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The Role of Anomalous Perception in Autonomous Sensory Meridian Response

Kayla Kilborn, Stephen D. Smith, and James M. Clark

Department of Psychology, University of Winnipeg

Autonomous Sensory Meridian Response (ASMR) is a tingling sensation that usually occurs as a response to a stimulus in another modality without tactile stimulation, and with concomitant affective reactions that are generally pleasant. The tingling sensation, often associated with the scalp and nape of the neck, exemplifies an atypical or anomalous perception given the absence of actual somatosensory stimulation. The present study examined scores on an ASMR scale with several measures of anomalous perceptions, such as hallucinations, to determine whether a general tendency to experience anomalous sensations can explain ASMR experiences. Three groups completed a series of questionnaires: A true-ASMR group from an online ASMR site that responded "yes" to a screening item and two groups from the general population, a Control group that responded "no" to an ASMR screening question, and a quasi-ASMR group that unexpectedly responded "yes." For all groups, the ASMR and anomalous perception scores correlated positively. As expected, the two "yes" groups scored higher on the ASMR scale than Controls; however, only for the quasi-ASMR group did anomalous perception scores differ from the Control group and mediate some of the difference in their ASMR scores. These results provide mixed support for the role of anomalous perception in AMSR experiences, have implications for comparative studies of ASMR, and suggest avenues for future research to identify and understand "real" ASMR effects.

Keywords: ASMR, anomalous perception, consciousness state

Autonomous Sensory Meridian Response (ASMR) is a pleasurable tingling sensation that, for many people, spreads across the scalp and down the back of the neck (Barratt & Davis, 2015). ASMR experiences can be relaxing and reliably produced by diverse triggers that typically are auditory, visual, or both (e.g., whispering, finger tapping), but can also be social (e.g., simulation of visit to dentist) in nature (Barratt et al., 2017; Fredborg et al., 2017; Roberts et al., 2021). Because ASMR creates a state of relaxation, triggers are sought by individuals to elicit the tingling, and studies have reported positive associations with mental health, such as increased subjective well-being (Del Campo & Kehle, 2016) and temporary reductions in self-reported depression and anxiety (e.g., Barratt & Davis, 2015).

Roberts et al. (2019, 2021) characterized ASMR as an altered state of consciousness given its combination of perceptual, affective, and cognitive components. With respect to the latter, Barratt and Davis (2015) noted the enhanced state of focus associated with ASMR stimuli and experiences. Roberts et al. (2021) reported that ASMR experiences correlated with various measures associated with altered states of consciousness in prior research. Their study measured ASMR experiences with the ASMR-15 (Roberts et al., 2019), a multidimensional measure that consists of four subscales: Altered Consciousness, Sensation, Relaxation, and Affect.

The present study examined aspects of the ASMR experience captured by the Sensation

James M. Clark https://orcid.org/0000-0003-2511-7769

Kayla Kilborn is now at Department of Psychology, University of Manitoba.

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Correspondence concerning this article should be addressed to James M. Clark, Department of Psychology, University of Winnipeg, 515 Portage Avenue, Winnipeg, MB R3B 2E9, Canada. Email: j.clark@uwinnipeg.ca

subscale of the ASMR-15. Specifically, we focused on the defining feature of ASMR, namely, the atypical perceptual experiences often characterized as "tingling" in the absence of external stimulation. This feature of ASMR is another example of what Cardeña et al. (2017) called anomalous experiences, akin to those studied in the context of hallucinations, meditation, flow (Barratt & Davis, 2015), and similar experiences. We refer collectively to such experiences as anomalous perception in recognition of their intrinsic sensory or perceptual nature, the specific case with ASMR being a somatosensory experience generally in the absence of tactile stimulation. "Anomalous perception" does *not* imply that ASMR is associated with psychopathology, given such experiences are also observed in nonclinical populations.

A number of indirect findings are consistent with an association between ASMR and anomalous perceptual experiences, in addition to the Roberts et al. (2019, 2021) studies. Janik McErlean and Banissy (2017) reported higher scores for ASMR participants on a measure of fantasizing about events that might happen. ASMR participants report parallels between ASMR and drug effects (Roberts et al., 2019) and score highly on sensory processing sensitivity (Roberts et al., 2019, 2020). Keizer et al. (2020) reported that ASMR participants were less able to discriminate between actual and suggested sensory experiences. Moreover, several studies have related ASMR to other anomalous perceptual phenomena, notably synesthesia (Poerio, 2016), which can also involve tactile sensations (Banissy et al., 2014).

Of particular importance, there is convincing evidence that the perceptual experiences that occur during ASMR do lead to measurable physical changes in the perceiver. Poerio et al. (2018) found differences in skin conductance changes between ASMR and non-ASMR participants exposed to triggering stimuli. Fredborg et al. (2021), Lochte et al. (2018), and Smith et al. (2019b) all reported distinct patterns of brain activity when ASMR-sensitive individuals viewed ASMR-eliciting videos. The challenge for researchers is to determine why some individuals experience these anomalous perceptions (e.g., tingling sensations without being touched), whether the cognitive and perceptual mechanisms leading to ASMR are the same for all individuals who report such experiences, and how ASMR relates theoretically to other examples of anomalous perception or altered states of consciousness.

One purpose of the present study was to quantify the ASMR sensory experience and to determine whether resulting ASMR scores correlated with diverse measures of anomalous perception. This study was conducted before the ASMR-15 with its Sensation subscale was available, nor did another questionnaire exist to quantify ASMR sensory experiences. Unlike the multidimensional measure of Roberts et al., the scale developed for the present study was unidimensional in its focus on sensation. Close examination of the perceptual component will further our understanding of ASMR given the central role that tactile experience plays in eliciting affective and cognitive components. Our focus on sensory experience, however, does mean that the present study is insensitive to features (e.g., relaxing) that distinguish ASMR from phenomena involving similar sensory experiences (e.g., the chills observed with frisson).

The second purpose of the present study was to use this quantitative measure of ASMR to examine more closely the potential relationship between ASMR and various measures of anomalous perception. Individuals who score high on ASMR sensory experiences were predicted to score high on general measures of anomalous perception compared to a non-ASMR Control group. To maximize reliability and validity, we included five scales that directly measure or have implicated anomalous perception in altered states of consciousness and related phenomena. The Cardiff Anomalous Perception Scale (CAPS) measures anomalous perceptual experiences in the general public as well as in clinical populations (Bell et al., 2006). The Creative Experiences Questionnaire (CEXQ) measures fantasy proneness (Merckelbach et al., 2001). The Launay–Slade Hallucinations Scale—Revised (HALL) assesses the predisposition to hallucinations in the normal population (Launay & Slade, 1981; Waters et al., 2003). The Inventory of Psychotic-Like Anomalous Self-Experiences (PLAS) measures anomalous experiences of the self, including unusual bodily sensations (Cicero et al., 2017), and has been validated with nonclinical participants (Cicero et al., 2021). The Autism Spectrum Quotient (ASQ) measures the degree to which adults have traits associated with autism spectrum disorder (Baron-Cohen et al., 2001), including several related to anomalous perception. Previous research with nonclinical samples has shown an association between autism measures and unusual perceptual experiences (Horder et al., 2014) and hypersensitivity to sensory stimuli (Bryant et al., 2019). However, ASQ is clearly not a pure measure of anomalous perception as the results confirmed.

In summary, the present study examined average differences between ASMR and non-ASMR groups on a quantitative measure of ASMR sensory experiences and on various measures of anomalous perception. Moreover, correlations between anomalous perception and ASMR scores examined whether anomalous perception accounted for differences between groups in ASMR scores.

The original plan was to compare participants recruited from ASMR online sites (i.e., a true-ASMR group) and a comparison group from the general population. However, many participants from the general population reported having ASMR-like experiences (i.e., a quasi-ASMR group). These unexpected responses to an ASMR screening question prompted us to examine two additional issues: (a) whether self-reports from quasi-ASMR participants are similar to those from true-ASMR groups, and (b) whether anomalous perception findings predicted for true-ASMR respondents were observed in quasi-ASMR participants. Including a quasi-ASMR group has important implications for the prevalence of ASMR, for the design of studies to isolate unique features of the ASMR experience, and in general for our understanding of the phenomenon.

Method

Participants

To recruit ASMR participants, an invitation was posted on an ASMR online discussion group (www.reddit.com/r/asmr) for people with ASMR interests to complete several questionnaires that would allow a comparison to responses of non-ASMR participants. Three hundred and seven people accessed the survey, 259 responded "yes" to a screening question about ASMR described in materials, and six responded "no." A quantitative measure of ASMR was completed by 185 "yes" and 5 "no" respondents. We eliminated 31 participants who were under 18, did not state their age or sex, or responded "other," leaving 154 "yes" respondents. They were classified as true-ASMR participants. This sample represented the target population in our initial design.

Given the age and gender distribution of Reddit participants, a comparable sample was recruited from Qualtrics Panels (Qualtrics Inc., Provo, UT). These contributors are registered with Qualtrics and receive a modest incentive to complete surveys that they select. In total, 761 people from Qualtrics Panels matched our criteria and accessed the survey. Only 302 completed the screening item, 135 responded "no" and, unexpectedly, 167 responded "yes." The quantitative ASMR measure was completed by 65 people who responded "no" and 95 people who responded "yes." Elimination by age and sex, as described for the ASMR group, resulted in 58 "no" and 91 "yes" respondents. The former were classified as non-ASMR, are referred to as the Control group, and corresponded to the planned comparison group.

Rather than discard the substantial number of respondents from the general population who indicated that they did have ASMR experiences, we created a third group classified as quasi-ASMR. We opted to separate participants from the two online samples for several reasons. First, individuals from the online ASMR site specifically subscribed to that site in order to view ASMR-eliciting material and to discuss their experiences; therefore, ASMR is of interest to them and a significant part of identity for many. It was unclear whether ASMR played a significant role in the lives of participants from the Qualtrics group. Second, it was also not clear that somatosensory sensations reported by the Qualtrics quasi-ASMR group were actual ASMR experiences or some related phenomenon (e.g., frisson), whereas we can infer that at least for most members of the true-ASMR group given they accessed ASMR-related material. Finally, comparing the results from different populations provides information that could benefit the design of future studies. Therefore, the final design included three groups: true-ASMR participants from the online ASMR site, quasi-ASMR participants from the general population, and a Control group comprised of non-ASMR participants from the general population.

The mean age of respondents was 26.34 years, $SD = 7.99$, and 62% were male. The three groups did not differ by age, $F(2, 300) = .23$, $MSE = 64.21$, $p = .79$, but did marginally by gender, $\chi^2(2) = 5.96$, $p = .05$. The percentage male was 48.27% for the Control group, 67.03% for the quasi-ASMR group, and 64.29% for the true-ASMR group. Because there were also some weak and inconsistent correlations with various measures, the following analyses included age and sex as covariates. The results for analyses without covariates were equivalent in all substantial respects to those reported here, except for minor changes in numerical values.

Materials

To facilitate responding, given the length of the survey, all quantitative measures used a 7-point Likert scale, one being strongly disagree and seven strongly agree. This modification ensured that participants were not delayed or confused by changes in the orientation or labeling of different rating scales, but does mean that the present results cannot be compared directly to those from published studies with other response scales. Mean ratings were used in analyses and can be compared to the 7-point rating scale. Means fell around the midpoint on the scale, somewhat higher for Autonomous Sensory Meridian Response Scale [all scales are mean 1–7 rating] (ASMRS; see Table 1). Except for the ASQ, scores varied markedly as reflected in the *SD*s in Table 1. Indeed, individual scores on the other measures ranged from 1 to 7, the extreme ends of the rating scale.

Table 1
Descriptive Statistics and Correlations of the ASMRS and Five Measures of Anomalous Perception

Measures	ASMRS	CAPS	CREX	HALL	PLAS	ASQ
ASMRS	*.96*					
CAPS	.66	*.98*				
CREX	.55	.81	*.95*			
HALL	.54	.85	.88	*.93*		
PLAS	.49	.84	.81	.87	*.99*	
ASQ	.10	.25	.20	.26	.35	*.78*
M	4.68	3.54	4.13	3.77	3.24	3.75
SD	1.39	1.63	1.28	1.49	1.66	0.50
N	303	285	249	243	233	263

Note. Reliabilities for each scale are in italics on the diagonal. Values below the diagonal are correlation coefficients. ASMRS = Autonomous Sensory Meridian Response Scale (all scales are mean 1–7 rating); CAPS = Cardiff Anomalous Perception Scale; CREX = Creative Experiences Questionnaire; HALL = Launay—Slade Hallucinations Scale; PLAS = Inventory of Psychotic-like Anomalous Self-experiences; ASQ = Autism Spectrum Quotient.

Participants responded to demographic questions about sex and age, and to the following "yes" or "no" screening statement: "Autonomous Sensory Meridian Response is a pleasurable tingling sensation that occurs by an environmental trigger (e.g., watching someone tap their fingers may elicit a tingling sensation for some individuals with ASMR). To your knowledge, do you experience ASMR?" The answer was used to classify people as described in Participants.

Autonomous Sensory Meridian Response Scale

The ASMRS measure was created for this study and consists of 22 statements that reflect sensory experiences reported by individuals with ASMR. Items appear in the Appendix and focus on the perceptual experience of tingling sensations. Sample items are: "Sometimes I feel that I am being touched on the back of the scalp even when no one is touching me" and "At times my scalp and/or neck feels like something is crawling on the back of it." The scale demonstrated excellent internal reliability (see Table 1). With respect to face validity, items correspond closely to those on the Sensation subscale of the ASMR-15 (e.g., "I experience an unusual sensation in my head and body.").

Cardiff Anomalous Perception Scale (Bell et al., 2006)

CAPS is a measure of anomalous perception in the general public. It consists of 32 statements such as: "whether or not people hear their own thoughts repeated or echoed" and "do they ever detect smells that do not seem to come from their surroundings." Items assess unusual perceptions in diverse modalities, including several related to touch (e.g., "Do you ever feel that someone is touching you, but when you look nobody is there?"). The measure has excellent internal consistency and test–retest reliability, and discriminates between nonclinical and clinical samples (Bell et al., 2011). Kelsall-Foreman et al. (2020) reported a two-factor model in the general population, one factor being body-centered experiences and the other external experiences. Smailes et al. (2015) found that high scorers on CAPS reported more false alarms on an auditory signal detection task, reflecting a tendency to "detect" stimulation when there was none.

Creative Experiences Questionnaire (Merckelbach et al., 2001)

The CEXQ consists of 25 items related to whether people had make-believe friends or animals as children and easily identified with characters in a story. A few items explicitly refer to sensory experiences (e.g., "When I think of something cold, I actually get cold."), and perceptual elements can be inferred from a number of other items (e.g., "Many of my fantasies have a realistic intensity."). High scorers on the CEXQ are prone to report hallucinations (Daniel & Mason, 2015), auditory experiences in the absence of an appropriate stimulus (Merckelbach & van de Ven, 2001), and strange bodily sensations and other experiences like those on Greyson (1983) "Near-Death Experience Scale" (Martial et al., 2018).

Launay–Slade Hallucinations Scale—Revised (Launay & Slade, 1981)

This scale measures a predisposition to hallucinations in the general population (Waters et al., 2003). The 12 items ask whether people hear voices speaking their thoughts aloud and if they are troubled by hearing voices. The standard scale focuses on auditory hallucinations and vividly imagined experiences (e.g., daydreams), with factor analyses revealing three (Waters et al., 2003) or four (Spector & Maurer, 2013) factors. Larøi et al. (2019) added several items, including some that referred explicitly to touch (e.g., "I have had the feeling of being touched even though no one was there.") and found high levels of hallucinations in the general population. Using a laboratory task designed to induce auditory hallucinations, Merckelbach and van de Ven (2001) found that undergraduates who reported auditory experiences in the absence of an appropriate stimulus scored higher on the HALL scale. Siddi et al. (2019) found HALL scores correlated with reports of psychic experiences, another possible case of sensory reactions absent stimulation.

Inventory of Psychotic-Like Anomalous Self-Experiences (Cicero et al., 2017)

The PLAS primarily measures anomalous experiences of the self, originally for people who suffer from schizophrenia (Cicero et al., 2017). It consists of 57 items such as difficulty telling whether people experience something or just imagine it and feeling like their legs, arms, or other body parts are not really theirs. A somatization factor is explicitly concerned with unusual bodily experiences (e.g., electric sensations) and PLAS correlates significantly with the Perceptual Aberration Scale. Several large-scale studies with university students demonstrated the construct validity of the PLAS and its positive association with a cognitive-perceptual factor that included measures of perceptual aberrations, unusual perceptual experiences, and magical ideation (Cicero et al., 2020, 2021).

Autism Spectrum Quotient (Baron-Cohen et al., 2001)

The ASQ measures traits associated with Autism Spectrum Disorder. The 50 items include whether the person finds social situations easy and whether or not the person is drawn more strongly to people than to things. Although less obviously a measure of anomalous perception than the other scales, several items assess such experiences (e.g., "I often notice small sounds when others do not"), and high scores are associated with reports of sensory processing anomalies (Horder et al., 2014) and with sensory functioning in neuro-typical participants (Mayer, 2017). Measures of autism-like traits are associated with higher CAPS scores (Milne et al., 2017), tactile hypersensitivity (Sapey-Triomphe et al., 2019), and psychophysical measures for individuals with hypersensitivity to sensory stimuli (Bryant et al., 2019).

Procedure

Upon accessing the survey, participants read a consent form that briefly described the study as research about ASMR and correlated traits, indicated ethics approval by the University of Winnipeg, provided contact information, and stated that participants could quit the survey at any time. They then completed the tasks, first the demographic and ASMR yes/no questions, followed by the surveys in this order: ASMRS, CAPS, ASQ, CREX, HALL, and PLAS. Given minimal incentive and permission to quit at any time, the number of subjects decreased from early to late measures, as shown in Table 1.

Results

Table 1 presents descriptive statistics for the ASMRS scale and the five measures of anomalous perception. Means are close to the midpoint of the seven-point scale suggesting moderate degrees of agreement, but there was considerable variability about the average. Notably with respect to variability, *SD*s for measures other than ASQ are very large for seven-point scales. As discussed later, distributions of ASMR scores were quite polarized.

Reliabilities appear on the diagonal and are very good for ASQ, and extremely high for the other measures. High Cronbach alphas occur with features that were present for most of these measures: high interitem correlations reflecting homogeneous scales, a substantial number of items for most measures, and high degrees of variability on individual items, as just noted.

Table 1 also shows that, except for the ASQ, the four other measures correlate highly with one another, rs $\geq .81$, and clearly reflect some common underlying factor, presumably anomalous sensory experiences. A factor analysis of the four measures showed that a single factor accounted for over 88% of the variability in scores.

Table 1 also reports the number of participants completing each measure, which decreased with the order of the scales. All participants who completed each measure were included in the following analyses because measures were highly correlated and initial analyses compared groups separately for each measure. Also, excluding participants who only completed some measures would have disproportionately affected the online ASMR group. Unlike that group, Qualtrics Panels participants had external motivation to complete all measures, and recruitment was less limited than for the Reddit sample because responses were collected until the requested number of participants completed all measures.

Subsequent analyses compared the 58 Control participants, the 91 quasi-ASMR participants, and the 154 true-ASMR participants. One important question pursued in the following analyses was whether respondents from the general population who responded "yes" to an ASMR screening question were comparable to participants solicited from the ASMR online site. This has important implications for future ASMR research. ASMR is more common if respondents from the general population are comparable to those from ASMR online sites, and designs with three or more groups may be necessary to identify unique features of actual ASMR experiences if the quasi- and true-ASMR groups differ.

The three groups differed significantly on the ASMRS measure, $F(2, 298) = 89.01$, $MSE = 1.22$, $p < .001$, $\eta^2 = .37$. For follow-up independent t tests here and in later sections, *df*s correspond to denominator *df*s for the F statistics. Also, ps are not corrected for number of comparisons so as to strengthen critical claims about nonsignificant differences in the following comparisons. However, significant differences of importance would still be significant by conservative Bonferroni tests except where noted for a few cases. Pairwise comparisons between adjusted ASMRS means were all significant, $t = 13.25$, $p < .001$ for Controls ($M = 3.05$) versus quasi-ASMR ($M = 5.54$), $t = 10.04$, $p < .001$ for Controls versus true-ASMR ($M = 4.78$), and $t = 5.21$, $p < .001$ for quasi- versus true-ASMR. Notably, both the quasi- and true-ASMR groups scored higher than Controls on this measure.

In addition to differences in average, the shapes of the ASMRS distributions also varied markedly among the three groups, in particular for Control participants. As expected, Control participants showed limited evidence for ASMR experiences. Almost half (46%) of ASMRS scores in this group were less than three on the seven-point scale and no one scored six or higher. In contrast, only three people in the quasi- and true-ASMR groups scored below three, and 59 had averages of six or higher, including some perfect sevens.

The quasi- and true-ASMR groups scored higher on the ASMRS measure than the non-ASMR group and scores for both ASMR groups had similar distributions. Moreover, the difference in sex composition reported earlier reflects the fact that quasi- and true-ASMR groups had a higher proportion of males, unlike the Control group. Collectively these observations suggest that both ASMR groups may represent the actual population of people who experience ASMR.

Despite these similarities, analyses of the other measures revealed a very different story. As shown in the following paragraphs, Control participants differed from quasi-ASMR participants on measures of anomalous perception, markedly except for ASQ, but did not differ significantly from the true-ASMR group. Indeed, what modest differences there were between Control and true-ASMR participants were opposite to expectations; that is, the true-ASMR group scored slightly lower than Controls on measures of anomalous perception.

With respect to CAPS, the three groups ($M_{Control}$ = 2.91, M_{Quasi} = 4.99, M_{True} = 2.86) differed significantly, $F(2, 280) = 80.51$, MSE = 1.70, $p < .001$, $\eta^2 = .37$. The quasi-ASMR group differed significantly from the Control group, t = 9.23, $p < .001$ and the true-ASMR group, t = 12.07, $p < .001$. In contrast, the difference between Control and true-ASMR groups was not significant, t = .23, p = .83, and the Control group scored slightly higher.

The CREX measure also revealed significant differences among the groups ($M_{Control}$ = 3.77, M_{Quasi} = 4.98, M_{True} = 3.65), $F(2, 244) = 46.51$, MSE = 1.27, $p < .001$, $\eta^2 = .23$. Again, the quasi-ASMR group differed from Control, t = 5.97, $p <$ .001, and true-ASMR, t = 8.22, $p < .001$ groups. However, the Control and true-ASMR groups did not differ, t = .62, p = .53, and the Control group even scored slightly higher.

Groups differed significantly on HALL ($M_{Control}$ = 3.39, M_{Quasi} = 4.80, M_{True} = 3.13), $F(2, 238) = 43.26$, MSE = 1.62, $p < .001$, $\eta^2 = .27$. The quasi-ASMR group once again differed from Control, t = 6.08, $p < .001$, and true-ASMR, t = 9.04, $p <$ .001, groups. As for previous scales, the Control and true-ASMR groups did not differ, t = 1.19, p = .24, and the Control group again produced higher scores.

PLAS showed a similar pattern ($M_{Control}$ = 2.84, M_{Quasi} = 4.39, M_{True} = 2.50), $F(2, 228) = 45.49$, MSE = 1.89, $p < .001$, $\eta^2 = .29$. The quasi-ASMR group differed from Controls, t = 6.08, $p < .001$, and the true-ASMR group, t = 9.30, $p <$ .001. Once again, the Controls and true-ASMR participants did not differ, t = 1.38, p = .17, with Controls scoring higher.

The pattern was similar but much weaker for ASQ. The three groups differed overall ($M_{Control}$ 3.67, M_{Quasi} = 3.88, M_{True} = 3.73), $F(2, 258) = 4.88$, MSE = .24, $p < .01$, $\eta^2 = .04$, but weakly. Moreover, the difference between the quasi-ASMR and Control groups was modest, t = 2.55, p = .012 (p = .036 corrected for number of comparisons), as was the difference between the quasi- and true-ASMR groups, t = 2.80, p = .006 (p = .018 corrected for number of comparisons). As with other measures, Control and true-ASMR participants did not differ on the ASQ, t = .32, p = .75.

The findings are quite consistent across the four specific measures of anomalous perception. That is, average scores of the true-ASMR group did not differ from those of the non-ASMR Control group, whereas the quasi-ASMR group did have higher mean scores. This pattern was much weaker or absent for the ASQ measure.

In addition to differences in average, the quasi- and true-ASMR groups differed on the strength of the relationship between the preceding measures and the ASMRS scale. Table 2 shows correlations between ASMRS scores and the other measures, separately for each group. All measures correlated significantly with ASMRS, ps < .003, but the magnitude of the relationships varied between groups. Notably, correlations were significantly stronger for the quasi-ASMR group than for the true-ASMR group, except for the ASQ measure, which overall correlated less strongly with ASMRS scores consistent with the earlier analysis of means.

Given the correlations between the anomalous perception measures and ASMRS scores, we examined whether the former accounted for any differences between groups on ASMRS. Because of their high intercorrelations and different Ns the measures were normalized and aggregated to produce an average anomalous perception score (ANOM). A single score eliminated the problem of multicollinearity and was included in a regression to determine whether anomalous perception accounted for mean differences among the three groups in ASMR experiences. ANOM correlated with each of the four

Table 2
Correlation of ASMRS With Anomalous Perception Measures by Group

Measure	Group: Control	Quasi-ASMR	True-ASMR	p
CAPS	.81	.73	.49	.004
CREX	.54	.72	.34	.001
HALL	.46	.67	.35	.003
PLAS	.43	.55	.29	.038
ASQ	.03	.09	−.08	.382

Note. ASMRS = Autonomous Sensory Meridian Response Scale (all scales are mean 1–7 rating); CAPS = Cardiff Anomalous Perception Scale; CREX = Creative Experiences Questionnaire; HALL = Launay–Slade Hallucinations Scale; PLAS = Inventory of Psychotic-like Anomalous Self-experiences; ASQ = Autism Spectrum Quotient. p is the significance of the difference between rs for the quasi- and true-ASMR groups calculated using Fisher's r-to-z transformation.

components .93 or higher, indicating that it represented well the four measures of anomalous perception, excluding the ASQ.

Table 3 shows a hierarchical regression of ASMRS scores on indicator variables for the critical comparisons between groups. CvsQ contrasts the means for Control and quasi-ASMR groups controlling for other predictors in the equation. CvsT contrasts means for Control and true-ASMR groups, again controlling for covariates. Model 1 controls only for sex and age and Model 2 includes average anomaly scores as well. Of particular importance, including ANOM produced a marked decrease in the regression coefficient and sr^2 for the contrast between Control and quasi-ASMR means, but not for the contrast between Control and true-ASMR means. This indicates that ANOM accounted for some of the mean difference on ASMRS between Control and quasi-ASMR groups, but not for the difference between Control and true-ASMR conditions.

To determine whether the mediating effects of ANOM were significant, the PROCESS macro of Hayes (2017) tested the difference between regression coefficients in Models 1 and 2. The reduction was significant for the contrast comparing the Control and quasi-ASMR groups (CvsQ), indirect effect = .84, bootstrapped CI = .59 to 1.12, but not for the contrast comparing Control and true-ASMR groups (CvsT), indirect effect = −.11, CI = −.31 to .07. In addition to being not significant, the regression coefficient comparing Control and true-ASMR groups actually increased, opposite to expectation if anomalous perception contributed to the difference between these groups on ASMRS.

Table 3

Predicting ASMR Scores From Group and Average Anomalous Perception Scores

Predictor	Model 1 *b*	Model 1 *SE*	Model 1 sr^2	Model 2 *b*	Model 2 *SE*	Model 2 sr^2
Constant	2.75			3.23		
Sex	−.08	.14	.00	-.22	.11	.01
Age	.02	.01	.01	.02	.01	.01
CvsQ	2.48	.19	.38	1.64	.17	.15
CvsT	1.65	.18	.20	1.77	.14	.22
ANOM				.81	.07	.20
R^2	.39			.59		
F	44.70[a]			80.17[b]		

Note. ASMR = Autonomous Sensory Meridian Response; CvsQ = contrasts control and quasi-ASMR groups. CvsT = contrasts control and true-ASMR groups. ANOM = average anomalous perception measure.
[a] $df = 4, 280$. [b] $df = 5, 279$.

Despite the preceding differences between the quasi- and true-ASMR groups, the various measures of anomalous perception, excepting ASQ, were in fact robust predictors of ASMRS scores, as shown in Table 2, *p*s < .003, and Table 3, $p <$ .001. Individual differences on the various anomalous perception measures do capture variability in ASMRS scores within groups and account for some of the difference between Control and quasi-ASMR groups, but do not account for differences between Control and true-ASMR groups.

Various findings suggest that the ASQ scale measures a different construct than the other questionnaires, which is why it was excluded from ANOM. In addition to weaker relationships with ASMR described earlier, correlations of ASQ with the other anomalous perception measures, *r*s < .32, were much weaker than correlations between the other measures, *r*s ≥ .81 (see Table 1). Not surprisingly, only 11% of the variability in ASQ was explained by the single factor that resulted from a factor analysis of all five scales, versus 85% or higher for the other measures. The pooled *SD* for ASQ is also much smaller than the other scales, as seen in Table 1, suggesting as well that it measured something distinct. Although weaker, the correlations of ASQ with the anomalous perception measures were positive and significant, consistent with past research reviewed earlier. Specifically, ASQ scores correlated significantly with the four other measures (see Table 1), *p*s < .01, and with ANOM, $r = .28$, $p < .001$.

Discussion

To summarize, the quasi- but not true-ASMR group scored higher on anomalous perception than Control, ASMRS scores correlated within groups with anomalous perception, and anomalous perception partly mediated the difference on ASMRS between the quasi-ASMR and Controls, but not the difference between the true-ASMR and Controls. The conclusions warranted by these findings depend largely on interpretation of the results for quasi-ASMR participants. The original design planned to compare participants solicited from an ASMR website who responded “yes” to the ASMR screening question (true-ASMR group) with participants from the general population who responded "no" to the screening question (non-ASMR Control group). Based on this contrast alone, the study provides weak support for a theoretical role of anomalous perception in ASMR. Despite a correlation between anomalous perception measures and ASMRS, the true-ASMR group did not differ from the non-ASMR group on the anomalous perception measures, nor did anomalous perception account for any of the difference between Control and true-ASMR groups on the ASMRS measure.

The only positive result for the initial design, then, was the correlation within groups between anomalous perception and ASMRS scores. Correlations within conditions provide some evidence for a relationship between anomalous perception and ASMR (e.g., Bryant et al., 2019), but on their own within-group correlations provide at best weak support for models that hypothesize an underlying relationship between the two given the lack of group differences on the correlates and no evidence for mediation. Hence, the present within-group correlations are limited support for the role of anomalous perception in ASMR.

The story is more complex if responses for both quasi- and true-ASMR participants reflect actual ASMR experiences. Similar to true-ASMR participants, quasi-ASMR participants responded "yes" to the screening question and obtained elevated scores on the ASMRS measure, even though they came from the general population. Unlike the true-ASMR group, however, the quasi-ASMR group differed from the Control group on the anomalous perception measures, which not only correlated with ASMRS scores but also mediated some of the difference between Control and quasi-ASMR groups on the ASMRS. If the quasi-ASMR group ratings do reflect actual ASMR experiences, these findings more strongly support a relationship between anomalous perception and ASMR.

The quasi-ASMR results are unlikely to be an artifact of some general response bias, including a simple desire to continue with the survey. Expectancy effects do contribute to ASMR experiences for naive but not ASMR participants (Cash et al., 2018; Hostler et al., 2019), but an extreme version of this explanation fails on several grounds. Most telling is the distinct pattern of responses for the ASQ scale. Responses for participants in both the true- and quasi-ASMR groups were less variable and less elevated on the ASQ scale than on the anomalous perception measures and, unlike the other measures, ASQ scores did not correlate with ASMRS scores (Table 2). Moreover, anomalous perception scores only accounted for some of the elevated responses on the ASMRS measure. These results are inconsistent with quasi-ASMR participants giving high ratings due to general response tendencies. A global tendency would produce ASQ results similar to the other measures and anomalous perception would account for the entire difference between Control and quasi-ASMR groups. In addition, once accepted into the study, there was no pressure on participants to provide elevated ratings for the measures.

The legitimacy of the quasi-ASMR results can also be questioned because so many people from the general population responded "yes" to the screening question, which was not expected. Although "yes" participants represented 22% of the initial 761 respondents, other studies have reported high or even higher percentages of "yes" respondents to ASMR queries, albeit in some cases from samples less random than ours. Notably, Roberts et al. (2020) reported that 43% of undergraduate psychology students responded four or five for more than half of the Sensation items on the ASMR-15, much higher than for other subscales. Similarly, elevated scores would be expected for ASMRS in the present study given its focus on perceptual experience. Also telling, Poerio (2016) found that 58% of an audience at a public event reported ASMR responses to an ASMR video and another 25% were not sure. A selective audience is unlikely to account for many of these cases given only 26% of those reporting an ASMR response even knew the term. Rouw and Erfanian (2018) found that half of their misophonia participants (i.e., people who experience aversive reactions to certain sounds) reported ASMR experiences. The number of followers on ASMR sites also suggests some prevalence of the phenomenon.

Together, the contrasting results for the quasi- and true-ASMR participants are intriguing. One speculative possibility given the present findings are correlational is that different mechanisms could underlie reports of ASMR sensations in the two groups, with the quasi-ASMR experience closely associated with anomalous perception. That is, reports of ASMR-like symptoms in the general population could reflect an exceptional tendency to experience unusual perceptual phenomena. Alternatively, a common ASMR trait could underlie the experience of both groups, but ASMRS scores for quasi-ASMR participants benefited from processes associated with anomalous perception. For example, a general sensitivity to bodily and other sensations could result in greater awareness of ASMR sensations in the quasi-ASMR group.

Without further data, differential sensitivity to ASMR-related sensations appears more likely given the quasi-ASMR group scored higher on ASMRS than the true-ASMR group and controlling for anomalous perception accounted for only part of the difference between the quasi-ASMR and Control groups on the ASMRS measure. This issue parallels a finding in Roberts et al. (2021) that respondents from two ASMR sites differed in average scores on an ASMR measure. They suggested that demand characteristics could have inflated scores in one group and advocated a priority for future research be to explore differences between online ASMR samples, a recommendation we strongly support and extend to ASMR samples from diverse populations. Resolution of this issue must wait on such research and a more definitive test of the reality of ASMR experiences reported by participants, as discussed below.

The present findings have several implications for future research on ASMR. In particular, selecting ASMR participants from the general population is problematic given the present study found different results for quasi- and true-ASMR groups. Ideally, ASMR participants from both general and ASMR-specific populations will be included in future studies to determine similarities and differences between the two groups. In the present study, neither a positive response to a description of ASMR nor scores on the quantitative ASMRS questionnaire discriminated between quasi- and true-ASMR participants. If anything, the quasi-ASMR group scored higher on ASMRS. Even if not included as a comparison, researchers should report the percentage of participants excluded from non-ASMR comparison groups. This information can be omitted inadvertently if online platforms use a screening question to recruit participants without documenting the number of exclusions. Moreover, such data provide important information about the prevalence of self-reported ASMR experiences in the general population.

The present findings also indicate that a priority for future research should be to use more diverse and, ideally, objective measures of the ASMR experience, given self-reports did not distinguish between quasi- and true-ASMR groups and self-reports have also been an issue in research on synesthesia and similar phenomena (Janik McErlean & Banissy, 2017). The ASMR-15, for example, measures more diverse aspects of the ASMR experience (i.e., Altered Consciousness, Relaxation, Affect) than the present focus on perceptual qualities (Roberts et al., 2019). These and other qualities might discriminate quasi- and true-ASMR groups. The present measure, for example, included only one item related to seeking ASMR experiences. Researchers have also used ASMR-inducing videos to screen participants, (e.g., Smith et al., 2017, 2019a, 2019b), perhaps a more rigorous criterion, although Poerio (2016) still found a high level of ASMR responding to videos in a general audience, consistent with the present results.

Past research on ASMR and related phenomena suggests several objective strategies for assessing the "reality" of ASMR experiences. One approach would be to measure physiological responses during ASMR experiences. Poerio et al. (2018), for example, reported skin conductance as a possible physiological marker for ASMR, an important finding that merits replication with respondents from the general population who report ASMR experiences. The impact of actual stimulation might also differentiate quasi- and true-ASMR groups. For example, the nape of the neck may be more sensitive to tactile stimulation in true-ASMR participants, or more prone to imagined sensations. Stimulation could also interact with the ASMR experience, as observed for synesthesia (Spector & Maurer, 2013; Ward, 2013).

The present findings also have implications for control groups and comparisons to ASMR participants. Given the high percentage of the general population who reported ASMR experiences (see also Roberts et al., 2020), strict vetting is clearly required to exclude people prone to endorse ASMR experiences. Control groups based on such exclusions, however, warrant some caution in the interpretation of differences between ASMR and control participants. Only recruiting participants from the general population who respond "no" to a screening question does not guarantee that comparisons with a distinct ASMR group are unique to ASMR given similar results may occur in excluded members from the general population who responded "yes" to the screening but were not tested further. Elevated scores on the ASMRS measure were not unique to participants solicited from an ASMR site in the present study, but this fact was uncovered only because we tested "yes" respondents.

One concern about the anomalous perception measures could be our use of overall scores and even an aggregate score. This strategy ensured a robust index of generic anomalous perception, but may have masked relationships between ASMR and more specific facets (i.e., subscales, factors) of anomalous perception. However, responding by participants was very consistent across items as shown by the exceptionally high reliabilities for the measures (see Table 1). Moreover, published evidence for distinct factors in these measures is far from robust. Factors are not orthogonal and their intercorrelations can be substantial. For example, subscale scores for the PLAS correlate highly with one another (e.g., from .50 to .84 in Klaunig et al., 2018), as do the two factors identified by Kelsall-Foreman et al. (2020) for CAPS. Moreover, efforts to determine whether separate components of anomalous perception accounted better for ASMRS scores in the present study were unsuccessful. The CAPS factors, one measuring external sensations and the other proximal, body-centered ones (e.g., alterations in touch) correlated highly and behaved as reported here for the entire scale. A subset of the HALL items that specifically mentioned bodily hallucinations also correlated highly with the entire scale and showed equivalent results.

In addition to guidance by empirical findings, future research would benefit from theoretical perspectives on ASMR and other alternative states of consciousness. A common underlying model is suggested by hypotheses described at different levels of explanation (e.g., physiological, psychological) and using different terminology. Roberts et al. (2021) noted the possible relevance of Hartmann's boundaries of the mind hypothesis, which posits that people vary in how thin or thick barriers between subjective experiences are. People with thin boundaries are more likely to report anomalous perceptions and other forms of altered consciousness. Roberts et al. (2021) also described parallels between ASMR and transliminality, which has been associated with anomalous perception, fantasy proneness, and mystical experiences. Consistent with the boundary theory, Evans et al. (2019) demonstrated that transliminality correlated with reduced thresholds for subliminal and vibrotactile stimuli.

The hypothesis of permeable boundaries is also consistent with research related to personality traits. People who experience ASMR obtain higher scores on openness to experience (Fredborg et al., 2017; Janik McErlean & Banissy, 2017), the Fantasy subscale of the Interpersonal Reactivity Index (Janik McErlean & Banissy, 2017), and the Sensory Suggestibility Scale (Keizer et al., 2020). Such findings suggest collectively that ASMR is more common in people who experience sensory events in a global manner.

The permeable boundaries hypothesis is also consistent with several related physiological theories. Smith et al. (2017) reported that individuals with ASMR showed atypical patterns of functional connectivity in the default mode network and hypothesized that this may indicate decreased attentional inhibition. Subsequent research found atypical functional connectivity in other resting-state networks, including the central executive network (Smith et al., 2019a). Atypical functional connectivity and reduced inhibition have been observed for related phenomena. Notably, imbalances of excitatory and inhibitory influences are implicated in synesthesia (Freeman, 2020), meditation (Panda et al., 2016), hallucinations (Jardri et al., 2016), and models for alternative states of consciousness (Vaitl et al., 2013). Decreased inhibition would allow global activation across regions of the brain, providing a mechanism for thin and thick boundaries. For example, a decrease in network modularity with age (Chan et al., 2014) is associated with reductions in the inhibitory neurotransmitter GABA (Cassady et al., 2019). An avenue for future research is to determine whether functional connectivity and decreased inhibition differentiate true- and quasi-ASMR participants.

One aspect of ASMR that these general theories fail to explain is the tendency for perceptual experiences to be localized in the scalp and nape of the neck. Consistent with reports from people who experience ASMR, most of the ASMRS items referred to that region and perhaps some feature makes the nape particularly sensitive to tactile stimulation. A search for data on sensitivity to touch at different parts of the body, including the neck, uncovered nothing directly relevant. There was, however, one intriguing finding. Turnbull et al. (2014) carried out a study in which numerous participants rated the erogenous intensity of stimulation to 41 different body parts. The nape of neck ranked 4th for women and 5th for men, suggesting some unusual sensitivity to touch in that area given the few higher ranked regions were more obviously sexual in nature. Clearly, further investigation of the localized nature of sensory experiences and of tingling itself (Tihanyi et al., 2018) would contribute to a more complete model of ASMR.

In conclusion, the role of anomalous perception in ASMR remains ambiguous given the contrasting results for the two ASMR groups. Compared to a non-ASMR Control group, true-ASMR respondents from an online site obtained higher scores on our ASMR measure, but not higher scores on anomalous perception. Nor did anomalous perception account for any of the difference in ASMR scores between Control and true-ASMR groups. In contrast, the quasi-ASMR group showed both mean difference and mediation effects. For participants in all three groups, however, ASMR and anomalous perception scores did correlate positively within conditions. These mixed results suggest several directions for future research to further our understanding of ASMR, including studies guided by general models for altered states of consciousness, such as hallucinations and other anomalous perceptual experiences.

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Appendix

Autonomous Sensory Meridian Response Scale

Use the following scale to rate your degree of agreement with each of the statements that appear below. For statements with which you strongly agree, give a high rating of 6 or 7. For statements with which you strongly disagree, give low ratings of 1 or 2. For intermediate degrees of agreement, give ratings of 3, 4, or 5. Some of these questions may seem redundant, please read each one carefully before making your selection.

(*Appendix continues*)

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

1. I sometimes experience tingling sensations on my scalp, neck, back, limbs, and/or another part of my body when seeing or hearing a certain sound or action.
2. There have been times when I thought that I was being tickled on the back of the neck and/or scalp when seeing or hearing a particular sound or action but no one was present except me.
3. Sometimes I feel that I am being touched on the back of the head even when no one is actually touching me when seeing or hearing a particular sound or action.
4. There have been occasions when I felt strange sensations on my head, neck, limbs, and/or other parts of my body when seeing or hearing a particular sound or action.
5. At times my scalp feels like something is crawling on the back of my head, neck, limbs, and/or other parts of my body when seeing or hearing a particular sound or action.
6. Occasionally, I feel unusual sensations on the back of my head, neck, and/or through my limbs when seeing or hearing a particular sound or action.
7. There are times when I am sure that something is stimulating the back of my head and/or neck when seeing or hearing a particular sound or action.
8. I sometimes have feelings that someone is stroking my head at the back and/or neck when seeing or hearing a particular sound or action.
9. There are times when I think that something has brushed against the back of my head and/or neck when seeing or hearing a particular sound or action.
10. I sometimes experience tingling sensations on my scalp, neck, limbs, and/or other parts of my body that have no obvious explanation
11. There have been times when I thought that I was being tickled on the back of the neck and scalp but no one was present except me.
12. Sometimes I feel that I am being touched on the back of the scalp even when no one is touching me.
13. There have been occasions when I felt strange sensations on my scalp, neck, limbs, and/or other parts of my body.
14. At times my scalp and/or neck feels like something is crawling on the back of it.
15. Occasionally, I feel unusual sensations at the back of my scalp, neck, limbs, and/or other parts of my body.
16. There are times when I am sure that something is stimulating the back of my scalp and/or neck.
17. I sometimes have feelings that someone is stroking my scalp and/or back of the neck.
18. There are times when I think that something has brushed against the back of my scalp and/or neck.
19. I feel tingling sensations on my scalp and/or back of the neck when hearing or seeing a certain sound or action and they are pleasurable/relaxing.
20. I feel tingling sensations in other parts of my body (e.g., limbs, ears, etc.) when hearing or seeing a certain sound or action and they are pleasurable/relaxing.
21. I feel sensations on my scalp, back of the neck, and other parts of the body when no one appears to be around and this is pleasurable/relaxing.
22. I actively seek out tingling sensations by purposely viewing or watching sounds or actions that may create them.

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