Situational factors influencing social anxiety in treatment-seeking adults who stutter: An exploratory factor analysis

Tomosumi Haitani ^{a*}, Naomi Sakai ^a, Koichi Mori ^b, Tomohito Houjou ^c

^a Department of Rehabilitation for Sensory Functions, Research Institute, National Rehabilitation Center for Persons with Disabilities (NRCD)

^b NRCD.

^c Hospital, NRCD.

**Corresponding author:* Tomosumi Haitani highj118@gmail.com

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Declaration of competing interest

The authors have no declarations of interest to report.

Abstract

Purpose: Adults who stutter (AWS) often show high levels of social anxiety. Stuttering is a speech disorder, making the latent factors influencing social anxiety potentially different from those in individuals with a social anxiety disorder (SAD) or general populations. This study aims to examine the situational factors influencing social anxiety in AWS.

Methods: We analyzed data of 351 AWS using the fear/anxiety scale in the Japanese self-report version of the Liebowitz Social Anxiety Scale (LSAS). We conducted exploratory factor analysis and investigated subscale scores.

Results: We extracted five factors: (i) eating, drinking, and party, (ii) telephone, (iii) observation or non-speech, (iv) interaction with strangers, and (v) public speaking. The factor for telephone was newly extracted, and anxiety in telephone situations was poorly explained by the total score of fear/anxiety of the LSAS. On the other hand, the other four factors are similar to those previously extracted in individuals with SAD and general populations, and more than 60% of the variance of the subscale constructs was explained by the total score. Preliminary comparisons revealed that AWS had saliently higher anxiety in telephone situations and lower anxiety in observation or non-speech situations than individuals with anxiety disorders and Japanese university students.

Conclusions: The factor for telephone was uniquely extracted in AWS, and the severity of anxiety in telephone situations was not explained well by the overall severity of social anxiety as a whole. Telephone situations have specific impacts on social anxiety in AWS.

39 **Keywords:** Stuttering, Social anxiety, Liebowitz Social Anxiety Scale, Factor analysis, Anxiety
40 disorder

41 **1. Introduction**

42 *1.1. Stuttering and social anxiety*

43 Adults who stutter (AWS) have often had aversive or stressful social experiences throughout
44 life, including negative listener's reactions associated with stereotypes (Healey, 2010), teasing and
45 bullying during school years (Blood & Blood, 2004, 2007, 2016; Blood et al., 2011), and difficulty to
46 get or continue a job (Klein & Hood, 2004). These stuttering-related negative experiences can cause
47 social and psychological challenges, including social anxiety, low self-esteem and dissatisfaction
48 with life, and/or depression (Blood & Blood, 2016; Iverach et al., 2010; Iverach & Rapee, 2014).

49 One of prevalent psychosocial difficulties is social anxiety or social anxiety disorder (SAD)
50 (Blumgart et al., 2010; Craig & Tran, 2014; Iverach et al., 2009; Menzies et al., 2008; Stein et al.,
51 1996). SAD is a mental disorder characterized by salient fear or anxiety concerning possible
52 exposure to observation (American Psychiatric Association, 2013). In general, AWS have higher
53 social anxiety than those who do not stutter (Craig & Tran, 2014) and the prevalence of SAD among
54 AWS ranges from 21.7% to 60% (Iverach et al., 2009; Menzies et al., 2008; Stein et al., 1996). Social
55 anxiety symptoms in individuals with SAD and less severe social anxiety symptoms in general
56 population are quantitatively continuous on a single dimension (Ruscio, 2010). This suggests that
57 investigations on social anxiety symptoms, regardless of the diagnosis of SAD, have practical value.

58 Stuttering is a speech disorder; some specific speech-related situational factors can influence
59 social anxiety among AWS (Blood et al., 2001; Diehl et al., 2018; Ezrati-Vinacour & Levin, 2004;

60 Messenger et al., 2004; Vanryckeghem et al., 2017). In some situations, such as talking on the phone,
61 interacting with strangers, and interpersonal conversations, people who stutter can report higher
62 anxiety levels than those who do not (Blood et al., 2001; Diehl et al., 2018; Vanryckeghem et al.,
63 2017). In other situations, such as public speaking and non-speech or non-evaluative situations,
64 people who stutter have a similar anxiety level to those who do not (Blood et al., 2001; Diehl et al.,
65 2018; Ezrati-Vinacour & Levin, 2004; Messenger et al., 2004). Therefore, the present study focuses
66 on situational factors influencing social anxiety.

67 *1.2. Situational factors influencing social anxiety*

68 Social anxiety can be assessed through several scales, including the Social Phobia and
69 Anxiety Inventory (Turner et al., 1989), the Social Phobia Scale and the Social Interaction Anxiety
70 Scale (Mattick & Clarke, 1998), and the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987).
71 These are frequently used scales for measuring social anxiety symptoms in general (Wong et al.,
72 2016). The LSAS comprises two scales, namely, fear/anxiety and avoidance scales. As the LSAS
73 assesses degrees of both fear/anxiety and avoidance in each of 24 social situations, it can reveal
74 situational factors influencing social anxiety. The above-mentioned scales, other than the LSAS, can
75 reflect not only situational factors, but also cognitive, behavioral, and physiological factors related to
76 social anxiety. However, since the study focuses on situational factors, we used the LSAS.

77 The 24 situations in the LSAS include 13 performance (e.g., “telephoning in public”) and 11
78 social interaction (e.g., “talking to people in authority”) situations, assumed to comprise subscales

79 (Liebowitz, 1987). The LSAS has been used to assess social anxiety in clinical and non-clinical
80 samples, including AWS, in observational studies (e.g., Chu et al., 2020; Fresco et al., 2001) and
81 intervention studies or clinical trials (e.g., McAllister et al., 2017; Stein et al., 2004). The LSAS has
82 good psychometric properties, including high internal consistency, test-retest reliability, and
83 concurrent validity in both clinical samples of SAD and non-clinical samples (Asakura et al., 2002;
84 Fresco et al., 2001). Asakura et al. (2002) provide the scores of the LSAS in Japanese individuals
85 with mild, moderate, and severe SAD. The LSAS has also been used to assess social anxiety
86 symptoms concurrent with other neurodevelopmental disorders, including autism spectrum disorder
87 (Bejerot et al., 2014) and attention-deficit hyperactivity disorder (Adler et al., 2009).

88 Psychometric scales aim to measure psychological *latent construct* or *factor* through
89 *observed* item scores. For example, the fear/anxiety scale of the LSAS aims to measure one
90 construct, namely, general social anxiety. A psychometric scale could also measure some
91 multidimensional constructs if the scale consists of meaningful *subscales* (Reise et al., 2013).
92 Subscales reflect latent *factor structure* of a scale, which is defined as correlations of items with a set
93 of latent factors (Gorsuch, 1983). In other words, factor structure represents correlational
94 characteristics of items. In the LSAS, performance and social interaction factors were originally
95 assumed (Liebowitz, 1987). Factor structure can be specified through factor analyses, including
96 confirmatory factor analysis (CFA) and exploratory factor analysis (EFA) (Thompson, 2004).

97 Factor structure originally proposed by Liebowitz (1987), where performance and social

98 interactions factors are assumed, has not been supported well through the CFAs (Oakman et al.,
99 2003; Safren et al., 1999). Previous studies have extracted multiple factors, not necessarily matching
100 originally proposed performance and social interaction factors, from the items included in the LSAS
101 in individuals with SAD through the EFAs (Baker et al., 2002; Safren et al., 1999; Stein et al., 2004).
102 Safren et al. (1999) extracted four factors in each scale, namely, *social interaction* (e.g., “talking with
103 people you don’t know very well”), *public speaking* (e.g., “acting or performance in front of an
104 audience”), *observation fear* (e.g., “working while being observed”), and *eating and drinking in*
105 *public* (e.g., “eating in public places”). This factor structure has been moderately or strongly
106 supported in individuals with anxiety disorders, including SAD (Baker et al., 2002; Beard et al.,
107 2011; Caballo et al., 2019; Oakman et al., 2003), and general populations (Caballo et al., 2019;
108 Heeren et al., 2012; Sugawara et al., 2012) through the CFAs.

109 These factors seem to correspond to speech-related and potentially speech-irrelevant factors;
110 while items loading on the observation fear and eating and drinking in public factors do not
111 necessarily represent speaking situations, those on the social interaction and public speaking factors
112 usually represent speaking situations. However, some items representing non-speaking situations
113 loaded on the social interaction factor (“looking at people you do not know very well” and “entering
114 a room when others are already seated”) and an item representing a speaking situation (“telephoning
115 in public”) loaded on the observation fear factor. Therefore, factor structure of the LSAS would be
116 different between AWS and individuals with SAD and general populations, if speech-related and

117 speech-irrelevant anxiety were separated in AWS.

118 *1.3. Purpose*

119 Even though previous studies have investigated quantitative differences of social anxiety in
120 various situations between AWS and those who do not stutter, as described above, their qualitative
121 (correlational) characteristics have been poorly investigated in AWS. Furthermore, although previous
122 studies have reported only total or prespecified subscale (performance and social interaction) scores
123 of the LSAS without considering the qualitative separation of speech-related and speech-irrelevant
124 situations (Chu et al., 2020; McAllister et al., 2017), empirical investigations would reveal a more
125 appropriate factor structure or subscales. We aim to explore factor structure of the LSAS, assuming
126 the separation of speech-related and speech-irrelevant anxiety, and reveal situational factors
127 influencing social anxiety. It can provide clinical insights on assessments as well as qualitative
128 aspects of social anxiety in AWS.

129 Based on the obtained factor structure, we also aimed to investigate quantitative
130 characteristics of social anxiety in AWS. It is possible that speech-related anxiety is higher than
131 speech-irrelevant anxiety in AWS (Messenger et al., 2004) and their speech-related anxiety is
132 comparable to that in socially anxious clinical samples (Kraaimaat et al., 2002).

133 **2. Methods**

134 *2.1. Participants*

135 The sample included 351 Japanese adults who sought treatment for stuttering at the Hospital

of [confidential for review] in Japan. They visited the hospital for the first time between August 2011 and December 2017. We analyzed the data retrospectively. Eligibility criteria were (a) aged 18 years and above and (b) diagnosed with stuttering by a medical team, including a doctor (the third author) and speech therapists (the second and fourth authors and two other therapists). Throughout the data collection period, at least one of them had more than five years of clinical experiences in stuttering. All participants who visited the hospital were assessed, representing the population of treatment-seeking AWS. Participants' overall mean age was 29.32 years ($SD = 9.27$). Table 1 presents summary of demographic information.

2.2. Measure

Social anxiety was measured using the Japanese self-report version of the LSAS (Asakura et al., 2002), which was adapted by Chu et al. (2020). The fear/anxiety scale was used in the present study, consistent with previous studies exploring factor structure of the LSAS (e.g., Baker et al., 2002). Participants rated the degrees of fear/anxiety over the last one week for 24 social situations using a four-point Likert-type scale where 0 (*none*), 1 (*mild*), 2 (*moderate*), and 3 (*severe*). The items of the LSAS are listed in Appendix A. It was administered at the first visit as part of the screening questionnaires. Asakura et al. (2002) showed that the fear/anxiety total scores of the self-report version of the LSAS in Japanese individuals with mild, moderate, and severe SAD were 33.0, 46.1, and 52.6, respectively.

2.3. Data analyses

We used R 4.0.0 and *Mplus* (Muthén & Muthén, 1998-2017) in the analyses. First, we examined how missing data occurred to treat the missing data. Second, we conducted EFA and constructed the subscales of the LSAS. Third, subscale scores of the LSAS were compared within AWS and preliminarily compared with scores of individuals with anxiety disorders, including SAD, and Japanese university students. We calculated adjusted standardized mean difference (Hedges' g) in investigating within-group differences.

2.3.1. Treatments of missing data

The number of missing data in the fear/anxiety scale was 48 (0.57%). The number of respondents with missing values in the fear/anxiety scale was 19 (5.41%). The missing data of the items per respondent ranged from 1 to 18; most of these respondents (17/19) missed three items or less. The scores of the items in the fear/anxiety scale tended to be higher for those with missing values than those without missing values ($-.08 \leq g_s \leq .56$, Mean of $g_s = 0.18$). We tentatively adopted the missing at random (MAR) assumption, usually adopted in observational studies, where missingness is assumed to be explained by observed variables in a dataset (Enders, 2010). When calculating scale scores, item-level missingness was treated by available-item analysis (Parent, 2013). We used full information maximum likelihood estimation to deal with scale-level missingness (Muthén & Muthén, 1998-2017; Revelle, 2018).

2.3.2. Exploratory factor analysis

We used *Mplus* (Muthén & Muthén, 1998-2017) and *MplusAutomation* library (Hallquist &

174 Wiley, 2018) in conducting EFA.

175 EFA consists of several procedures, including determining the number of factors, estimating
176 factor structure, calculating factor scores, and investigating factor score indeterminacies. Exploring
177 the internal factor structure in the psychiatric scale requires at least 300 participants (Rouquette &
178 Falissard, 2011); therefore, the present sample size was sufficient.

179 2.3.2.1 *Determining the number of factors*

180 We conducted statistical parallel analysis (see details in Horn, 1965) following Garrido et al.
181 (2013). Both statistical criteria, namely, parallel analysis, and conceptual or theoretical fit were
182 considered in determining the number of factors (Garrido et al., 2016).

183 2.3.2.2. *Estimating factor structure*

184 We estimated the *pattern coefficients* and their 95% confidence intervals (CIs) and inter-factor
185 correlations with the robust diagonally weighted least squares estimator (WLSMV in *Mplus*), which
186 is suitable to treat ordinal data, and oblimin rotation. Pattern coefficients are weights of the observed
187 variables (items) to obtain scores of latent factors (*factor scores*).

188 2.3.2.3. *Calculating factor scores*

189 Factor scores can be calculated through several methods, including those using weights of
190 the items (Grice, 2001). The unit-weighted factor score estimates, calculated by summing (and
191 averaging) the raw scores of the salient items within the factor pattern coefficient matrix, are simple
192 and effective (Grice, 2001). In this study, factor scores were calculated considering pattern

193 coefficients and their CIs, as described in the Results section.

194 2.3.2.4. *Investigating factor score indeterminacies*

195 Factor scores can be calculated through various methods or arbitrary cutoff criteria and are
196 mathematically *indeterminate* (Grice, 2001). Thus, we assessed whether factor score estimates
197 represented corresponding factors appropriately (Grice, 2001). *Validity coefficients*, which are
198 correlations between factor score estimates and the corresponding factors, need to be greater than .80
199 (Gorsuch, 1983, p. 260) or .90 (Grice, 2001) to substitute factor score estimates for their
200 corresponding factors. We calculated the validity coefficients of factor score estimates. We also
201 examined consistency between inter-factor correlations and correlations of factor score estimates
202 (Grice, 2001).

203 2.3.3. *Investigations on the subscale scores*

204 In a classical test theory, which is one of the fundamental theories of psychometrics,
205 *observed* scale score consists of uncorrelated *true* and *error scores*, which cannot be directly
206 observed (see details in Lord et al., 1968). True score represents actual degrees of the attribute
207 measured individuals have, a focus of psychometric measure. *Reliability* represents proportion of
208 variance of true score in observed scale score and ranges from 0 to 1 (Lord et al., 1968), and is often
209 estimated through Cronbach's alpha (Cronbach, 1951; but also see Sijtsma, 2009). Measures with
210 higher reliability (less error) assess psychological attributes more precisely and reliability increases
211 when scales include more items (Cronbach, 1951). Longer total scale score usually has higher

212 reliability than subscale scores; therefore, observed total scale score may be a better indicator of a
 213 subscale construct (true score) than observed subscale scores (Haberman, 2008; Reise et al., 2013).
 214 In such a case, observed subscale score has limited utility (Reise et al., 2013).

215 *2.3.3.1. Examining psychometric worth of subscales*

216 Reise et al. (2013) recommend that the *proportional reduction in mean square error*
 217 (*PRMSE*) for true subscale scores should be examined to use observed subscale scores of
 218 psychometric scales, based on the method proposed in Haberman (2008). *PRMSE* corresponds to
 219 proportion of explained variance or coefficient of determination, ranging from 0 to 1. *PRMSE* for
 220 true subscale scores based on observed subscale score (proportion of variance explained for true
 221 subscale score by observed subscale score) is represented by $PRMSE_{sub}$, which equates to reliability
 222 of the subscale score, as described above. *PRMSE* for true subscale scores based on observed total
 223 score (proportion of variance explained for true subscale score by observed total score) is represented
 224 as $PRMSE_{tot}$, which can be calculated through reliability and *SD* or variance of total and subscale
 225 scores and intercorrelation of the subscale scores (Haberman, 2008). When $PRMSE_{sub}$ is larger than
 226 $PRMSE_{tot}$, observed subscale score can explain true subscale score better than the observed total
 227 score. As a result, the observed subscale score has added value beyond observed total score. We
 228 calculated $PRMSE_{sub}$ and $PRMSE_{tot}$ for each subscale score.

229 *2.3.3.2. Comparisons of subscale scores*

230 First, we compared subscale scores within AWS. Adjusted standardized mean differences

231 (Hedges' g) and their CIs were calculated based on the means and SD s and pairwise paired t -tests
232 were conducted with Holm's correction. We also investigated the gender differences of the subscale
233 scores using Welch's t -tests with Holm's correction. All the available data was analyzed. Finally, a
234 preliminary comparison was made between the subscale scores of AWS and that of individuals with
235 anxiety disorders (Oakman et al., 2003) and Japanese university students (Okajima, et al., 2007).¹

236 2.4. Ethics

237 This research was approved by the institutional review board of [confidential for review].
238 The opt-out procedure was conducted in December 2018 on the website and at [confidential for
239 review].

240 3. Results

241 The raw data of this study, excluding demographic information, are available at Mendeley
242 Data (Authors, 2021). Demographic information was not disclosed to maintain confidentiality of the
243 participants.

244 3.1. Descriptive statistics and the internal consistencies of the measure

¹ Dr. J. Oakman and Dr. I. Okajima kindly provided the first author (T. Haitani) the data of the means and SD s of the items. The data provided by Dr. Oakman included missing data; means and SD s were calculated using listwise deletion (N was 188, and valid data ranged from 175 to 188). We defined the subscale scores as the means of the items included in the corresponding subscales. We also calculated the LSAS fear/anxiety total score of the sample in Oakman et al. (2003) by the same procedure. The data provided by Dr. Okajima did not include any missing data (N was 914). These comparisons were preliminary because measurement invariance between the samples was not examined.

245 The mean of the fear/anxiety scale was 30.45 ($SD = 14.75$). The fear/anxiety score tended to
246 be higher in women ($M = 33.31$, $SD = 14.41$) than men ($M = 29.85$, $SD = 14.77$) with small effect size
247 ($g = 0.23 [-0.04, 0.51]$). The Cronbach's alpha of the fear/anxiety scales was .93 (95% CI [.93, .94]).
248 Age weakly and negatively correlated with the fear/anxiety score ($r = -.08$, 95% CI [-.18, .02]).
249 Skewness of the items included in the scale ranged from -0.91 (item 1, $N = 351$) to 3.17 (item 13, $N =$
250 350) based on all the observed data.

251 3.2. *Exploratory factor analysis*

252 3.2.1. *Determining the number of factors*

253 The parallel analysis revealed a preference for the four-factors solution. However, in this
254 solution, the two items of telephone (items 1 and 10) and those of interacting with strangers (items 11
255 and 12) were explained by the same factor. However, it is reasonable for these two pairs to be
256 explained by different factors, suggested by supplementary CFAs². We considered the five-factors
257 solution separating those two pairs of items to be conceptually preferable and adopted it.

258 3.2.2. *Exploring factor structure*

259 The pattern coefficients matrix is shown in the upper part of Table 3. The extracted factors
260 were interpreted as *eating, drinking, and party* (Factor 1), *telephone* (Factor 2), *observation or non-*
261 *speech* (Factor 3), *interaction with strangers* (Factor 4), and *public speaking* (Factor 5). The upper
262 part of Table 3 shows the pattern coefficients, their 95% CIs, and the communalities of the items.

² Detailed results of the CFAs are available on request to author.

263 While potentially speech-irrelevant items mainly loaded on Factors 1 and 3, potentially speech-
264 related items loaded on Factors 2, 4, and 5.

265 The inter-factor correlations are shown in the lower triangular part in Table 3. Factor 1 and 3
266 were moderately correlated with Factor 2, 4, and 5 ($.27 \leq rs \leq .47$).

267 3.2.3. Calculating factor scores

268 We assumed that the LSAS included subscales comprising items (1) whose lower limits of
269 the 95% CIs of the pattern coefficients for a factor were greater than 0.32 (Comrey and Lee, 1992;
270 Tabachnick & Fidell, 2013, p. 654) and (2) point estimates of the pattern coefficients for a factor
271 were greater than those for the other factors by 0.15 or more. These two conditions were employed to
272 avoid (1) misinterpretation caused by sampling fluctuation and (2) including the items loading on
273 more than two factors. The calculated factor score estimates were used in subsequent analyses.

274 3.2.4. Investigating factor score indeterminacies

275 The correlation matrix between the factor score estimates are shown in the lower upper
276 triangular part of Table 2, showing results consistent with inter-factor correlations. The validity
277 coefficients of the factor score estimates of Factor 1 to 5 were .95, .93, .91, .94, and .84. They were
278 higher than .80, the value recommended by Gorsuch (1983, p. 260). We assumed that the items
279 saliently loading on Factor 1, 2, 3, 4, and 5 comprised subscales 1, 2, 3, 4, and 5, respectively. We used
280 the subscales in the subsequent analyses.

281 3.3. Investigations of the subscale scores

282 The means, *SDs*, Cronbach's alphas ($PRMSE_{sub}$), and $PRMSE_{tot}$ of the subscales are shown
283 on the left side of Table 3. Skewness and kurtosis of were 1.06 and 0.59 (subscale 1), -0.67 and -0.54
284 (subscale 2), 0.97 and 0.17 (subscale 3), -0.01 and -0.95 (subscale 4), and -0.30 and -0.75 (subscale
285 5)³.

286 3.3.1. Examining psychometric worth of subscales

287 Comparisons of $PRMSE_{sub}$ and $PRMSE_{tot}$ suggest that all the subscale scores, except for public
288 speaking scale score, have added values beyond the fear/anxiety total score. In particular, only 38% of
289 the variance in anxiety in telephone situations was explained by the fear/anxiety total score. We
290 reported all the subscale scores for the comparisons.

291 3.3.2. Comparisons of subscale scores

292 Pairwise comparisons within AWS revealed that the score of subscale 2 was highest among
293 the five subscale scores ($0.44 \leq gs \leq 1.85, ps < .001$). The scores of subscales 5 and 4 were the
294 second and third highest, respectively (subscale 5 vs the remaining three subscale scores: $0.18 \leq gs \leq$
295 $1.40, ps < .001$; subscale 4 vs remaining two subscale scores: $0.99 \leq gs \leq 1.12, ps < .001$). The scores
296 of subscales 1 and 3 were nearly equivalent ($g = 0.10$, 95% CI [-0.05, 0.25], $p = .06$). Investigation of
297 the gender differences revealed that the score of subscale 5 was higher in women with a small effect
298 size ($g = 0.35$, 95% CI [0.06, 0.66], $p = .01$), while the other subscale scores were not statistically
299 significantly different ($gs \leq 0.22, ps \geq .12$).

³ We reported skewness and kurtosis through the available subscale scores.

300 Finally, we preliminarily compared the subscale scores in AWS with those in individuals
301 with anxiety disorders, including SAD (Oakman et al., 2003), and Japanese university students
302 (Okajima et al., 2007), as shown in the right side of Table 3. The score of subscale 2 was about one
303 point higher in AWS than in both samples. On the other hand, the score of subscale 3 tended to be
304 lower in AWS than in both samples⁴.

305 **4. Discussion**

306 *4.1. Summary of findings*

307 This study aimed to explore appropriate factor structure of the LSAS in AWS through the
308 EFA, assuming the separation of speech-related and speech-irrelevant anxiety. The five situational
309 factors for social anxiety, including (i) eating, drinking, and party, (ii) telephone, (iii) observation or
310 non-speech, (iv) interaction with strangers, and (v) public speaking, were extracted through EFA in
311 AWS. Whereas the telephone factor was newly extracted in AWS, factors similar to the other four
312 have been extracted in individuals with SAD and general populations (e.g., Caballo et al., 2019).
313 Potentially speech-irrelevant items loaded on (i) eating, drinking, and party and (iii) observation or
314 non-speech factors; and speech-related items loaded on (ii) telephone, (iv) interaction with strangers,
315 and (v) public speaking factors. It was also found that speech-related and potentially speech-
316 irrelevant factors were moderately correlated with each other, consistent with individuals with SAD

⁴ Test anxiety can be prevalent among university students. When item 17 (“taking a test”) was excluded from the comparison, the score of subscale 3 was 0.06 points lower in AWS.

317 and the general population (Caballo et al., 2019). Investigations of the subscale scores based on EFA
318 revealed that anxiety in telephone situations was particularly poorly explained by the fear/anxiety
319 total score.

320 We expected speech-related and speech-irrelevant anxiety to be clearly separated in AWS.
321 However, this was not supported, except when considering anxiety in telephone situations. The
322 present study provides clinical insights of qualitative aspects and assessments of social anxiety in
323 AWS.

324 The present study also aimed to investigate quantitative characteristics of social anxiety in
325 AWS, based on an obtained factor structure. It was expected that AWS would have high speech-
326 related anxiety, comparable to that in a clinical sample. It was found that AWS are characterized by
327 lower anxiety in observation or non-speech situations and higher in telephone situations, compared to
328 individuals with anxiety disorders, including SAD (Oakman et al., 2003).

329 *4.2. Extracted factors*

330 *4.2.1. Telephone*

331 Although the two items of telephone loaded on the same factor in AWS, these two items
332 loaded on different factors or components in individuals with anxiety disorders, including SAD (Baker
333 et al., 2002; Oakman et al., 2003; Safren et al., 1999; Stein et al., 2004). In other words, while the
334 common factor of telephone in these two items significantly impacted AWS, it did not have any
335 significant impact on individuals with SAD. $PRMSE_t$ for the telephone subscale was .38 and the lowest

336 among the five subscales. It indicates that the fear/anxiety total score of the LSAS explained only 38%
337 of the variance in anxiety in telephone situations, distinguishable from the overall severity of social
338 anxiety. Anxiety in telephone situations likely leads to the multidimensionality of social anxiety in
339 AWS.

340 The telephone subscale score was highest among the five subscales in AWS. A higher
341 anxiety score in telephone situations is consistent with the findings or statements of previous studies
342 (Diehl et al., 2018; James et al., 2009; James et al., 1999; Leith & Timmons, 1983; Menzies et al.,
343 2009; Vanryckeghem et al., 2017). Results of the preliminary comparisons between AWS and
344 individuals with anxiety disorders (Oakman et al., 2003) and Japanese university students (Okajima
345 et al., 2007) revealed that AWS showed higher anxiety in telephone situations (mean telephone
346 subscale score), despite the mean of the fear/anxiety total score in the LSAS being higher among
347 individuals with anxiety disorders. This finding may suggest that treatment-seeking AWS, as a
348 whole, show clinically elevated social anxiety symptoms in telephone situations.

349 James et al. (1999) surveyed 223 AWS, using a questionnaire enquiring about the use of and
350 attitudes towards the telephone. In this study, AWS reported many reasons for the telephone being
351 more difficult than ‘face-to-face’ communication, including the inability to use nonverbal
352 communication, lack of visual feedback, and less understanding of the stuttering problem. It might be
353 possible that while an adult who stutters blocks words, such as “hello,” at the beginning of a phone
354 conversation (see Trotter & Lesch, 1967), the person on the other end of the line may not understand

355 what is happening because of the silence. The person who receives the call may think it is a prank or
356 a result of machine trouble (see also Klompas & Ross, 2004) and may disconnect the call, causing
357 AWS to feel hurt and develop anxiety and fear of speaking on the telephone (see also Menzies et al.,
358 2009 for implications of treatments).

359 4.2.2. *Observation or non-speech and eating, drinking, and party*

360 Anxiety in (iii) observation or non-speech situations, and (i) eating, drinking, and party
361 situations were lower within AWS. Relatively lower anxiety in these situations in AWS can be
362 consistent with individuals with SAD and general populations (Crome & Baillie, 2014; Eng et al.,
363 2000; Ruscio et al., 2008). Moreover, the items comprising the factor for observation or non-speech
364 and that for eating, drinking, and party generally overlapped those comprising the factor for
365 observation fear and eating and drinking in public as extracted from the work of Safren et al. (1999).

366 The fact that $PRMSE_t$ in subscales 3 (iii. observation or non-speech situations) (.66) and 1(i.
367 eating, drinking, and party situations) (.62) were moderate indicates that anxiety in these situations
368 could be explained well by the fear/anxiety total score. Preliminary comparisons with individuals
369 with anxiety disorders and Japanese university students revealed that anxiety in observation or non-
370 speech situations tended to be lower among AWS, although the fear/anxiety total score was lower in
371 Japanese university students. It might be possible that anxiety in observation or non-speech situations
372 is not qualitatively different from that of individuals with anxiety disorders and general populations
373 but quantitatively lower in AWS.

374 4.2.3. *Interaction with strangers*

375 The two items of interacting with strangers loaded on the same factor in AWS. In individuals
376 with SAD, a factor comprising these two items was also extracted (Stein et al., 2004). These items
377 loaded on the factor or component for social interaction with the highest and second-highest loadings
378 (Baker et al., 2002; Safren et al., 1999). As a result, it may not be possible for this factor to be unique
379 in AWS.

380 However, anxiety in interacting with strangers was moderately high in AWS, consistent with
381 the finding in a previous study (Diehl et al., 2018). People could have public stigmas or stereotypes
382 of stuttering (St. Louis, 2015), possibly internalized among AWS (Boyle, 2018). They might lead to
383 expectations of negative reactions or evaluations when interacting with strangers, leading to higher
384 social anxiety.

385 4.2.4. *Public speaking*

386 In accordance with previous studies on individuals with anxiety disorders, including SAD
387 and general populations (Baker et al., 2002; Caballo et al., 2019; Safren et al., 1999; Stein et al.,
388 2004), the factor for public speaking was also extracted in AWS. Although the items comprising the
389 factor for public speaking were slightly different from those in previous studies (Baker et al., 2002;
390 Safren et al., 1999), the point estimates of the pattern coefficients of items 2, 6, and 15, which
391 composed the factor for public speaking in Safren et al. (1999), were greater than 0.32 in the present
392 study. This can mean that public speaking anxiety in AWS largely overlaps with that in individuals

with SAD and general populations.

Moreover, the score of subscale 5 (public speaking) was the second highest among the five subscales in AWS. Higher $PRMSE_{tot}$ in the subscale suggests that public speaking anxiety is explained well by general social anxiety. The situations with high social threat, in which stuttering is observed by a potentially large number of people, may have caused a high level of anxiety in AWS. However, it has been reported that public speaking anxiety is pervasive not only among AWS but also among individuals with SAD and general populations (Diehl et al., 2018; Furmark et al., 1999; Furmark et al., 2000). It is possible that public speaking is accompanied by significant social threats in general (Crome & Baillie, 2014). Higher public speaking anxiety among women who stutter was also consistent with the tendency of individuals with SAD and the general population (Caballo et al., 2014). Some factors common to these populations, including high social threat not necessarily related to speech and gender, might lead to higher public speaking anxiety among AWS.

In summary, the factor for telephone was extracted uniquely in AWS, which was not present among individuals with SAD and general populations. Relatively smaller $PRMSE_t$ in subscale 2 suggests that a bi-dimensional model, including general social anxiety and anxiety in telephone situations, may be more parsimonious.

4.3. Clinical implications

First, the present findings suggest the need to assess the severity of anxiety in telephone situations separately from the overall severity of social anxiety in AWS. Unidimensional model of

412 social anxiety can overlook specific social anxiety, as suggested in Caballo et al. (2012). In
413 particular, anxiety specific to telephone situations should be considered in AWS. The present results
414 suggest that anxiety in telephone situations should be treated independently of general social anxiety.

415 Second, the LSAS fear/anxiety total score explained more than 60% of variance of both
416 speech-related and potentially speech-irrelevant anxiety, excluding anxiety in telephone situations. It
417 means that both speech-related and potentially speech-irrelevant anxiety are related to common
418 factors among AWS, despite potential between-group differences of anxiety in observation or non-
419 speech situations. Previous studies have suggested that some factors, including fear of evaluation and
420 self-focused attention, may maintain social anxiety (e.g., Iverach et al., 2017). It is possible that
421 while unique factor contributes to anxiety in telephone situations to a larger extent, common factor
422 may largely contribute to anxiety in the other social situations, consistent with individuals with SAD
423 (Ruscio et al., 2008) and the general population (Crome & Baillie, 2014). It is possible that general
424 treatments, such as cognitive behavioral therapy, for social anxiety (Mayo-Wilson et al., 2014;
425 Menzies et al., 2009) are effective and efficient for ameliorating both speech-related and potentially
426 speech-irrelevant anxiety.

427 *4.4. Limitations and future directions*

428 Many studies have investigated social anxiety in the Western culture, including the
429 American and European cultures (e.g., Caballo et al., 2019; Oakman et al., 2003; Safren et al., 1999).
430 The Japanese culture might partly influence the factor structure of the LSAS. In the present study,

431 items 7 and 23 on party loaded factors differed from previous studies in Western contexts (e.g.,
432 Safren et al., 1999). This result may reflect the fact that Japanese people perceive the “party
433 situation” differently from those in Western cultures; home parties do not seem to be common in
434 Japan. Party situations seemed to influence social anxiety in the Japanese culture differently from
435 that in Western cultures (Moriyasu & Olkin, 2019).

436 However, because of the reported high anxiety in telephone situations among AWS in
437 several previous studies conducted in the Western cultural context (Diehl et al., 2018; James et al.,
438 2009; James et al., 1999; Vanryckeghem et al., 2017), the factor of telephone situation might be
439 uniquely extracted in the LSAS among AWS regardless of culture. Reliance on speech in telephone is
440 apparent across cultures. Future studies should investigate whether the findings in the present study
441 could be replicated across different cultures and countries.

442 **5. Conclusions**

443 In the present study, the EFA revealed that the factor for telephone was newly extracted,
444 which has not been seen in individuals with SAD and general populations. It was also found that
445 while the fear/anxiety total score poorly explained anxiety in telephone situations, it explained more
446 than 60% of the variance of anxiety in the other types of situations, including both speech-related
447 (interaction with strangers and public speaking) and potentially speech-irrelevant (eating, drinking,
448 and party and observation or non-speech) situations. Preliminary comparisons with individuals with
449 anxiety disorders and Japanese university students suggest that anxiety in AWS was saliently higher

450 in telephone situations but tended to be lower in observation or non-speech situations. In assessing
451 social anxiety in AWS, it is necessary to consider not only the fear/anxiety total score of the LSAS,
452 but also the subscale scores, especially for telephone situations.

453

References

- Adler, L. A., Liebowitz, M., Kronenberger, W., Qiao, M., Rubin, R., Hollandbeck, M., Deldar, A., Schuh, K., & Durell, T. (2009). Atomoxetine treatment in adults with attention-deficit/hyperactivity disorder and comorbid social anxiety disorder. *Depression and Anxiety*, 26(3), 212-221. <https://doi.org/10.1002/da.20549>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). <https://doi.org/10.1176/appi.books.9780890425596>
- Asakura, S., Inoue, S., Sasaki, F., Sasaki, Y., Kitagawa, N., Inoue, T., Denda, K., Ito, M., Matsubara, R., & Koyama, T. (2002). Liebowitz Social Anxiety Scale nihongo ban no shinraisei oyobi datousei no kentou [Reliability and validity of the Japanese version of the Liebowitz Social Anxiety Scale]. *Japan Journal of Clinical Psychiatry*, 44(10), 1077-1084.
- Baker, S. L., Heinrichs, N., Kim, H. J., & Hofmann, S. G. (2002). The Liebowitz social anxiety scale as a self-report instrument: A preliminary psychometric analysis. *Behaviour Research and Therapy*, 40(6), 701-715. [https://doi.org/10.1016/S0005-7967\(01\)00060-2](https://doi.org/10.1016/S0005-7967(01)00060-2)
- Beard, C., Rodriguez, B. F., Moitra, E., Sibrava, N. J., Bjornsson, A., Weisberg, R. B., & Keller, M. B. (2011). Psychometric properties of the Liebowitz Social Anxiety Scale (LSAS) in a longitudinal study of African Americans with anxiety disorders. *Journal of Anxiety Disorders*, 25(5), 722-726. <https://doi.org/10.1016/j.janxdis.2011.03.009>
- Bejerot, S., Eriksson, J. M., & Mörtberg, E. (2014). Social anxiety in adult autism spectrum disorder.

473 *Psychiatry Research*, 220(1), 705-707. <https://doi.org/10.1016/j.psychres.2014.08.030>

474 Blood, G. W., & Blood, I. M. (2004). Bullying in adolescents who stutter: Communicative competence
 475 and self-esteem. *Contemporary Issues in Communication Science and Disorders*, 31(31), 69-
 476 79. https://doi.org/10.1044/cicsd_31_s_69

477 Blood, G. W., & Blood, I. M. (2007). Preliminary study of self-reported experience of physical
 478 aggression and bullying of boys who stutter: Relation to increased anxiety. *Perceptual and*
 479 *Motor Skills*, 104(3 Pt 2), 1060-1066. <https://doi.org/10.2466/pms.104.4.1060-1066>

480 Blood, G. W., & Blood, I. M. (2016). Long-term consequences of childhood bullying in adults who
 481 stutter: Social anxiety, fear of negative evaluation, self-esteem, and satisfaction with life.
 482 *Journal of Fluency Disorders*, 50, 72-84. <https://doi.org/10.1016/j.jfludis.2016.10.002>

483 Blood, G. W., Blood, I. M., Tellis, G., & Gabel, R. (2001). Communication apprehension and self-
 484 perceived communication competence in adolescents who stutter. *Journal of Fluency Disorders*,
 485 26(3), 161-178. [https://doi.org/10.1016/S0094-730X\(01\)00097-3](https://doi.org/10.1016/S0094-730X(01)00097-3)

486 Blood, G. W., Blood, I. M., Tramontana, G. M., Sylvia, A. J., Boyle, M. P., & Motzko, G. R. (2011).
 487 Self-reported experience of bullying of students who stutter: Relations with life satisfaction,
 488 life orientation, and self-esteem. *Perceptual and Motor Skills*, 113(2), 353-364.
 489 <https://doi.org/10.2466/07.10.15.17.pms.113.5.353-364>

490 Blumgart, E., Tran, Y., & Craig, A. (2010). Social anxiety disorder in adults who stutter. *Depression*
 491 *and Anxiety*, 27(7), 687-692. <https://doi.org/10.1002/da.20657>

- 492 Boyle, M. P. (2018). Enacted stigma and felt stigma experienced by adults who stutter. *Journal of*
 493 *Communication Disorders*, 73, 50-61. <https://doi.org/10.1016/j.jcomdis.2018.03.004>
- 494 Caballo, V. E., Salazar, I. C., Arias, V., Hofmann, S. G., & Curtiss, J. (2019). Psychometric properties
 495 of the Liebowitz Social Anxiety Scale in a large cross-cultural Spanish and Portuguese
 496 speaking sample. *Brazilian Journal of Psychiatry*, 41(2), 122-130.
 497 <https://doi.org/10.1590/1516-4446-2018-0006>
- 498 Caballo, V. E., Salazar, I. C., Irurtia, M. J., Arias, B., & Hofmann, S. G. (2012). The multidimensional
 499 nature and multicultural validity of a new measure of social anxiety: The Social Anxiety
 500 Questionnaire for Adults. *Behavior Therapy*, 43(2), 313-328.
 501 <https://doi.org/10.1016/j.beth.2011.07.001>
- 502 Caballo, V. E., Salazar, I. C., Irurtia, M. J., Arias, B., Hofmann, S. G., & Team, C.-A. R. (2014).
 503 Differences in social anxiety between men and women across 18 countries. *Personality and*
 504 *Individual Differences*, 64, 35-40. <https://doi.org/10.1016/j.paid.2014.02.013>
- 505 Chu, S. Y., Sakai, N., Lee, J., Harrison, E., Tang, K. P., & Mori, K. (2020). Comparison of social
 506 anxiety between Japanese adults who stutter and non-stuttering controls. *Journal of Fluency*
 507 *Disorders*, 105767. <https://doi.org/10.1016/j.jfludis.2020.105767>
- 508 Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis, 2nd ed.* Lawrence Erlbaum
 509 Associates, Inc.
- 510 Craig, A., & Tran, Y. (2014). Trait and social anxiety in adults with chronic stuttering: Conclusions

511 following meta-analysis. *Journal of Fluency Disorders*, 40, 35-43.
 512 <https://doi.org/10.1016/j.jfludis.2014.01.001>

513 Crome, E., & Baillie, A. (2014). Mild to severe social fears: Ranking types of feared social situations
 514 using item response theory. *Journal of Anxiety Disorders*, 28(5), 471-479.
 515 <https://doi.org/10.1016/j.janxdis.2014.05.002>

516 Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-
 517 334. <https://doi.org/10.1007/BF02310555>

518 Diehl, J., Robb, M. P., Lewis, J. G., & Ormond, T. (2018). Situational speaking anxiety in adults who
 519 stutter. *Speech, Language and Hearing*, 22(2), 100-110.
 520 <https://doi.org/10.1080/2050571x.2018.1441782>

521 Enders, C. K. (2010). *Applied missing data analysis*. Guilford press.

522 Eng, W., Heimberg, R. G., Coles, M. E., Schneier, F. R., & Liebowitz, M. R. (2000). An empirical
 523 approach to subtype identification in individuals with social phobia. *Psychological Medicine*,
 524 30(6), 1345-1357. <https://doi.org/10.1017/s0033291799002895>

525 Ezrati-Vinacour, R., & Levin, I. (2004). The relationship between anxiety and stuttering: A
 526 multidimensional approach. *Journal of Fluency Disorders*, 29(2), 135-148.
 527 <https://doi.org/10.1016/j.jfludis.2004.02.003>

528 Fresco, D. M., Coles, M. E., Heimberg, R. G., Liebowitz, M. R., Hami, S., Stein, M. B., & Goetz, D.
 529 (2001). The Liebowitz Social Anxiety Scale: A comparison of the psychometric properties of

530 self-report and clinician-administered formats. *Psychological medicine*, 31(6), 1025–1035.
 531 <https://doi.org/10.1017/s0033291701004056>

532 Furmark, T., Tillfors, M., Everz, P., Marteinsdottir, I., Gefvert, O., & Fredrikson, M. (1999). Social
 533 phobia in the general population: Prevalence and sociodemographic profile. *Social Psychiatry*
 534 *and Psychiatric Epidemiology*, 34(8), 416-424. <https://doi.org/10.1007/s001270050163>

535 Furmark, T., Tillfors, M., Stattin, H., Ekselius, L., & Fredrikson, M. (2000). Social phobia subtypes in
 536 the general population revealed by cluster analysis. *Psychological Medicine*, 30(6), 1335-1344.
 537 <https://doi.org/10.1017/s0033291799002615>

538 Garrido, L. E., Abad, F. J., & Ponsoda, V. (2013). A new look at Horn's parallel analysis with ordinal
 539 variables. *Psychological Methods*, 18(4), 454-474. <https://doi.org/10.1037/a0030005>

540 Garrido, L. E., Abad, F. J., & Ponsoda, V. (2016). Are fit indices really fit to estimate the number of
 541 factors with categorical variables? Some cautionary findings via Monte Carlo simulation.
 542 *Psychological Methods*, 21(1), 93-111. <https://doi.org/10.1037/met0000064>

543 Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). Lawrence Erlbaum Associates.

544 Grice, J. W. (2001). Computing and evaluating factor scores. *Psychological Methods*, 6(4), 430-450.
 545 <https://doi.org/10.1037//1082-989x.6.4.430>

546 Haberman, S. J. (2008). When can subscores have value? *Journal of Educational and Behavioral*
 547 *Statistics*, 33(2), 204-229. <https://doi.org/10.3102/1076998607302636>

548 Hallquist, M. N., & Wiley, J. F. (2018). MplusAutomation: An R package for facilitating large-scale

latent variable analyses in Mplus. *Structural Equation Modeling: A Multidisciplinary Journal*,
25(4), 621-638. <https://doi.org/10.1080/10705511.2017.1402334>

Healey, E. C. (2010). What the literature tells us about listeners' reactions to stuttering: Implications
for the clinical management of stuttering. *Seminars in Speech and Language*, 31(4), 227-235.
<https://doi.org/10.1055/s-0030-1265756>

Heeren, A., Maurage, P., Rossignol, M., Vanhaelen, M., Peschard, V., Eeckhout, C., & Philippot, P.
(2012). Self-report version of the Liebowitz Social Anxiety Scale: Psychometric properties of
the French version. *Canadian Journal of Behavioural Science*, 44(2), 99-107.
<https://doi.org/10.1037/a0026249>

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*,
30(2), 179-185. <https://doi.org/10.1007/bf02289447>

Iverach, L., Jones, M., O'Brian, S., Block, S., Lincoln, M., Harrison, E., Hewat, S., Menzies, R. G.,
Packman, A., & Onslow, M. (2010). Mood and substance use disorders among adults seeking
speech treatment for stuttering. *Journal of Speech, Language, and Hearing Research*, 53(5),
[https://doi.org/10.1044/1092-4388\(2010/09-0166\)](https://doi.org/10.1044/1092-4388(2010/09-0166))

Iverach, L., O'Brian, S., Jones, M., Block, S., Lincoln, M., Harrison, E., Hewat, S., Menzies, R. G.,
Packman, A., & Onslow, M. (2009). Prevalence of anxiety disorders among adults seeking
speech therapy for stuttering. *Journal of Anxiety Disorders*, 23(7), 928-934.
<https://doi.org/10.1016/j.janxdis.2009.06.003>

- 568 Iverach, L., & Rapee, R. M. (2014). Social anxiety disorder and stuttering: Current status and future
 569 directions. *Journal of Fluency Disorders*, 40, 69-82.
 570 <https://doi.org/10.1016/j.jfludis.2013.08.003>
- 571 Iverach, L., Rapee, R. M., Wong, Q. J. J., & Lowe, R. (2017). Maintenance of social anxiety in
 572 stuttering: A cognitive-behavioral model. *American Journal of Speech-Language Pathology*,
 573 26(2), 540-556. https://doi.org/10.1044/2016_ajslp-16-0033
- 574 James, S. E., Brumfitt, S., & Cowell, P. (2009). The influence of communication situation on self-
 575 report in people who stutter. *International Journal of Speech-Language Pathology*, 11(1), 34-
 576 44. <https://doi.org/10.1080/17549500802588179>
- 577 James, S. E., Brumfitt, S. M., & Cudd, P. A. (1999). Communicating by telephone: Views of a group
 578 of people with stuttering impairment. *Journal of Fluency Disorders*, 24(4), 299-317.
 579 [https://doi.org/10.1016/S0094-730X\(99\)00019-4](https://doi.org/10.1016/S0094-730X(99)00019-4)
- 580 Klein, J. F., & Hood, S. B. (2004). The impact of stuttering on employment opportunities and job
 581 performance. *Journal of Fluency Disorders*, 29(4), 255-273.
 582 <https://doi.org/10.1016/j.jfludis.2004.08.001>
- 583 Klompas, M., & Ross, E. (2004). Life experiences of people who stutter, and the perceived impact of
 584 stuttering on quality of life: Personal accounts of South African individuals. *Journal of Fluency*
 585 *Disorders*, 29(4), 275-305. <https://doi.org/10.1016/j.jfludis.2004.10.001>
- 586 Kraaimaat, F. W., Vanryckeghem, M., & Van Dam-Baggen, R. (2002). Stuttering and social anxiety.

587 *Journal of Fluency Disorders*, 27(4), 319-331. [https://doi.org/10.1016/s0094-730x\(02\)00160-](https://doi.org/10.1016/s0094-730x(02)00160-2)

588 2

589 Leith, W. R., & Timmons, J. L. (1983). The stutterer's reaction to the telephone as a speaking situation.

590 *Journal of Fluency Disorders*, 8(3), 233–243. [https://doi.org/10.1016/0094-730X\(83\)90037-2](https://doi.org/10.1016/0094-730X(83)90037-2)

591 Liebowitz, M. R. (1987). Social phobia. In D. F. Klein (Ed.), *Anxiety. Modern Problems of*

592 *Pharmacopsychiatry* (Vol. 22, pp. 141-173). Karger Publishers.

593 <https://doi.org/10.1159/000414022>

594 Lord, F. M., Novick, M. R., & Birnbaum, A. (1968). *Statistical theories of mental test scores*. Addison-

595 Wesley.

596 Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia

597 scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy*, 36(4), 455-470.

598 [https://doi.org/10.1016/s0005-7967\(97\)10031-6](https://doi.org/10.1016/s0005-7967(97)10031-6)

599 Mayo-Wilson, E., Dias, S., Mavranouzouli, I., Kew, K., Clark, D. M., Ades, A. E., & Pilling, S. (2014).

600 Psychological and pharmacological interventions for social anxiety disorder in adults: A

601 systematic review and network meta-analysis. *The lancet. Psychiatry*, 1(5), 368-376.

602 [https://doi.org/10.1016/S2215-0366\(14\)70329-3](https://doi.org/10.1016/S2215-0366(14)70329-3)

603 McAllister, J., Gascoine, S., Carroll, A., Humby, K., Kingston, M., Shepstone, L., Risebro, H.,

604 Mackintosh, B., Thompson, T. D., & Hodgekins, J. (2017). Cognitive bias modification for

605 social anxiety in adults who stutter: A feasibility study of a randomised controlled trial. *BMJ*

606 *Open*, 7(10), e015601. <https://doi.org/10.1136/bmjopen-2016-015601>

607 Menzies, R. G., O'Brian, S., Onslow, M., Packman, A., St Clare, T., & Block, S. (2008). An
 608 experimental clinical trial of a cognitive-behavior therapy package for chronic stuttering.
 609 *Journal of Speech, Language, and Hearing Research*, 51(6), 1451-1464.
 610 [https://doi.org/10.1044/1092-4388\(2008/07-0070\)](https://doi.org/10.1044/1092-4388(2008/07-0070))

611 Menzies, R. G., Onslow, M., Packman, A., & O'Brian, S. (2009). Cognitive behavior therapy for adults
 612 who stutter: A tutorial for speech-language pathologists. *Journal of Fluency Disorders*, 34(3),
 613 187-200. <https://doi.org/10.1016/j.jfludis.2009.09.002>

614 Messenger, M., Onslow, M., Packman, A., & Menzies, R. (2004). Social anxiety in stuttering:
 615 Measuring negative social expectancies. *Journal of Fluency Disorders*, 29(3), 201-212.
 616 <https://doi.org/10.1016/j.jfludis.2004.06.002>

617 Moriyasu, M., & Olkin, R. (2019). Assessing social anxiety in Japanese and Japanese-Americans in
 618 the United States. *Journal of Depression and Anxiety*, 8, 340. [https://doi.org/10.35248/2167-](https://doi.org/10.35248/2167-1044.19.8.340)
 619 [1044.19.8.340](https://doi.org/10.35248/2167-1044.19.8.340)

620 Muthén, L. K., & Muthén, B. O. (1998-2017). *Mplus User's Guide. Eighth Edition*. Muthén & Muthén.

621 Oakman, J., Van Ameringen, M., Mancini, C., & Farvolden, P. (2003). A confirmatory factor analysis
 622 of a self-report version of the Liebowitz Social Anxiety Scale. *Journal of Clinical Psychology*,
 623 59(1), 149-161. <https://doi.org/10.1002/jclp.10124>

624 Okajima, I., Kanai, Y., Chen, J., & Sakano, Y. (2007). Nihongo-ban Liebowitz Social Anxiety Scale

625 (LSAS) no inshi kouzou: Kakuninteki inshi bunseki ni yoru kentou [Factor structure of the
 626 Japanese Version of Liebowitz Social Anxiety Scale (LSAS): A confirmatory factor analysis].
 627 *Seishin Igaku. Clinical Psychiatry*, 49(8), 829-835.

628 Parent, M. C. (2013). Handling item-level missing data: Simpler is just as good. *The Counseling*
 629 *Psychologist*, 41(4), 568-600. <https://doi.org/10.1177/0011000012445176>

630 Reise, S. P., Bonifay, W. E., & Haviland, M. G. (2013). Scoring and modeling psychological measures
 631 in the presence of multidimensionality. *Journal of Personality Assessment*, 95(2), 129-140.
 632 <https://doi.org/10.1080/00223891.2012.725437>

633 Revelle, W. (2018). psych: Procedures for personality and psychological research, Northwestern
 634 University, Evanston, Illinois, USA, Version = 1.8.3. [https://CRAN.R-](https://CRAN.R-project.org/package=psych)
 635 [project.org/package=psych](https://CRAN.R-project.org/package=psych)

636 Rouquette, A., & Falissard, B. (2011). Sample size requirements for the internal validation of
 637 psychiatric scales. *International Journal of Methods in Psychiatric Research*, 20(4), 235-249.
 638 <https://doi.org/10.1002/mpr.352>

639 Ruscio, A. M. (2010). The latent structure of social anxiety disorder: Consequences of shifting to a
 640 dimensional diagnosis. *Journal of abnormal psychology*, 119(4), 662-671.
 641 <https://doi.org/10.1037/a0019341>

642 Ruscio, A. M., Brown, T. A., Chiu, W. T., Sareen, J., Stein, M. B., & Kessler, R. C. (2008). Social fears
 643 and social phobia in the USA: Results from the National Comorbidity Survey Replication.

644 *Psychological Medicine*, 38(1), 15-28. <https://doi.org/10.1017/s0033291707001699>

645 Safren, S. A., Heimberg, R. G., Horner, K. J., Juster, H. R., Schneier, F. R., & Liebowitz, M. R. (1999).
646 Factor structure of social fears: The Liebowitz Social Anxiety Scale. *Journal of Anxiety*
647 *Disorders*, 13(3), 253-270. [https://doi.org/10.1016/s0887-6185\(99\)00003-1](https://doi.org/10.1016/s0887-6185(99)00003-1)

648 Sijtsma K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's alpha.
649 *Psychometrika*, 74(1), 107–120. <https://doi.org/10.1007/s11336-008-9101-0>

650 St. Louis, K. O. (2015). *Stuttering meets stereotypes, stigma, and discrimination* (K. O. St. Louis, Ed.).
651 West Virginia University Press.

652 Stein, D. J., Kasper, S., Andersen, E. W., Nil, R., & Lader, M. (2004). Escitalopram in the treatment of
653 social anxiety disorder: Analysis of efficacy for different clinical subgroups and symptom
654 dimensions. *Depression and Anxiety*, 20(4), 175-181. <https://doi.org/10.1002/da.20043>

655 Stein, M. B., Baird, A., & Walker, J. R. (1996). Social phobia in adults with stuttering. *American*
656 *Journal of Psychiatry*, 153(2), 278-280. <https://doi.org/10.1176/ajp.153.2.278>

657 Sugawara, N., Yasui-Furukori, N., Kaneda, A., Sato, Y., Tsuchimine, S., Fujii, A., Danjo, K., Takahashi,
658 I., Matsuzaka, M., & Kaneko, S. (2012). Factor structure of the Liebowitz Social Anxiety Scale
659 in community-dwelling subjects in Japan. *Psychiatry and Clinical Neurosciences*, 66(6), 525-
660 528. <https://doi.org/10.1111/j.1440-1819.2012.02381.x>

661 Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (Sixth edition ed.). Pearson
662 Education, Inc.

- 663 Thompson, B. (2004). *Exploratory and confirmatory factor analysis : Understanding concepts and*
 664 *applications*. American Psychological Association.
- 665 Trotter, W. D., & Lesch, M. M. (1967). Personal experiences with a stutter-aid. *Journal of Speech and*
 666 *Hearing Disorders*, 32(3), 270-272. <https://doi.org/10.1044/jshd.3203.270>
- 667 Turner, S. M., Beidel, D. C., Dancu, C. V., & Stanley, M. A. (1989). An empirically derived inventory
 668 to measure social fears and anxiety: The Social Phobia and Anxiety Inventory. *Psychological*
 669 *Assessment: A Journal of Consulting and Clinical Psychology*, 1(1), 35-40.
 670 <https://doi.org/10.1037/1040-3590.1.1.35>
- 671 Vanryckeghem, M., Matthews, M., & Xu, P. (2017). Speech Situation Checklist-Revised: Investigation
 672 with adults who do not stutter and treatment-seeking adults who stutter. *American Journal of*
 673 *Speech-Language Pathology*, 26(4), 1129-1140. https://doi.org/10.1044/2017_AJSLP-16-0170
- 674 Wong, Q. J. J., Gregory, B., & McLellan, L. F. (2016). A review of scales to measure social anxiety
 675 disorder in clinical and epidemiological studies. *Current Psychiatry Reports*, 18(4), 38.
 676 <https://doi.org/10.1007/s11920-016-0677-2>
- 677 [dataset] Data of the Liebowitz social anxiety scale among Japanese treatment-seeking adults who
 678 stutter. Mandeley data, 2021. (Auhtor names are blind in the review process)

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Table 1*Summary of demographic data of participants*

	<i>n</i> (percentage)
Age	
10's	24 (6.8%)
20's	196 (55.8%)
30's	78 (22.2%)
40's	40 (11.4%)
50's	10 (2.9%)
60's	3 (0.9%)
Gender	
Women	61 (17.4%)
Men	290 (82.6%)
Onset of stuttering	
Under 10 years old	220 (62.7%)
10's	85 (24.2%)
20's	24 (6.8%)
30's	4 (1.1%)
40's	2 (0.6%)
50's	2 (0.6%)
Unclear	14 (4.0%)
Employment status	
Employed	182 (51.9%)
Unemployed	52 (14.8%)
Student	93 (26.5%)
Unclear	24 (6.8%)

Note. $N = 351$. Sums of percentages do not necessarily equal to 100% because of rounding error.

Table 2

Pattern coefficients matrix and their 95% confidence intervals, inter-factor correlations and

correlations between factor score estimates

Item	Factor1	Factor2	Factor3	Factor4	Factor5	Communalities
1	-0.08 [-0.16, 0.00]	0.84 [0.72, 0.96]	0.04 [-0.04, 0.13]	-0.02 [-0.10, 0.05]	0.11 [0.00, 0.22]	.73
2	0.44 [0.31, 0.58]	0.14 [0.04, 0.24]	0.02 [-0.10, 0.13]	0.12 [0.01, 0.23]	0.32 [0.17, 0.46]	.62
3	0.75 [0.62, 0.88]	0.00 [-0.12, 0.11]	0.21 [0.08, 0.33]	0.04 [-0.07, 0.15]	-0.07 [-0.19, 0.05]	.73
4	0.99 [0.92, 1.06]	-0.05 [-0.10, 0.01]	-0.04 [-0.10, 0.01]	0.03 [-0.03, 0.09]	-0.03 [-0.11, 0.05]	.92
5	0.21 [0.09, 0.33]	0.18 [0.06, 0.31]	0.16 [0.03, 0.29]	0.25 [0.13, 0.37]	0.13 [-0.01, 0.26]	.47
6	0.04 [-0.09, 0.17]	0.04 [-0.07, 0.15]	0.06 [-0.08, 0.19]	0.42 [0.27, 0.58]	0.38 [0.22, 0.53]	.56
7	0.61 [0.48, 0.74]	0.02 [-0.08, 0.13]	0.01 [-0.10, 0.11]	0.15 [0.03, 0.27]	0.21 [0.07, 0.35]	.67
8	0.10 [-0.02, 0.21]	0.12 [0.01, 0.22]	0.60 [0.46, 0.74]	0.15 [0.03, 0.28]	-0.02 [-0.15, 0.12]	.61
9	0.06 [-0.03, 0.14]	0.12 [0.03, 0.21]	0.90 [0.79, 1.01]	-0.08 [-0.15, 0.00]	-0.13 [-0.21, -0.06]	.77
10	0.03 [-0.06, 0.11]	0.80 [0.65, 0.94]	0.03 [-0.06, 0.12]	0.20 [0.05, 0.34]	-0.05 [-0.15, 0.05]	.83
11	0.17 [0.07, 0.26]	0.18 [0.08, 0.28]	-0.03 [-0.09, 0.04]	0.77 [0.65, 0.89]	0.01 [-0.08, 0.11]	.92
12	0.10 [0.00, 0.20]	0.12 [-0.01, 0.24]	0.07 [-0.01, 0.14]	0.79 [0.67, 0.91]	-0.09 [-0.17, -0.02]	.82
13	0.05 [-0.13, 0.23]	-0.11 [-0.32, 0.09]	0.56 [0.37, 0.75]	-0.01 [-0.22, 0.19]	0.18 [-0.07, 0.42]	.42
14	-0.01 [-0.13, 0.11]	0.03 [-0.11, 0.18]	0.36 [0.21, 0.50]	0.30 [0.14, 0.46]	0.20 [0.05, 0.35]	.48
15	-0.09 [-0.19, 0.02]	-0.10 [-0.20, 0.00]	0.24 [0.09, 0.39]	0.42 [0.27, 0.57]	0.46 [0.29, 0.62]	.65
16	-0.01 [-0.13, 0.12]	0.24 [0.13, 0.35]	0.00 [-0.12, 0.11]	0.26 [0.11, 0.40]	0.55 [0.39, 0.72]	.68
17	-0.04 [-0.17, 0.10]	-0.08 [-0.22, 0.06]	0.62 [0.45, 0.79]	0.10 [-0.05, 0.24]	0.14 [-0.04, 0.31]	.49
18	-0.07 [-0.18, 0.04]	0.02 [-0.10, 0.14]	0.36 [0.20, 0.52]	0.28 [0.13, 0.43]	0.34 [0.18, 0.51]	.58
19	0.07 [-0.04, 0.18]	-0.18 [-0.31, -0.06]	0.46 [0.31, 0.62]	0.25 [0.10, 0.40]	0.26 [0.11, 0.42]	.59
20	0.19 [0.04, 0.34]	0.25 [0.12, 0.38]	0.08 [-0.03, 0.19]	-0.16 [-0.26, -0.06]	0.63 [0.45, 0.82]	.66
21	0.34 [0.20, 0.47]	0.08 [-0.03, 0.19]	0.16 [0.05, 0.28]	0.05 [-0.06, 0.16]	0.40 [0.26, 0.54]	.61
22	0.38 [0.23, 0.52]	0.11 [0.01, 0.22]	0.15 [0.02, 0.28]	0.04 [-0.07, 0.15]	0.33 [0.17, 0.50]	.58
23	0.28 [0.13, 0.44]	0.18 [0.06, 0.29]	0.02 [-0.09, 0.12]	0.10 [-0.02, 0.23]	0.49 [0.34, 0.65]	.67
24	0.26 [0.12, 0.41]	-0.03 [-0.16, 0.10]	0.32 [0.16, 0.48]	-0.08 [-0.21, 0.05]	0.40 [0.21, 0.58]	.53

Inter-factor correlations (lower triangle) and correlations between factor score estimates and the total fear/anxiety score (upper triangle and right end)

Factor1	Factor2	Factor3	Factor4	Factor5	Total fear/anxiety
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						score
Factor1	-	.30	.50	.52	.52	.75
Factor2	.32	-	.29	.53	.48	.58
Factor3	.47	.27	-	.44	.47	.74
Factor4	.47	.49	.44	-	.56	.76
Factor5	.39	.31	.46	.43	-	.82

Note. $N = 351$. Extraction method was robust diagonally weighted least squares with oblimin rotation. Pattern coefficients of the salient items (whose lower confidence limits are greater than .32) are in bold.

Table 3

Psychometric properties of the subscale scores of the LSAS in adults who stutter (AWS) and preliminary comparisons with individuals with anxiety disorders including social anxiety disorder (SAD) and Japanese university students

Subscale	AWS				Individuals with anxiety disorders including SAD ^a		Japanese university students ^b	
	<i>M</i>	<i>SD</i>	Reliability [95% CI] (<i>PRMSE_{sub}</i>)	<i>PRMSE_{tot}</i>	<i>M</i>	Difference with AWS	<i>M</i>	Difference with AWS
Subscale 1	0.77	0.77	.80 [.77, .83]	.62	0.95	0.18	0.58	-0.19
Subscale 2	2.13	0.87	.79 [.76, .82]	.38	1.02	-1.11	1.09	-1.04
Subscale 3	0.69	0.66	.70 [.66, .75]	.66	1.29	0.60	0.93	0.24
Subscale 4	1.60	0.92	.88 [.86, .90]	.62	1.40	-0.20	1.43	-0.17
Subscale 5	1.75	0.84	.78 [.74, .81]	.78	1.77	0.02	1.27	-0.48

^a Mean of total fear/anxiety score was 33.41 and 2.96 higher than that of AWS. Data was used in Oakman et al. (2003).

^b Mean of total fear/anxiety score was 26.47 and 3.98 lower than that of AWS. Data was used in Okajima et al. (2007).

Appendix A. Items of the LSAS-J

1. Telephoning in public.
 2. Participating in small groups.
 3. Eating in public places.
 4. Drinking with others in public places.
 5. Talking to people in authority.
 6. Acting or performance in front of an audience.
 7. Going to a party.
 8. Working while being observed.
 9. Writing while being observed.
 10. Calling someone you don't know very well.
 11. Talking with people you don't know very well.
 12. Meeting strangers.
 13. Urinating in a public bathroom.
 14. Entering a room when others are already seated and waiting.
 15. Being the center of attention.
 16. Speaking up at a meeting.
 17. Taking a test.
 18. Expressing a disagreement or disapproval to people you don't know very well.
 19. Looking at people you don't know very well in the eyes.
 20. Giving a report to a group.
 21. Trying to pick up someone.
 22. Returning goods to a store.
 23. Host a party (become an organizer)
 24. Resisting a high-pressure salesperson
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