Title page

Title: Factors predicting satisfaction with communication in daily lives of adults who stutter: An experience sampling study

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Abstract

Purpose: Improving satisfaction with communication (SC) is one of the issues in treatments of adults who stutter (AWS). SC can be influenced by self-rated stuttering severity (SS), negative/positive emotions, and emotion regulations and they are variable in daily communications. The present study aimed to explore factors predicting SC in daily communications of AWS, considering their variabilities and speaking contexts.

Method: Twenty-seven AWS were surveyed by trait questionnaires and then by experience sampling method (ESM) seven times per day for 2 weeks, reporting speaking contexts and subjective experiences, including SC, SS, negative/positive emotions, and emotion regulations. Intra- and inter-individual variabilities and relationships of the variables were investigated.

Results: Speaking contexts were summarized by unofficial/official communications. SC, SS, and emotion regulations in unofficial communications were less variable and SC was more strongly related to trait questionnaires. Items of the ESM loaded on three latent factors in each communication type, including (1) negative emotion, (2) stuttering and associated reactions (including SS and stuttering- and anxiety-related behaviors and cognitions), and (3) positive emotion and attending to communication. SC was more strongly associated with (3) than (2) in unofficial communications while the opposite trend was found in official communications.

Conclusions: SC, SS, and stuttering- and anxiety-related emotion regulations in unofficial communications are more trait-like. Not only negative emotion regulations but also positive emotion

regulations should be treated to improve SC in AWS, considering speaking contexts.

Introduction

Satisfaction with communication as an outcome measure in stuttering treatments

It has been reported that quality of life is significantly impaired in adults who stutter (AWS) (Craig et al., 2009; Koedoot et al., 2011). In treatments of AWS, not only ameliorating stuttering severity but also improving quality of life or well-being is warranted. Stuttering is a speech disorder; therefore, quality of speaking communication seems to be one important aspect of quality of life or well-being in adults who stutter (AWS) (Karimi et al., 2018; Koedoot et al., 2011; Yaruss & Quesal, 2006).

It was shown that the daily satisfaction with communication is associated with self-rated stuttering severity and a wide range of psychosocial difficulties in AWS, including social anxiety and avoidance, trait anxiety, depression, and unhelpful thoughts and beliefs about stuttering. (Karimi et al., 2018). Daily satisfaction with communication is a potential overarching outcome measure in stuttering treatments (Karimi et al., 2018). In the present study, we focused on factors improving daily satisfaction with communication in AWS, as described below.

Stuttering and emotion regulation

Communication can be significantly impaired by emotional disturbances in general (Keltner & Kring, 1998). In AWS emotional disturbances are often represented as social anxiety, which is highly prevalent among AWS (Blumgart et al., 2010; Craig & Tran, 2014; Iverach et al., 2009). Emotional

49 disturbances include not only social anxiety but also anger, depression, and others. They can be caused
50 in AWS through aversive social experiences or social disadvantages across the life span, including
51 teasing or bullying (Blood & Blood, 2004, 2016), negative reactions by others such as confusion or
52 mock (Langevin et al., 2009), and limited job opportunities and performance (Klein & Hood, 2004).

53 Emotion or emotional disturbances can be regulated through *emotion regulation*: attempts to
54 influence which emotions an individual has, when he or she has them, and how he or she experiences
55 and expresses emotions (Gross, 1998, 2015). Emotion regulation can be automatic or controlled and
56 conscious or unconscious and both negative and positive emotions can be regulated (Gross, 1998,
57 2015). Emotion regulation significantly relates to quality of social interaction in general (Lopes et al.,
58 2005). The present study investigated the relationships between emotions, emotion regulations, self-
59 rated stuttering severity, and satisfaction with communication in AWS.

60 Previous studies suggest that several factors are involved in maintenance of emotional
61 disturbances in AWS, particularly social anxiety, including negative social-evaluative cognitions,
62 excessive attention to stuttering, and safety or coping behaviors, including speech effort to speak
63 fluently (Clark & Wells, 1995; Iverach et al., 2017). Attending to stuttering could distract from social
64 task at hand and interfere with effective communications (Iverach et al., 2017) and negative cognitions
65 about stuttering relates to poorer communication attitudes (Chu et al., 2017).

66 Stuttering might be related to not only negative emotions and experiences but also lack of
67 positive emotions and experiences; it is shown that stuttering is related to poor vitality (Craig et al.,

2009) and social anxiety is characterized by lower positive emotions in general (Kashdan, 2007). However, role of positive emotions has not been empirically investigated in AWS, as far as we know¹. Lack of positive emotions is closely related to experiential avoidance (Kashdan et al., 2006); trying to alter the form or frequency of aversive private events, including emotions, cognitions, and behavioral tendencies (Hayes et al., 1996). Experiential avoidance may include avoiding negative emotions (Hayes et al., 1996) and stuttering (Beilby et al., 2012) in communications. It has been suggested that diminished positive emotions and/or experiential avoidance are related to lower satisfaction with communications in general (Butler et al., 2003; Gross & John, 2003). Furthermore, it is reported that emotion suppressions, not displaying one's affect outward and closely related to experiential avoidance (Kashdan et al., 2006), lead to speech dysfluency in people who do not stutter (Roche & Arnold, 2018). It may be possible that diminished positive emotions and experiential avoidance are related to higher stuttering severity and lower satisfaction with communication among AWS.

Measuring variabilities of subjective experiences in the daily lives of AWS

Karimi et al. (2018) revealed that satisfaction with communication, stuttering severity, and emotional disturbances, including anxiety, are related to each other *between* individuals. However, it has been shown that stuttering and anxiety, potentially predicting satisfaction with communication, are variable depending on speaking contexts *within* individuals (Constantino et al., 2020; Constantino et

¹ Although Harley (2018) discussed the role of positive emotion in stuttering therapy, she did not conduct empirical investigations.

85 al., 2016; Diehl et al., 2018). Thus, we should take the within-individual variabilities of stuttering,
86 negative/positive emotions, and emotion regulations into consideration in order to predict satisfaction
87 with communication, potentially variable in the daily lives.

88 Experience sampling method (ESM) is a longitudinal technique for investigating both the
89 surrounding contexts and the experiences of the daily lives of individuals (Hektner et al., 2007). ESM
90 is a kind of ecological momentary assessment, which involves repeated sampling of real-time
91 behaviors and experiences in natural daily environments (Shiffman et al., 2008). ESM has been used
92 for assessing variabilities of symptoms, including those of psychopathologies (Myin-Germeyns et al.,
93 2018) and stuttering (Constantino et al., 2020).

94 Repeated assessments within individuals allow to investigate within-individual relationships
95 of the variables. It is important to note that between-individual relationships cannot generalize to
96 within-individual relationships (Molenaar & Campbell, 2009). Within-individual findings can provide
97 more valid suggestions for treatments than between-individual findings, because treatments aim at
98 within-individual changes.

99 ESM also reduces recall biases of experiences while retrospective global self-reports can
100 induce them (Shiffman et al., 2008). Since retrospective global self-reports can reflect self-concepts
101 rather than actual experiences, immediate sampling through the ESM can provide findings less biased
102 by memory or self-concept.

103 Recently, Constantino et al. (2020) conducted an ESM study focusing on spontaneity of

104 speech, which is a similar concept to speech effort (Ingham et al., 2006). They showed that while
105 challenging situations lead to diminished spontaneity, more relaxing situations, including speaking to
106 family or people with whom AWS have discussed stuttering, increased spontaneity. Speech effort was
107 also measured in the present study because it can be related to social anxiety in AWS, as stated above.

108 ***Types of speaking situations***

109 Previous studies have investigated variabilities of stuttering and anxiety in various kinds of
110 speaking situations, including speaking in front of a group, speaking to family, friends, boss or
111 subordinate, or strangers, and speaking on the phone, and others (Constantino et al., 2020; Diehl et al.,
112 2018; Vanryckeghem et al., 2017). However, these detailed investigations have made more
113 parsimonious understanding of the speaking situations difficult.

114 It is possible that *unofficial/official* communications can explain various speaking situations
115 parsimoniously. It has been reported that AWS feel safe and show less severe anxiety and stuttering in
116 unofficial communications, including speaking to family or friends (Diehl et al., 2018), while they feel
117 threat and show much severe anxiety and stuttering in official communications, including speaking to
118 boss (Constantino et al., 2020). Although we do not know any empirical studies to adopt this distinction,
119 it might lead to efficient understandings.

120 ***Purpose***

121 The purpose of the present study was investigating factors contributing to satisfaction with
122 communication in daily natural contexts of AWS, particularly from the viewpoint of emotion

123 regulations, considering daily variabilities and speaking contexts.

124 **Method**

125 ***Participants***

126 Twenty-seven AWS (5 women and 22 men, age ranges from 20 to 47 and $M = 27.04$ and SD
127 $= 6.61$ old ages) participated in the present study. They were gathered through self-help or support
128 groups of AWS and the webpage of the Research Institute in the National Rehabilitation Center for
129 Persons with Disabilities (NRCD).

130 ***Procedure***

131 On the first day, participants visited at the NRCD. Participants answered a set of
132 questionnaires and took the test to assess stuttering severity. Then, they were explained for the ESM
133 using their own smartphones.

134 ***Experience sampling***

135 We used the Personal Analytics Comparison (PACO: <https://www.pacoapp.com/>), a
136 smartphone app developed by PACO team. We used random sampling procedure, in which notices
137 appeared randomly during specified periods in a day (Myin-Germeys et al., 2018). Alert was made on
138 their smartphones seven times a day, from 8:00 a.m. to 22:00 p.m. Every alert was separate at least for
139 one hour. Participants were instructed to answer the questions as soon as possible they can, unless there
140 were special circumstances including jobs. Answering the questions took about three minutes.
141 Participants could check if they had missed some alert on the app. If some alert was missed, they could

142 answer the questions on their own by standing up the app.

143 Different items were presented according to whether the participants had experienced any
144 communication with speech since the last answer. When experiencing any communication with speech
145 after the last answer, participants answered 30 questions in total. Otherwise, participants answered 10
146 questions. Questions used in the present study are shown in Supplementary Table S1².

147 ***Trait measures***

148 *The Japanese version of the Liebowitz social anxiety scale* (LSAS; Chu et al., 2020; Liebowitz, 1987)

149 The LSAS measures the degrees of fear/anxiety and avoidance in 24 social situations for the
150 past week with the four-point Likert type scale, ranged from 0 to 3. When rating the fear/anxiety, 0-3
151 indicate *none, mild, moderate, and severe*, respectively. When rating the avoidance, 0-3 indicate *never,*
152 *occasionally, often, and usually*, respectively. We used the total score of the LSAS in the present study.
153 Alpha coefficient of the measure was .97 (95% CI [.95, .99]).

154 *The Japanese version of the overall assessment of the speaker's experience for stuttering* (OASES;
155 Sakai et al., 2017; Yaruss & Quesal, 2006)

156 The OASES includes four sections, including general perspectives about stuttering (section
157 I), affective, behavioral, and cognitive reactions to stuttering (section II), functional communication
158 difficulties (section III), and impact of stuttering on the speaker's quality of life (section IV). We used
159 the total score of the OASES. Alpha coefficient was .98 (95% CI [.97, .99]), estimated through a

² Full list of the items can be seen in the dissertation of the first author and available on request from the author.

160 pairwise variance-covariance matrix.

161 *The Japanese version of the modified S-24 communication attitudes scale* (S-24; Andrews & Cutler,
162 1974; Sakai et al., 2014)

163 The S-24 includes the 24 items measuring communication attitudes which distinguish people
164 who stutter and those who do not. Participants answered to each item with *yes* or *no*. Alpha coefficient
165 of the measure was .89 (95% CI [.83, .95]) based on the available data³.

166 *The Japanese version of the acceptance and action questionnaire-II* (AAQ-II; Bond et al., 2011; Shima
167 et al., 2013)

168 The AAQ-II includes the 7 items measuring trait experiential avoidance. Participants
169 answered the items with seven-point Likert-type scale ranged from 1 (*never true*) to 7 (*always true*).
170 We used the total score of the AAQ-II and alpha coefficient was .90 (95% CI [.85, .96]).

171 ***Data analyses***

172 In the present study, the multilevel or hierarchical data was obtained, in which communication
173 scenes were nested within individuals. Statistical analyses which consider the multilevel or hierarchical
174 data structure were conducted because it allows to distinguish the within- and between- individual
175 relationships (Reise et al., 2005; Snijders & Bosker, 2012). In the present study, “level 1” refers to
176 communication scenes while “level 2” refers to individuals.

177 *Summarizing communication scenes*

³ One item was missing in a participant.

The relationships between communication partner and communication types were investigated through cross-tabulation table and chi-squared tests.

Assessments of potential recall biases

To assess potential recall biases, the answers were classified with those within 15 minutes since the last communication, that within 15 to 30 minutes, that within 30 to 60 minutes, and that over 60 minutes. We investigated potential recall biases using the multilevel modeling, with the variables measured through the experience sampling as response variables, the passed time as fixed effect with answers within 15 minutes after the last communication as the reference level, and the individuals as the random intercept.

Intra-individual variabilities of the daily measures

Intraclass correlation coefficient (*ICC*) reflects the correlation between two answers within the same individuals. *ICC* can take negative values and is less than or equal to 1. Higher *ICC* indicates lower within-individual variation or higher between-individual variation. In other words, as the *ICC* approaches 1, the corresponding measure reflects more trait-like tendencies of individuals. *ICC* can be calculated from the null model, in which no exploratory variable is included. The null model was represented by the following equation.

$$y_{ij} = \mu + w_{ij}$$

where y_{ij} represents the i th response of the j th subject and w_{ij} represents error term normally distributed with a mean of 0 and correlated within individuals. *ICC* of continuous variable is

$$ICC = \frac{\sigma_b^2}{\sigma_b^2 + \sigma_w^2}$$

where σ_b^2 represents between-individual variance and σ_w^2 represents within-individual variance. Differences of ICC between communication types and their confidence intervals were also calculated (Ramasundarahettige et al., 2009).

Intra-individual relationships between the daily measures

In order to reveal latent structures of the constructs measured by the EMA, we conducted correlation analyses and factor analyses. According to Reise et al. (2005), when conducting the factor analysis in multilevel data, we had to distinguish the variations caused by hierarchy of data. In the present study, answers of the participants (level 1) could be nested within speaking context (level 2), which was nested within individuals (level 3). By subtracting corresponding mean score in speaking context j of an individual i ($\bar{y}_{ij}$) from original data (y_{ijk}), deviation (centered) score in a speaking context of an individual ($y_{ijk} - \bar{y}_{ij}$) was obtained⁴. When overlooking speaking context, by subtracting mean score of an individual i ($\bar{y}_i$) from original data (y_{ik}), deviation (centered) score of an individual ($y_{ik} - \bar{y}_i$) was obtained. The correlation matrix calculated from these deviation scores corresponds to the population correlation matrix (Reise et al., 2005).

First, we conducted exploratory factor analysis (EFA) with oblimin rotation to the within-individual correlation matrix in all communications excluding SC, calculated through $y_{ik} - \bar{y}_i$ above,

⁴ Subscript i, j , and k represents an individual, a speaking context, and an answer in a speaking context of an individual, respectively.

214 to reveal the latent factors of the daily measures. Then, we conducted confirmatory factor analyses
215 (CFAs) to examine whether factor structure obtained in the EFA was supported in distinct speaking
216 contexts.

217 We estimated composite reliability (ω) of the factor score estimates (averages of the
218 standardized centered scores of the items whose factor loadings were greater than 0.30) in speaking
219 contexts of the individuals through factor loadings obtained in the CFAs (Geldhof et al., 2014).

220 Finally, multiple regression analyses with the standardized centered score of SC as response
221 variable and obtained factor score estimates, calculated from within-individual standardized scores of
222 the variables, as explanatory variables in each speaking context⁵.

223 *Relationships between the daily measures and the trait measures*

224 We investigated the relationships between the daily satisfaction with communication and trait
225 measures through separate multilevel analyses, with score of satisfaction with communication in level
226 1 being response variable, standardized score of the trait measures in level 2 being explanatory variable,
227 and individuals being random intercept. We also calculated R squared (Edwards et al., 2008).

228 We used R version 4.0.3 (R Core Team, 2020) with the lme4 (Bates et al., 2015), lmerTest

⁵ We focused on within-individual prediction of SC by the data obtained from experience sampling and did not include any between-individual predictors (individual mean or latent variable) of experience sampling measures in the analyses. Although we tried to fit multilevel model with random effects (intercepts and slopes) of situations, the model resulted in a singular fit maybe because of model complexity. Therefore, we adopted simpler multiple regression analyses with centered variables.

(Kuznetsova A et al., 2017), r2glmm (Jaeger, 2017), lavaan (Rosseel, 2012), and psych libraries (Revelle, 2018) for statistical analyses. Some analyses, including calculating *ICC* with confidence intervals, were conducted through the Mplus 8.2 (Muthén & Muthén, 1998-2017) and the MplusAutomation library (Hallquist & Wiley, 2018). Maximum likelihood or full information maximum likelihood estimation was used in the analyses.

Ethics

The present study was approved by the ethical committee of the NRCD. We got informed consent from the participants.

Results

Description of the experience sampling measures

The number of the total answer was 1,749 and the answer rate was 66.1%, $1,749 / (27 \times 98)$. The numbers of the individual answers ranged 6 to 95 and mean was 64.8 ($SD = 30.7$). Among them, the number of the answers after the participants had experienced communication with speech was 1,058. Scores of satisfactions with communication were missing in 286 communication scenes of 5 individuals in total because of some human or machine errors. We excluded two answers in which number of communication partner was 0. The number of the answers conducted within 15 minutes since the last communication was 683, that within 15 to 30 minutes was 116, that within 30 to 60 minutes was 104 and that above 60 was 153.

Summarizing communication scenes

248 A cross-tabulation table of communication partner and communication types was shown in
 249 Table 1. A chi-square test revealed a significant association between communication partner and
 250 conversation type ($\chi^2 = 543.93$, $df = 18$, $p < .001$). We found that unofficial communications mainly
 251 consist of those with friends, family members, and a romantic partner whereas official communications
 252 mainly consist of those with boss, business partners, and salesclerks. This finding indicates that the
 253 unofficial and official communications are efficient in classifying communication partner. We used
 254 these communication types in the following because it is more parsimony than using communication
 255 partner.

256 Next, the chi-square test was conducted to examine the association between passed time since
 257 the last communication and communication types. The test revealed that the passed time and
 258 communication types were significantly related ($\chi^2 = 18.21$, $df = 6$, $p < .01$; see Table S2).

259 *Assessments of potential recall biases*

260 Because the passed time and the situation types were associated, when investigating potential
 261 recall biases, we entered the situation types as a covariate. The results of the multilevel analyses are
 262 shown in Supplementary Table S3. Based on the results, we decided to use the answers within 30
 263 minutes after the last communications with speech to minimize the effects of potential recall biases in
 264 the following analyses. They included 433, 226, and 141 answers in unofficial, official, and combined
 265 (unofficial and official) communications, respectively. Overall means and *SDs* of the daily measures
 266 are shown on the left side in Table S4.

267 ***Differences of the daily measures by communication types***

268 In order to investigate whether situation types led to significant difference of the scores of the
269 measures, we conducted multilevel analyses with situation types being fixed effects and individuals
270 being random intercepts. *P*-values were adjusted for multiple comparisons within scales by Holm's
271 method. The results are shown in Table S5. We found significant differences of the daily measures
272 between unofficial and official communications except for *strong*, self-rated stuttering severity, and
273 attending to communication, although self-rated stuttering severity tended to be worsened in official
274 communications. Because these communication types significantly influenced the daily measures, we
275 also considered them in the subsequent analyses.

276 ***Intra-individual variabilities of the daily measures***

277 *ICCs* of the daily measures in the communication types and their differences are shown in
278 Table 2. The results indicated that *ICCs* of satisfaction with communication, self-rated stuttering
279 severity, and stuttering-related behaviors and cognitions excluding emotional avoidance in official
280 communications were consistently lower than those in unofficial communications.

281 ***Intra-individual relationships between the daily measures***

282 Correlation matrix of the centered scores in each situation type is shown in Table S6.

283 ***Factor analyses***

284 The results of exploratory factor analysis to the within-individual centered data in all
285 communications are shown on the left side in Table 3. It was found that social-evaluative threat of

286 situation, negative emotions, anxiety, anger, and helplessness loaded on Factor 1, severity of stuttering,
287 emotional avoidance, attention to stuttering, coping with stuttering, avoidant cognition of stuttering,
288 and speech effort on Factor 2, and positive emotions and attending to social interaction on Factor 3.
289 Factors 1, 2, and 3 were named “negative emotion”, “stuttering and associated reactions”, and “positive
290 emotion and attending to social interaction”, respectively.

291 Since safety of situation and emotional avoidance showed double loadings in the EFA, we
292 excluded these two items when conducting the CFAs. The result of the CFAs to the centered data in
293 unofficial and official communications are also shown in Table 3. Since similar patterns of factor
294 loadings were found, unit-weighted factor score estimates could be used across the communication
295 types.

296 These factor loadings led to ω of .86 (factor score estimate of Factor 1), .87 (that of Factor 2),
297 and .65 (that of Factor 3) in official communications and .82 (estimate of Factor 1), .78 (that of Factor
298 2), and .56 (that of Factor 3) in unofficial communications.

299 *Multiple regression analyses within individuals*

300 The results of multiple regression analyses are shown in Table 4. After controlling the factor
301 score estimates of Factor 2 and 3, that of Factor 1 significantly predict SC only in unofficial
302 communications. While the factor score estimate of Factor 3 predicted SC more strongly than that of
303 Factor 2 in unofficial speaking situation, the opposite trend was found in official communications.

304 *Relationships between the daily and trait measures*

305 Descriptive statistics of the trait questionnaires and the results of multilevel analyses are
306 shown in Table S7 and Table 5, respectively. In general, trait measures were more strongly related to
307 daily satisfaction with communication in unofficial communications than official communications
308 according to both fixed effects and R squared.

309 **Discussion**

310 As far as we know, this is the first study which investigated variability of satisfaction with
311 communication and factors related to that in natural daily communications of AWS.

312 We found some potential recall biases of the daily subjective experiences; as time passed,
313 negative emotions were rated higher and stuttering-related cognitions and behaviors more intense. In
314 the present study, within-individual relationships less biased by autobiographical memory could be
315 found by focusing on responses within 30 minutes after the last communications with speech.

316 It was found that some subjective experiences, including satisfaction with communication,
317 self-rated stuttering severity, and stuttering-related behaviors and cognitions, were less variable in
318 unofficial communications than in official communications. Moreover, trait questionnaires were more
319 strongly related to satisfaction with communication in unofficial communications than official
320 communications in general. It is possible that satisfaction with communication in unofficial
321 communication scenes are more trait-like and is more strongly related to clinically significant distress
322 while that in official communication scenes is state-like and less related to significant distress.
323 Therefore, improving satisfaction with communication in unofficial communications may be more

324 clinically important.

325 Exploratory factor analyses on the daily measures extracted the three factors: negative
326 emotion, stuttering and associated reactions, and positive emotion and attending to communication.
327 While the former two was correlated with each other across the communication types, consistent with
328 previous studies (e.g., Iverach et al., 2017), factors for positive emotion and attending to
329 communication were weakly correlated with other twos. Multiple regression analyses revealed that
330 these factors were significantly related to satisfaction with communication, except for negative
331 emotion in official communication scenes, within individuals. It was also found that some relationships
332 between satisfaction with communication and the score estimates of the extracted factors were
333 moderated by communication types; positive emotion and attending to communication was more
334 strongly related to satisfaction with communication than stuttering and associated reactions in
335 unofficial communication scenes while the opposite trend was found in official communication scenes.
336 It is possible that negative and positive emotions have different roles in daily communications in AWS
337 and satisfaction with communication is related to these different factors depending on speaking
338 contexts.

339 Negative and positive emotions have distinct psychobiological processes in general (Dockray
340 & Steptoe, 2010). This can be also true in daily communications of AWS, because negative and positive
341 emotions and emotion-related factors were weakly correlated with each other in the present study.
342 Furthermore, only weak correlation was found between attending to stuttering and attending to

communication (see Table S5), although Iverach et al. (2017) suggests that attending to stuttering can interfere with attending to social task at hand. It may be possible that these two types of attention are related to different emotions; while capturing attention by stuttering is related to negative emotions, attending to communication at hand is positive emotions. The findings on the positive relationships between satisfaction with communication, positive emotions, and attending to communication can have in common with previous studies (Killingsworth & Gilbert, 2010; Merolla et al., 2019; Quoidbach et al., 2010), showing that attending to the present moment or communication is related to more positive feeling or well-being in the daily lives of general populations. The present study found that attending to communication at hand is significantly related to satisfaction with communication among AWS especially in unofficial speaking contexts, potentially independent of negative emotions and stuttering.

Speech effort was explained by the same factor as stuttering severity within individuals, consistent with Constantino et al. (2020). It may be possible that speech effort is one of negative emotion regulations of AWS. The present study suggests that attention to stuttering and coping with stuttering are most representative items of negative emotion regulations in both speaking contexts. It might be desirable to investigate speech effort in broader perspective of negative emotion regulations.

Clinical implications

Importance of enhancing positive emotions and improving their regulations have been discussed in the literatures of psychology; repeated experiences of positive emotions can lead to

362 sustained trait positive changes of behaviors and cognitions, which can promote well-being and counter
363 negative behaviors and cognitions in a long-term (e.g., Fredrickson & Branigan, 2005; Garland et al.,
364 2010). It may be beneficial to focus on not only negative emotion regulations but also positive emotion
365 regulations to improve satisfaction with communication in AWS especially in unofficial
366 communication scenes, potentially reflecting more trait-like tendencies of individuals.

367 While CBT for social anxiety does not specifically focus on improving positive emotion, other
368 therapies, including positive psychotherapy, mindfulness-based interventions, and compassion and
369 loving-kindness meditations, can improve positive emotion and its regulations (Garland et al., 2015;
370 Rashid, 2015; Zeng et al., 2015). Although some of these therapies have been applied to AWS (De
371 Veer et al., 2009; Gupta et al., 2016), its effects on positive emotion regulations are unclear.
372 Furthermore, understanding *change processes* considering contexts can lead to further developments
373 of modern psychotherapies (Hofmann & Hayes, 2019). It may be beneficial to investigate the effects
374 of psychological interventions and change processes caused by them, in terms of positive and negative
375 emotion regulations in AWS, possibly having distinct psychological processes.

376 ***Limitations and future directions***

377 First, participants in the present study do not necessarily seek treatments and the results of the
378 study cannot generalize to treatment-seeking AWS. Negative emotions reported by participants showed
379 floor effects because of potential lower communication difficulties in the present sample (Table S4).
380 Future studies should include treatment-seeking AWS.

381 Second, we did not randomize the order of the items in the ESM; therefore, some order effects
382 might appear. Şahin (2021) showed that the fixed order of the grouped self-report items measuring the
383 same dimension led to slightly higher correlations between the items than the random order of them
384 using cross-sectional observation data. It may be possible that the order effect is also apparent in the
385 present study.

386 Third, reliability of some composite measures, especially measures of positive emotion and
387 attending to communication in both communication types, was poor. However, low reliability can lead
388 to attenuated estimate of regression slope and correlation but not increased estimate and correlation
389 (e.g., Rhemtulla et al., 2020). It is also important to note that measurement invariance could not be
390 hold because some pattern coefficients in the CFAs were different between speaking contexts; factor
391 score estimates can reflect somewhat different constructs between the contexts, although similar
392 patterns of factor loadings were obtained. Furthermore, we measured high-arousal positive emotions
393 such as *active* and did not low-arousal positive emotion, including *calm*, *content*, and *peaceful*.
394 Interventions which increase low-arousal positive emotions have been applied to AWS (Boyle, 2011;
395 Gilman & Yaruss, 2000). and future studies should investigate roles of low-arousal positive emotions
396 in daily communications of AWS.

397 Finally, general satisfaction with communication measured in the present study could be
398 somewhat different from stuttering-related communication *dissatisfaction* in the previous study
399 (Karimi et al., 2018). The present study suggests that general satisfaction with communication is

400 heavily influenced by stuttering severity in AWS, especially in official communication scenes (Table
401 S6). Furthermore, it was also found that some trait measures of stuttering-related difficulties
402 significantly predicted the daily satisfaction with communication in unofficial communication scenes.
403 It is possible that general satisfaction with communication reflect stuttering-related communication
404 dissatisfactions.

405 ***Conclusions***

406 Subjective experiences including satisfaction with communication in unofficial
407 communication scenes were more trait-like than those in official communication scenes.
408 Negative/positive emotions and emotion regulations differently influenced satisfaction with
409 communication depending on speaking contexts; positive emotions and attending to communication
410 were more strongly related to satisfaction with communication in unofficial communication scenes.
411 For improving satisfaction with communication of AWS regularly, not only negative emotions and
412 their regulations but also positive emotions and their regulations should be considered, especially in
413 unofficial communication scenes.

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Table 1. Cross-tabulation table between communication partner and communication types

Communication partner	Communication types			Total
	Unofficial	Official	Combined	
Friend	148	7	23	178
Family	243	11	42	296
Boss or superior colleague in workplace or school	49	96	27	172
Co-worker or colleague in workplace or school	17	16	10	43
Staff or subordinate colleague in workplace or school	15	24	8	47
Business associate or client	5	35	54	94
Romantic partner	31	0	0	31
Stranger	8	9	4	21
Salesclerk	33	78	5	116
Others	14	41	5	60
Total	563	317	178	1,058

Note. Superior and subordinate colleague include Japanese *senpai* and *kouhai*, respectively.

Table 2. Intraclass correlation coefficients of the daily measures in unofficial and official communications

Daily measures	Communication types						Differences between communication types		
	Unofficial			Official					
	<i>ICC</i>	95% CI		<i>ICC</i>	95% CI		<i>ICC</i>	95% CI	
		<i>LL</i>	<i>UL</i>		<i>LL</i>	<i>UL</i>		<i>LL</i>	<i>UL</i>
Social-evaluative threat of situation	.43	.28	.59	.39	.22	.57	.04	-.08	.23
Safety of situation	.39	.24	.55	.41	.23	.58	-.02	-.14	.17
Scared	.47	.30	.65	.25	.08	.41	.22	.07	.42
Afraid	.34	.18	.51	.38	.19	.57	-.04	-.18	.15
Upset	.38	.20	.56	.51	.33	.69	-.13	-.29	.07
Active	.37	.22	.52	.50	.32	.68	-.13	-.25	.05
Proud	.61	.47	.76	.45	.27	.63	.16	.03	.32
Strong	.68	.55	.81	.37	.18	.56	.31	.20	.46
Anxiety	.26	.12	.41	.08	-.03	.20	.18	.05	.34
Anger	.36	.19	.52	.64	.48	.80	-.28	-.44	-.11
Helplessness	.50	.32	.68	.34	.16	.53	.16	-.01	.35
Severity of stuttering	.64	.48	.79	.25	.09	.42	.39	.25	.56
Emotional avoidance	.31	.14	.48	.19	.04	.33	.12	-.04	.31
Attention to stuttering	.54	.36	.72	.17	.01	.33	.37	.21	.57
Coping with stuttering	.50	.34	.67	.21	.07	.36	.29	.15	.47
Avoidant cognition of stuttering	.57	.41	.73	.34	.18	.50	.23	.08	.40
Speech effort	.70	.58	.83	.48	.30	.66	.22	.11	.36
Attending to communication	.54	.37	.70	.39	.21	.57	.15	.01	.34
Satisfaction with communication	.66	.50	.81	.38	.18	.58	.28	.13	.45

Note. *ICC* = intraclass correlation coefficient; *CI* = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 3. Pattern coefficients matrix obtained from the exploratory factor analysis in all communications and the confirmatory factor analyses (CFAs) in each communication type

Daily measures	All communications			Unofficial communications			Official communications		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Negative social-evaluative threat of situation	0.54	0.16	0.06	0.56	-	-	0.61	-	-
Safety of situation	-0.32	-0.24	0.30	-	-	-	-	-	-
Scared	0.84	0.04	-0.03	0.79	-	-	0.88	-	-
Afraid	0.88	-0.04	-0.01	0.73	-	-	0.86	-	-
Upset	0.78	-0.08	0.02	0.63	-	-	0.64	-	-
Active	-0.08	0.12	0.66	-	-	0.59	-	-	0.65
Proud	0.09	-0.09	0.63	-	-	0.56	-	-	0.53
Strong	0.07	-0.01	0.55	-	-	0.41	-	-	0.71
Anxiety	0.75	0.09	0.00	0.64	-	-	0.82	-	-
Anger	0.48	-0.10	0.00	0.54	-	-	0.51	-	-
Helplessness	0.59	0.03	0.06	0.45	-	-	0.44	-	-
Severity of stuttering	0.01	0.61	0.17	-	0.58	-	-	0.70	-
Emotional avoidance	0.32	0.39	0.03	-	-	-	-	-	-
Attention to stuttering	0.01	0.83	-0.02	-	0.73	-	-	0.85	-
Coping with stuttering	-0.04	0.86	-0.03	-	0.81	-	-	0.84	-
Avoidant cognition of stuttering	0.20	0.62	-0.02	-	0.64	-	-	0.72	-
Speech effort	-0.03	0.54	0.05	-	0.42	-	-	0.66	-
Attending to communication	-0.05	0.00	0.44	-	-	0.39	-	-	0.34
Inter-factor correlations									
Factor 2	.56			.52			.54		
Factor 3	-.10	.04		.01	.05	-	-.04	.27	

Note. Pattern coefficients greater than 0.40 was in bold. Standardized coefficients are shown.

Table 4. Results of the within-individuals multiple regression analyses in unofficial and official communications

	Communications types					
	Unofficial			Official		
	<i>B</i>	95% CI		<i>B</i>	95% CI	
		<i>LL</i>	<i>UL</i>		<i>LL</i>	<i>UL</i>
Factor 1	-0.25**	-0.41	-0.08	-0.04	-0.24	0.16
Factor 2	-0.21**	-0.35	-0.07	-0.63***	-0.82	-0.44
Factor 3	0.83***	0.69	0.96	0.46***	0.28	0.65
<i>R</i> ²		.34			.30	

Note. Factor 1, 2, and 3 represent negative emotion, stuttering and associated reactions, and positive emotion and attending to communication, respectively.

** $p < .01$, *** $p < .001$

Table 5. The relationships between the trait questionnaires and daily satisfaction with communication

Trait questionnaires	Unofficial communications						Official communications					
	<i>B</i>	95% CI		<i>R</i> ²	95% CI		<i>B</i>	95% CI		<i>R</i> ²	95% CI	
		<i>LL</i>	<i>UL</i>		<i>LL</i>	<i>UL</i>		<i>LL</i>	<i>UL</i>		<i>LL</i>	<i>UL</i>
LSAS	-0.72**	-1.19	-0.25	.30	.20	.40	-0.26	-0.76	0.25	.04	.00	.13
OASES	-0.72**	-1.19	-0.25	.49	.40	.58	-0.22	-0.81	0.37	.02	.00	.10
S-24	-1.03***	-1.54	-0.52	.49	.40	.58	-0.70*	-1.33	-0.08	.12	.04	.24
AAQ-II	-0.82***	-1.22	-0.42	.51	.42	.59	-0.34	-0.83	0.15	.07	.01	.17

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit; LSAS = Liebowitz social anxiety scale; OASES = overall assessment of the

speaker's experience for stuttering; S-24 = modified S-24 communication attitudes scale; AAQ-II = acceptance and action questionnaire-II.

* $p < .05$, ** $p < .01$, *** $p < .001$