something that is emotionally arousing in order to limit the emotional effects of the stimulus.
13. Emotional reactivity and emotion regulation have been found to relate to the development of:
14. Fluent speech.
15. Language abilities.
16. Social abilities.
17. A and B only.
18. A, B, and C.
19. The findings of the present study include:
20. CWS were more emotionally reactive than CWNS.
21. CWS were better regulated than CWNS.
22. CWS were less skillful at attention regulation than CWNS.
23. A and B only.
24. A and C only.

Fig. 1. Emotional Reactivity, Regulation and Stuttering Model. The constructs of emotional reactivity and regulation are thought to be exacerbating and/or maintaining in nature in contrast to communicative (Comm.), motoric, or linguistic constructs, the latter three thought to act, singularly or in concert, to precipitate instances of childhood stuttering. Major constructs are designated by upper-case letters, and paths of influence between constructs by Arabic numerals.

Fig. 2.

Group means for children who stutter and children who do not stutter for 31 selected individual items from the Behavioral Style Questionnaire (BSQ) that reflect emotional reactivity and regulation in young children. Data indicate that reactivity is higher and regulation (emotional and attention) lower in CWS than CWNS. All group differences are statistically significant.

Fig. 3.
Graph of the interaction of age group (3, 4, or 5 years) and talker group (CWS or CWNS) in predicting reactivity.

Table 1

Means, standard deviations, and inferential statistics demonstrating between-group differences in reactivity and regulation for CWS ($n = 65$) and CWNS ($n = 56$)

Dependent variable	CWS		CWNS		Model F (2, 118)	Group effect F (1, 118)
	M	S.D.	M	S.D.		
Reactivity	4.11	.72	3.85	.67	4.78**	4.35*
Emotion regulation	3.64	.84	3.93	.60	7.31***	5.13*
Attention regulation	3.63	.69	3.99	.62	6.55**	9.35**

Note: Multivariate F (3, 116) = 3.96**.

*
 $p < .05$.

**
 $p < .01$.

 $p < .001$.

Table 2

Correlations among reactivity, emotion regulation, attention regulation, chronological age, and time since onset of stuttering (CWS only)

Dependent variable	Emotion regulation	Attention regulation	Chronological age	Time since onset ^a
Reactivity	-.67***	-.23*	.03	-.01
Emotion regulation		.43***	-.09	-.09
Attention regulation			-.18*	-.16
Chronological age				.63***

^a CWS only ($n = 58$).

* $p < .05$.

*** $p < .001$.

Table 3

Gender ratio, chronological age, and SES for 3-, 4-, and 5-year-old CWS and CWNS

Age group	CWS				CWNS			
	<i>n</i>	Gender (M:F) ratio	Age (months)	SES score	<i>n</i>	Gender (M:F) ratio	Age (months)	SES score
3 years old	26	1.8:1	41.5 (3.1)	25.4 (13.1)	25	1.0:1	41.1 (3.2)	24.5 (15.6)
4 years old	25	7.3:1	53.2 (3.6)	25.9 (14.3)	18	1.7:1	53.0 (2.5)	24.8 (14.1)
5 years old	14	6.5:1	64.3 (3.8)	25.1 (16.8)	13	3.5:1	64.7 (3.4)	24.9 (15.1)