EXPLORING SOUNDS THAT EVOKE AUTONOMOUS SENSORY MERIDIAN RESPONSE

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ABSTRACT

Large Internet communities have formed around a genre of sounds and videos known as ASMR. These sounds elicit a physiological response described by subjects as "pleasant tingling" in the scalp and shoulders [4]. Despite the prevalence of ASMR videos and sounds on websites including YouTube, SoundCloud, and Reddit, ASMR is virtually unstudied by the scientific community. The term is notably absent from academic literature, and as of March, 2015 there are no studies of brain activity in those who experience ASMR. Our aim is not to explore the neurological basis of the claimed affect, but rather to shed light on the sounds that produce the sensation. Using machine learning techniques, we explore the space of sounds that elicit this physiological response. First, we create a corpus of ASMR sounds using links from the /r/asmr subreddit on Reddit.com. We extract audio features to summarize each of the sound clips, and then use the Weka machine learning package to classify clips. We seek to answer a simple question: what features separate ASMR sounds from other sounds, including speech?

1. INTRODUCTION

A brief introduction to ASMR will help justify it as an interesting subject. ASMR is a phenomenon in which a stimulus (generally auditory) induces a tingling feeling in subjects. Those who experience ASMR describe the sensation as "a pleasurable, specific and intense tingling feeling in the head and body upon hearing "soft" or "crackling" sounds" [6]. This tingling is generally felt in the scalp (particularly, the occipital and parietal areas of the head), often extending to the shoulders and spine. Those who experience ASMR have described the sensation as pleasurable, relaxing and massage-like [4]. ASMR can refer either to this sensation or the stimuli that evoke it.

The stimuli are even more varied than the sensation. A 2009 article on Vice.com describes ASMR videos:

Figure 1. Frame from an ASMR video featuring bubble wrap sounds. ASMR videos are feature close, quiet sounds: although the performer manipulated the bubble wrap for over 20 minutes, no bubbles popped [7].

> ...pretty young women talking softly and pretending to be travel agents; a pair of hands stroking and crinkling plastic bags in almost disturbingly sensual ways; another pair of hands opening a box of Legos; a 12-minute long pretend-eye exam monologue with no video [5].

The most common triggers include whispering, crisp sounds (such as crinkling paper), tapping, and close personal attention [4]. Although little is know for certain, the wide range of ASMR stimuli and anecdotal evidence from ASMR community members suggests that there may be no universal stimulus that will trigger ASMR in all subjects who experience ASMR.

Perhaps most striking is the strength of online ASMR communities. Synaesthesia, which is a relatively well-studied phenomenon, has fewer than 5000 members of online communities across Reddit and Facebook, while ASMR communities top 100,000 members (See Table 1 on page 2). Wilson and Peterson define online communities as having two principles components: Access and Identity [9]. In the case of ASMR, the community is only truly accessible to those who experience the phenomenon. Certainly, those who do not experience ASMR can access the same content, but they will likely quickly leave the community, because the videos are relatively uninteresting, and comments center around which sections of the video trigger tingling for

Community	Size
GentleWhispering on YouTube	385k viewers
ASMRrequests on Youtube	218k viewers
EphemeralRift on Youtube	111k viewers
/r/asmr on Reddit	98k subscribers
ASMRofficial on Facebook	24k likes
ASMRSounds on SoundCloud	261 listeners
Society of Sensationalists on Yahoo	168 members

Table 1. Sizes of various ASMR communities, including the top three ASMR YouTube channels by number of subscribers.

individual. ASMR Identity is defined along similar lines. Because of the inherent inaccessibility of ASMR, ASMR community members often feel outside the mainstream experience, even as if they are engaging in "transgressive intimacy" [1]. This is especially true of creators of ASMR content, who typically do not reveal their real names, and often refuse to give interviews [2]. Since ASMR videos are widely watched on YouTube, ASMR content creators can earn significant income if their videos contain advertisements.

Although online communities for ASMR have existed since at least 2007, the term ASMR was coined in 2009 as the name of an online community on Facebook [2]. The term — Autononmous Sensory Meridian Response — deliberately evokes scientific jargon, indicating a desire for legitimacy and scientific recognition: "the ASMR community has tried to ground their discussions of the experience in scientific terms that suggest empirical proof of its existence" [2]. An earlier community referred to the experience as Attention Induced Head Orgasms (AIHO), but ASMR is now the dominant term.

Due to the strength of ASMR communities, ASMR research (albeit unscientific), usually centers around the online communities. Since the sensation appears to be relatively rare, and the community is eager to engage with researchers, online ASMR communities are a good way to gain subjects for studies and surveys: "participants presented themselves as volunteers via online 97 advertisement on specialised ASMR interest groups on Facebook and Reddit."

ASMR videos are relatively long: while the average video length on Reddit is just under two minutes, the average length of ASMR videos in our sample was 11 minutes. It is not uncommon for ASMR videos to be over 40 minutes long.

Although the triggers for ASMR generally contain a visual component, we justify focusing on sounds for two reasons:

- Audio-only ASMR communities exist [1] , but we have not found any communities that primarily focus on visual stimuli.
- ASMR videos are more acoustically similar than visually similar, so audio provides a better . . .

The ASMR Reddit community rejects gifs and silent videos, apparently not considering them to be legitimate triggers.

Listening to ASMR sounds is typically a solitary activity. The ASMR subreddit sidebar suggests listening with headphones (many ASMR videos feature binaural sounds) in a dark or dimly-lit environment. As ASMR is by nature a personal experience, it is perhaps unsurprising that very specific communities cater to small subsets of ASMR stimuli. One community excludes whispering and talking, another only includes monologues; one excludes male performers, another excludes performance itself — requiring that the ASMR be produced "unintentionally." Ahuja posits ASMR as an antidote to "isolation mediated by modernity". He hypothesizes that ASMR is the result of "a kind of hypersensitivity to touch in the setting of its relative deficiency" [1]. The "touch" in the case of ASMR, is primarily auditory. The sound qualities create an illusion of closeness reminiscent of physical proximity.

We might also define what ASMR is not. ASMR is not traditionally musical: the sounds are not organized by pitch or any regular rhythm. The ASMR community on Reddit defines *frisson* as a related phenomenon, in which music elicits shivers or tingling. However, Reddit users organize *frisson* and ASMR as different sensations, evidenced by the existence of /r/asmrmusic as separate from /r/asmr (with no content shared between them). Nor is ASMR purely random: white noise was not found to be a strong trigger in a study with 475 participants who self-reported experiencing ASMR [4].

ASMR is sometimes compared to other types of pleasure: drug induced euphoria, and particularly orgasm. The emphasis on role play in ASMR videos makes it easy to draw comparisons to sexual fetishes, but the video subjects are not uniform enough to be a true fetish. Rather than focusing on a specific situation or physical attribute, ASMR role play videos emphasize situations that involve personal attention, including everything from hair cutting to a whispered conversation [1]. Community members insist that the phenomenon is asexual, and object to comparisons between ASMR and sexual arousal. A typical comment reads:

> As I've stated before, I really don't like the sexualization of ASMR. I think it is very detrimental to the "community" to have sexual terms in the description of this subreddit. The first example I can think of is an elementary teacher I know that gets ASMR from certain speech patterns like most of us. One of the teacher's students gives her ASMR. I really don't think people who do not understand ASMR would find it kosher if they thought the teacher was having "head orgasms" at school from one of her very young students, when really it's just

[1] For example, the ASMR Audio group on SoundCloud: https://soundcloud.com/groups/asmr-audio.

tag	occurrence per 1000 posts
intentional	286
female	256
unintentional	233
male	213
soft spoken	146
asmr	116
whispering	87
binaural	81
tapping	77
whisper	72
soft-spoken	57
british accent	43

Table 2. Most common tags for videos in the Reddit ASMR community.

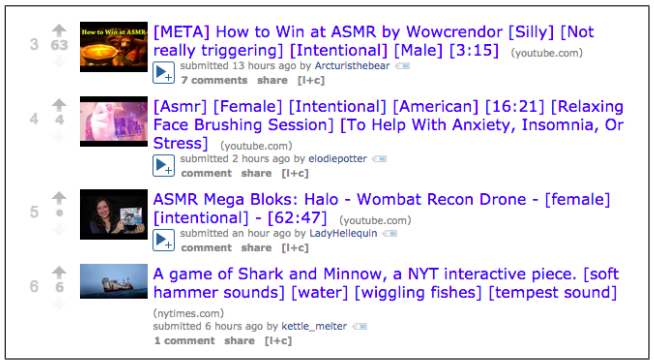

Figure 2. Tags appear in brackets.

a relaxing speech pattern. [2]

The main ASMR subreddit does not allow sexual content, pushing it to a small splinter community ("Not Safe for Work ASMR) for erotic content that induces ASMR. The relative size of these communities belies claims that ASMR is primarily erotic.

ASMR is also often compared with synaesthesia, although the two present quite different somatic responses [3]. The phenomena may be related, as those who report experiencing ASMR are more likely to report experiencing synaesthesia than the general population [4].

2. METHODOLOGY

We wrote a script using Node.js to extract audio posted by the ASMR community on Reddit. The script identifies posts from http://reddit.com/r/asmr that link to videos on YouTube. We then converted the files to Waveform Audio File Format with a uniform sampling rate of 22.05 kHz.

The Reddit ASMR community uses a tagging system to allow users to find content with specific triggers (See figure 2 on page 3). While downloading videos, we collected tags to compare the triggers with an existing study on ASMR triggers. We wrote a short script to organize audio files into a folder based on their tag, and attempted to classify ASMR samples based on their tags using Weka.

To reduce the effect of video length on our results, we only extracted features from the first five minutes of each audio file. We did not normalize the data, because normalizing sounds reduced the accuracy of Weka"s classification. A notable feature of ASMR videos is their relatively low amplitude, so it is unsurprising that non-normalized audio yielded better results.

Some ASMR videos include a musical introduction, so we excluded the first 30 seconds from the ASMR samples to reduce the effect that introductions had on classification. Removing introductions improved the accuracy of the Weka classifier (a Multilayer Perceptron with 20% training) by 0.5%. As relatively few non-ASMR videos contained introductions, we extracted features from the full duration of the non-ASMR clips. We also removed 43 duplicate samples, by searching for files with similar lengths (within 1 second) and manually identifying duplicates. Duplicates occur when the same video is uploaded by a different user and then submitted again to Reddit. We exclude posts with the [META] tag, as they include content about the phenomenon and community. Videos linked from [META] posts do not necessarily share characteristics with sounds that evoke the ASMR response.

Thus, we constructed a corpus of ASMR sounds. For comparison, we needed a representative sample of non-ASMR sounds. We collected non-ASMR sounds using the same method used to created the ASMR corpus. In addition to non-ASMR sounds from the /r/videos subreddit, we collected sounds from the /r/speeches subreddit as part of the non-ASMR sample. The inclusion of these sounds ensures that we classify ASMR sounds a separate from normal speech.

We extracted audio features using the Marsyas (Music Analysis, Retrieval and Synthesis for Audio Signals) package, exporting to an .arff file. We used `bbextract` from Marsyas to extract timbral features as well as stereo panning spectrum features. We included stereo panning spectrum features, because ASMR performers often use binaural microphones to create . Including stereo features improved the accuracy of the Weka classifier (a Multilayer Perceptron with 20% training) by 0.8%.

Finally, we imported the extracted features into Weka for analysis. Weka provides tools for visualizing and classifying data using machine learning and clustering. We used unsupervised classification (K-means clustering) and supervised classification (Naive Bayes and a Multilayer Perceptron). For the supervised classifiers, we trained with both a 5% and 20% split between training and test data. We also plotted the samples along their principle components.

Due to copyright concerns, we cannot share the audio files themselves, but the code used to extract audio from Youtube videos is freely available on Github [3]. The extracted features and miscellaneous functions used in the analysis can also be found on github [4].

[2] Comment on the ASMR subreddit by user elizabethmeghan. http://www.reddit.com/r/asmr/comments/1dagb3/c9ojbj0

[3] http://github.com/harquail/subredditTomp3s

[4] https://github.com/harquail/asmrProjectHelpers

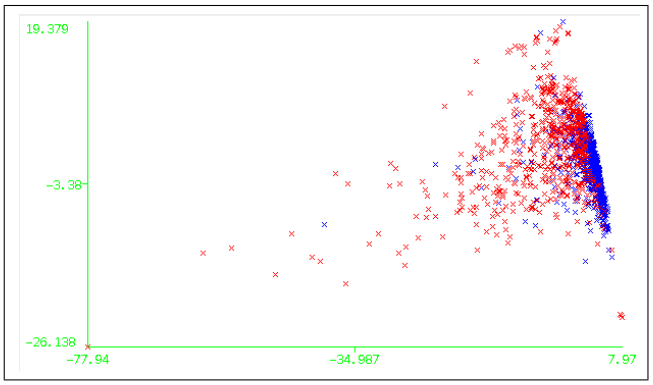

Figure 3. Samples plotted along their first two principle components. ASMR samples appear in red, non-ASMR samples in blue.

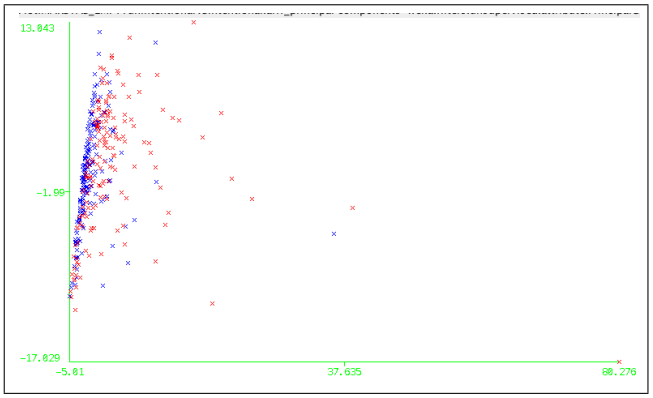

Figure 4. Samples plotted along their first two principle components. Samples tagged as [unintentional] appear in red, samples tagged as [intentional] in blue.

3. RESULTS AND DISCUSSION

Classifying ASMR and non-ASMR sounds revealed that ASMR sounds have unique sound qualities that separate them from non-ASMR sounds. We extracted features from 1002 samples of ASMR sounds, and 1000 samples of non-ASMR sounds. Even without training data (only the desired number of groups was given), a naive clustering algorithm was able to achieve 77.5% success in classifying sounds based on their features. With training data and a more sophisticated learning algorithm, we were able to achieve 87.8% success (See Table 3 on page 4). We can speculate that these qualities include relatively now volume, a high amount of noise, and sounds than pan across channels.

Manually examining outliers yields even greater confidence in the classification. For example, one ASMR video that Weka classified as non-ASMR was also controversial on Reddit, with community members complaining that the sounds were too jarring to induce ASMR [5] . Non-ASMR sounds classified as ASMR tended to be relatively quiet, or contain a lot of noise [6] .

[5] The video in question featured a manual typewriter: http://www.youtube.com/watch?v=c_S5Ttgbw

[6] For example, Bane"s monologue from "The Dark Night Rises" was likely classified as ASMR due to sounds of quiet voices, rain, and muffled explosions: https://www.youtube.com/watch?v=bpmNgPzklmQ.

Algorithm	Accuracy
Multilayer Perceptron, 20% training	87.8% correct
Multilayer Perceptron, 5% training	83.3% correct
Naive Bayes, 20% training	80.2% correct
Naive Bayes, 5% training	79.4% correct
Unsupervised k-means clustering	77.5% correct

Table 3. Accuracy of classification methods in classifying ASMR and non-ASMR audio files.

Algorithm	Accuracy
Multilayer Perceptron, 20% training	70.4% correct
Multilayer Perceptron, 5% training	62.9% correct
Naive Bayes, 20% training	54.8% correct
Naive Bayes, 5% training	54.3% correct
Unsupervised k-means clustering	49% correct

Table 4. Accuracy of classification methods in classifying ASMR audio files tagged as [intentional] and [unintentional].

In general, we observed less variation in ASMR sounds than in non-ASMR samples (see Figure 3 and Figure 4 on page 4). This is consistent with the notion that ASMR sounds are a specific subset of a wide range of sounds, and that is is possible that some sounds in our non-ASMR sample would be considered ASMR by those who experience it.

We also ran the classification on ambiguous data: sounds from the /r/poetryreading subreddit. These sounds have many similarities to ASMR, but are often too jarring to be relaxing. Anecdotally, the poetry readings classified as ASMR tended to be quieter and have lower sound quality than those classified as non-ASMR.

We also attempted to classify sounds with the ASMR corpus, training based on the [unintentional] and [intentional] tags. We ran the same classification algorithms on 329 sounds tagged as intentionally created to induce ASMR, and 224 sounds tagged as accidentally inducing ASMR. This classification was relatively unsuccessful, yielding a maximum success rate of 70.4%, with unsupervised clustering performing equivalently to random guessing (See Table 3 on page 4). This result seems to indicate that ASMR stimuli have similar qualities, regardless of whether not they are intentionally produced. We did not have enough data to run meaningful tests on any other tags.

4. FUTURE WORK

As a relatively unstudied phenomenon, ASMR provides rich opportunities for research. There is an obvious need for fMRI studies to examine brain activity in those who experience ASMR compared to those who do not. Because of participants" claims that ASMR is relaxing and helps induce sleep, some hope that ASMR may be use-

ful in treating post-traumatic stress disorder and in treating sleep disorders [8].

There are also many possible extensions of our work. We describe a pipeline that makes it easy to extract features from an online community that posts and tags sound clips. This could be easily transferred to examine other audio communities, or extended to examine the ASMR community in more detail. For example, it would be trivial to collect text from comments while extracting videos and analyze comments associated with ASMR videos or their audio features.

Another interesting extension would be to use similar learning techniques to develop an algorithm for generating sounds that widely induce ASMR. This would be usfeul for future human-subject studies on ASMR (and valuable to the ASMR community).

5. REFERENCES

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