Personality in Children with Vocal Fold Nodules: A Multitrait Analysis

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ABSTRACT

Purpose: Vocal fold nodules (VNs) are bilateral, symmetrical, callous-like lesions related to phonotrauma that may be associated with specific personality traits. This case-control study examined the relation between personality and VNs in children within the context of the Trait Theory of VNs (Roy & Bless, 2000a).

Method: We compared children with VNs (N =39) and two medial control groups voice disordered controls (VDCs, N = 40) and vocally normal controls (VNCs, N = 40) using the Inventory of Childhood Individual Differences a personality instrument that describes the Big Five superfactors as well as 15 lower-order personality traits.

Results: Children with VNs, as compared to VNCs, were (i) emotionally reactive (higher N – Neuroticism, $p<0.05$?), (ii) Antagonistic, Strong-Willed, and less Compliant (lower A - Agreeableness, $p<0.05$?), and (iii) Distractible and Disorganized (lower C - Conscientiousness, $p<0.05$?). Children with VNs displayed a similar personality typology as women with VNs (with the exception of elevated Extraversion (E)), thereby providing support for the relevance of the Trait Theory of VNs in both children and adults. Both voice disordered groups (VNs and VDCs) received elevated scores on the personality superfactor of Neuroticism (N) (and the "Negative Emotions" lower-order trait), supporting its pivotal role in the voice disorder-N relationship. In addition, VDC children displayed a combination of lower levels of Activity and greater Shyness (within the context of elevated N) than children with VNs and VNCs.

Conclusions: Collectively, our results suggest that children with VNs are (1) emotionally reactive (i.e., high N), Antagonistic, Strong-Willed (i.e., low A), Distractible, Disorganized (i.e., low C), and (2) the combination of these traits and related behavioral inclinations may play a

central role in VN development. Moreover, the personality traits identified in this study may attenuate the effectiveness of voice therapy. Thus, clinicians treating children with voice disorders, including VNs, should consider their underlying personality traits and associated behavioral tendencies in assessment and management.

Keywords: Voice Disorders, Vocal Nodules, Personality traits, Neuroticism, Children

1. INTRODUCTION

Vocal nodules ((VNs) are bilateral, symmetrical, callous-like lesions on the mid-membranous vocal folds—the site of greatest tissue collision and shearing forces during phonation (Jiang & Titze, 1994), phonotraumatic behavior (i.e., chronic, repetitive, intense vocal

activity) such as screaming, yelling, and prolonged loud talking is often considered the proximate cause (Murry & Rosen, 2000). With reported prevalence rates ranging from 1 to 14%, VNs represent the most common cause of dysphonia in children (Carding, Roulstone, & Northstone, 2006). VNs occur more frequently among prepubescent boys (ratio 3:1), with a peak age of onset between 5 to 10 years of age (Angelillo et al., 2008; Toolhill, 1975). Disordered vocal pitch, loudness, and quality can result in adverse educational, psychological, and social consequences (Roy, Holt, Redmond, & Muntz, 2007), which may include: (1) being judged more negatively by teachers and listeners than their vocally normal peers (Zacharias, Kelchner, & Creaghead, 2013), (2) experiencing adverse physical sensations during phonation including vocal fatigue and discomfort which lead to decreased voice-related quality of life, and (3) experiencing negative voice-related socioemotional effects (e.g., anxiety, frustration, embarrassment) (Hoffman-Ruddy & Sapienza, 2004).

Although phonotrauma is featured prominently as the foundation of VN development, an expanding literature suggests that personality traits (such as extraversion, impulsivity, aggressiveness, and emotional reactivity) may predispose some children toward phonotraumatic voice use, thereby contributing secondarily to their formation. (Green, 1989; Lee, Roy, & Dietrich, 2019; Niedzielski, Niedzielska, & Gwizda, 2002; Verduyckt, Rhéault, Remacle, & Morsomme, 2019). Furthermore, voice therapy for VNs demands considerable self-regulation, often including deliberate self-monitoring and inhibition of intense phonotraumatic behaviors. Such sustained self-regulation may be at odds with specific personality dispositions, thereby potentially attenuating treatment effectiveness (Roy et al., 2007). Thus, an improved understanding of personality and related behavioral propensities that (1) predispose the child to the development and maintenance of VNs and (2) possibly attenuate voice therapy success is

important. This investigation aimed to explore personality traits (and related psychological factors) compared to controls to improve understanding of possible contributors to VNs in children. In the section that follows, we provide a brief introduction to personality and its description.

1.1 Trait Approach to Personality: The "Five Factor Model"

Personality is regarded as a complex set of systematically internalized and interrelated individual traits. (Roberts & Mroczek, 2008; Watson & Clark, 1984). Traits are defined as an individuals' relatively stable and enduring characteristics, which are often inherited and can be changed through environmental experiences (Allport, 1937). A hierarchical personality structure exists with three or five broad orthogonal personality dimensions at the highest level of the hierarchy (i.e., the Big Three or Big Five superfactors), and narrow traits/facets at the lower level (Eysenck & Eysenck, 1985). While these broad superfactors provide for general personality description, the narrow lower-order traits subsumed under each of the superfactors provide improved precision (i.e., fidelity) in personality description. According to Eysenck and others, the "Big Three" superfactor dimensions include Extraversion (vs. Introversion), Neuroticism (vs. Stability), and Constraint (vs. Disinhibition) (Eysenck & Eysenck, 1985). These three global dimensions have served as a foundation for personality description/classification.

Following Eysenck's work, McCrae and Costa (1997) proposed a Five Factor Model (FFM) to describe individual differences in adults. McCrae and Costa (1997) expanded on Eysenck's Big Three superfactors and identified five key dimensions of personality: Extraversion (E), Neuroticism (N), Agreeableness (A), Conscientiousness (C), and Openness to Experience (O). A is a tendency to be warm, compassionate, and cooperative toward others. The C dimension describes a personality that is organized, self-controlled, harm avoidant, productive,

and efficient. The O dimension describes a person as artistic, curious, and imaginative (McCrae & Costa, 1996, 1997). E and N are the two superfactors that overlap between the Big Three and Five Factor frameworks of personality. Those individuals who score high on E, (i.e., extraverts) actively approach life with energy, cheerfulness, confidence, and enthusiasm. They enjoy and seek the company of others and are satisfied with interpersonal situations. They also pursue rewarding and exciting experiences and often enjoy occupying the social limelight. In contrast, those who score low on E (i.e., introverts) prefer solitary activities and may have lower levels of energy and enthusiasm. They are socially aloof, reserved, and tend to avoid exciting or intense situations. The second factor, N is another broad, stable, heritable and temperament-related dimension that reflects individual differences in how a person perceives and responds to the world as threatening and/or distressing (Eysenck, 1967). The core of this dimension is related to emotional reactivity and overall emotional responses or a temperamental awareness of negative cues (Tellegen, 1982). Therefore, individuals who score high on N report heightened levels of negative psychological states such as irritability, fear/anxiety, worry, sadness, and nervousness (Watson & Clark, 1984; Tellegen, 1982). Those individuals who score low on N recover quickly from emotional upsets and might experience less stress, and feel greater relationship satisfaction, calmness, and emotional stability (Tellegen, 1982). Recent studies have adopted the Five Factor approach to describe personality characteristics and development across the age span, including age groups as early as toddlers and preschool children (Halverson et al., 2003; Tackett, Kushner, De Fruyt, & Mervielde, 2013).

1.2 The "Trait Theory" of Voice Disorders in Adults and Its Relation to Children with VNs

To explain how individual differences in personality might contribute to the pathogenesis of VNs in *women*, Roy and Bless (2000a, 2000b) developed the "Trait Theory." They proposed

that personality and associated cognitive processing and subsequent behavioral manifestations are important to the pathogenesis of VNs. In the Trait Theory of VNs, the two superfactor personality dimensions – Extraversion (E) and Neuroticism (N) – play a crucial role. Based on the Theory, women with VNs were postulated to score high on both N and E and would be sensitive to social reward cues and would exhibit impulsivity in the presence of such cues. (Roy et al., 2000c, 2000d). In brief, Roy and Bless proposed that "vocal nodule development is, in part, a result of an information processing pattern related to the *impulsive behavior of neurotic extraverts* (Roy & Bless, 2000a, p. 476). They postulated that a combination of high N and E personality features might ultimately manifest in phonotraumatic vocal patterns, thus contributing to the development and maintenance of VNs (Roy & Bless, 2000b; Roy, Bless, & Heisey, 2000c, 2000d). It was argued that persistent loud voice use (and other vocal excesses), which elevate the risk for developing VNs, coupled with inattention to symptoms of vocal fatigue and discomfort (especially within the context of potential social rewards), reflect behavioral manifestations of specific personality traits. For example, women with VNs, when faced with the opportunity to occupy the social limelight (i.e., and the associated social rewards), would be unable to restrict talking, shouting, or speaking loudly despite experiencing signs of laryngeal discomfort and audible voice deterioration. Since Roy and colleagues (2000a, 2000b, 2000c, 2000d) published their original research supporting the fundamental predictions of the Trait Theory of VNs, other investigations have also explored the role of personality traits. These investigators also reported higher levels of E, N, impulsivity, and aggression in women with VNs as compared with vocally normal controls (VNCs) (Dietrich, Abbott, Gartner-Schmidt, & Rosen 2008; El Uali Abeida et al., 2013; Mattei, Revis, & Giovanni, 2017).

Though an expanding literature exists to support the role of personality traits in the formation of VNs in adults (El Uali Abeida et al., 2013; Mattei et al., 2017), less is known regarding whether such a role for personality exists in children. In a recent systematic review, Lee et al. (2019) critically evaluated the literature pertaining to the role of personality in the pathogenesis of VNs in children. Overall, the general findings in *children* were strikingly similar to personality traits previously identified in women with VNs. For instance, studies by Green (1989), Niedzielski et al. (2002), Roy et al. (2007), and Verduyckt et al. (2019) concluded that children with VNs seemed to be more "extraverted," "socially dominant," and "aggressive," findings that are compatible with the Trait Theory of VNs (Roy et al., 2000c, 2000d). These results support a fundamental tenet of the Trait Theory in adults, which suggests that a combination of high Extraversion and high Neuroticism, and in particular social potency/dominance, may contribute to the development of VNs in children.

1.3. Aims of the Current Study

Although a small subset of studies reviewed by Lee et al. (2019) identified specific personality features in children with VNs, many of the studies suffered methodological shortcomings including: (1) limited details related to participant inclusion/exclusion criteria, (2) reliance on small sample sizes without any report of sample size determination, (3) no inclusion of voice-disordered controls who were diagnosed with dysphonia from causes other than nodules, and (4) use of extremely abbreviated/short personality questionnaires, which failed to permit evaluation of personality at both superfactor and lower trait levels.

The current study aims to improve our understanding of the personality-VNs relationship in children by addressing the above-stated methodologicalissues. We evaluated differences in personality traits by comparing three groups of children: a group with VNs, a second group with

voice disorders that are *not nodules* (i.e., voice disordered controls, VDCs), and a third group of normophonic controls (i.e., vocally normal controls, VNCs). Including another voice-disordered control group for comparison permits evaluation of whether certain personality traits are common to all children with voice disorders or unique to children with VNs only (i.e., commonality versus specificity). We also employed a psychometrically validated personality instrument with sufficient items to permit fidelity in personality description at both the superfactor and lower-order trait levels. Lastly, we focused the investigation within the context of the fundamental tenets and predictions of the Trait Theory of VNs by Roy and Bless (2000a, 2000b).

2. METHODS

2.1 Participants

The current *case-control* study recruited eligible participants from the outpatient pediatric otolaryngology clinic at the Primary Children's Medical Center in Salt Lake City, Utah. Consecutive cases (i.e., children with VNs) and medical controls (age- and gender-matched VDCs as well as VNCs) were identified and recruited to participate in two ways: on-site prospective invitation and retrospective search and review of electronic medical records. A priori sample size calculation indicated that the entire experiment required a total of 119 participants. Thus, we aimed to recruit 40 participants for each group. A total of 320 potential parents were invited to participate. From that total, 273 parents (85.3%) agreed to complete the questionnaire. Despite receiving reminder notices, 143 parents failed to return their completed questionnaires, resulting in 130 (40.6%) of all participants recruited. Six subjects from the VNCs were eventually excluded based upon a review of the results of their total pediatric Voice Handicap (pVHI) score and rating of the overall voice severity, which indicated that the subjects exceeded the cutoff criteria, and therefore did not permit their inclusion in the study. Furthermore, one

child from the VDCs and three children from the VNCs group were later excluded when these cases were identified as statistical outliers after each group's data were screened to identify potential outliers and to precisely match the gender distribution across all groups. Additionally, of the original 40 cases of VNs, one subject's ICID data were excluded from analysis because of issues of data reliability/validity (i.e., the parent selected an identical response across more than 90% of the 108 ICID items). The final number of participants in the current study was 119, or 37.5% of all subjects recruited. As a result, parents of 39 children with VNs, 40 VDCs, and 40 vocally normal controls (VNCs) participated in this study.

2.2. Groups

2.2.1 Children with Vocal Nodules (VNs)

This case group consisted of 12 girls and 27 boys between the ages of 5 and 12 years (total $N = 39$, mean age =7.43 years, standard deviation = 2.01). Children with VN received a confirmed diagnosis byt flexible fiberoptic laryngoscopy by a pediatric otolaryngologist. They were included only if their parents reported that they (a) have no identified speech (except voice disorder), hearing, language, cognitive, or physical disabilities, (b) are within typical limits in intellectual ability, (c) had no neurological disorder signs, (d) had no neurodevelopmental disorders such as Autism Spectrum disorders or Down syndrome, (e) have no coexisting chronic illness related to ear, nose, and throat (aside from VNs), and (f) has no history of prolonged or recent intubation or a craniofacial anomaly/syndrome such as cleft palate or any other coexisting vocal pathology.

2.2.2 Voice Disordered Controls (VDCs)

The voice disordered medical control group consisted of 12 girls and 28 boys between the ages of 5 and 12 years (total $N = 40$, mean age = 7.09, standard deviation = 2.01), which was

recruited as a comparison group. They were typically developing children with disordered voices in the presence of organic/neurological/structural changes of the vocal folds. They received a diagnosis of structural or neurogenic based dysphonia after a flexible fiberoptic laryngoscopy by a pediatric otolaryngologist. Diagnostic categories making up the VDCs included: airway obstruction/subglottic stenosis, gastroesophageal reflux, vocal fold paralysis, laryngeal papilloma, muscle tension dysphonia, and vocal fold cyst. Furthermore, over half of the VDC children had undergone medical or surgical interventions to correct their disordered voice.

2.2.3 Vocally Normal Controls (VNCs)

The vocally normal medical control group consisted of 12 girls and 28 boys (total $N = 40$, mean age = 7.6, standard deviation = 1.54) recruited from the same clinic for comparison purposes. These children were typically developing children seeking medical help for complaints not associated with the voice (e.g., nasal obstruction, tonsillitis, otitis media). To be included in the study, these normophonic participants had to satisfy the following inclusion criteria: (a) a report by caregivers/parents that the child has no current or past history of voice-related complaints/symptoms within the last year, (b) a confirmation of normal voice quality by the attending otolaryngologist, *and* (c) scores within the normal range on the pVHI scales (i.e., the visual analog scale of overall dysphonia severity less than 13mm and the total pVHI score lower than 7; Veder et al., 2017). The VNC's medical histories did not include any previous voice disorder, a history of voice therapy, surgical or medical treatment for dysphonic voice, or a history of neurological disorders (e.g., TBI, tics, etc.). Children who had undergone medical or surgical treatment for pediatric head and neck cancers were not recruited due to the likely discordant psychological distress, physical problems, and perceived quality of life compared to other subjects with dysphonia.

2.3 Procedures

2.3.1 Description of Test Instrument

To address our research questions, personality was evaluated using the Inventory of Childhood Individual Differences (ICID; Halverson et al., 2003), a recently developed 108 item personality questionnaire. The ICID is a factor-analytically developed self- and proxy report personality instrument designed to survey the Big Five dimensions of childhood personality (as well as associated 15 lower-order traits; Deal, Halverson, Martin, Victor, & Baker, 2007; Halverson et al., 2003). It consists of 108 statements describing the child's personality or behavioral tendencies. The ICID asks parents to read each statement and rate from 1 = "Much less than the average child or not at all" to 7 = "Much more than in the average child" based on their long-term observation of their child in comparison to other children's behavior.

The ICID generates scale scores for the Big Five personality superfactor dimensions: Extraversion (E), Neuroticism (N), Agreeableness (A), Conscientiousness (C), and Openness to Experience (O). Additionally, it provides scores for the 15 lower-order traits (Achievement Orientation, Activity Level, Antagonism, Considerate, Compliant, Distractible, Fearful/Insecure, Intellect, Negative Emotions, Positive Emotions, Openness, Organized, Shyness, Sociability, Strong-Willed) that contribute to the Big Five broad superfactor personality dimensions. The ICID was selected based upon substantial evidence of good structural validity, test-retest reliability, internal consistency, and temporal stability (Deal et al., 2007; Halverson et al., 2003; Tackett et al., 2013). For the interested reader, brief descriptions and example items of the Big Five superfactors, as well as the 15 lower-order trait scales from the ICID are provided in the Appendix (Halverson et al., 2003).

3. RESULTS

One-way analysis of variance (ANOVA) was used to compare personality across the three groups of children at both the superfactor and lower-order trait levels. Post-hoc comparisons only followed a significant omnibus ANOVA *F*-test. Pairwise group means were then compared using Fisher's protected Least Significant Difference (LSD). To identify unique personality characteristics in children with VNs compared with the controls, we adjusted for the possible confounding effects of age and gender using analysis of covariance (ANCOVA). Finally, the effect size parameter "*d"* proposed by Cohen (1988) was selected to estimate pair-wise effect sizes from the LSD analysis. Cohen's *d* values within the range of 0.2 to 0.49 were interpreted as a small effect size, *d* values within the range of 0.5 to 0.79 as a medium effect size, and *d* value higher than 0.8 as large effect size (Cohen, 1988). The means and standard deviations of superfactor scale scores and *T*-scores of lower-order traits for the ICID are presented in Table 1.

Table 1. Mean and standard deviation of the Big Five superfactor scale scores and lower-order personality trait *T*-scores of the ICID and ANOVA *F*-test results comparing all three groups (*N* = 119).

ICID Superfactor Scales	Vocal Nodules (*N* = 39)		Voice Disordered Controls (*N* = 40)		Vocally Normal Controls (*N* = 40)		Group Differences	
	Mean	SD	Mean	SD	Mean	SD	F	*P*
Extraversion	301	33	291	33	301	26	1.3	.266
Neuroticism	266	28	269	23	252	25	5.5	.005*

Agreeableness	-68	38	-66	31	-48	29	4.5	.014*
Conscientiousness	48	21	49	16	59	18	4.9	.009*
Openness to Experience	154.84	20.61	150.92	16.77	159.33	12.47	2.471	.089
ICID Lower Order Traits								
Achievement Orientation	50.06	8.78	50.29	7.56	53.86	6.59	3.067	.050*
Activity Level	50.51	6.28	47.1	7.62	48.38	7.72	2.225	.113
Antagonism	52.87	8.67	52.74	6.88	48.68	6.96	3.98	.021*
Compliance	45.24	10.07	47.77	7.69	51.17	6.62	5.163	.007*
Considerate	47.37	10.07	47.27	8.47	50.84	6.87	2.023	.137
Distractible	52.48	8.02	53.4	6.68	49.1	6.98	3.902	.023*
Fearful/Insecure	53.04	7.57	55.13	6.21	52.26	5.45	2.114	.125
Intelligent	50.88	7.92	48.63	7.28	52.57	5.63	3.192	.045*
Negative Emotions	55.77	8.64	54.91	8.25	49.93	7.92	5.755	.004*
Openness	53.9	7.02	52.01	6.8	52.89	4.44	.922	.401
Organized	50.08	7.84	52.52	5.99	54.93	6.37	5.075	.008*
Positive Emotions	46.9	10.04	46.33	8.62	49.45	6.33	1.543	.218
Shy	50.56	8.16	53.8	6.78	50.42	5.42	3.096	.049*
Sociable	49.09	9.03	46.32	8.74	49.16	6.75	1.538	.219
Strong-Willed	53.75	6.09	52.16	6.81	49.82	7.49	3.311	.040*

**Note:* * $P < .05$; The superfactor scores – Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness – were calculated by combining several lower-order trait scores. For instance, Extraversion reflected the addition of the following scales: Positive Emotions + Sociable + Considerate + Activity Level + Openness to Experience + Strong-Willed.

3.1. ICID Superfactor Analysis

3.1.1. Extraversion (E)

Extraversion (E) is a personality dimension that is "denoted by habitual outgoingness, venturing forth with careless confidence into the unknown, and being particularly interested in

people and events in the external world" (De Raad & Perugini, 2002, p. 6). In the ICID personality instrument (Halverson et al., 2003), several lower-order traits contribute to the E superfactor score, including Activity Level (e.g., energetic), Considerate (e.g., thoughtful of others), Openness (e.g., creative), Positive Emotions (e.g., happy), Sociable (e.g., outgoing, makes friends easily), and Strong-Willed (e.g., likes to be the center of the attention, wants things his/her way; Halverson et al., 2003). The results of ANOVA revealed no significant main effect between group [F (2, 116) = 1.34, $P < .266$]. Figure 1 graphically illustrates the ranked order group means and standard errors for E superfactor. Inspection of the results using ranked data also revealed no significant between-group differences. However, a significant gender effect was identified in ANCOVA [F (1, 117) = 4.355, $P < .039$], but adjusting scores for gender did not alter the significance patterns.

3.1.2 Neuroticism (N)

The Neuroticism dimension in the ICID is generated from five lower-order traits, including Distractible (e.g., easily distracted), Fearful/Insecure (e.g., afraid of a lot of things), Negative Emotions (e.g., irritable, quick-tempered), Shy (e.g., withdrawn), and Strong-willed (e.g., likes to be the center of the attention, wants things his/her own way; Halverson et al., 2003). It evaluates tendencies that reflect emotional instability and reactivity in children. A significant omnibus F-test indicated differences between groups in N [F (2, 116) = 5.504, $P < .005$]. Fisher's protected LSD test revealed that children with VNs and VDCs were more "neurotic" (i.e., high N) than VNCs (*Note:* the term "neurotic" as it is used in this context is not synonymous with the Freudian concept of the neurotic as an individual with a clinical neurosis). The VDCs were significantly more neurotic than the VNCs ($P < .002$, Cohen's $d = .75$, indicating a medium effect size), and the pattern of results was similar for the VNs ($P < .015$,

Cohen's d = .53, indicating a medium effect size). However, children with VNs did not differ significantly from the VDCs on the N scale. Figure 1 illustrates the differences between the three groups in N, with the VNs and VDCs scoring at the high end of the N continuum. The ANCOVA did not reveal a significant effect of age or gender.

3.1.3 Agreeableness (A)

The A dimension score is composed of five lower-order traits of ICID including Considerate (e.g., thoughtful of others), Positive Emotions (e.g., a joy to be with), Negative Emotions (e.g., irritable), Antagonism (e.g., aggressive towards others), and Strong-Willed (e.g., likes to be the center of the attention, wants things his/her way; Halverson et al., 2003). A significant omnibus test showed differences between the groups [F (2, 116) = 4.454, P < .014]. As illustrated in Figure 1, the VNs (P < .008, Cohen's d = .59, indicating a medium effect size) and VDCs (P < .016, Cohen's d = .60, indicating a medium effect size) were significantly less agreeable (i.e., Low A) than the VNCs. However, no significant difference between the VNs and the VDCs was evident on the A. Likewise, a significant effect of gender was detected with ANCOVA [F (2, 114) = 4.233, P < .017]; however, entering gender as a covariate did not change the significance patterns of the results.

3.1.4 Conscientiousness (C)

The C dimension is defined by three lower-order traits, including Achievement Orientation (e.g., self-disciplined, a hard worker), Organized (e.g., keeps things neat and tidy), and Distractible (reverse-scored) (e.g., gets bored easily; Halverson et al., 2003). ANOVA revealed that there was a significance difference between groups [F (2, 116) = 4.882, P < .009]. The post hoc analysis results, as shown in Figure 1, indicated that the children with VNs (P < .005, Cohen's d = .62, indicating a medium effect size) and the VDCs (P < .015, Cohen's d

= .60, indicating a medium effect size) scored significantly lower on C than the VNCs. Again, no significant differences were found between the VNs and the VDCs. ANCOVA revealed a significant gender effect [F (1, 117) = 10.32, $P < .002$]; however, adjusting scores for gender did not alter the significance patterns.

3.1.5 Openness to Experience (O)

The Openness to Experience (O) dimension assesses individual differences in openness to new ideas, creativity, imagination, and curiosity. The omnibus F-test revealed between-group differences that approached significance on the O dimension [F (2, 116) = 2.471, $P < .089$]. We explored this near-significant omnibus F-test with pairwise LSD tests, which indicated that the VDCs were less open to experience than the VNCs ($P < .028$, Cohen's d = .57, indicating a medium effect size), as illustrated in Figure 1. However, a significant gender effect was revealed by ANCOVA [F (1, 117) = 6.723, $P < .011$]; but, the significance patterns of the results did not change after controlling for gender.

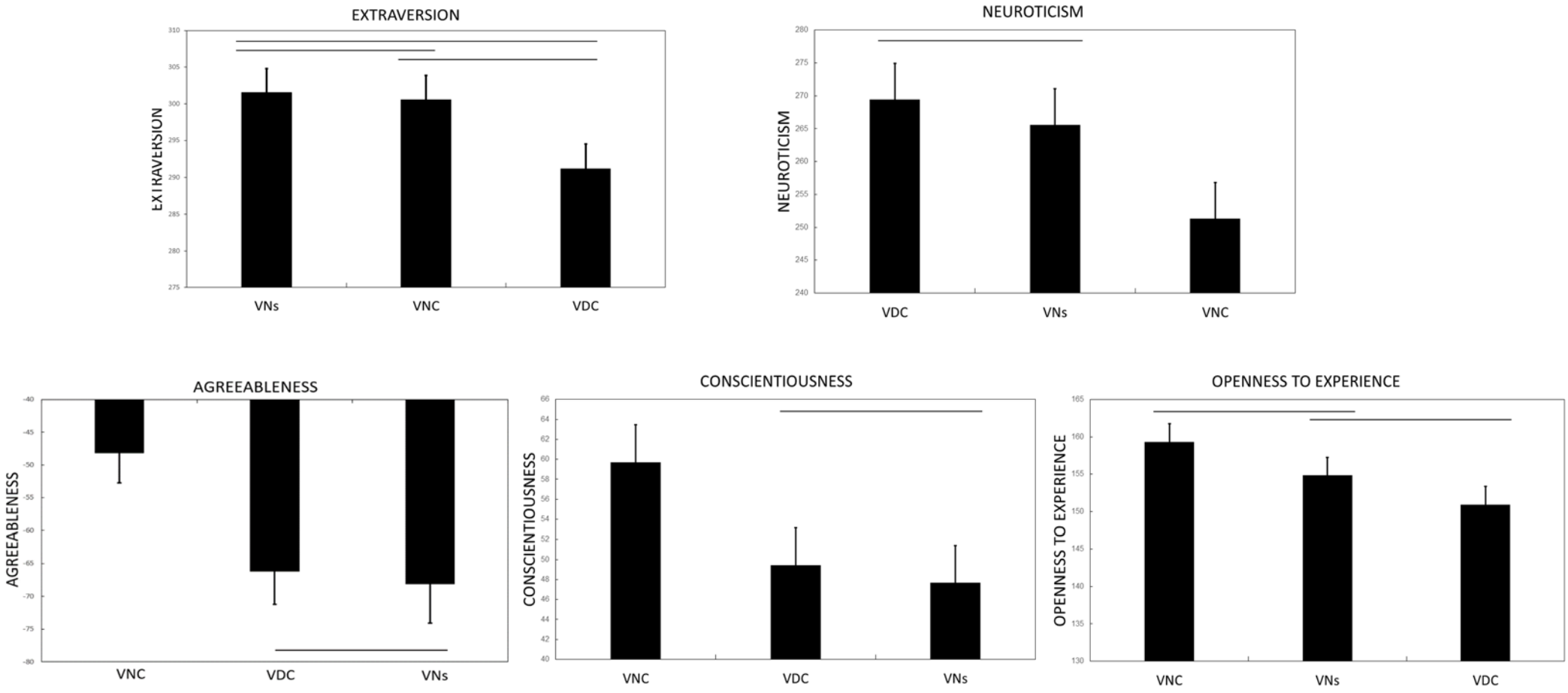

Figure 1. Rank-ordered group means and standard errors of the total scale score for each of the superfactors of the Inventory of Child Individual Differences (ICID). Lines drawn above or below selected groups reflect non-significant differences between those groups, thus reflecting homogeneous subsets of groups. Groups not covered by a line are significantly different at $P < .05$. *Note:* The bar graph of the "Agreeableness" superfactor is reversed to reflect negative mean total scores.

3.2 ICID Lower-Order Trait Level Analysis

From the 15 lower order traits, the results that follow reflect only those scales/traits wherein significant between-group pairwise differences were identified following a significant omnibus *F*-test from the ANOVA.

3.2.1 Achievement Orientation

The Achievement Orientation personality trait is sensitive to an individual's tendencies including self-discipline, responsibility, and hard work. One-way ANOVA revealed omnibus differences between groups [F (2,116) = 3.067, $P < .050$]. The two voice-disordered groups (VNs and VDCs) scored significantly lower on this trait than the VNCs. The VNs scored substantially lower on this trait than the VNCs ($P < .030$, Cohen's $d = .49$, indicating a small effect size). The VDCs also displayed this pattern of results ($P < .040$, Cohen's $d = .50$, indicating a medium effect size; see Figure 2). There was no between-group difference between VNs and VDCs ($P < .894$). A significant effect of gender was identified by ANCOVA [F (1, 117) = 7.241, $P < .008$]; however, adjusting scores for gender did not alter the significance patterns.

3.2.2 Antagonism

Halverson et al. (2003) described a high scorer on the Antagonism trait as a child who is aggressive towards others, self-centered, and rude. A low scorer is described as one who is obedient and cooperative with others. Significant omnibus differences were found [F (2, 116) = 3.98, $P < .021$], and post hoc LSD tests revealed that the VNs and the VDCs scored higher on this trait than the VNCs. Again, the VNs were more antagonistic than the VNCs ($P < .015$, Cohen's $d = .53$, indicating a medium effect size), and the pattern of results was also observed for the VDCs ($P < .018$, Cohen's $d = .59$, indicating a medium effect size; see Figure 2). There was

no statistical difference between the VNs and VDCs on the Antagonism trait ($P < .94$). ANCOVA detected no significant effect of age and gender.

3.2.3 Compliance

A significant omnibus *F*-test indicated differences between groups on the Compliance trait [F (2, 116) = 5.163, $P < .007$]. This trait reflects a child's tendency to be well-mannered and self-disciplined. A significant omnibus *F*-test was followed by LSD tests, which revealed that the VNs were less compliant than the VNCs ($P < .002$, Cohen's $d = .70$, indicating a medium effect size). The VDCs were also less compliant than the VNCs (unranked data, $P < .067$, Cohen's $d = .47$, indicating a small effect size; ranked data, $P < .019$, Cohen's $d = .64$, indicating a medium effect size). Additionally, the difference between the VNs and the VDCs ($P < .176$) suggested a trend indicating that the VNs were less compliant than the two control groups (VNs versus VNCs, $P < .002$; see Figure 2). Despite a significant gender effect revealed by ANCOVA [F (1, 117) = 6.873, $P < .010$], adjusting for gender did not alter the pattern of the significant results.

3.2.4 Distractible

The Distractible lower-order trait reflects whether a child has a short attention span, is easily distracted, forgets things easily, and has poor concentration. The omnibus *F*-test indicated significant between-group differences [F (2,116) = 3.902, $P < .023$]. Again, the two voice-disordered groups (VNs and VDCs) scored significantly higher on this trait than the VNCs. The VDCs and VNs were more distractible than the VNCs (VDCs, $P < .009$, Cohen's $d = .63$; VNs indicating a medium effect size, $P < .040$, Cohen's $d = .45$ indicating a small effect size, respectively; see Figure 2). There were no significant group differences between the VNs and the VDCs ($P < .574$). A significant effect of gender was identified by ANCOVA [F (1, 117) = 5.79, $P < .018$]; however, adjusting scores for gender did not alter the significance patterns.

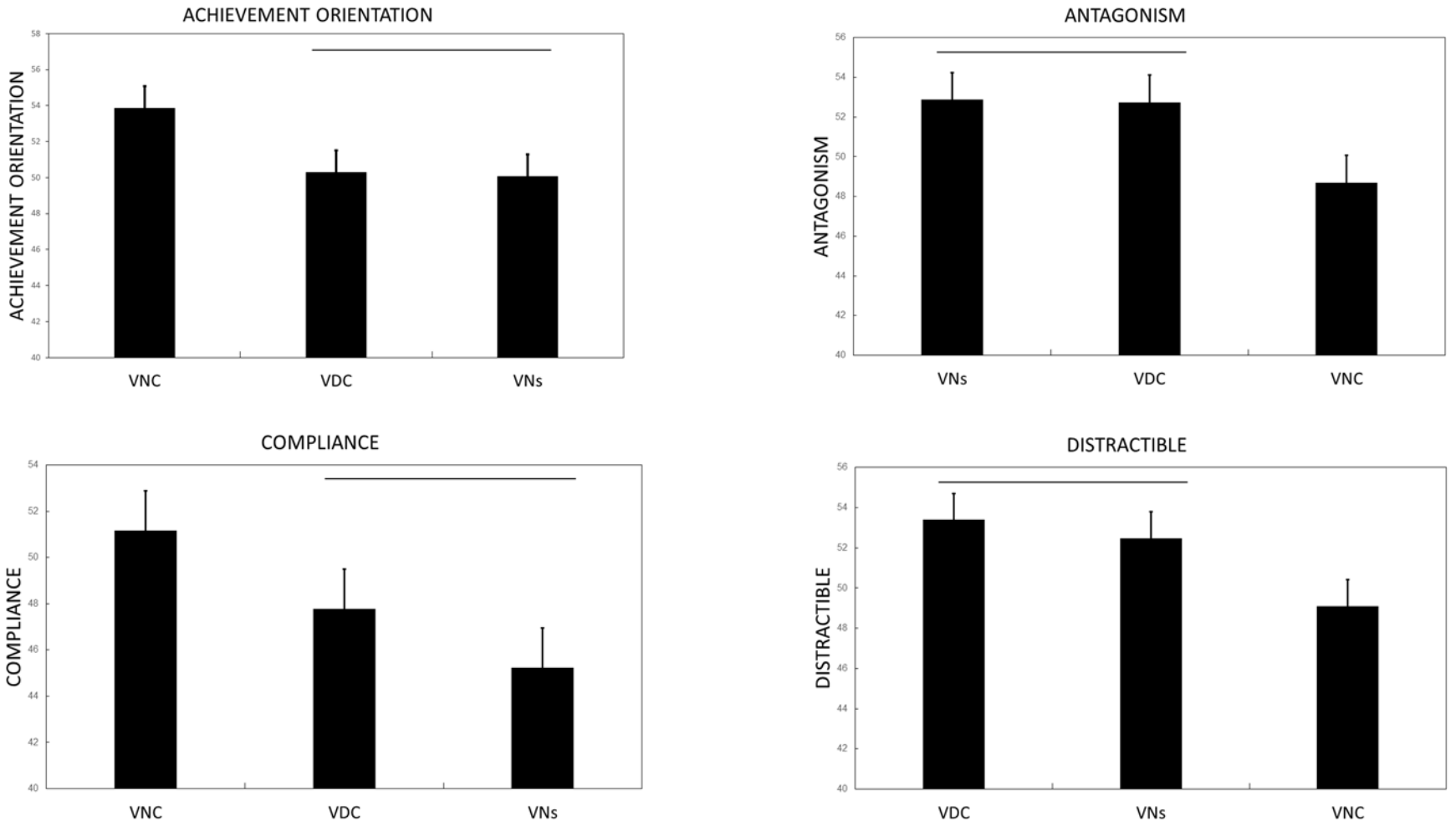

Figure 2. Rank-ordered group *T*-score means and standard errors for each of the significant lower-order traits of the Inventory of Child Individual Differences (ICID). Lines drawn above selected groups reflect non-significant differences between those groups, thus reflecting homogeneous subsets of groups. Groups not covered by a line are significantly different at $P < .05$.

3.2.5 Negative Emotions

A child who scores higher on the Negative Emotions trait is described as being whiny, quick-tempered, and easily angry. ANOVA revealed significant omnibus differences among the three groups [F (2, 116) = 5.755, P < .004], and post hoc LSD tests showed that the two voice disordered groups (VNs and VDCs) experienced more negative emotions than the VNCs (VNs, P < .002, Cohen's d = .70, indicating a medium effect size; VDCs, P < .008, Cohen's d = .62, indicating a medium effect size). However, the VNs and the VDCs did not differ significantly from each other (P < .645), as shown in Figure 3. ANCOVA did not reveal a significant effect of age and/or gender.

3.2.6 Organized

Halverson et al. (2003) described a child who is organized as tidy and a perfectionist and who does things carefully and with thought. A significant omnibus F-test confirmed differences between groups on this trait [F (2, 116) = 5.075, P < .008]. As shown in Figure 3, the VNs were significantly less organized than the VNCs (P < .002, Cohen's d = .68, indicating a medium effect size). Moreover, a trend was observed wherein the VNs were less organized than the VDCs on this trait, although the difference did not achieve statistical significance (ANOVA, P < .112). Despite a significant gender effect [F (1, 117) = 9.871, P < .002], ANCOVA did not alter the pattern of the significant results when scores were adjusted for gender.

3.2.7 Shy

The Shy personality trait reflects a child's tendency to be withdrawn, prefers to be alone, and has difficulty making friends. A significant omnibus F-test revealed between-group differences in this trait [F (2, 116) = 3.096, P < .049]. Pairwise LSD tests revealed the VDCs to be clearly much shyer than the VNs (P < .038, Cohen's d = .43, indicating a small effect size)

and the VNCs ($P < .030$, Cohen's $d = .55$, indicating a medium effect size). However, the VNs and the VNCs did not differ significantly from each other ($P < .929$), as shown in Figure 3. The ANCOVA did not reveal a significant effect of age and/or gender.

3.2.8 Strong-Willed

According to the ICID items, a child with a Strong-Willed personality would be described as being stubborn and hard-headed, likes to be the center of attention, and does not give in to others. ANOVA revealed significant omnibus differences between the two groups [$F (2, 116) = 3.311$, $P < .040$], such that the VNs scored significantly higher than the VNCs ($P < .012$, Cohen's $d = .58$, indicating a medium effect size; see Figure 3). There were no significant group differences between the VNs and the VDCs ($P < .304$), as well as the VDCs and VNCs ($P < .128$). ANCOVA revealed a significant effect of gender [$F (1, 117) = 7.241$, $P < .008$]; however, the significance patterns were not altered when scores were adjusted for gender.

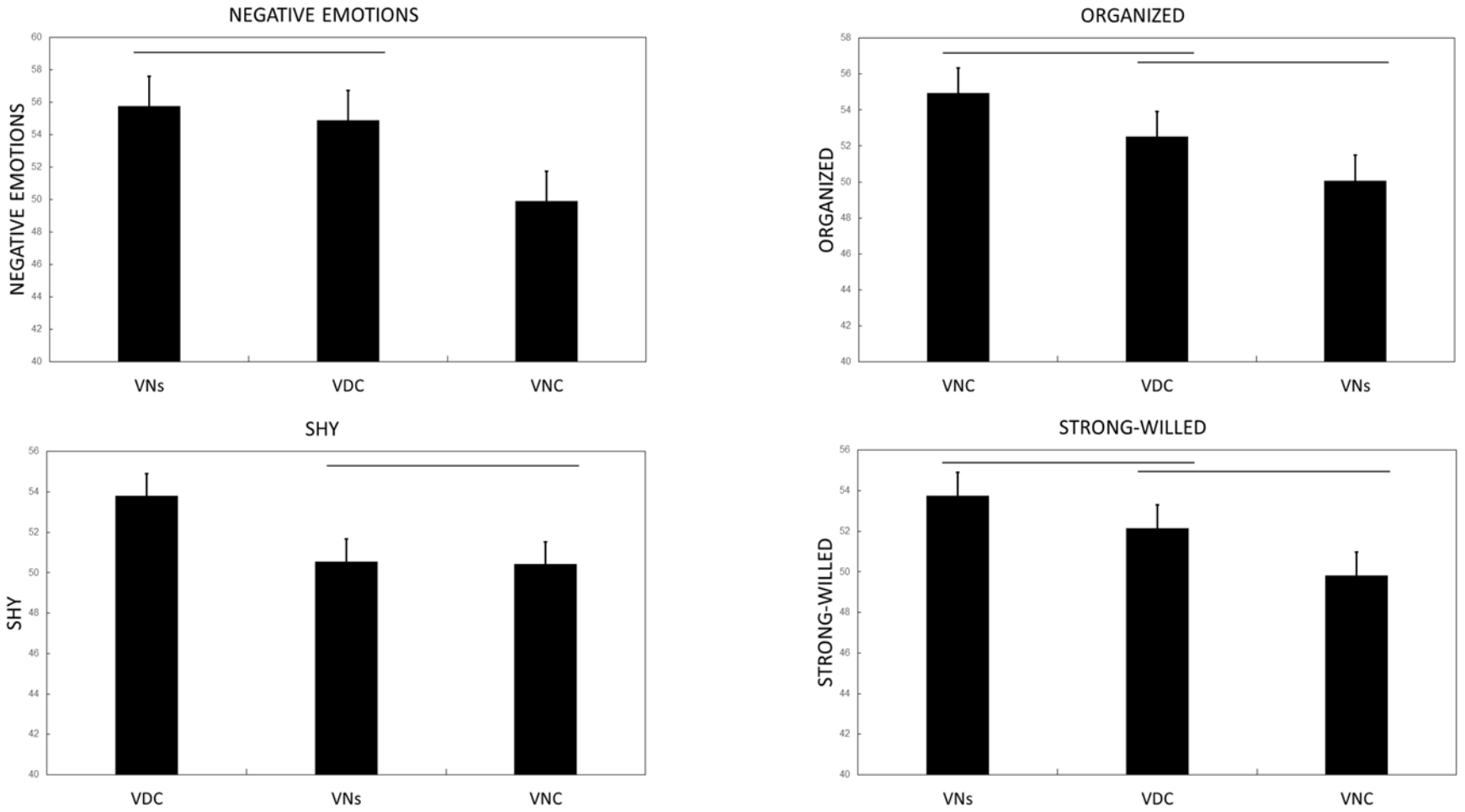

Figure 3. Rank-ordered group *T*-score means and standard errors for each of the significant lower-order traits of the Inventory of Child Individual Differences (ICID). Lines drawn above selected groups reflect non-significant differences between those groups. Groups not covered by a line are significantly different at $P < .05$.

3.3. Stepwise Logistic Regression Analysis of the Personality Superfactors and Lower-Order Level Traits of the ICID

Four separate logistic regression analyses were performed to identify possible personality factors that distinguished the VNs from the VDCs and the VNCs. Significant (and/or near-significant) superfactors and lower-order traits identified from previous ANOVA and ANCOVA analyses were entered in a logistic regression using a stepwise forward method. In the first logistic regression model, distinguishing between children with VNs and VDCs ($N = 79$) was the outcome (i.e., independent variable), and the lower-order traits that were previously identified as significant in the univariate analysis were entered as predictors. This regression model, with the lower-order traits, entered as predictors, revealed that the Activity Level was the most salient variable reliably distinguishing between the two voice disordered groups [χ^2 (1, 79) = 4.64, $P < .031$]. Further, the odds ratio of 1.073 indicated that as the Activity Level trait score increased by one unit, the odds of a child having VNs increased by 7.3%. This result confirmed the finding that children with VNs have a behavioral tendency of being always on the move, physically active, and liking to play outdoors compared to the VDCs. The second regression model (i.e., a test of the regression model) that included the superfactors failed to identify any superfactors that distinguished between the VNs and the VDCs [χ^2 (1, 79) = 1.91, $P < .167$].

Third and fourth logistic regressions using all statistically significant lower-order traits and superfactors (identified from the original univariate analyses) were then performed to identify personality variables that potentially distinguished between the VNs and the VNCs. Of the nine lower-order traits with significance, the Negative Emotions trait reliably distinguished between VNs and VNCs [χ^2 (1, 79) = 9.49, $P < .002$], and accounted for 15% of the variance in group membership (Nagelkerke's $R^2 = .15$). The odds ratio of 1.092 showed that for every one-unit increase in the Negative Emotions trait score, there was a 9.2% increase in the likelihood

that the child would have VNs rather than the VNCs. Additionally, a test of the regression model including four superfactors was also statistically significant [χ^2 (1, 79) = 7.38, $P < .007$], and revealed that the Conscientiousness superfactor reliably distinguished between the children with VNs and the VNCs, accounting for approximately 12% of the variance in group membership (Nagelkerke's $R^2 = .12$). However, the odds ratio of .968 (i.e., less than 1) showed a lower likelihood of having VNs based on a one-unit increase in Conscientiousness superfactor score. That is, for every one-unit increase in Conscientiousness superfactor score, there was a 3.2% decrease in the likelihood of having VN in children. Taken together, the results of logistic regression analyses of personality variables indicated that as compared to the VNCs, 1) the children with VNs were more likely to express negative emotionality, and 2) these children were less organized and more distractible suggested by lower Conscientiousness superfactor scores.

4. DISCUSSION

Overall, the results of the current study provided evidence that children with VNs possessed a personality profile (at the superfactor level) that was characterized by – higher levels of Neuroticism (N) and lower levels of Agreeableness (A) and Conscientiousness (C). To help guide our discussion, we summarized the Big Five superfactors and lower-order traits of the ICID that were significant from the univariate analyses in Table 2. Furthermore, a summary of statistically significant group differences of VNs and VDCs (i.e., VNs versus VNC and VDC versus VNC) ranked by their Cohen's *d* effect sizes are presented in Table 3.

Table 2. A summary of Big Five superfactors and lower-order traits that were significant from the univariate analyses.

Big Five Superfactors	Vocal Nodules	Voice Disordered Controls	Vocally Normal Controls
Neuroticism	↑	↑	↓
Agreeableness	↓	↓	↑
Conscientiousness	↓	↓	↑
Lower-Order Traits			
Achievement Orientation	↓	↓	↑
Antagonism	↑	↑	
Compliance	↓	↓	↑
Distractible	↑	↑	↓
Negative Emotions	↑	↑	↓
Organized	↓	↓	↑
Shy	–	↓	–
Strong-Willed	↑	↑	↓

**Note:* ↑ = the superfactor or lower-order trait score is significantly higher than the vocally normal controls (i.e., VNs vs. VNCs or VDCs vs. VNCs), ↓ = the superfactor or lower-order trait score is significantly lower than the vocally normal controls (i.e., VNs vs. VNCs or VDCs vs. VNCs), – = the lower-order trait score is not significantly lower or higher than vocally normal controls (i.e., VNs vs. VNCs or VDCs vs. VNCs).

Table 3. A summary of statistically significant group differences of VNs and VDCs ranked by their effect sizes (i.e., Cohen's *d*) from the univariate analyses.

Big Five Superfactors	VNs versus VNC	VDC versus VNC	Effect Size Interpretation
Conscientiousness	0.62	0.6	Medium
Agreeableness	0.59	0.6	Medium
Neuroticism	0.53	0.75	Medium
Lower-Order Traits			
Negative Emotions	0.7	0.62	Medium
Compliance	0.7	0.47	Medium/Small
Organized	0.68	0.4	Medium/Small
Strong-Willed	0.58	0.33	Medium/Small
Antagonism	0.53	0.59	Medium
Achievement Orientation	0.49	–	Small
Distractible	0.45	0.63	Small/Medium

**Note:* Cohen's *d* values within the range of 0.2 to 0.49 were interpreted as a small effect size, *d* values within the range of 0.5 to 0.79 as a medium effect size, and *d* values higher than 0.8 as a large effect size (Cohen, 1988).

4.1 "Personological Resumé" of Children with VNs

4.1.1 Personality Features of High Neuroticism (N) in Children with VNs

Our sample of children with VNs showed a high N profile that emerged from both superfactor and lower-order trait levels of personality. The superfactor dimension of N broadly includes trait descriptors related to emotional reactivity. Thus, an individual with a high N score is described as a child who is fearful/insecure, anxious, moody, and gets angry easily. Such children appear to have a lower threshold for emotional upset (i.e., emotional reactivity) and recover more slowly from such an upset. These descriptions provided evidence to support the VNs- Neuroticism hypothesis. N is one of the prime constituents of the Trait Theory of VNs (Roy & Bless, 2000a, 2000b). Therefore, this finding provides evidence of N's importance in the dispositional bases of VNs in children, thereby validating the VNs-N relationship in both *children and adults*.

The significantly elevated lower-order trait of "Negative Emotions" also provided further evidence of the high N claim. This trait was the only variable that uniquely distinguished between children with VNs and vocally normal controls (VNCs) both in the univariate and logistic regression analysis. Individuals with negative emotions are whiny, irritable, quick-tempered, and tend to complain frequently. Thus, our findings of elevated N, both at the superfactor and the lower-order trait level, suggest that children with VNs appear to have a lower threshold for emotional upset. This emotional reactivity/lability might contribute to diminished self-regulation of behaviors, emotions, and related cognitive function. This interpretation is consistent with Wallace and Newman's (1997) contention that "…Neuroticism contributes to negative affect and psychopathology by impairing cognitive processes involved in self-regulation. In other words, Neuroticism may be conceptualized as a predisposition to

dysregulation" (Wallace & Newman, 1997, p. 138). Such emotional dysregulation could manifest in phonotraumatic vocal behaviors, such as persistent, repetitive, intense loud voice use (e.g., screaming/shouting at the extremes of pitch and loudness, etc.), and these vocal "excesses" might reflect (in part) higher levels of N, as posited by Wallace and Newman (1997). Such trait-based dysregulation may contribute secondarily to vocal fold mucosal injury, the development of vocal symptoms, and, eventually, VNs.

4.1.2 Personality Features of Low Agreeableness (A) in Children with VNs

The superfactor analysis also revealed that children with VNs scored lower on Agreeableness (A) than the VNCs, indicating that they were much less agreeable children. The A superfactor is mainly characterized in part by two lower-order traits of the ICID – Antagonism and Strong-Willed. A child who displays elevated trait scores on Antagonism is described as rude, self-centered, and disobedient. A higher scorer on the Strong-Willed trait is characterized as a child who wants to be the center of attention and manipulates others to get their way. Children with low A also show reduced Compliance, indicating that they may make unreasonable demands, are less self-disciplined, and less well-mannered. These Antagonistic, Strong-willed, and less Compliant personality traits are related to a child's ability to solve conflicts and deal with frustration within the context of other children or adults (Ahadi & Rothbart, 1994; Jensen-Campbell, Gleason, Adams, & Malcom, 2003). Thus, these low A children are more likely to strongly express their interests/opinions, which would interfere with getting along with their peers (Jensen-Campbell et al., 2003). Thus, a low A personality style may interfere with establishing a positive relationship with other children or adults. This result might partly explain why children with VNs did not score significantly higher than the VNCs on the Sociable trait (a facet of the Extraversion superfactor within the ICID personality inventory).

According to Halverson et al. (2003), sociable children are described as friendly, love to be with other people, make friends easily, quickly adapt to new situations, and have many friends. Our findings suggest that children with VNs are less likely to be friendly, are less sociable, and may find it difficult to make friends reflecting a low A personality typology (i.e., Antagonistic and Strong-willed). Therefore, low A combined with high N in children with VNs may represent a mix of traits (both at the superfactor and lower-order levels) that could potentially contribute to dysregulated vocal behavior (e.g., intense screaming and shouting), especially in interpersonal contexts. Such a combination of traits (which might manifest vocally) could be exacerbated by low Conscientiousness (i.e., low C) described in the following section.

4.1.3 Personality Features of Low Conscientiousness (C) in Children with VNs

Another important finding was that children with VNs scored lowest on the Conscientiousness (C) superfactor, indicating that they were less Organized, and more Distractible. Three lower-order traits of the ICID characterize the C dimension: Organized, Achievement Orientation, and Distractible. Halverson et al. (2003) described a low scorer on the Organized trait as a careless child who does not keep things tidy and does not manage things carefully. A low scorer on the Achievement Orientation trait is characterized as a less self-disciplined and less responsible child. Individuals with high scores on the Distractible trait are featured as a child who gets easily distracted. These descriptions fit with reduced ability to self-regulate behavior across a variety of settings, including interpersonal settings. The combination of traits that contribute to the low C profile may generally reflect a disinhibited (i.e., impulsive) personality style in children with VNs. Impulsivity reflects diminished "stop and reflect" behavior before acting on impulses. Such disinhibition in children with VNs (low C) combined with a low threshold for an emotional upset (i.e., elevated emotional reactivity, high N), and

within the context of low A (i.e., tendency to be Antagonistic and Strong-Willed), could represent a blend of personality traits that contribute to persistent, intense phonotraumatic vocal behaviors, without consideration for or simply disregarding any negative vocal consequences (e.g., physical discomfort or audible deterioration of voice).

Furthermore, our results of low A and low C in children with VNs are in line with the personality profiles of women with VNs (Roy et al., 2000c, 2000d). Despite differences in the instruments employed, there was significant overlap in the personality characteristics of women and children with VNs. For instance, Roy and colleagues (2000a, 2000b) reported that women with VNs scored significantly lower on the Constraint (CON) dimension of the Multidimensional Personality Questionnaire (MPQ; Tellegen, 1982) and substantially higher on the Psychoticism (P) dimension of the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975). Tellegen (1982) described low scorers on the MPQ-CON dimension as less cautious, less planful, and do not avoid danger. The profile of low CON shares some common features with the low C superfactor of the ICID in our sample of children with VNs. Furthermore, the P dimension is one of the Big Three dimensions in the EPQ (Eysenck & Eysenck, 1975), which includes an individual's tendency to be impulsive and aggressive. The P has been described as a blend of low Agreeableness (A) and Conscientiousness (C) from the Five Factor model of personality (Eysenck & Eysenck, 1975; McCrae & Costa, 1996). Based on these findings, Roy et al. (2000c, 2000d) concluded that women with VNs were impulsive, spontaneous, and less cautious. Their personality dispositions (i.e., low CON/high P) highlighted the role of impulsivity and its potential contribution to the vocal excesses presumed to contribute to VNs in women (Roy et al., 2000a, 2000b). Likewise, our finding of low A and C personality characteristics in children with VNs seems consistent with Roy and colleagues' (2000a, 2000b) findings in women with VNs.

These children with VNs also possessed Strong-Willed, impulsive, and disinhibited personality traits.

Furthermore, Roy and colleagues (2000c, 2000d) reported that women with VNs were reactive to stress and aggressive. The women (with VNs) scored higher on the Neuroticism (N) superfactor dimension of the EPQ as well as Stress Reaction and Aggression subscales from the MPQ. Our children with VNs also scored higher on the N superfactor dimension on the ICID inventory. Additionally, the children with VNs were also emotionally reactive, irritable, slower to recover from emotional upset (or stress), and aggressive, thereby providing evidence of elevated N in *adults and children* with VNs. Thus, our study results suggest considerable overlap in personality typology between children and women with VNs.

4.1.4. Personality Findings on Extraversion in Children with VNs

Turning to the experimental evidence on Extraversion (E), it is somewhat surprising that children with VNs did not score higher on the ICID superfactor E than the other groups. This finding at the superfactor level is inconsistent with the predictions and prior evidence supporting the Trait Theory, wherein women with VNs were classified as high E individuals compared to other voice disorder groups. Recall that Roy et al. (2000c, 2000d) emphasized the importance of high E as one of the primary traits contributing to VN development in women. Several studies by Roy et al. (2000c, 2000d) reported elevated Extraversion (using the EPQ; Eysenck & Eysenck, 1975) and elevated Positive Emotionality (PEM), as measured by the MPQ (Tellegen, 1982). At the lower-order trait level of the MPQ, women with VNs scored higher on the 'Social Potency' and 'Sociability' scales than other control groups (Roy et al., 2000c, 2000d). Thus, results from superfactor and lower-order trait level analyses of the EPQ and MPQ indicated that women with VNs not only preferred being with others (i.e., highly Social), but also enjoyed being in the

social limelight and taking leadership roles (i.e., Social Potency). These traits are generally interpreted as being positively-valenced (i.e., generally associated with the expression of positive emotions) (Roy et al., 2000c, 2000d). In this regard, one possible explanation for our conflicting results might be related to the component traits that contribute to the E personality superfactor within the ICID Five Factor personality instrument. That is, there are six lower-order traits that contribute to the E superfactor dimension in the ICID (i.e., which evaluates the Big Five) including Activity Level, Considerate, Openness, Positive Emotions, Sociable, and Strong-Willed. Based on these lower-order traits that constitute the E superfactor in the ICID, a child scoring high on E is described as energetic (i.e., Activity Level), thoughtful of others (i.e., Considerate), curious and interested in new things (i.e., Openness), happy (i.e., Positive Emotions), gets along well with other children (i.e., Sociable), and likes to take charge (i.e., Strong-Willed). Thus, the majority of traits subsumed under E within the ICID load particularly heavily towards positive emotions. However, our children with VNs did not evidence this type and degree of positive emotionality. Instead, they were Strong-Willed and Antagonistic toward others (i.e., low A) and a propensity to experience negatively-valenced emotions (reflected in the elevated N and the Negative Emotions traits), rather than positively-valenced traits generally captured by the E dimension in the ICID. Therefore, the pattern of results with respect to the role of E in women with VNs (high E) as compared with children with VNs (low E), likely reflects differences in the degree to which children with VNs experience negative emotions. Although women with VNs generally displayed prosocial traits (reflecting high E and positive emotionality), the children with VNs displayed a combination of personality traits that reflected a less positive/prosocial personality typology (such as being Strong-willed, emotionally reactive,

Antagonistic, etc.) and greater negative emotionality (i.e., high N with a tendency toward angry outbursts etc.).

4.2 Personality Findings in Voice Disordered Controls (VDCs)

In the current study, VDC children's personality characteristics (somewhat surprisingly) shared common features with those of children with VNs. At a superfactor level, we found higher scores in Neuroticism (N) and lower scores on Agreeableness (A) and Conscientiousness (C) in both voice disordered groups compared with VNCs. A closer examination at the lower-order trait level indicated that both voice disordered groups shared relatively similar personality traits/profiles. In particular, the children with VNs and VDCs scored lower on Achievement Orientation (i.e., self-disciplined), Compliance (i.e., well-mannered and obedient to others), and Organized (i.e., keep things neat and tidy) trait than VNCs. These two groups also scored significantly higher on Antagonism (i.e., rude, disrespectful), Distractible (i.e., forgets things easily), Negative Emotions (i.e., irritable and angry), and Strong-Willed (i.e., likes to take charge) traits compared with VNCs. Thus, the results of the current study implicate a common set of personality traits between children with VNs and VDCs.

Based on our current results, both of our voice-disordered groups demonstrated emotional dysregulation and/or emotional reactivity (i.e., reflecting the high N personality superfactor). While both groups shared features of high N, it is worth noting that each group manifested N somewhat differently in the emotional reactivity of N. For instance, the VDC's personality profile was characterized by the inclusion of high scores on the "Shy" lower-order trait compared with children with VNs. The Shy trait describes a child's tendency to be slow to warm up to new people or situations and has difficulty adjusting to new situations or making new friends. In general, VDC's personality configuration fits with children's personality and behavioral patterns

characterized as introverts (e.g., a strong preference to be alone, low E) and elevated emotional reactivity (high N). So, by comparison to the children with VNs, the VDCs appeared to be operating toward the introversion end of the E dimension.

With the combination of elevated Shyness levels (i.e., low E) and high N (and with elevated levels of depression and anxiety), the current findings lend partial support for the possible existence of 'neurotic introvert' personality dispositions in VDC children relative to children with VNs. Interestingly, this combination of low E (shy and introverted) and high N (emotionally reactive with a propensity to experience anxiety or depression) is compatible with the description of women with "functional dysphonia" (who present with a voice disturbance in the absence of vocal fold lesions/pathology) within the Trait Theory of Voice Disorders. According to the Trait Theory, N's role was seen as a common personality trait (a common denominator) contributing to vocal nodules and functional dysphonia. Furthermore, the combination of low E and high N is said to contribute to affective disturbances, including anxiety and depression (Roy et al., 2000c). The finding that our VDC children share some of the personality traits of women with functional dysphonia is certainly an enticing finding worthy of further exploration.

4.3 Clinical Implications

VNs are the most common cause of dysphonia in children; therefore, clinicians who are on the front line of pediatric voice care routinely treat children with VNs using both indirect (i.e., vocal hygiene instructions) and direct (i.e., vocal exercises, retraining) treatment approaches (Hartnick et al., 2018). However, pediatric voice care clinicians are "often rendered helpless and frustrated" (Dohar, Shaffer, & White, 2019, p. 151) due to treatment failures and poor compliance with voice therapy. In the context of adults, Roy et al. (2000b) reported that voice

clinicians often experience frustration regarding "lack of patient compliance with therapy, especially suggestions aimed at limiting the type and extent of voice use" (Roy et al., 2000d, p. 765). Furthermore, individuals with VNs may follow a pattern of recurrence or relapse. According to Dohar et al. (2019), voice outcomes in children with VNs frequently remain unacceptable even after receiving extensive voice therapy. This lack of positive and/or sustained response to behavior therapy (whether direct or indirect) in children and adults may reflect, in part, a persistent dispositional diathesis. That is, the inclination to voice in a phonotraumatic manner may reflect specific personality traits, and given that such traits are relatively enduring/persistent in nature, children with VNs who possess such characteristics may be vulnerable to recurrence. Thus, it appears that personality and/or related psycho-behavioral characteristics need to be considered early in assessment as potentially contributing to the pathophysiology of VNs in children. Furthermore, voice therapy's success relies on the extent to which the child follows therapeutic guidance and practices vocal exercises outside the clinic. Given the many possible trait combinations in a child with VNs [e.g., emotionally reactive (i.e., high N), Antagonistic and Strong-Willed (i.e., low A), Disorganized and Distracted (i.e., low C) traits], it is evident that a child's compliance with clinical recommendations after a diagnosis of VNs may be challenging. The children with VNs who are less agreeable, not compliant, and less rule-abiding may have more barriers to treatment success and have difficulty adhering to treatment guidelines (e.g., vocal hygiene recommendations such as reducing vocal loudness) due to their personality features. Additionally, the children with VNs who are distracted and disorganized might experience further challenges due to their diminished ability to maintain concentration, control behavior carefully, and be organized during the treatment sessions. Such a combination of traits could be exacerbated by high N, reflecting a child's emotional reactivity

and representing another significant barrier to treatment adherence and success in children with VNs.

For the above-stated reasons, it seems critical for clinicians to identify and be sensitive to the presence and level of these unique personality dispositions in pediatric patients with VNs during assessment and treatment. For instance, as part of the initial assessment, speech-language pathologists could discuss with parents the frequency of their child's emotional outbursts (i.e., high N), oppositional (i.e., low A), distracted, and impulsive behaviors (i.e., low C), which are relatively easy to notice. Observing such behaviors that seem to appear irrespective of context and potentially within the clinician's presence does not require completing a comprehensive personality questionnaire by their caregivers. When frequent, such behaviors may represent a negative prognostic indicator and may likely reflect underlying personality dispositions. If a child rises to a level of being clinically anxious, aggressive, and impulsive, clinicians may or should refer these children for further psychological assessment and treatment with a clinical psychologist or psychiatrist before starting voice therapy.

4.4 Limitations and Suggestions for Future Research

In the preceding sections, we identified several topics worthy of further investigation. Clearly, multiple factors contribute to VN development. Therefore, additional research is needed before one can be confident in a cause-and-effect relationship between personality factors and the pathogenesis of VNs in children. Further longitudinal studies are required to determine the exact nature of the relationships among these phenomena. Therefore, investigations should be designed to examine personality's influence as a persistent diathesis and its effects on the persistence of voice problems in children in the long-term. Another limitation is the potential confound of reduced measurement variance due to parental report instrument used in this study.

In a future investigation, it might be wise to use various measurement methods (e.g., parental, self-, and teacher report instruments) within and across psychological constructs.

The current study highlights the relationship between personality and voice disorders in children and draws attention to the possible role of personality in voice disorder development. Thus, the findings are important for both clinical and research reasons. Although the current study used a well-validated instrument of personality in children, perhaps the inclusion of vocal dosimetry (and associated vocal dose parameters) in older children could have provided additional insights and strengthened this study. It would be interesting to explore whether personality differences are related to specific vocal dose parameters (e.g., cycle dose, distance dose, and total phonation time, etc.) and which personality traits predict or relate to the vocal dose in children by using ambulatory voice monitoring (Toles et al., 2021). Perhaps a combination of specific psycho-behavioral characteristics and dosimetry parameters could be used as markers to identify children who might be least responsive to voice therapy and/or at the highest risk of relapse. Furthermore, identifying additional acoustic markers/features in children with VNs may help link certain voice features (e.g., higher speaking fundamental frequency, higher mean loudness levels etc.) and specific personality traits in this population.

5. CONCLUSIONS

The current study is the most extensive study to investigate personality features of children with dysphonia, including VNs, by administering parental ratings of childhood personality based on the Five Factor model. Our research suggests that the children with VNs were more emotionally reactive (i.e., high N), Antagonistic, and Strong-Willed (i.e., low A), Disorganized and Distracted (i.e., low C) than VNCs. Additionally, the VDCs manifested personality characteristics compatible with a profile of elevated N and a high level of Shyness

compared to the children with VNs and vocally normal controls. Therefore, it is suggested that underlying personality dispositions require further attention in evaluating and treating children with voice disorders, irrespective of having mucosal lesions.

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Appendix

Inventory of Child Individual Differences Lower-Order Personality Trait Scale Summaries and Representative Items (Halverson et al., 2003)

Scale	Description	Representative Items
1. Achievement Orientation	Children who are persistent and focused on goal attainment, who follow tasks through to completion.	"Self-disciplined" "Has a drive to do better"
2. Activity Level	The level of energy output indicated by vigorous locomotion and being constantly on the move.	"Energetic" "Always busy doing something"
3. Antagonism	The amount of confrontational behavior indicated by being discourteous, rude, aggressive; directly expressing anger in interpersonal situations.	"Aggressive toward others" "Uncooperative"
4. Compliance	Indicates cooperative behavior in response to interpersonal authority.	"Well-mannered" "Obedient" "Dependable and trustworthy"
5. Considerate	Is actively concerned about what happens to others, readily helps and nurtures others.	"Caring" "Sensitive to other's feelings"
6. Distractible	Behavior that is described as showing poor concentration and being low on sustained directed attention.	"Who get bored easily" "Are easily distracted" "Gives up easily"
7.Fearful/Insecure	Children who are easily upset and tend to be apprehensive, distressed, and quick to panic.	"Child is insecure" "Lacks confidence" "Is afraid of a lot of things"
8. Intelligent	This scale measures children who are quick to understand what is said or is going on, who are intelligent and learning oriented.	"Has good thinking abilities" "Is eager to learn" "Is quick to learn"
9. Negative Emotions	Negative emotions experienced in interpersonal situations.	"Irritable" "Moody" "Get angry easily" "Quick tempered"
10. Openness	This is a scale that measures the tendency to explore, find out about things and ask a lot of questions.	"Has a lot of imagination" "Curious" "Interested in new things"
11. Organized	Describes children who are organized, orderly and tidy.	"Do things carefully and with thought" "A perfectionist"

12. Positive Emotions	Describes children who are sweet, loving, and who get along well with others.	"A joy to be with" "Happy" "Cheerful"
13. Shy	Scale describes children who are socially reticent and "slow to warm up to new people or new situations."	"Withdrawn" "Quiet" "Prefer to be alone"
14. Sociable	This scale describes children who like to be with other people, actively seek their company, and popular with people.	"Have a lot of friends" "Make friends easily"
15. Strong-Willed	These are bossy, self-assertive children, who "want things their own way."	"Like to take charge" "Manipulate to get their own way"