Journal of Communication Disorders 44 (2011) 276–293

Contents lists available at ScienceDirect

Journal of Communication Disorders

Emotional reactivity, regulation and childhood stuttering: A behavioral and electrophysiological study☆

Hayley S. Arnold *, Edward G. Conture, Alexandra P.F. Key, Tedra Walden

Vanderbilt University, United States

ARTICLE INFO

Article history:
Received 4 March 2010
Received in revised form 31 October 2010
Accepted 16 December 2010
Available online 24 December 2010

Keywords:
Stuttering
Preschool
Emotional reactivity
Emotion regulation
EEG

ABSTRACT

The purpose of this preliminary study was to assess whether behavioral and psychophysiological correlates of emotional reactivity and regulation are associated with developmental stuttering, as well as determine the feasibility of these methods in preschool-age children. Nine preschool-age children who stutter (CWS) and nine preschool-age children who do not stutter (CWNS) listened to brief background conversations conveying happy, neutral, and angry emotions (a resolution conversation followed the angry conversation), then produced narratives based on a text-free storybook. Electroencephalograms (EEG) recorded during listening examined cortical correlates of emotional reactivity and regulation. Speech disfluencies and observed emotion regulation were measured during a narrative immediately after each background conversation. Results indicated that decreased use of regulatory strategies is related to more stuttering in children who stutter. However, no significant differences were found in EEG measurements of emotional reactivity and regulation between CWS and CWNS or between emotion elicitation conditions. Findings were taken to suggest that use of regulatory strategies may relate to the fluency of preschool-age children's speech-language output.

Learning outcomes: The reader will be able to (1) describe emotional reactivity and regulation processes, (2) discuss evidence for or against the relations of emotional reactivity, regulation and stuttering, (3) understand how multiple measures can be used to measure emotional reactivity and regulation.

1. Introduction

Speculation on the potential impact of personality, emotional adjustment, and other psychological constructs on developmental stuttering began as early as the 1930s (e.g., Bender, 1939; Brown & Hull, 1942; Glauber, 1958; Murphy, 1953; Murphy & Fitzsimons, 1960) and continues to receive theoretical, empirical, and clinical attention (e.g., Adams, 1993; Alm, 2004; Conture et al., 2006; Eggers, De Nil, & Van den Bergh, 2010; Peters & Hulstijn, 1984; Weber & Smith, 1990; Yairi, 1997). To date, most empirical studies of emotions and childhood stuttering have focused on stable, trait-like characteristics of

☆ This work was supported in part by National Institutes of Health (NIH) grants from the National Institute on Deafness and Other Communication Disorders (NIDCD) to Vanderbilt University (R01 DC006477-01A2, R01 DC000523-14) and a Vanderbilt University Discovery Grant. The research reported herein does not reflect the views of the NIH, NIDCD, Kent State University or Vanderbilt University.

* Corresponding author. Current address: Kent State University, Department of Speech Pathology and Audiology, Music and Speech Center, 1325 Theatre Drive, Kent, OH 44242-0001, United States. Tel.: +1 330 672 2672.
E-mail address: harnold5@kent.edu (H.S. Arnold).

0021-9924/$ – see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.jcomdis.2010.12.003

children who do (CWS) and do not stutter (CWNS). These studies have provided some evidence that CWS, compared to CWNS, demonstrate higher emotional reactivity in that they may be more sensitive or reactive to environmental changes (Fowlie & Cooper, 1978; Glasner, 1949; Schwenk, Conture, & Walden, 2007), more active and impulsive (Embrechts, Ebben, Franke, & van de Poel, 1998), and more apt to react with negative emotions (Fowlie & Cooper, 1978; Johnson et al., 2010; Karrass, Conture, & Walden, 2008; Karrass et al., 2006). There is also some support for the notion that CWS, compared to CWNS, demonstrate lower emotion regulation in that they are less adaptable (Anderson, Pellowski, Conture, & Kelly, 2003), exhibit less inhibitory control (Embrechts et al., 1998), and have less effective emotion and attention regulation (Karrass et al., 2006).

In contrast, one parent-report study indicated that CWS, compared to CWNS, were less negative in their emotions and more adaptable (Lewis & Goldberg, 1997). Similarly, another parent-report study, indicated that 20% of the CWS, compared to 5% of the CWNS, demonstrated a temperamental constellation of "easy child" (Williams, 2006), though it is interesting to note that in this study a higher proportion of CWS, compared to CWNS, fit the temperamental constellation of "slow to warm up." This latter finding appears consistent with previous findings that CWS may be less adaptable to new situations (Anderson et al., 2003).

The variance in findings in empirical studies of emotional reactivity and regulation in CWS may relate to the measures used. Most such studies have used parent-report measures to assess temperament and emotions (Anderson et al., 2003; Embrechts et al., 1998; Fowlie & Cooper, 1978; Glasner, 1949; Karrass et al., 2006; Lewis & Goldberg, 1997; Williams, 2006). Although well-crafted parent-report measures have many strengths (Goldsmith & Hewitt, 2003), behavioral coding and psychophysiological measures such as electroencephalography (EEG) – which have sufficient temporal resolution to track moment-to-moment changes in cognitive, emotional and speech-language behavior – may aid in further understanding the relations between stuttering and emotions.

Although psychophysiological measures have not been used to assess emotion in CWS, behavioral coding has been used. For example, one laboratory observation study reported increased reactivity to environmental stimuli and poorer attentional control in CWS, compared to CWNS (Schwenk et al., 2007). This apparent decrease in attentional control may have implications for the ability of CWS to effectively regulate their emotions as regulatory strategies involving the modulation of attention have been found to be effective in decreasing emotional intensity (Derryberry & Rothbart, 1988; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002).

In another empirical study of emotional reactivity and regulation in which behavioral coding procedures were used, CWS demonstrated more negative reactions than CWNS after receiving a disappointing gift (Johnson et al., 2010). Taken together, parent-report and laboratory-based results support further study of emotional reactivity and regulation in young children who stutter.

1.1. Emotional reactivity and regulation: Defined

Emotional reactivity refers to the intensity and threshold for both positive and negative emotional responding that individuals tend to experience (Eisenberg & Fabes, 1992). For example a child with a high level of emotional reactivity would be more likely to experience intense levels of negative emotionality during peer conflict (Fabes et al., 1999), intense levels of positive emotionality during peer play interactions (Derryberry & Reed, 2003), or both.

Emotion regulation is the process of monitoring, evaluating, and modifying emotional reactions (Thompson, 1994). There is some debate on how emotion regulation is defined (e.g., Bell & Wolfe, 2004; Bridges, Denham, & Ganiban, 2004; Campos, Frankel, & Camras, 2004; Eisenberg & Spinrad, 2004). For example, some view emotion and emotion regulation as two distinct processes (Bridges et al., 2004; Cole, Martin, & Dennis, 2004; Eisenberg & Spinrad, 2004; Hoeksma, Oosterlaan, & Schipper, 2004), whereas others see emotion and emotion regulation as one unified process (Campos et al., 2004; Lewis & Stieben, 2004).

Evidence indicates that neural structures responsible for emotional reactions are also responsible for emotion regulation and that these two processes do not occur in discrete temporal windows (Lewis & Stieben, 2004) or in a linear fashion (Campos et al., 2004). For example, an emotion may be preceded by regulatory processes, such as cognitive reappraisal, that influence the type or strength of response (Campos et al., 2004; Gross, 2002).

Thus, there is some evidence that emotional reactions and emotion regulation are interrelated. However, some argue and have demonstrated that these two constructs can be measured separately by using experimental procedures that activate target emotions, establishing predictable temporal relations between regulatory efforts and changes in activated emotions (Cole et al., 2004; Jackson et al., 2003). Another way to disambiguate emotional reactivity and regulation, as suggested by Cole et al. (2004), is to use multiple, converging measures such as physiological and behavioral methods. For example, if behavioral coding indicates a child is attempting to regulate emotions and physiological measures indicate a decrease in emotional reactivity during or after those putative regulatory attempts, then one might reasonably suggest that at least some degree of emotion regulation occurred. The present study was designed in accordance with these suggestions. After the emotion elicitation procedures (i.e., background conversation stimuli to be described in Section 2.2), participants' attempts at regulation were coded. In addition, a second, physiological measure, EEG, was used to assess whether there was a decrease in emotional reactivity during or after these regulatory attempts.

Such measurement of changes in emotional reactivity is important as emotion regulation strategies may differ according to their effectiveness. For example, Gilliom et al. (2002) reported that in 3-and-a-half-year old boys during a task in which a