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SENSORY CHANNEL EFFECTS OF AUTONOMOUS SENSORY MERIDIAN RESPONSE ON SHORT-TERM MEMORY

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Abstract. *Autonomous Sensory Meridian Response (ASMR) is nowadays popular to the general public and it is often suggested that ASMR may help individuals feel relaxation and well-being. There are, however, few experimental studies about ASMR. This study aims to investigate the sensory channel effects of ASMR on short-term memory. ASMR and negative affect contents were prepared to compare their differences of short-term memory performance according to three types of sensory channels ('visual', 'auditory' and 'visual + auditory' channels). The short-term memory performance was measured by nonsense syllable memory tests. 45 participants who were randomly assigned to each of three sensory channel conditions took part in the experiments, which consisted of three sessions: training session, negative affect session and ASMR session. Through three sessions, each of participants perceived negative affect and ASMR contents using the assigned sensory channel and then conducted short-term memory tests, respectively. The differences of short-term memory test scores between negative affect and ASMR contents were analyzed using the paired t-tests, according to three types of sensory channels. The experimental results showed that the difference of short-term memory test scores between negative affect and ASMR contents is statistically significant only for 'auditory' channel. It means that the positive effects of ASMR contents on short-term memory are significant only through 'auditory' channel, so it would be recommended to use ASMR sounds for increasing short-term memory performance.*

Keywords: ASMR, Short-term memory, Nonsense syllable test, Visual channel, Auditory channel

1. **Introduction.** Autonomous Sensory Meridian Response (ASMR) is a sensory phenomenon or a perceptual condition, in which particular visual and auditory stimuli trigger tingling, pleasant, static-like sensations across the scalp, back of neck and at sometimes further areas in the back and limbs [1-3]. In recent years, many ASMR experiences have been discussed and video clips to elicit ASMR tingles have been shared in online communities (e.g., YouTube and https://www.reddit.com/r/asmr/). It is often discussed that this sensation may give individuals feelings of relaxation and well-being, and that temporary relief through ASMR may be provided to individuals with depression, stress and chronic pain. As such, even though ASMR is widely spread to the general public, there are surprisingly few studies that reported scientific research results regarding ASMR. Among them, Barratt and Davis [1] reported that several common triggers used to achieve ASMR include whispering, personal attention, crisp sounds and slow movements, and that a flow-like mental state may be closely associated with ASMR. Smith et al. [2] investigated the neural underpinnings of ASMR and suggested that ASMR is associated with a blending of multiple resting-state networks, which likely influences the unique sensory-emotional

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experiences associated with ASMR. Those studies did not focus on investigating sensory channels for delivering ASMR stimuli, but tried to examine just overall mental states and neural phenomena associated with ASMR, despite the definition of ASMR, which is a sensory phenomenon or a perceptual condition. Thus, it is needed to investigate the role of sensory channels for increasing the benefits of ASMR.

In contrast to the recency and scarcity of sensory-emotional research associated with ASMR, research on emotion and memory has long been in progress. For example, Bower [4] investigated the influence of emotions on memory and thinking, and concluded that people recalled effectively their experiences congruent with the mood and that emotion strongly influenced cognitive processes, including social perception and snap judgments. Hamann [5] summarized recent findings from neuroimaging and neuropsychological studies, which indicated that emotional stimuli engaged specific cognitive and neural mechanisms that enhanced explicit memory. Specifically, Phelps [6] reported that the amygdala and hippocampal complex, which were linked to two independent memory systems in brain, acted in concert when emotional situations happened. In addition, Um et al. [7] conducted the experiments related to emotion and multimedia learning, and concluded that cognitive processes and learning were facilitated by positive emotions, which increased the amount of learners' mental effort, motivation and satisfaction. In sum, there were enough evidence for the relationship between emotion and memory. In this study, we consider video clips of ASMR contents as a kind of positive emotional stimuli whose influence on short-term memory is not fully studied by experiments yet.

This study focuses on examining the sensory channel effects of ASMR on short-term memory. Since ASMR is considered as a sensory phenomenon or a perceptual condition that induces the experience of positive emotions, it is reasonable that ASMR would have positive influences on memory according to the results from prior research. Most of ASMR contents are perceived through visual and/or auditory channels [10-12], so our research question is which sensory channel is most influential for perceiving ASMR to achieve short-term memory performance. Negative affect contents are used as a base line to examine the effects of ASMR on short-term memory by comparing short-term memory performance after perceiving ASMR contents with that after perceiving negative affect contents. This paper is organized as follows. This section gave an overview of basic topics related to this study, and is followed by a description of research methods in Section 2. Sections 3 and 4 provide the results of the experiments and discussion on the results with conclusions, respectively.

2. **Methods.**

In order to find the sensory channel effects of ASMR on short-term memory, the experiment was designed to collect data for short-term memory performance with six experimental conditions: the combination of two kinds of stimuli, such as ASMR and negative affect contents, and three types of sensory channels, that is, 'visual', 'auditory' and 'visual + auditory' channels.

2.1. **Preparation of ASMR and negative affect contents.**

Before conducting the experiment, two kinds of stimuli (i.e., ASMR and negative affect contents) were prepared in the form of video clips with respect to three types of sensory channels (i.e., 'visual', 'auditory' and 'visual + auditory' channels) as follows. First, among popular video clips in the website of 'YouTube', three ASMR contents and three negative affect contents were selected as candidates of stimuli for the experiments by five human factors experts. Three ASMR video clips are related to contents of 'brushing the cat hair', 'cutting or scrubbing the soap by a chisel' and 'cutting the kinetic sand by a knife', and three negative affect video clips include a scene of 'lightning and thunder', a summary of 'Train to Busan (a famous Korean zombie movie)' and a summary of 'The exorcist (a famous horror movie)'.

Second, thirty participants, who were 13 males and 17 females aged 22.3 years on average with a standard deviation of 1.73 years, took part in the preliminary test for selecting proper ASMR and negative affect contents used in the main experiment. In this preliminary test, each of participants was asked to respond the agreeability to items of 'Positive and Negative Affect Schedule (PANAS)' questionnaire [8] based on 5-point interval scales after perceiving each of three ASMR contents and three negative affect contents using 'visual', 'auditory' and 'visual + auditory' channels within 5 minutes, respectively. Table 1 shows the items of the PANAS questionnaire. As a result of the preliminary test, the video clip of 'cutting the kinetic sand by a knife [10]' was chosen as a proper ASMR content for both of 'visual' and 'visual + auditory' channels, and 'brushing the cat hair [11]' as a proper ASMR content for an 'auditory' channel, based on the highest average score of positive affect items and the lowest average score of negative affect items in the PANAS. The summary version video clip of 'The exorcist [12]' was chosen as a proper negative affect content for all three sensory channels, based on the lowest average score of positive affect items and the highest average score of negative affect items in the PANAS. Figure 1 shows three stilled images of ASMR and negative affect contents for three types of sensory channels, which were used in the main experiment.

Table 1. Items of PANAS [8]

Positive affect items		Negative affect items	
· Interested	· Alert	· Distressed	· Irritable
· Excited	· Inspired	· Upset	· Ashamed
· Strong	· Determined	· Guilty	· Nervous
· Enthusiastic	· Attentive	· Scared	· Jittery
· Proud	· Active	· Hostile	· Afraid

(a)

(b)

(c)

Figure 1. ASMR and negative affect contents in the experiment ((a) ASMR content for 'visual + auditory' and 'visual' channels, (b) ASMR content for 'auditory' channel, (c) negative affect content for all three sensory channels)

2.2. **Participants.** A total of 45 college students participated in the main experiment. Participants were 30 males and 15 females, and they were 23.0 years old on average, with a standard deviation of 2.01 years. They were randomly assigned to the experiments on three sensory channels, each of 15 participants based on the between-subject design: experiments on 'visual' channel (12 males and 3 females), 'auditory' channel (8 males and 7 females) and 'visual + auditory' channel (10 males and 5 females). Participants did not have any problem to watch the video clips in their eyes and ears.

2.3. **Procedure of experiment.** The main experiments consisted of three sessions. The first session was a training session, in which each of participants was told the aims and procedures of the experiments and then repeated the short-term memory tests up to 5 times until he or she got used to them. The short-term memory test was the modified version of recalling tasks for nonsense syllables, which was originally used in Ebbinghaus' study for forgetting curve and its replication experiments [9]. During a set of the short-term memory test, a participant reads and tries to memorize 20 nonsense syllables consisting of four upper-case letters in the problem set for 1 minute, and then checks the memorized nonsense syllables in the answer sheet (see Figure 2). The score is computed by adding correct number and deducting wrong number of checked nonsense syllables in the answer sheet, which results in a maximum score of 10 points and a minimum score of -10 points.

SDFQ	EFGH	VKFR	NMEW
QVBX	SNRW	AMJE	APLO
GAXC	FQZC	GNQA	SDOL
UJYH	FVDE	AQBT	NHWQ
VBFS	EERQ	HRQA	EDKU

(a) Problem set

VFMQ	EFGH	VKFR	MKMW
QVBX	ZZDE	BVEQ	APLO
NMVB	FGRE	GNQA	SDOL
UJYH	FVDE	QKZY	QAMI
IKLO	EERQ	ELMQ	EDKU

(b) Answer sheet

FIGURE 2. An example of short-term memory test set

In the second session, each of participants was asked to take three sets of the short-term memory test after perceiving negative affect contents of video clips for 5 minutes. In order to perceive negative affect contents of video clips, the participants who were assigned for the experiment on 'visual' channel watched the video clips of 'The exorcist' with sound removed wearing earmuffs; the participants who were assigned for the experiment on 'auditory' channel listened to the video clips of 'The exorcist' without screen putting blindfolds on; and the participants who were assigned for the experiment on 'visual + auditory' channel watched the video clips of 'The exorcist' with screen and sound.

After a 5-minute break between sessions, in the third session, each of participants was asked to take three sets of the short-term memory test after perceiving ASMR contents of video clips for 5 minutes. In order to perceive ASMR contents of video clips, the participants who were assigned for the experiment on 'visual' channel watched the video clips of 'cutting the kinetic sand by a knife' with sound removed wearing earmuffs; the participants who were assigned for the experiment on 'auditory' channel listened to the video clips of 'brushing the cat hair' without screen putting blindfolds on; and the participants who were assigned for the experiment on 'visual + auditory' channel watched the video clips of 'cutting the kinetic sand by a knife' with screen and sound. In sum, each of 45 participants followed the same procedures of three sessions individually, but the experimental conditions that they experienced in the second and third sessions were

different depending on the assigned experiments on three types of sensory channels to 15 participants each.

3. **Results.** In order to examine the sensory channel effects of ASMR on short-term memory, the short-term memory test scores after perceiving ASMR contents were compared with those after negative affect contents for each of three sensory channels. Since the short-term memory test scores after perceiving negative affect contents played a role of the base line scores to reveal the effects of ASMR on short-term memory for each of sensory channels, we focused on analyzing the difference of short-term memory test scores between ASMR and negative affect contents. In so doing, the paired t-tests were conducted for each of three sensory channels.

Participants' individual short-term memory test scores were computed by averaging scores from three test sets as results of the second and third sessions, and the average short-term memory test scores of 15 participants for two kinds of stimuli and three types of sensory channels were calculated as shown in Figure 3. The gender difference was ignored because there was no statistically significant gender effect on short-term memory test scores for all of three sensory channels. In general, the short-term memory test scores after perceiving ASMR contents (visual channel: 3.6222, auditory channel: 4.2444, visual + auditory channel: 5.1556) tend to be higher than those after perceiving negative affect contents (visual channel: 3.8889, auditory channel: 5.0889, visual + auditory channel: 5.2889). Through the one-sided paired t-tests for each of three sensory channels, it was examined whether the difference of short-term memory test scores between ASMR and negative affect contents had statistical significance. As seen in Table 2, the difference of

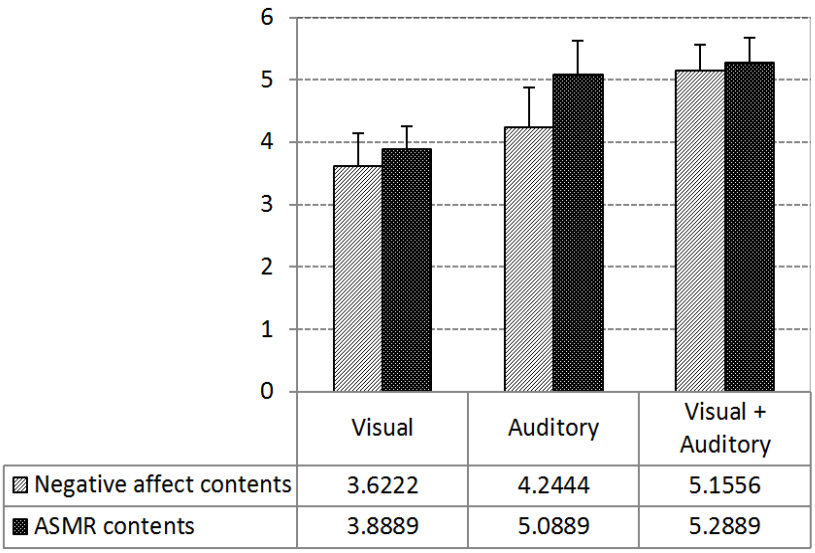

FIGURE 3. Short-term memory test scores

TABLE 2. Paired t-test results for the short-term memory test scores

Sensory channel	Mean of the differences (ASMR – negative affect)	t-value	DF	p-value	Lower bound of 95% CI	Upper bound of 95% CI
Visual	0.2667	0.4596	14	0.3264	−0.7554	Infinite
Auditory	0.8444	1.9302	14	0.0370*	0.0739	Infinite
Visual + Auditory	0.1333	0.3176	14	0.3777	−0.6061	Infinite

Notes. * : $p < 0.05$

short-term memory test scores between ASMR and negative affect contents (0.8444) is statistically significant for 'auditory' channels ($t_{14} = 1.9302$, $p = 0.0370$), but for 'visual' and 'visual + auditory' channels, there is no significant difference of short-term memory test scores between ASMR and negative affect contents. It means that we can expect the significant effect of ASMR contents on short-term memory when we perceive ASMR contents through 'auditory' channels rather than 'visual' or 'visual + auditory' channels.

4. **Conclusion.** From the experiments, we investigated the sensory channel effects of ASMR on short-term memory. The short-term memory test results in this study indicate that ASMR contents tend to have positive effects on short-term memory compared to negative affect contents, and that the positive effects of ASMR contents on short-term memory are significant only through 'auditory' channel. It could be inferred that one of reasons why ASMR contents tend to have positive effects on short-term memory would be the arousal effects of ASMR, which help short-term memory ready to work. And also, we need to consider the possibility that experimental results for the advantage of 'auditory' channel would be related to the characteristics of the short-term memory tests, one of which is that the tests require participants to use 'visual' channels. Overloaded visual areas in the brain due to visual ASMR might negatively influence on visual test tasks, which means that auditory ASMR can have advantages for visual test tasks. To get experimental evidences for the above arguments, in further study we need to consider the short-term memory tests based on various sensory channels and need enough data from more participants than this study. In addition to the sensory channels of perceiving ASMR contents, content types of ASMR would be a promising factor for ASMR research with related to short-term memory in further study.

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