Misophonia in the UK: norms of the selective sound sensitivity five factor model (S-Five) for misophonia and prevalence of the disorder using a large sample representative of the UK population

Short title: *The prevalence and norms of misophonia in the UK*

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Abstract:

What is the reality of the misophonic experience in the general population? This is a study on misophonia in a large sample, representative of the UK general population. The study utilises a multidimensional psychometric tool, the S-Five, to study the intensity of the triggering misophonic sounds in everyday activities, the emotions/feelings related to them, and the norms of the key components of the misophonic experience: internalising and externalising appraisals, perceived threat and avoidance behaviours, outbursts, and the impact on functioning. Based on the S-Five scores and a semi-structured interview delivered by clinicians who specialise in misophonia, the estimated prevalence of people for whom symptoms of misophonia cause a significant burden in their life in the UK was estimated to be 18%. The psychometric properties of the S-Five in the UK general population were also evaluated and differences across gender and age were explored. Our results show that the five-factor structure is reproduced, and that the S-Five is a reliable and valid scale for the measurement of the severity of the misophonic experience in the general UK population.

Data availability statement:

The data presented in this study are available on request from the first author.

Introduction

Misophonia, by consensus (Swedo et al., 2021), is recognised as a disorder characterised by a disproportionate emotional response to everyday sounds (Jastreboff et al., 2002). The misophonic response can range from mild irritation to anger and distress and can result in impairment to social and occupational functioning (Rouw et al., 2018; Schröder et al., 2013). Common manifestations of misophonia include feelings of anger, disgust, and anxiety (Edelstein et al., 2013; Jager et al., 2020; Johnson, 2013; Kumar et al., 2017; Schröder et al., 2013); muscle tension (Cavanna et al., 2015; Rouw et al., 2018); avoidance of triggering stimuli (Alekri et al., 2019; Rouw et al., 2018; Schneider et al., 2015; Singer, 2018), withdrawal from social situations (Alekri et al., 2019; Hocaoglu, 2018; Johnson et al., 2013; Muller et al., 2018; Schneider et al., 2015; Singer, 2018) and, in some cases, verbal and physical aggression (Alekri et al., 2019; Hocaoglu, 2018; Jager et al., 2020; Reid et al., 2016). Secondary emotional responses have also been reported, for example shame, guilt (Bernstein et al., 2013; Edelstein et al., 2013) and anticipatory anxiety (Alekri et al., 2019).

To date, there is little research on the prevalence of misophonia, with reported estimates varying between 5% and 20% in specific samples. A study of 483 American undergraduate students, reported that nearly 20% of the sample experienced clinically significant symptoms of misophonia (Wu et al., 2014). In a study of 415 Chinese university students reported that 20% of participants were either "often" or "always" sensitive to sounds of people eating, nasal sounds and repetitive tapping, and 6% reported clinically significant misophonia (Zhou et al., 2017). A study on the prevalence of misophonia in Turkey reported the prevalence of 12.8% while 78% of the participants reported to experience aversion to at least one sound (Kılıç et al., 2021). Naylor et al. (2020) found almost half of the undergraduate medical students of their sample reported clinically significant symptoms of misophonia, with the majority (37%) reporting mild symptoms of misophonia and a small number of students (0.3%) reporting severe misophonia. The higher prevalence rate in this population may be explained by the increased propensity of medical students to experience conditions which have been found to co-occur with misophonia.

Research studies have used self-report questionnaires to study misophonia in the general population (Naylor et al., 2020; Wu et al., 2014; Zhou et al., 2017) and in individuals identifying with the condition (Jager et al., 2020; Rouw et al., 2018; Schröder et al., 2013). Vitoratou et

al. (2021b) used the responses of individuals who identified with having misophonia in four waves of sampling to develop a robust psychometric tool that assesses the severity of the misophonic experience. Their work resulted in the S-Five (Selective Sound Sensitivity Syndrome Scale) which surfaced five dimensions of the misophonic experience: a sense of emotional *threat*, *internalising* and *externalising appraisals*, *outbursts* and *impact*. In this work we use this scale to assess misophonia in the UK general population.

To date, no study has investigated misophonia in a sample representative of the UK general population. The S-Five was used to present estimates of the intensity of the emotions caused by sounds which trigger misophonic reactions in everyday activities, and the norms related to the five key components of the misophonic experience. A second aim of the study was to estimate the prevalence of people in the UK for whom symptoms of misophonia cause a significant burden in their life. We aimed to use the outcomes of semi-structured interviews to determine the point on the S-Five at which someone can be considered likely to have significant symptoms of misophonia, and to use that to estimate its prevalence in the UK general population.

Methods

Recruitment

Participants constituted a representative sample of the UK general population, recruited via Prolific.co, via an allocation algorithm to stratify sample size across sex, age, and ethnicity using census data from the UK (Office for National Statistics, 2020). Participants read and consented to participants' information sheet (ethics approval reference RESCM-19/20-11826) and were subsequently screened for their eligibility criteria, which included being aged 18 years or older, English fluency, and no diagnosis of a severe learning or intellectual disability.

Measures

An extended battery of 17 scales were considered within the S-Five study, described in Vitoratou et al. (2021b) and reprinted here in the Appendix (Table A4). In this section we present the tools used in the current validation.

Selective sound sensitivity syndrome scale (S-Five; Vitoratou et al., 2021b)

The S-Five consists of 25 items assessing the severity of misophonia. It is rated an interval scale from 0: not at all true to 10: completely true. The severity scale is also complemented

by a trigger checklist (S-Five-T), to assess the trigger sounds, the response to them, and the intensity of the response. The checklist currently uses 37 triggers suggested by research data, but researchers can add or remove sounds. The type of reaction to the trigger can be recorded and in this study were: no feeling, irritation, distress, disgust, anger, panic, other feeling: negative, and other feeling: positive. Each trigger item also rates the intensity (henceforth trigger intensity) of the reaction (from 0: doesn't bother me at all to 10: unbearable/causes suffering). This allows for the computation of four indices: 1) the trigger count (TC), which is the total number of triggers endorsed by a participant from the list provided, 2) the reaction count (RC), which is the number of times each particular reaction type is endorsed and can be counted across triggers in a single participant, or across participants, 3) the frequency/intensity of reactions score (FIRS) is the total value of the intensity items of all endorsed triggers, and 4) the relative intensity of reactions score (RIRS) which gives an estimate of the intensity of reactions to triggers, relative to the number of triggers reported. The 25 statements and the trigger checklist used in this study are reprinted here in the Appendix (Table A1) along with the details and examples for the computation of the five factors and the four trigger indices, originally presented in Vitoratou et al. (2021a; 2021b).

Misophonia Questionnaire (MQ; Wu et al., 2014)

The MQ is a self-report measure consisting of three measures for misophonia: the Misophonia Symptom Scale (MSYS) which assesses sensitivity to specific triggers in comparison to other people, the Misophonia Emotions and Behaviours Scale (MEBS) which relates to an individual's reactions to triggering sounds. The MQ total score which is calculated by combining the scores of both the MSYS and the MEBS. The third section of the MQ, is the Misophonia Severity Scale (MSES). It is a single item which asks individuals to rate the severity of their sound sensitivity on a scale from 1 (minimal) to 15 (very severe), with a score greater than or equal to 7 indicating clinically significant symptoms.

Amsterdam Misophonia Scale (A-MISO-S; Schröder et al., 2013)

The A-MISO-S was adapted from the Yale-Brown Obsessive-Compulsive Scale (YBOCS; Goodman et al., 1989). The A-MISO-S address different aspects of misophonia, including time spent occupied by misophonia, impact on functioning, distress, attempts to resist, perceived control over sounds and thoughts, and avoidance. An interviewer discusses the questions

with the patient and uses clinical judgement to rate each item (Schröder et al., 2013), although it has also been used as a self-report tool (Quek et al., 2018).

Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001)

PHQ-9 has 9 items measuring the severity of depression with items scored on a 4-point ordinal scale, and a total score range of 0 to 27.

General Anxiety Disorder-7 questionnaire (GAD-7; Spitzer et al., 2006)

GAD-7 is a 7-item scale measuring severity of anxiety symptoms, rated on a 4-point ordinal scale and a total score ranging from 0 to 21.

The diagnostic interview

A preliminary version of the Oxford King's Structured Clinical Interview for Misophonia (Pre-OK-SCIM, in development by the authors) was used. The preliminary version used for the present study contained a series of questions and prompts to determine whether six key criteria were met, adapted from the Amsterdam UMC revised diagnostic criteria for misophonia (Jager et al., 2020). The modifications were made based on outcomes from recent research (Vitoratou et al., 2021a; Vitoratou et al., 2021b) and observations in clinical practice. Notably, we did not require an oral or nasal sounds to be a trigger (A), intense reactions were not limited to irritation, anger and disgust (B), the individual did not need to recognise the excessive nature of the response (B), loss of control included experiencing panic and helplessness (C), and coping strategies were included (D).

An outcome of "significant misophonia" on the Pre-OK-SCIM indicated that the individual was significantly burdened by misophonia in their life at the time of the interview. It was not intended to be a clinical diagnosis of misophonia at a disorder level, and therefore does not assume levels of distress and impairment on par with, for instance, diagnoses such as obsessive-compulsive disorder or posttraumatic stress disorder. The Pre-OK-SCIM was administered by registered psychologists experienced with misophonia to allow for flexibility and clinical judgement in the use of the protocol.

Statistical Analysis

The latent structure of the S-Five was assessed using exploratory (EFA) and confirmatory factor analysis (CFA). The data were checked for their suitability for factor analysis using the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy (Kaiser, 1960; Kaiser et al., 1974) and

Bartlett (1951) test of sphericity. In EFA, the maximum likelihood estimator with robust standard errors (MLR; Muthen et al., 1998-2017) was incorporated due to data being skewed, with Oblimin rotation. To establish the number of factors, the Guttman-Kaiser criterion (Guttman, 1954; Kaiser, 1960) and the parallel analysis criterion (Horn, 1965) were followed, depicted using Cattell's scree plot (1966). The percentage of variance explained was also evaluated (see for instance Nunnally et al., 1994). Goodness of fit indices were computed to to assess the relative and absolute fit of competing models. The measures of fit that are reported include the relative chi-square (relative χ^2: values close to 2 suggest an acceptable fit; Hoelter, 1983), the Root Mean Square Error of Approximation (RMSEA: values <.06 are required for adequate fit; Hu et al., 1999), the Taylor-Lewis Index (TLI: values >.95 suggest close fit; Hu et al., 1999), the Comparative Fit Index (CFI: values >.95 are required for close fit; Hu et al., 1999; West et al., 2012) and the Standardized Root Mean Residual (SRMR: values <.08 are needed for good fit; Hu et al., 1999). The multiple indicator multiple causes model (MIMIC; Joreskog et al., 1975; Muthén, 1979) was used to assess the measurement invariance in relation to gender and age.

Internal consistency was computed within each factor using the Cronbach's alpha coefficient (Cronbach, 1951; α) and McDonald's (1999) Omega (ω). Test-retest reliability was assessed at item level by computing the Psi coefficient (Kuiper et al., 2019), to accommodate the skewness of the data on item level, and at factor level using the (mixed effects, absolute agreement) Intraclass Correlation Coefficient (ICC; Shrout et al., 1979). The latter was evaluated according to interpretation guidelines outlined by Landis et al. (1977). The assessment of convergent validity and hypothesis testing were conducted using parametric (Pearson's r, t-test) and non-parametric (Spearman's rho, Mann-Whitney test) methods depending on the distribution of the data.

To establish a cut-off score for significant misophonia from the S-Five, and subsequently estimate of prevalence, receiver operating characteristic (ROC) curve analysis was carried out. Using the outcome of the Pre-OK-SCIM, those with significant misophonia were classified as cases and those without this outcome were classified as controls. The ROC (Altman et al., 1994a, 1994b) curves were plotted for each of the S-Five subscales and total score and for the S-Five-T variables, with the Pre-OK-SCIM caseness as the classification variable. First, the area under the curve (AUC) values were considered, with good predictive ability achieved by an

AUC above or equal to 0.8. Where an adequate AUC was established, the optimal cut-off scores were considered, for which a balance of sensitivity and specificity, close to 80%, and the (Youden, 1950) J index. The ROC analysis was extended to test the presence of significant covariates through ROC regression analysis (Janes et al., 2009; Janes et al., 2008; Pardo-Fernandez et al., 2014).

The interview was conducted on a sample from the general population and a self-reporting misophonia sample. Thirty individuals who identified with the condition were randomly invited for the interview. A second sample of 30 individuals from the Prolific sample (representative of the UK population) were invited, which included individuals from all 10th-tiles of the total S-Five distribution, to ensure representation of the interviews of various levels of severity and to ensure the presence of people with significant misophonia.

Data analyses were conducted using MPlus 8 (Muthen et al., 1998-2017), Stata 16 (StataCorp, 2019), and R (R Core Team, 2017) statistical packages.

Results

Descriptive indices

With respect to gender, 396 individuals identified as females (7 trans women), 372 as males (1 trans man), and 4 identified as non-binary or other. The mean age was 46.4 years old (standard deviation SD=15.5, min=19, max=83) and did not differ across genders (t=0.905, df=758, p=0.366). Only 13.6% of the sample was aware of the term misophonia and 2.3% identify as having the disorder.

S-Five statements

Statement responses

The norms of each of the S-Five item/statements for the UK population are presented in Table 1. More highly endorsed were the item statements which refer to 'externalising appraisals' (for example I06 'others should avoid making noises'). The least endorsed statements were the statements related to being verbally aggressive (I04) and violent (I24), and impact (I01 'do not meet friends' and I20 'limited job opportunities').

With respect to reported gender, females scored significantly lower than males in one of the statements (I17 'physically aggressive'; Table 1). Almost all items had significant but weak,

negative correlations with age. The older the responder, the lower the endorsement of the statements were, apart from I13 'others should not make sounds' which was weakly related to age.

EFA and CFA: dimensionality and measurement invariance

The data were suitable for factor analysis according to the diagnostic criteria (anti-image correlations >0.88 in all statements, KMO=0.94, Bartlett's test: χ^2=13773,1, df=300, p<0.001).

The first random split half of the data was used in EFA. The sample correlation matrix with five eigenvalues above 1 (10.3, 2.8, 1.7, 1.5, and 1.3) suggested a five-factor structure according to Kaiser-Guttman criterion, explaining 73% of the total variance. Parallel analysis also indicated that five factors should be extracted, as is depicted in the Scree plot in Figure 1. The goodness of fit examination suggested adequate to close fit indices for the five-factor model (rel χ^2=2.25; RMSEA=0.057 with 95% (0.050,0.065), TLI=0.90, CFI=0.93, SRMR=0.025). We therefore accepted this solution (Table 2) and proceeded with CFA in the second split half of the data which also indicated good fit to our data (rel χ^2=2.38; RMSEA=0.066 with 95% (0.060,0.072), TLI=0.88, CFI=0.89, SRMR=0.062). The model presented in Table 2 (EFA and CFA loadings) coincides with the original model found by Vitoratou et al. (2021b) using responses from people identifying with misophonia.

The complete sample was used in the evaluation of the measurement invariance of the tool with respect to gender and age using a MIMIC model. At least one item per factor was found to be non-invariant due to gender (six significant direct effects d.e. in total: I02 d.e.=0.22, I04 d.e.=0.23, I05 d.e.=0.35, I12 d.e.=0.48, I14 d.e. 0.12, I20 d.e=0.47, and I25 d.e.=-0.61). However, the actual differences in the expected scores were remarkably low, as the magnitude of all gender direct effects found significant was half a unit over eleven possible units. For example, for the same levels of latent sound sensitivity, women are expected to score significantly higher on the internalising statement I05 'respect myself less' by 0.35 units, on the 0-10 scale. When it comes to age, the effects were even less, with about 0.03 units expected increase per year of age (I05 d.e.=0.03 and I08 d.e.=0.02). Therefore, we consider the bias introduced in the measurement by gender and age minimal if not negligible and we conclude that the assessment of structural invariance is attainable.

Norms for the UK population, reliability, and validity

The norms of the S-Five factor scores for the UK general population are presented in Table 2. There were no significant differences in the total and factor scores with respect to gender. All S-Five scores were significantly lower than those reported in the Vitoratou et al. (2021b) sample of individuals who identify with the condition (p<0.001 in all cases; data available on request).

With respect to internal consistency, alpha and omega were satisfactory for all factors (0.83 or higher; Table 2), while test-retest reliability was also satisfactory with ICC being larger than 0.86 for all S-Five scores. No significant differences occurred with respect to gender for each factor of the S-Five, while negative low correlations emerged with age (-0.12 to -0.20), except for the *externalising* factor (Table 2). The factor intercorrelations were moderate to moderately strong and positive, as anticipated (Table 3).

Next, we follow Vitoratou et al. (2021b) and we present the correlations of the S-Five factor and total scores with the two other misophonia scales (MQ and A-MISO-R), PHQ9 (depression) and GAD7 (anxiety; Table 3). All S-Five scores emerged moderately strong, positive significant correlations with the MQ and A-MISO-R scores, thus providing evidence of the concurrent, convergent validity of the measurements. Correlations between the S-Five total scores and PHQ9 and GAD7 were weak to moderate with the lowest correlation between the *externalising* factor and PHQ9, followed by correlations between GAD7 and *externalising* factor, and PHQ9 and the *impact* factor.

S-Five trigger checklist (S-Five-T)

The scoring guide and the programming codes (SPSS, R project, Stata) to obtain factors and indices are freely available upon request made to the first author.

Trigger count and reactions per trigger

On average, individuals reported a negative reaction to 17 triggers out of 37. Only 28 individuals selected *no feeling* to all sounds presented.

For each specific sound we computed the percentage of individuals who selected each reaction. In this general population sample, the *no feeling* option was selected by most of the participants across all sounds (see Figure 2 which presents the percentage of respondents which selected each reaction for the 37 trigger items; for example, for the trigger sound 'yawning', 84% of the participants selected 'no feeling', 12% 'irritation', 1% selected 'distress', etc).

For sounds such as 'normal breathing', 'yawning', 'footsteps', and 'certain accents (letters)', more than 80% of the participants reported *no feeling*. On the contrary, there were sounds where the percentages were reversed. For instance, less than 25% percent of the participants reported *no feeling* when it came to the sounds 'teeth sucking', '[dog] barking', 'slurping', 'chewing gum', 'snoring', 'sniffing', 'coughing', and 'loud breathing'. The most frequently reported negative reaction was *irritation*, for all trigger sounds except loud chewing, for which *disgust* was more frequently reported (39%). The largest percentage of individuals reporting *distress* was in relation to 'baby crying' (21%), reporting *anger* was in relation to 'snoring' (15%) and 'barking' (14%), and reporting *panic* was in relation to 'footsteps' (4%).

Reaction counts

For each specific reaction we computed the number of times (that is number of trigger sounds) it was selected, over all triggers, to compute the corresponding reaction count (RC).

The norms for the UK population of the RC for each reaction to trigger sounds are presented in Table 4. Women related more often than men to feelings of *disgust* and *distress* to the triggers sounds, whereas men reported more often *no feeling* related to the triggers. With respect to age, there were significant low negative correlations with all RC apart from *irritation* where the correlation was positive (Table 4).

Table 5 presents the Intercorrelations of the S-Five, S-Five-T scores, and correlations with other measures. There were significant positive moderate correlations between RCs and the S-Five factors, A-MISO-S, and MQ, except for *no feeling*, which showed moderate negative correlations (please see Table 5). Furthermore, the FIRS had moderate to strong correlations

with the S-Five factors, A-MISO-R, and MQ. Lower yet significant correlations emerged between the RC scores and the measures of depression and anxiety.

Intensity of the emotional response. Table 6 presents the norms and reliability of the intensity items for the 37 S-Five-T sounds. The highest mean intensity occurred in the 'loud chewing', 'repetitive barking', 'snoring', and 'chewing gum' sounds (see also Figure 3). Females reported higher intensity than males in all triggers, some were statistically significant, with the largest differences occurring in 'loud chewing', 'joint cracking', and 'slurping'. Very weak yet significant correlations with age emerged. The stability of the intensity items was excellent (ICC>0.8).

Women had higher FIRS scores than men by 9 units on average (Table 6), while a very low and negative correlation with age emerged. FIRS correlated very strongly and negatively with the 'no feeling' RC, indicating convergence validity of the scores. Moderate to strong correlations emerged with other RC scores and had moderate to strong correlations with the S-Five factor and total scores (Table 5). FIRS had low correlations with GAD7 and PHQ9, and moderate with A-MISO-S and moderately strong correlations with the MQ symptom scale.

With respect to the total RIRS score (Table 6), no significant associations with age and gender emerged. RIRS correlated negatively with the 'no feeling' RC, indicating convergence validity of the scores. Moderate to strong correlations emerged with the other RC scores, the S-Five factor and total scores, and the scores of the other measures (Table 5).

Prevalence of misophonia in the UK population. The Pre-OK-SCIM was implemented with 29 participants sampled from the general population and 26 from the misophonia population (five individuals did not respond to our invitation). The two samples did not significantly differ by age (t=0.55, df=53, p=0.59), with average age of 44 years old (mean=44.0, sd=13.7). Of the general sample, 44.8% identified as women, compared to 84.6% women in the misophonia sample (χ^2 (1, N=55) =9.3786, *p*=0.002). The Pre-OK-SCIM classified 14% (4 participants) of the general population sample and 81% (21 participants) of the misophonia sample as having 'significant misophonia'.

The ROC analysis suggested a cut-off score for the S-Five total as 87 or above (out of 250) for the presence of significant misophonia, where sensitivity and specificity were most balanced (sensitivity 84%, specificity 72%, Youden's J value 0.564, AUC=0.83). A large AUC was also

present for the impact (AUC=0.87) and threat scores (AUC=0.88), while the least discriminative of the S-Five scores was the externalising factor (Figure 3). Moderately discriminative were the S-Five-T scores (Figure A1).

With 87 as the cut-off point on the S-Five, we found that 142 individuals out of 772 met the threshold for significant misophonia in our UK representative sample. Therefore, we estimated that a percentage of 18.4% of the UK population experiences misophonia to an extent that it causes significant burden. There were no significant differences in gender in the prevalence of misophonia (χ^2 (1, N=768) =0.06, p=0.80). The average age of those above the threshold for misophonia (mean = 43.7 years; SD = 1.21) was lower than those below the threshold for misophonia (mean = 47.0 years; SD = 0.63), and this difference was significant (t=2.18, df=770, p=0.03). The age and gender of participants were not found to significantly affect either the performance of the S-Five total score or the ability of the S-Five total score to discriminate between cases and controls.

Discussion

The main purpose of this study was to evaluate the structure and psychometric properties of the scale, present the S-Five and S-Five-T norms for the general UK population, and to estimate the prevalence of misophonia in the UK.

Factor analyses supported the five-factor structure originally validated in a sample of individuals identifying with misophonia (Vitoratou et al., 2021b), suggesting that this tool is suitable for use in both clinical and community samples. Measurement invariance with respect to age and gender was established. The scale showed satisfactory reliability indices (internal consistency and stability) and concurrent (convergent and discriminant) validity. In all assessments, the S-Five was found to have satisfactory psychometric properties for the UK general population.

Average scores were highest for the *externalising appraisals*, and lowest in the *impact* factor. This is in contrast to the pattern of findings found in the population of individuals identifying with the condition (Vitoratou et al., 2021b), where the mean scores were the highest for the *threat* factor while the lowest for the *outburst* factor. These results indicate that attributing blame on others for making aversive sounds is a relatively common phenomenon, compared

with the other factors measured by the S-Five. This is supported by the finding that the *externalising* factor showed to be the least discriminative of misophonia.

In relation to trigger sounds, we found that there were certain sounds that frequently elicited a negative emotional response, such as loud chewing, slurping, snoring and loud breathing. The most common reaction reported was irritation, except in the case of loud chewing, where disgust was more frequent. This suggests that many of the sounds frequently reported as triggers in misophonia are also aversive to the general population. However, there appear to be two key differences in the pattern of trigger reactions in misophonia compared with the general population. The first is in the types of triggers, for example, normal breathing being indicative of higher levels of misophonia, and swallowing being a highly reliable indicator for individuals with higher misophonia levels (Vitoratou et al., 2021a). Both these sounds were reported as eliciting no feeling in most of the general population in the present study.

The second key difference is in the nature of the reaction, with anger and panic reported more often in misophonia (Vitoratou et al., 2021b). We found that irritation was frequently reported by the general population for a range of sounds, and that the irritation reaction count had only a low correlation with the total S-Five and the A-MISO-S, providing further evidence that responding with irritation is not a good indicator of the presence of misophonia (Remmert et al., 2022; Vitoratou et al., 2021b). Additionally, irritation was not correlated with any of the other negative emotion reaction counts (anger, disgust, distress and panic), nor with symptoms of anxiety and depression, all of which were moderately correlated with each other and with S-five total scores. This study estimated that almost one in five people (18.4%) in the UK experience misophonia to a level where it causes significant burden in terms of distress and impact. The prevalence and severity of misophonia appears to be similar in men and women, which was surprising considering the disproportionate number of women in previous misophonia research samples (see for instance Jager et al., 2021; Rouw et al., 2018; Wu et al., 2014). Further, there was a small but significant difference in the average age for those with significant and non-significant misophonia with those above the threshold for misophonia being on average 3.3 years younger than those below the threshold. This is consistent with the prevalence study in Ankara, Turkey (Kılıç et al., 2021), which indicated younger age to be a predictor of misophonia. This could be due to improved coping strategies

and developing more effective organisation of everyday functioning to minimise the exposure to sounds and their impact as the age progresses.

It is important to note that the preliminary version of the OK-SCIM was developed prior to the consensus definition of misophonia as a disorder (Swedo et al., 2021). Our research team have refined the OK-SCIM and are validating the tool's capacity to distinguish clinical misophonia (i.e. misophonia that causes current significant distress or impairment at a "disordered" level) from subclinical misophonia (presence of misophonia symptoms without current significant distress and impairment) and no misophonia. This will enable us to estimate prevalence of misophonia as a disorder as well as significant symptoms of misophonia. The present study should therefore be interpreted as the prevalence of individuals who have misophonia symptoms to an extent that they consider it to cause a significant burden in their lives.

The strength of the present study is that a large sample representative of the UK general population was used, which contributed to the external validity of the results. Furthermore, state-of-the-art psychometric techniques were used, including ROC curve regression analysis, which allowed us to establish a meaningful cut-off score for significant misophonia, found not to be affected by age or gender. We therefore present the best estimate available for misophonia in the UK.

There were several limitations to this study. First, the sample was representative of the UK population only; the results may differ across countries and cultures. Second, there were limitations to the interview protocol, as described above. We attempted to minimise the limitations of this tool by having it administered by qualified psychologists experienced in working with misophonia, who were able to use the tool flexibly to determine the presence or absence of significant misophonia. The OK-SCIM has since been refined by the research team in line with the consensus definition of misophonia as a disorder (Swedo et al., 2021), and subsequently tested for use by non-clinician interviewers, to validate its capacity to identify subclinical and clinical misophonia (data currently being analysed). Finally, the questionnaire should be tested in a treatment sample to assess its suitability for use as a measure of clinical change.

In conclusion, our results show that the S-Five is a valid and reliable tool for measuring the presence and severity of misophonia in the UK general population. The Vitoratou et al. (2021b) five-factor solution was replicated in the general population data, with good reliability and validity. By using semi-structured clinical interviews, we were able to establish a cut-off score for significantly burdensome misophonia. This, in turn, allowed us to estimate that the prevalence of misophonia in the UK is 18.4%. Our results show that misophonia is relatively common condition and further research is needed to determine at what point this condition becomes "disordered" in terms of distress, impact and need for treatment.

References

Alekri, J., & Al Saif, F. (2019). Suicidal misophonia: a case report. *Psychiatry and Clinical Psychopharmacology, 29*(2), 232-237. https://doi.org/10.1080/24750573.2019.1597585

Altman, D. G., & Bland, J. M. (1994a). Diagnostic tests. 1: Sensitivity and specificity. *BMJ (Clinical research ed.), 308*(6943), 1552. https://doi.org/10.1136/bmj.308.6943.1552

Altman, D. G., & Bland, J. M. (1994b). Statistics Notes: Diagnostic tests. 2: predictive values. *BMJ (Clinical research ed.), 309*(6947), 102. https://doi.org/10.1136/bmj.309.6947.102

Bartlett, M. S. (1951). The effect of standardization on a Chi-square approximation in factor analysis. *Biometrika, 38*(3/4), 337-344.

Bernstein, R., Angell, K., & Dehle, C. (2013). A brief course of cognitive behavioural therapy for the treatment of misophonia: a case example. *The Cognitive Behaviour Therapist, 6*. https://doi.org/10.1017/s1754470x13000172

Cattell, R. B. (1966, Apr 1). The Scree Test For The Number Of Factors. *Multivariate Behavioral Research, 1*(2), 245-276. https://doi.org/10.1207/s15327906mbr0102_10

Cavanna, A. E., & Seri, S. (2015). Misophonia: current perspectives. *Neuropsychiatr Dis Treat, 11*, 2117-2123. https://doi.org/10.2147/NDT.S81438

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

Edelstein, M., Brang, D., Rouw, R., & Ramachandran, V. S. (2013). Misophonia: physiological investigations and case descriptions. *Frontiers in Human Neuroscience, 7*, 296. https://doi.org/10.3389/fnhum.2013.00296

Goodman, W. K., Price, L. H., Rasmussen, S. A., Mazure, C., Fleischmann, R. L., Hill, C. L., Heninger, G. R., & Charney, D. S. (1989, Nov). The Yale-Brown Obsessive Compulsive Scale. I. Development, use, and reliability. *Archives of general psychiatry, 46*(11), 1006-1011. https://doi.org/10.1001/archpsyc.1989.01810110048007

Guttman, L. (1954). Some necessary conditions for common factor analysis. *Psychometrika, 19*, 149–161. https://doi.org/10.1007/bf02289162

Hocaoglu, C. (2018). A little known topic misophonia: two case reports. *Dusunen Adam: The Journal Of Psychiatry And Neurological Sciences, 31*(1), 89-96. https://doi.org/10.5350/dajpn2018310109

Hoelter, J. (1983). The Analysis of Covariance Structures. *Sociological Methods & Research, 11*, 325-344. https://doi.org/10.1177/0049124183011003003

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

Hu, L., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1-55. https://doi.org/10.1080/10705519909540118

Jager, I., de Koning, P., Bost, T., Denys, D., & Vulink, N. (2020). Misophonia: Phenomenology, comorbidity and demographics in a large sample. *PLOS ONE, 15*(4), e0231390. https://doi.org/10.1371/journal.pone.0231390

Jager, I., Vulink, N., Bergfeld, I., Loon, A., & Denys, D. (2021). Cognitive behavioral therapy for misophonia: A randomized clinical trial. *Depression And Anxiety, 38*, 708– 718. https://doi.org/10.1002/da.23127I

Janes, H., Longton, G., & Pepe, M. S. (2009). Accommodating covariates in receiver operating characteristic analysis. *The Stata Journal, 9*(1), 17-39.

Janes, H., & Pepe, M. S. (2008). Adjusting for covariates in studies of diagnostic, screening, or prognostic markers: an old concept in a new setting. *American journal of epidemiology, 168*(1), 89-97.

Jastreboff, M. M., & Jastreboff, P. J. (2002). Decreased sound tolerance and tinnitus retraining therapy (TRT). *The Australian and New Zealand Journal of Audiology, 24*(2), 74. https://doi.org/10.1375/audi.24.2.74.31105

Johnson, M. A. (2013). *Rating Misophonia Severity: The Misophonia Assessment Questionnaire*.

Johnson, P., Webber, T., Wu, M., Lewin, A., Murphy, T., & Storch, E. (2013). When selective audiovisual stimuli become unbearable: a case series on pediatric misophonia. *Neuropsychiatry, 3*, 569-575. https://doi.org/10.2217/npy.13.70

Joreskog, K., & Goldberger, A. (1975). Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable. *Journal of the American Statistical Association, 70*(351), 631-639. https://doi.org/10.2307/2285946

Kaiser, H. F. (1960). The Application of Electronic Computers to Factor Analysis. *Educational and Psychological Measurement, 20*(1), 141-151. https://doi.org/10.1177/001316446002000116

Kaiser, H. F., & Rice, J. (1974). Little Jiffy, Mark Iv. *Educational and Psychological Measurement, 34*(1), 111-117. https://doi.org/10.1177/001316447403400115

Kılıç, C., Öz, G., Avanoğlu, K., & Aksoy, S. (2021). The prevalence and characteristics of misophonia in Ankara, Turkey: population-based study. *Bjpsych Open, 7*(5). https://doi.org/10.1192/bjo.2021.978

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001, Sep). The PHQ-9: validity of a brief depression severity measure. *Journal of general internal medicine, 16*(9), 606-613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Kuiper, R., & Hoogenboezem, R. (2019). *nopaco: a Non-Parametric Concordance Coefficient.* In (Version 1.0.5) https://CRAN.R-project.org/package=nopaco

Kumar, S., Tansley-Hancock, O., Sedley, W., Winston, J. S., Callaghan, M. F., Allen, M., Cope, T. E., Gander, P. E., Bamiou, D.-E., & Griffiths, T. D. (2017). The Brain Basis for Misophonia. *Current Biology, 27*(4), 527-533. https://doi.org/10.1016/j.cub.2016.12.048

Landis, J. R., & Koch, G. G. (1977, Mar). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159-174.

McDonald, R. P. (1999). *Test Theory: A Unified Treatment*. Psychology Press. https://doi.org/10.4324/9781410601087

Muller, D., Khemlani-Patel, S., & Neziroglu, F. (2018). Cognitive-Behavioral Therapy for an Adolescent Female Presenting With Misophonia: A Case Example. *Clinical Case Studies, 17*(4), 249-258. https://doi.org/10.1177/1534650118782650

Muthén, B. (1979). A structural probit model with latent variables. *Journal of the American Statistical Association, 74*, 807-811. https://doi.org/10.2307/2286403

Muthen, L. K., & Muthén, B. (1998-2017). *Mplus User's Guide* (Eighth ed.). Los Angeles, CA: Muthén & Muthén.

Naylor, J., Caimino, C., Scutt, P., Hoare, D. J., & Baguley, D. M. (2020, Aug 23). The Prevalence and Severity of Misophonia in a UK Undergraduate Medical Student Population and Validation of the Amsterdam Misophonia Scale. *Psychiatric Quarterly*. https://doi.org/10.1007/s11126-020-09825-3

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. McGraw-Hill.

Office for National Statistics. (2020). *2011 Census: Aggregate Data* (SN 7427. https://doi.org/10.5257/census/aggregate-2011-2

Pardo-Fernandez, J. C., Rodríguez-Álvarez, M., & Keilegom, I. (2014). A review on ROC curves in the presence of covariates. *Revstat - Statistical Journal, 12*, 21-41.

Quek, T. C., Ho, C. S., Choo, C. C., Nguyen, L. H., Tran, B. X., & Ho, R. C. (2018, Jul 4). Misophonia in Singaporean Psychiatric Patients: A Cross-Sectional Study. *Int J Environ Res Public Health, 15*(7). https://doi.org/10.3390/ijerph15071410

R Core Team. (2017). *R: A language and environment for statistical computing.* In R Foundation for Statistical Computing. https://www.R-project.org/

Reid, A. M., Guzick, A. G., Gernand, A., & Olsen, B. (2016). Intensive cognitive-behavioral therapy for comorbid misophonic and obsessive-compulsive symptoms: A systematic case study. *Journal of Obsessive-Compulsive and Related Disorders, 10*, 1-9. https://doi.org/10.1016/j.jocrd.2016.04.009

Remmert, N., Jebens, A., Gruzman, R., Gregory, J., & Vitoratou, S. (2022). A nomological network for misophonia in two German samples using the S-Five model for misophonia. *Manuscript submitted in Advances in Understanding the Nature and Features of Misophonia, Frontiers in Psychology.*

Rouw, R., & Erfanian, M. (2018, Mar). A Large-Scale Study of Misophonia. *Journal of Clinical Psychology, 74*(3), 453-479. https://doi.org/10.1002/jclp.22500

Schneider, R. L., & Arch, J. J. (2015, Jul-Aug). Letter to the editor: potential treatment targets for misophonia. *General Hospital Psychiatry, 37*(4), 370-371. https://doi.org/10.1016/j.genhosppsych.2015.03.020

Schröder, A. E., Vulink, N., & Denys, D. (2013). Misophonia: Diagnostic Criteria for a New Psychiatric Disorder. *PLOS ONE, 8*(1), e54706. https://doi.org/10.1371/journal.pone.0054706

Shrout, P. E., & Fleiss, J. L. (1979, Mar). Intraclass correlations: uses in assessing rater reliability. *Psychological Bulletin, 86*(2), 420-428. https://doi.org/10.1037//0033-2909.86.2.420

Singer, D. A. (2018). *The mixed-methods case study of "Zara": Cognitive Behaviour* The state university of New Jersey]. New Brunswick, New Jersey. https://rucore.libraries.rutgers.edu/rutgers-lib/58681/PDF/1/play/

Spitzer, R. L., Kroenke, K., Williams, J. B., & Lowe, B. (2006, May 22). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of general psychiatry, 166*(10), 1092-1097. https://doi.org/10.1001/archinte.166.10.1092

StataCorp. (2019). *Stata Statistical Software: Release 16.* In

Swedo, S., Baguley, D. M., Denys, D., Dixon, L. J., Erfanian, M., Fioretti, A., Jastreboff, P. J., Kumar, S., Rosenthal, M. Z., Rouw, R., Schiller, D., Simner, J., Storch, E. A., Talylor, S., Werff, K. R. V., & Raver, S. M. (2021). A Consensus Definition of Misophonia: Using a Delphi Process to Reach

Expert Agreement. *medRxiv*, 2021.2004.2005.21254951. https://doi.org/10.1101/2021.04.05.21254951

Vitoratou, S., Uglik-Marucha, N., Hayes, C., Erfanian, M., Pearson, O., & Gregory, J. (2021a). Item Response Theory Investigation of Misophonia Auditory Triggers. *Audiology, 11*(4), 567-581. https://doi.org/10.3390/audiolres11040051

Vitoratou, S., Uglik-Marucha, N., Hayes, C., & Gregory, J. (2021b). Listening to people with misophonia: exploring the multiple dimensions of sound intolerance using a new psychometric tool, the S-Five, in a large sample of individuals identifying with the condition. *Psych, 3*, 639-662. https://doi.org/10.3390/psych3040041

West, S. G., Taylor, A. B., & Wu, W. (2012). Model fit and model selection in structural equation modeling. In H. R. H. (Ed.), *Handbook of structural equation modeling* (pp. 209-231). Guilford Press.

Wu, M. S., Lewin, A. B., Murphy, T. K., & Storch, E. A. (2014). Misophonia: Incidence, Phenomenology, and Clinical Correlates in an Undergraduate Student Sample. *Journal of Clinical Psychology, 70*(10), 994-1007. https://doi.org/10.1002/jclp.22098

Youden, W. J. (1950). Index for rating diagnostic tests. *Cancer, 3*(1), 32-35. https://doi.org/10.1002/1097-0142(1950)3:1<32::aid-cncr2820030106>3.0.co;2-3

Zhou, X., Wu, M. S., & Storch, E. A. (2017). Misophonia symptoms among Chinese university students: incidence, associated impairment, and clinical correlates. *Journal of Obsessive-Compulsive and Related Disorders, 14*, 7-12. https://doi.org/https://doi.org/10.1016/j.jocrd.2017.05.001

Appendix

Table A1. The S-Five statements.

Please read each statement* carefully and base your answer on how true they feel to you based on your current <u>thoughts, experiences, and reactions.</u>

Not at all true   **Completely true**
0   1   2   3   4   5   6   7   8   9   10

Externalising
I13 People should not make certain sounds, even if they do not know about others' sensitivities
I25 I get angry at other people because of how disrespectful they are with the noises they make
I06 People should do everything they can to avoid making noises that might bother others
I16 I react strongly to certain sounds because I cannot stand how selfish, thoughtless, or bad-mannered people can be
I21 Certain sounds are just bad manners, and it is not strange to feel intense anger about that

Internalising
I18 The way I react to certain sounds makes me wonder whether deep inside I am just a bad person
I08 The way I react to certain noises makes me feel like I must be an unlikable person deep down
I05 I respect myself less because of my responses to certain sounds
I12 I feel like I must be a very angry person inside because of the way I react to certain sounds
I19 I dislike myself in the moments of my reactions to sounds

Impact
I20 My job opportunities are limited because of my reaction to certain noises
I01 I do not meet friends as often as I would like to because of the noises they make
I14 There are places I would like to go but do not, because I am too worried about how the noises will impact me
I15 I can see future where I cannot do everyday things because of my reactions to noises
I09 The way I feel/react to certain sounds will eventually isolate me and prevent me from doing everyday things

Outburst
I17 I can get so angry at certain noises that I get physically aggressive towards people to make them stop
I22 Sometimes I get so distressed by noises that I use violence to try and make it stop
I23 Some sounds are so unbearable that I will shout at people to make them stop
I04 If people make certain sounds that I cannot bear, I become verbally aggressive
I24 I am afraid I will do something aggressive or violent because I cannot stand the noise someone is making

Threat
I11 I feel trapped if I cannot get away from certain noises
I07 I feel anxious if I cannot avoid listening to certain sounds
I02 If I cannot get away from certain noises, I am afraid I might panic or feel like I will explode
I03 If I cannot avoid certain sounds, I feel helpless
I10 I can experience distress as the result of some noises

* Items should be randomised before being administered and without enumeration.

Table A2. Scoring instructions for the S-Five.

Factor	Item number	Score calculation	Range
Externalising	I13, I25, I06, I16, I21	I13 + I25 + I06 + I16 + I21	0-50
Internalising	I18, I08, I05, I12, I19	I18 + I08 + I05 + I12 + I19	0-50
Impact	I20, I01, I14, I15, I09	I20 + I01 + I14 + I15 + I09	0-50
Outburst	I17, I22, I23, I04, I24	I17 + I22 + I23 + I04 + I24	0-50
Threat	I11, I07, I02, I03, I10	I11 + I07 + I02 + I03 + I10	0-50
Total S-Five-E score	I01-I25	$\sum$ (I01-I25)	0-250

Each factor has 5 items rated on a 0-10 ordinal scale, thus the scores are directly comparable in terms of statement endorsement.

The scoring guide and the programming codes (SPSS, R project, Stata) to obtain all factors and indices are freely available upon request made to the first author. The S-Five, © Copyright King's College London, 2021. All Rights Reserved.

Table A3. The S-Five-t triggers checklist and scoring.

Trigger reaction items

Thinking about the past few weeks, what is the main feeling this sound* has caused you? *(please choose the most characteristic one)*

No feeling Irritation Distress Disgust Anger Panic Other feeling: Negative Other feeling: Positive Other: Physiological reaction

Sound*

Trigger intensity items

Thinking about the past few weeks, please rate the intensity of your reaction to this sound* when made by another person or object *(from 0: doesn't bother me at all to 10: unbearable/causes suffering).*

Doesn't bother me at all   **Unbearable/causes suffering**
0   1   2   3   4   5   6   7   8   9   10

Sound*

*List of triggers currently included in the S-Five-t: Normal eating sounds, Certain letter sounds, Mushy foods being eaten, Sound of clipping nails, Swallowing, Keyboard tapping, Lip smacking, Normal breathing, Repetitive engine noises, Loud/unusual breathing, Mobile phone sounds, Repetitive coughing, Humming noise, Repetitive sniffing, Snoring, Certain accents, Whistling sound, Sound of tapping, Rustling, Chewing gum, Footsteps, Hiccups, Slurping, Cutlery noises, Sneezing, Certain words, Kissing, Joint cracking, Muffled sounds, Throat clearing, Baby crying, Repetitive barking, Loud chewing, Clock ticking, Crunching eating sounds, Teeth sucking, Yawning.

Scoring

Trigger Count (TC) for each participant over all triggers: the index is computed by counting the number of non-zero responses in the trigger intensity items. The index takes values between 0 and the number of triggers considered, here 37, and provides information on the volume of triggers.
Example: if an individual selected 'no feeling' or, 'other: positive' reaction to a trigger to 32 out of 37 triggers, their TC would be 5, that is, the number of triggers they experience.

Reaction Count (RC) for each trigger over all participants: the index is computed for each reaction type separately, by counting over all participants the times a certain reaction was selected (using the trigger response items). The RC for each

reaction (i.e., RC-Anger, RC-Irritability etc) takes values between 0 and the number of triggers considered, here 37. The index provides information on the frequency of endorsement of each specific reaction, across participants and triggers.
Example: if an individual selected anger as their main emotional reaction to three different triggers, and panic as their main reaction to two triggers, then their RC-anger would be 3 and their RC-panic would be 2.

Frequency/Intensity of Reactions Score (FIRS): the index is computed by counting the trigger intensity items. FIRS takes values between 0 and ten times the number of triggers considered, here between 0 and 370. The index provides a combined information of the number of triggers and their intensity.
Example: if an individual reported 5 triggers and the highest possible intensity to each (that is 10), their FIRS value would be 50. The same score would correspond to a participant who reported 10 triggers but of moderate intensity 5 to each.

Relative Intensity of Reactions Score (RIRS): the index is computed by dividing the FIRS index by the trigger count TC, to derive an estimation of the intensity of the responses to triggers, relative to the number of triggers reported. RIRS takes values between 0 and 100 and provides information on the intensity of the response to triggers regardless of their number.
Example: if an individual with FIRS equal to 50 as before reported 5 triggers with intensity 10 each, their RIRS would equal 10. But if an individual receives the same FIRS (50) by reporting 10 triggers of moderate intensity (5), their RIRS would be 5.

Table A4. Full list of administered questionnaires.

- **Bryant and Smith Aggression Questionnaire (BS-AQ; Bryant & Smith, 2001)** is a shorter refined version of the original AQ, with 12 items rather than 29 items, rated on a five-point Likert scale. The scale captures four aspects of aggression: physical aggression, verbal aggression, anger and hostility. Higher scores are indicative of higher levels of aggressive behaviour.

- **Generalized Anxiety Disorder-7 Questionnaire (GAD-7; Spitzer et al., 2006)** screens for measures severity of generalised anxiety disorder. The questionnaire asks the rater to consider the past two weeks and rate each item on a four-point scale from 'Not at all' to 'Nearly every day'. The scores for each item are totalled, with higher scores suggesting higher levels of generalised anxiety.

- The **Patient Health Questionnaire-9 (PHQ-9)**, from Kroenke et al. (2001), is the brief assessment of depression severity. The nine DSM-5 criteria are scored on a four-point scale, with higher scores indicating higher severity of depression.

- The **Work and Social Adjustment Scale (WSAS; Mundt et al., 2002)** is a simple measure of impairment in functioning, consisting of five items rated on a nine-point scale from "Not at all" (0) to "Severely impaired" (8). Higher scores on the WSAS indicate a greater level of impairment in work and social aspects of life.

- The **Beliefs about Emotions Scale (BES; Rimes & Chalder, 2010)** is a 12-item questionnaire on beliefs regarding the inability to accept negative emotions, and the adverse consequences of experiencing and expressing those emotions. Items are rated on a seven-point Likert scale, specifying level of agreement or disagreement.

- The **Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003)** assesses a receptive state of mind, which is a core feature of mindfulness. MAAS contains 15 items measured on a six-point ordinal scale ranging from 'almost always' to 'almost never'.

- The **Autonomous Sensory Meridian Response (ASMR-15; Roberts et al., 2019)** is a questionnaire assessing altered state of consciousness phenomena, namely autonomous sensory meridian response (ASMR), which is characterised by pleasurable tingling sensation in response to certain audio-visual stimuli, causing relaxation and euphoria. The 15-item scale is rated on a scale from 1, 'completely untrue for me' to 5, 'completely true for me', and consists of four subscales: altered consciousness, sensation, relaxation and affect.

- The reduced-item **Disgust Propensity and Sensitivity Scale-Revised (DPSS-R; Fergus & Valentiner, 2009)** consists of 12 items on a five-point response scale that assess how easily one is disgusted, known as disgust propensity, and how bothered a person is by their disgust, which is described as disgust sensitivity, both of which contribute to disgust reactions.

- The **Anxiety Sensitivity Index (ASI-3; Taylor et al., 2007)** is a shorter 18-item version of the original anxiety sensitivity index (Peterson & Reiss, 1992). It assesses anxiety sensitivity conceptualised as one's considerations regarding misinterpretations of anxiety-related sensations. The scale measures anxiety sensitivity on physical, cognitive, and social dimensions.

- The **Adult Eating Behaviour Questionnaire (AEBQ; Hunot et al., 2016)** is a 35-item measure that assesses appetitive traits in adulthood. AEBQ consists of eight subscales; however, for the purpose of this study only 'food fussiness' subscale was implemented, which consists of five items measured on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

- The **Temperament Evaluation of Memphis, Pisa, Paris and San Diego–autoquestionnaire (TEMPS-A; Akiskal et al., 2005)** measures temperamental variations based on diagnostic classifications for affective temperaments, namely cyclothymic, dysthymic, irritable, hyperthymic, and anxious, and has five subscales named as such. The scale is a yes-or-no type questionnaire and consists of 39 items.

- The **Big Five Inventory (BFI; John & Srivastava, 1999)** is a 44-item questionnaire with a five-point Likert agreement scale, which measures one's personality on the Big Five Factors of personality: extraversion vs. introversion, agreeableness vs. antagonism, conscientiousness vs. lack of direction, neuroticism vs. emotional stability, openness vs. closedness to experience. Those factors are further separated into personality dimensions.

- The **Leahy Emotional Schema Scale II (LESS II; Leahy, 2012)** is a 28-item measure with a six-point ordinal response scale that determines beliefs and attributions about emotions. The scale is divided into fourteen dimensions: invalidation, incomprehensibility, guilt, simplistic view of emotion, devalued, loss of control, numbness, overly rational, duration, low consensus, non-acceptance of feelings, rumination, low expression, and blame.

- The **Misophonia Questionnaire (MQ; Wu et al., 2014)** is a 34-item scale consisting of three sections that assesses misophonia regarding the presence of specific triggers, emotional and behavioural responses and its severity. The first two sections, misophonia symptom scale and misophonia emotions and behaviours scale, are rated on a five-point ordinal scale, whilst the third section, Misophonia Severity Scale, measures one's severity of sound sensitivity on a 1 to 15-point scale, with 1 suggesting minimal sound sensitivity and 15 indicating very severe sensitivity.

- The **Amsterdam Misophonia Scale (A-MISO-S; Schröder et al., 2013)** is a six-item scale that measures different facets of misophonia, namely time consumed by the condition, its impact on one's functioning, level of distress, level of resistance, perceived control over thoughts, and avoidance behaviours.
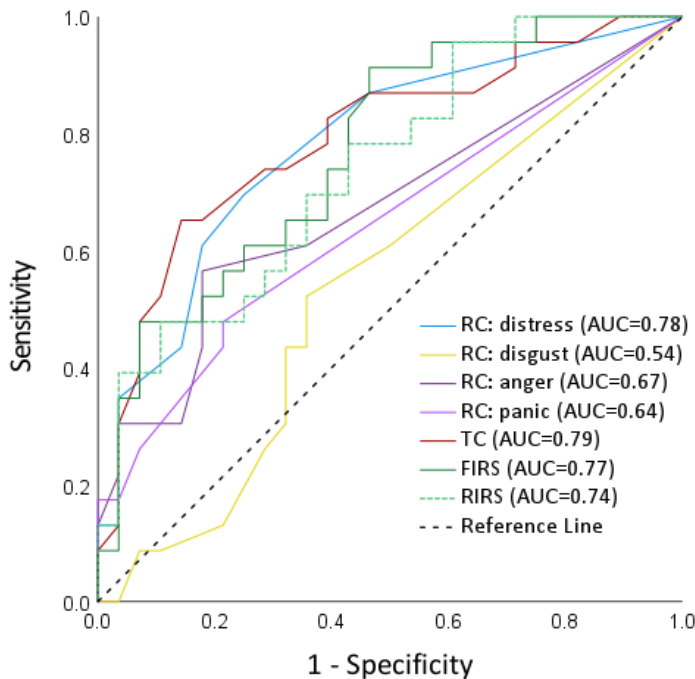
Figure A 1: ROC curves and the estimated area under the curve (AUC) for each of the S-Five-T scores

Tables and Figures

Table 1: Descriptive indices, associations with age and gender, factor analysis loadings, and reliability indices of the 25 S-Five items (N=772)

S-Five-E statements per factor	mean (sd)	median (Q1-Q3)	mode (min-max)	Age rho	Gender difference mean (se)‡	loadings EFA (CFA) [a]	Psi (95% CI)	ICC
Externalising								
I06 Others avoid making noises	4.8 (3.3)	5 (2-8)	0 (0-10)	**0.11	0.40 (0.2)	0.67 (0.73)	0.81 (0.8,1)	0.86
I13 Others should not make sounds	4.1 (3.3)	4 (1-7)	0 (0-10)	0.06	0.35 (0.2)	0.82 (0.76)	0.80 (0.8,1)	0.86
I16 Others selfish	2.9 (3.0)	2 (0-5)	0 (0-10)	-0.04	0.36 (0.2)	0.69 (0.82)	0.80 (0.8,1)	0.86
I21 Others bad manners	4.9 (3.3)	5 (2-8)	10 (0-10)	-0.03	0.12 (0.2)	0.94 (0.76)	0.79 (0.8,1)	0.85
I25 Others disrespectful	2.7 (3.0)	1 (0-5)	0 (0-10)	-0.01	0.38 (0.2)	0.67 (0.73)	0.80 (0.8,1)	0.86
Internalising								
I05 Respect myself less	0.9 (2.0)	0 (0-1)	0 (0-10)	**-0.12	-0.01 (0.1)	0.83 (0.79)	0.75 (0.7,1)	0.84
I08 Unlikeable person	1.2 (2.1)	0 (0-1)	0 (0-10)	**-0.22	-0.21 (0.2)	0.89 (0.85)	0.77 (0.7,1)	0.85
I12 Angry person inside	1.6 (2.5)	0 (0-2)	0 (0-10)	**-0.17	-0.21 (0.2)	0.82 (0.86)	0.78 (0.8,1)	0.85
I18 Bad person inside	1.2 (2.2)	0 (0-1)	0 (0-10)	**-0.24	-0.29 (0.2)	0.66 (0.87)	0.77 (0.7,1)	0.85
I19 Dislike self	1.4 (2.4)	0 (0-2)	0 (0-10)	**-0.20	-0.07 (0.2)	0.82 (0.83)	0.78 (0.8,1)	0.85
Impact								
I01 Do not meet friends	0.6 (1.4)	0 (0-1)	0 (0-10)	**-0.12	0.05 (0.1)	0.55 (0.61)	0.75 (0.7,1)	0.84
I09 Eventually isolated	0.9 (1.9)	0 (0-1)	0 (0-10)	**-0.15	-0.09 (0.1)	0.71 (0.91)	0.76 (0.7,1)	0.84
I14 Avoid places	1.3 (2.3)	0 (0-1)	0 (0-10)	-0.05	-0.03 (0.2)	0.66 (0.67)	0.76 (0.7,1)	0.84
I15 Cannot do everyday things	0.8 (1.7)	0 (0-1)	0 (0-10)	**-0.10	-0.06 (0.1)	0.60 (0.91)	0.75 (0.7,1)	0.84
I20 Limited job opportunities	0.5 (1.4)	0 (0-0)	0 (0-10)	**-0.14	-0.13 (0.1)	0.38 (0.68)	0.74 (0.7,1)	0.84
Outburst								
I04 Verbally aggressive	1.7 (2.4)	1 (0-2)	0 (0-10)	**-0.22	-0.12 (0.2)	0.55 (0.78)	0.78 (0.8,1)	0.85
I17 Physically aggressive	0.8 (1.6)	0 (0-1)	0 (0-10)	-0.07	*0.21 (0.1)	0.73 (0.77)	0.74 (0.7,1)	0.84
I22 Violence	0.5 (1.3)	0 (0-0)	0 (0-9)	**-0.14	0.13 (0.1)	0.56 (0.72)	0.71 (0.7,1)	0.83
I23 Shout at people	1.8 (2.6)	1 (0-3)	0 (0-10)	**-0.12	-0.01 (0.2)	0.65 (0.73)	0.79 (0.8,1)	0.85
I24 Afraid of outburst	0.6 (1.5)	0 (0-1)	0 (0-9)	**-0.13	0.13 (0.1)	0.56 (0.69)	0.73 (0.7,1)	0.83
Threat								
I02 Panic or explode	2.3 (2.9)	1 (0-4)	0 (0-10)	**-0.18	-0.39 (0.2)	0.73 (0.82)	0.82 (0.8,1)	0.86
I03 Feel helpless	2.2 (2.9)	1 (0-4)	0 (0-10)	**-0.14	-0.26 (0.2)	0.80 (0.87)	0.82 (0.8,1)	0.86
I07 Feel anxious	3.0 (3.3)	2 (0-5)	0 (0-10)	**-0.14	-0.42 (0.2)	0.66 (0.88)	0.84 (0.8,1)	0.87
I10 Experience distress	4.0 (3.3)	3 (1-7)	0 (0-10)	**-0.14	-0.11 (0.2)	0.77 (0.79)	0.84 (0.8,1)	0.87
I11 Feel trapped	3.1 (3.3)	2 (0-6)	0 (0-10)	**-0.10	-0.40 (0.2)	0.60 (0.87)	0.83 (0.8,1)	0.87

*Q1 Q3 first and third quartile; ICC intraclass correlation coefficient; Psi coefficient and 95% confidence intervals; rho: Spearman's correlation coefficient; *p<0.05; **p<0.01; ‡ mean difference (se) male vs female comparison, p-value via Mann Whitney test; [a]CFA loadings were standardised (STDXY).*

Table 2: Norms and reliability of the S-Five 5 factors and total scores (N=772)

Factor	descriptive indices					internal consistency		stability	
	mean (sd)	median (Q1-Q3)	mode (min-max)	Gender difference mean (sd)‡	Age rho	α / ω	ITC	Psi (95% CI)	ICC
Externalising	19.38 (12.9)	18 (9 -29)	7 (0 - 50)	-1.6 (0.9)	0.02	0.87 / 0.87	0.66-0.73	0.84 (0.8,1)	0.87
Internalising	6.34 (9.7)	2 (0 -9)	0 (0 - 49)	0.8 (0.7)	**-0.23	0.91 / 0.92	0.70-0.84	0.82 (0.8,1)	0.86
Impact	4.05 (7.0)	1 (0 -5)	0 (0 - 48)	0.3 (0.5)	**-0.11	0.85 / 0.86	0.56-0.79	0.81 (0.8,1)	0.86
Outburst	5.28 (7.5)	2 (0 -7)	0 (0 - 44)	-0.3 (0.5)	**-0.17	0.83 / 0.84	0.61-0.71	0.81 (0.8,1)	0.86
Threat	14.58 (13.8)	10 (3 -23)	0 (0 - 50)	1.6 (1)	**-0.17	0.93 / 0.93	0.75-0.85	0.87 (0.8,1)	0.89
S-Five total	49.64 (40.1)	38 (18 -72)	0 (0 - 215)	0.7 (2.9)	**-0.13	0.94 / 0.94	0.43-0.75	0.87 (0.8,1)	0.88

‡ mean difference (standard error) male vs female comparison, p-value via Mann Whitney test; sd: standard deviation; Q1 and Q3 first and third quartile respectively; α: Cronbach's alpha; ω: McDonald's omega; ITC: item-total correlations; ICC: intraclass correlation coefficient (two-way mixed effects, absolute agreement).

Table 3: Intercorrelations of the S-Five scores, and correlations with other measures (validity)

	Externalising	Internalising	Impact	Outburst	Threat	Total S-Five
S-Five (N=772)						
Internalising	0.39					
Impact	0.36	0.61				
Outburst	0.48	0.61	0.56			
Threat	0.54	0.62	0.60	0.60		
Total	0.79	0.73	0.67	0.73	0.88	
A-MISO-S (N=396)						
Total	0.38	0.47	0.47	0.43	0.55	0.59
MQ (N=376)						
MSYS (N=295)	0.38	0.41	0.30	0.39	0.44	0.49
MEBS (N=286)	0.50	0.53	0.51	0.62	0.68	0.72
MSES (N=376)	0.37	0.45	0.44	0.38	0.56	0.56
Total (N=295)	0.51	0.55	0.47	0.60	0.66	0.71
PHQ9 (N=761)						
Total	0.19	0.34	0.27	0.29	0.40	0.37
GAD7 (N=772)						
Total	0.25	0.37	0.31	0.30	0.45	0.43

Correlations are Spearman's rho and p-value<0.01 in all cases; A-MISO-S: Amsterdam Misophonia Scale; MQ: Misophonia Questionnaire; MSYS: Misophonia Symptoms Scale; MEBS: Misophonia Emotions and Behaviours Scale; MSES: Misophonia Severity Scale; PHQ-9: Physical Health Questionnaire; GAD-7: Generalised Anxiety Disorder Assessment.

Table 4: Norms and reliability of the S-Five-T scores

S-Five RC (N=752)	mean (sd)	median (Q1-Q3)	mode (min-max)	gender difference mean (se)‡	age rho	Psi (95% CI)	ICC
No feeling	18.7 (6.7)	18 (14-23)	17 (1-37)	*-1.4 (0.5)	0.06	0.85 (0.82,1)	0.87
Irritation	12 (5.0)	12 (9-15)	14 (0-29)	0.5 (0.4)	**0.19	0.82 (0.79,1)	0.86
Distress	1.2 (1.6)	1 (0-2)	0 (0-9)	**0.3 (0.1)	**-0.17	0.79 (0.76,1)	0.85
Disgust	2.2 (2.5)	1 (0-4)	0 (0-12)	**0.8 (0.2)	**-0.10	0.82 (0.8,1)	0.87
Anger	1.1 (1.7)	0 (0-2)	0 (0-16)	0 (0.1)	**-0.17	0.77 (0.75,1)	0.85
Panic	0.3 (0.8)	0 (0-0)	0 (0-7)	0 (0.1)	**-0.25	0.69 (0.67,1)	0.82
TC	17.5 (6.5)	18 (13-22)	17 (0-36)	*1.7 (0.5)	-0.01	0.85 (0.83,1)	0.88
FIRS	65 (41.6)	58 (32-88)	58 (1-241)	*9 (3.1)	**-0.15	0.85 (0.82,1)	0.87
RIRS	3.6 (1.5)	3 (2-5)	2 (0-10)	0.2 (0.1)	**-0.19	0.82 (0.79,1)	0.86

RC: response count; TC total count; FIRS frequency and intensity reaction count; RIRS relative intensity of reactions score; sd standard deviation; Q1 Q3 first and third quartile; rho: Spearman's correlation coefficient; ICC intraclass correlation coefficient; Psi coefficient and 95% confidence intervals; *p<0.05; **p<0.01; ‡ mean difference (se) male vs female comparison, p-value via Mann Whitney test.

Table 5: Intercorrelations of the S-Five, S-Five-T scores, and correlations with other measures

	No feeling	Irritation	Distress	Disgust	Anger	Panic	TC	FITS	RIRS
S-Five RC (N=752)									
No feeling		**-0.61	**-0.43	**-0.51	**-0.44	**-0.34	**-0.97	**-0.76	**-0.30
Irritation			0.05	-0.04	0.01	-0.06	**0.67	**0.33	*-0.09
Distress				**0.26	**0.16	**0.25	**0.41	**0.38	**0.21
Disgust					**0.39	**0.23	**0.50	**0.59	**0.42
Anger						**0.28	**0.43	**0.57	**0.47
Panic							**0.29	**0.35	**0.28
TC								**0.76	**0.28
FITS									**0.81
S-Five Factors (N=752)									
Externalising	**-0.35	**0.11	**0.13	**0.35	**0.37	**0.16	**0.36	**0.48	**0.41
Internalising	**-0.36	**0.10	**0.26	**0.28	**0.33	**0.26	**0.37	**0.50	**0.43
Impact	**-0.31	*0.09	**0.26	**0.22	**0.26	**0.26	**0.31	**0.43	**0.38
Outburst	**-0.35	0.07	**0.25	**0.29	**0.40	**0.25	**0.35	**0.48	**0.41
Threat	**-0.40	*0.08	**0.36	**0.31	**0.37	**0.30	**0.39	**0.51	**0.43
Total	**-0.44	**0.10	**0.30	**0.38	**0.44	**0.30	**0.44	**0.60	**0.52
A-MISO-S (N=319)									
Total	**-0.36	*0.13	**0.18	**0.32	**0.37	**0.21	**0.38	**0.44	**0.32
MQ (N=300)									
MSYS (N=261)	**-0.52	**0.27	**0.18	**0.38	**0.37	**0.19	**0.54	**0.56	**0.33
MEBS (N=261)	**-0.39	0.05	**0.19	**0.27	**0.44	**0.33	**0.39	**0.49	**0.43
MSES (N=300)	**-0.33	0.08	**0.18	**0.23	**0.31	**0.27	**0.31	**0.38	**0.29
Total (N=261)	**-0.52	**0.16	**0.21	**0.37	**0.47	**0.31	**0.51	**0.60	**0.46
PHQ9 (N=726)									
Total	**-0.29	0.07	**0.25	**0.22	**0.25	**0.24	**0.28	**0.31	**0.22
GAD7 (N=736)									
Total	**-0.22	0.02	**0.22	**0.23	**0.20	**0.23	**0.22	**0.26	**0.19

RC: response count; TC total count; FIRS frequency and intensity reaction count; RIRS relative intensity of reactions score; rho: Spearman's correlation coefficient; A-MISO-S: Amsterdam Misophonia Scale; MQ: Misophonia Questionnaire; MSYS: Misophonia Symptoms Scale; MEBS: Misophonia Emotions and Behaviours Scale; MSES: Misophonia Severity Scale; PHQ-9: Physical Health Questionnaire; GAD-7: Generalised Anxiety Disorder Assessment.

Table 6: Norms and reliability of the intensity items for the 37 S-Five-T sounds

Trigger sounds	mean (sd)	median (Q1-Q3)	mode (min-max)	Average gender difference[‡]	age rho	Psi (95% CI)	ICC
Normal eating	0.90 (1.8)	0 (0 -1)	0 (0 -10)	-0.2 (0.1)	-0.1	0.74 (0.72,1)	0.84
Certain letter	0.30 (1.1)	0 (0 -0)	0 (0 -10)	-0.1 (0.1)	-0.1	0.69 (0.67,1)	0.82
Mushy foods	1.27 (2.2)	0 (0 -2)	0 (0 -10)	-0.1 (0.2)	**-0.2	0.74 (0.71,1)	0.84
Sound of clipping	1.16 (2.0)	0 (0 -2)	0 (0 -10)	*-0.6 (0.1)	0	0.77 (0.75,1)	0.85
Swallowing	0.71 (1.7)	0 (0 -0)	0 (0 -10)	-0.2 (0.1)	**-0.2	0.73 (0.71,1)	0.83
Keyboard tapping	0.88 (1.7)	0 (0 -1)	0 (0 -10)	-0.1 (0.1)	0	0.74 (0.72,1)	0.84
Lip smacking	1.66 (2.3)	0 (0 -3)	0 (0 -10)	**-0.5 (0.2)	**-0.2	0.78 (0.75,1)	0.85
Normal breathing	0.23 (1.0)	0 (0 -0)	0 (0 -9)	0 (0.1)	**-0.1	0.67 (0.67,1)	0.82
Repetitive engine	2.14 (2.3)	2 (0 -3)	0 (0 -10)	0 (0.2)	0	0.79 (0.76,1)	0.85
Blocked nose	2.67 (2.4)	2 (0 -4)	0 (0 -10)	**-0.5 (0.2)	**-0.2	0.8 (0.77,1)	0.86
Mobile phone	1.48 (2.0)	0 (0 -3)	0 (0 -10)	0 (0.2)	*0.1	0.76 (0.74,1)	0.84
Repetitive	2.84 (2.4)	2 (1 -5)	0 (0 -10)	-0.1 (0.2)	0	0.79 (0.77,1)	0.85
Humming	1.46 (2.1)	0 (0 -2)	0 (0 -9)	-0.2 (0.2)	0	0.77 (0.75,1)	0.85
Repetitive sniffing	3.28 (2.6)	3 (1 -5)	0 (0 -10)	**-0.6 (0.2)	0	0.83 (0.8,1)	0.87
Snoring	3.54 (3.0)	3 (0 -6)	0 (0 -10)	**-0.9 (0.2)	0	0.83 (0.81,1)	0.87
Certain accents	0.97 (1.9)	0 (0 -1)	0 (0 -10)	*0.3 (0.1)	0.1	0.73 (0.7,1)	0.83
Whistling sound	1.30 (2.1)	0 (0 -2)	0 (0 -10)	-0.2 (0.2)	0	0.76 (0.74,1)	0.84
Tapping	1.99 (2.4)	1 (0 -3)	0 (0 -10)	*-0.4 (0.2)	0	0.81 (0.79,1)	0.86
Rustling plastic or	0.99 (1.9)	0 (0 -1)	0 (0 -10)	0 (0.1)	-0.1	0.76 (0.74,1)	0.84
Chewing gum	3.31 (2.8)	3 (1 -5)	0 (0 -10)	**-0.5 (0.2)	0	0.79 (0.77,1)	0.85
Footsteps	0.50 (1.5)	0 (0 -0)	0 (0 -10)	0.1 (0.1)	**-0.2	0.71 (0.69,1)	0.83
Hiccups	0.67 (1.5)	0 (0 -1)	0 (0 -9)	0.1 (0.1)	0	0.75 (0.72,1)	0.84
Slurping	2.99 (2.6)	3 (1 -5)	0 (0 -10)	**-0.8 (0.2)	0	0.8 (0.78,1)	0.86
Cutlery	2.87 (2.9)	2 (0 -5)	0 (0 -10)	**-0.6 (0.2)	**-0.2	0.81 (0.78,1)	0.86
Sneezing	0.99 (1.9)	0 (0 -1)	0 (0 -10)	0.1 (0.1)	0	0.74 (0.72,1)	0.84
Certain words	1.13 (2.1)	0 (0 -2)	0 (0 -10)	0 (0.2)	*0.1	0.75 (0.73,1)	0.84
Kissing	0.58 (1.6)	0 (0 -0)	0 (0 -10)	**-0.4 (0.1)	**-0.2	0.72 (0.7,1)	0.83
Joint cracking	1.83 (2.5)	0 (0 -3)	0 (0 -10)	**-0.9 (0.2)	*0.1	0.8 (0.77,1)	0.86
Muffled sounds	2.16 (2.5)	2 (0 -3)	0 (0 -10)	0.2 (0.2)	0	0.79 (0.76,1)	0.85
Throat clearing	1.89 (2.4)	1 (0 -3)	0 (0 -10)	*-0.4 (0.2)	0	0.78 (0.75,1)	0.85
Baby crying	2.78 (2.8)	2 (0 -5)	0 (0 -10)	0 (0.2)	**-0.2	0.83 (0.8,1)	0.87
Repetitive barking	3.63 (2.8)	3 (1 -6)	0 (0 -10)	-0.2 (0.2)	*0.1	0.81 (0.79,1)	0.86
Loud chewing	4.21 (3.0)	4 (2 -6)	0 (0 -10)	**-0.8 (0.2)	*-0.1	0.84 (0.82,1)	0.87
Clock ticking	1.02 (2.0)	0 (0 -1)	0 (0 -10)	-0.1 (0.2)	*-0.1	0.77 (0.74,1)	0.84
Crunching	1.29 (2.2)	0 (0 -2)	0 (0 -10)	-0.2 (0.2)	*-0.1	0.78 (0.75,1)	0.85
Teeth sucking	2.06 (2.5)	1 (0 -3)	0 (0 -10)	**-0.5 (0.2)	0	0.8 (0.78,1)	0.86
Yawning	0.44 (1.3)	0 (0 -0)	0 (0 -9)	-0.1 (0.1)	0	0.72 (0.7,1)	0.83

*sd standard deviation; Q1 Q3 first and third quartile; rho: Spearman's correlation coefficient; ICC intraclass correlation coefficient; Psi coefficient and 95% confidence intervals; *p<0.05; **p<0.01; ‡ mean difference (se) male vs female comparison, p-value via Mann Whitney test.*

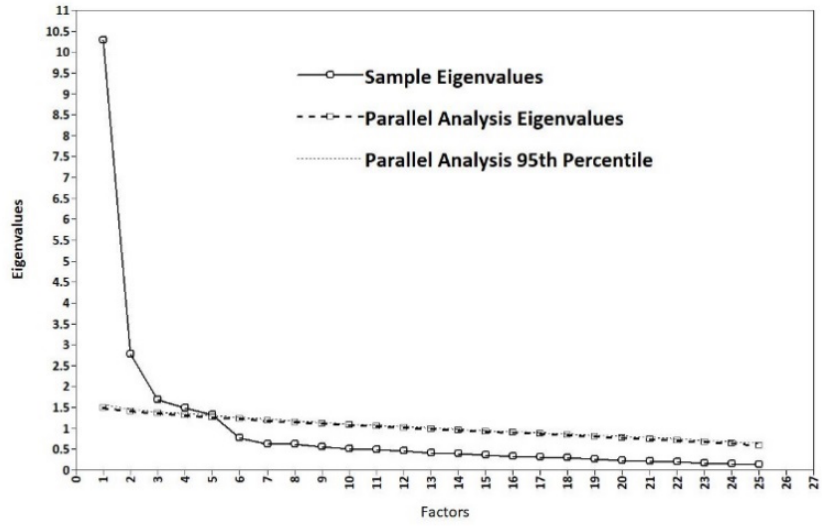**Figure 1: Scree plot and parallel analysis visualisation**

Figure 2 Percentages of selection per feeling per trigger

No feeling

Trigger	%
Yawning	84
Teeth sucking	42
Crunching eating	61
Clock ticking	60
Loud chewing	15
Repetitive barking	16
Baby crying	32
Throat clearing	45
Muffled sounds	40
Joint cracking	44
Kissing	68
Certain words	67
Sneezing	69
Cutlery	31
Slurping	21
Hiccups	70
Footsteps	85
Chewing gum	22
Rustling	66
Sound of tapping	38
Whistling sound	56
Certain accents	63
Snoring	23
Repetitive sniffing	17
Humming noise	50
Repetitive coughing	21
Mobile phone	50
Loud breathing	24
Repetitive engine	35
Normal breathing	90
Lip smacking	49
Keyboard tapping	63
Swallowing	78
Clipping nails	62
Mushy foods	64
Certain letter	90
Normal eating	60

% selected per trigger sound

Irritation

Trigger	%
Yawning	12
Teeth sucking	42
Crunching eating	29
Clock ticking	24
Loud chewing	34
Repetitive barking	54
Baby crying	34
Throat clearing	36
Muffled sounds	45
Joint cracking	27
Kissing	9
Certain words	18
Sneezing	17
Cutlery	42
Slurping	49
Hiccups	23
Footsteps	7
Chewing gum	45
Rustling	26
Sound of tapping	55
Whistling sound	35
Certain accents	24
Snoring	47
Repetitive sniffing	55
Humming noise	38
Repetitive coughing	54
Mobile phone	44
Loud breathing	56
Repetitive engine	50
Normal breathing	7
Lip smacking	35
Keyboard tapping	26
Swallowing	16
Clipping nails	24
Mushy foods	25
Certain letter	7
Normal eating	32

% selected per trigger sound

Distress

Trigger	%
Yawning	1
Teeth sucking	1
Crunching eating	1
Clock ticking	3
Loud chewing	1
Repetitive barking	9
Baby crying	21
Throat clearing	1
Muffled sounds	1
Joint cracking	7
Kissing	0
Certain words	2
Sneezing	2
Cutlery	12
Slurping	1
Hiccups	2
Footsteps	1
Chewing gum	1
Rustling	1
Sound of tapping	1
Whistling sound	1
Certain accents	2
Snoring	8
Repetitive sniffing	3
Humming noise	4
Repetitive coughing	8
Mobile phone	1
Loud breathing	4
Repetitive engine	4
Normal breathing	0
Lip smacking	1
Keyboard tapping	1
Swallowing	1
Clipping nails	1
Mushy foods	1
Certain letter	1
Normal eating	1

% selected per trigger sound

Disgust

Trigger	%
Yawning	1
Teeth sucking	12
Crunching eating	4
Clock ticking	0
Loud chewing	39
Repetitive barking	1
Baby crying	0
Throat clearing	14
Muffled sounds	0
Joint cracking	12
Kissing	6
Certain words	4
Sneezing	5
Cutlery	4
Slurping	24
Hiccups	1
Footsteps	0
Chewing gum	27
Rustling	0
Sound of tapping	1
Whistling sound	0
Certain accents	1
Snoring	2
Repetitive sniffing	18
Humming noise	0
Repetitive coughing	6
Mobile phone	0
Loud breathing	9
Repetitive engine	0
Normal breathing	0
Lip smacking	8
Keyboard tapping	0
Swallowing	3
Clipping nails	9
Mushy foods	8
Certain letter	0
Normal eating	4

% selected per trigger sound

Anger

Trigger	%
Yawning	0
Teeth sucking	1
Crunching eating	2
Clock ticking	1
Loud chewing	9
Repetitive barking	14
Baby crying	3
Throat clearing	1
Muffled sounds	7
Joint cracking	1
Kissing	0
Certain words	3
Sneezing	0
Cutlery	3
Slurping	3
Hiccups	0
Footsteps	1
Chewing gum	4
Rustling	2
Sound of tapping	3
Whistling sound	2
Certain accents	1
Snoring	15
Repetitive sniffing	5
Humming noise	2
Repetitive coughing	4
Mobile phone	2
Loud breathing	4
Repetitive engine	6
Normal breathing	0
Lip smacking	3
Keyboard tapping	1
Swallowing	0
Clipping nails	0
Mushy foods	1
Certain letter	0
Normal eating	1

% selected per trigger sound

Panic

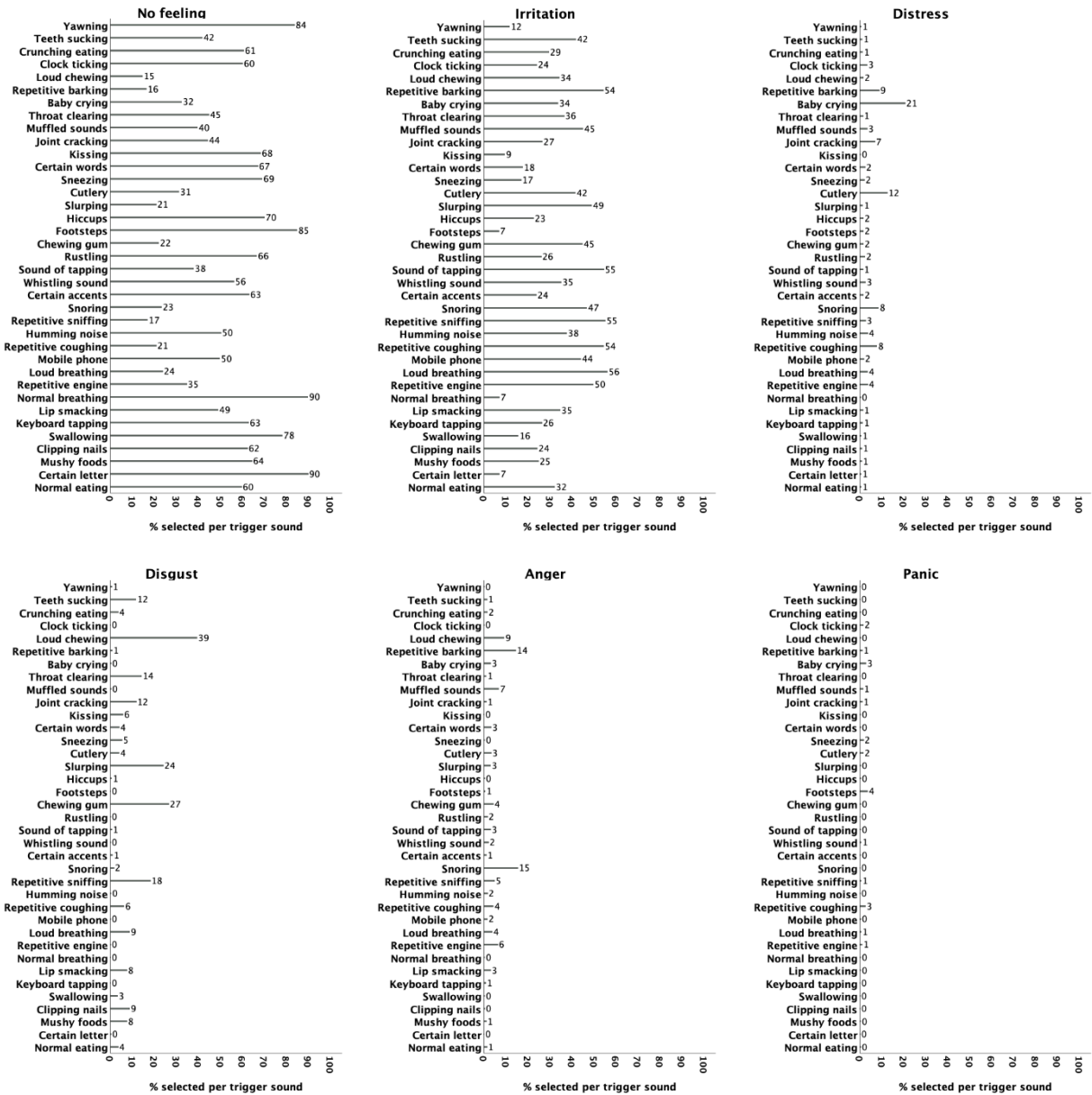| Trigger	%
Yawning	0
Teeth sucking	0
Crunching eating	0
Clock ticking	2
Loud chewing	0
Repetitive barking	1
Baby crying	3
Throat clearing	0
Muffled sounds	1
Joint cracking	1
Kissing	0
Certain words	0
Sneezing	2
Cutlery	2
Slurping	0
Hiccups	0
Footsteps	4
Chewing gum	0
Rustling	0
Sound of tapping	0
Whistling sound	1
Certain accents	0
Snoring	0
Repetitive sniffing	1
Humming noise	0
Repetitive coughing	3
Mobile phone	0
Loud breathing	1
Repetitive engine	1
Normal breathing	0
Lip smacking	0
Keyboard tapping	0
Swallowing	0
Clipping nails	0
Mushy foods	0
Certain letter	0
Normal eating	0

% selected per trigger sound

Figure 2: ROC curves and the estimated area under the curve (AUC) for each of the S-Five scores