The Effect of a Brief Mindfulness Exercise on Memory Recognition

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Abstract. Mindfulness is a psychological state of perception. Many studies abroad have shown that mindfulness exercise can affect memory performance. It was also found that individuals can recall living words more accurately than non-living words. However, in China, there is not enough research in this field. Therefore, this study is to verify whether there is a comprehensive effect on recognition memory from brief meditation exercises and the animacy of vocabulary in the Chinese sample. The participants were divided into three groups: the memory-improving mindfulness exercise group, the stress-reducing mindfulness exercise group, and the control group. The participants were asked to memorize 100 words and listen to the audio for three minutes. Finally, the participants' recognition of living words and non-living words was tested under the interference of lures. The results showed that Chinese individuals could recall living words more accurately than non-living words. Future research could explore whether brief mindfulness exercise needs to meet some conditions to improve cognitive memory performance. Physiological mechanism of animacy's influence on recognition memory performance could also be explored.

Keywords: Mindfulness · Memory · Animacy effect

1 Introduction

The systematic description of mindfulness originates from Indian Buddhism two thousand years ago. It refers to a mental state in which people perceive, that is, the state in which people think and accept themselves and even the world [1]. Mindfulness meditation, on the other hand, is defined as cultivating a kind of instantaneous awareness of one's perception, consciousness, emotion, state, and environment [2, 3].

Mindfulness-Based Stress Reduction (MBSR) is the standard mindfulness-based protocol. Its initial purpose is to reduce stress and anxiety. During this period, participants perform all kinds of mindfulness exercises, such as concentrated breathing, somatosensory perception, sitting meditation, etc. [3]. Research shows that mindfulness exercises may include three modules and may influence behavior differently. Among

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them, the "Presence module" is the module in which cognitive functions are affected, while the "Perspective and Affect" of the prosocial modules are more influential in reducing pressure and increasing metacognitive processing [4, 5].

Previous research has focused on how mindfulness exercise affected working memory (WM) [6]. Some studies have explored its mechanism and have found that the differences in acceptance level or behavior that is unjudged may influence how mindfulness practice affects WM [7]. Mindfulness increases WM capacity or efficiency [8]. Mindfulness practice has also been deeply studied in semantic memory and episodic memory. Some researchers conducted a free recall of emotional words and found that mindfulness did not improve the overall memory quality, but decreased the recall of negative words [9]. However, Roberts-Wolfe et al., who also researched free recall of emotional vocabulary, found that compared with the control group, mindfulness improved the recall of positive emotional words rather than negative words [10].

Later, more work has differentiated recall from recognition memory and focused more on how brief mindfulness exercises influence recognition memory [11–14]. Recognition memory means to be able to recognize the things that people have seen before or to recognize the events experienced before from the fabricated ones [12]. Wilson et al. found that participants generated both more-false recall and false recognition after mindfulness exercises [13]. However, later work pointed out the potential limitation of the design for research conducted by Wilson as the mind-wandering group might not be suitable as the control group [14]. Most of the previous studies suggested that recognition memory is positively affected by brief mindfulness exercises [11, 12, 14]. Researchers also investigated whether the mindfulness exercise positioned before encoding or before recognition would affect memory accuracy, and it was suggested that the mindfulness exercise improves recognition memory the most when the exercise is delivered before retrieval [15].

Recognition memory is also influenced by the type of memory material. Animacy is a semantic feature that represents whether the referent for the word is a living creature or not [16]. Living words could be words such as bee and wife, while non-living words could be school and wood [16]. People are found to recognize and recall animate words more accurately than inanimate words [16, 17]. It is relatively unclear what caused this effect while a possible explanation is that emotional arousal contributes to the animacy effect [18]. It is then interesting to see if the animacy effect persists with the introduction of a brief mindfulness exercise. This study is a replication study in China of the research conducted by Lloyd [19]. In the original article, researchers investigated both how brief mindfulness influenced recognition memory and the animacy effect which made the research stand out compared to other research on mindfulness. In their experiment, participants in the experimental group were told that the mindfulness exercise could help with memory and was asked to listen to a 3-min breathing pace mindfulness exercise after memorizing a list of 100 words containing both animate and inanimate words. The proportion of their "yes" response for the recognition phase of words was examined.

For China, there is not a long history of scientific research into meditation. It was not until around 2006 that the number of papers produced by Chinese researchers significantly increased year on year, officially entering the stage of treating meditation as a behavioral phenomenon for scientific research [20]. And after 2015, meditation research

in China has shown rapid growth despite fluctuations [20]. Chinese researchers have focused their meditation research on how meditation affects mood and mental health, and on two types of meditation: mindfulness and yoga [20]. At present, the frontiers of meditation research in China mainly focus on the fields of practical application such as yoga, meditation training, the effects of improving sleep quality, and the treatment of mental disorders [20]. Chinese researchers have been paying more and more attention to the importance of meditation.

Meditation is in a developmental stage now in China but is less researched here than abroad. While meditation research in China has focused more on emotional adjustment issues such as anxiety and depression, there is a lack of research into the role of meditation on memory. Focusing on the deautomatization effect of meditation, a study found that mindfulness meditation practices facilitate the completion of prospective memory tasks by inhibiting the automatization of familiar tasks [21]. With regard to the application of meditation in the field of nursing, the effect of meditation-assisted motor rehabilitation training on memory improvement in patients with cerebral infarction was supported [22]. Another study on high school student groups showed that mindful practice can improve the level of recognition memory [23]. In summary, the amount of research into the effects of meditation on memory in China is far from adequate, and the focus of the research is scattered. At the same time, meditation studies need to be integrated into the local Chinese culture in order to gain greater scope for development. Further targeted research into the effects of meditation on memory is needed.

Therefore, this study investigates the effect of a short meditation exercise on memory and whether the effect would apply to both living words and non-living words. The results could potentially help with the eyewitness testimony. The first hypothesis is that participants in mindfulness conditions would give more correct "yes" responses compared with those in the control condition. The second hypothesis is that participants would recognize more animate words compared to non-animate ones.

2 Method

2.1 Participants

A total of 100 participants, 37 males and 63 females were recruited. The age of participants ranged from 15 to 25 with a mean of 21.5. All participants came from various districts of China. Convenience sampling was used in the study and the experiment was conducted in the form of the questionnaire. The participants were recruited online and were the first 100 people to complete the questionnaire in Wenjuanxing, which is a popular platform for creating questionnaires in China. The questionnaires were spread through WeChat. No incentives were given to participants for their participation.

2.2 Stimuli

The recording of a 3-min mindfulness exercise in Chinese was used. It was a translated version of a mindfulness exercise by Oxford Mindfulness Centre. The audio recording of a neutral history documentary was also used. The list containing 100 words for the

memory phase and 24 words for recognition was approximately the same utilized in the original article with direct translation to Chinese [19]. The lure word "trout" was replaced with "shark" in Chinese for the glyph reason. The audio recordings and word lists in this study can be found at the following link (https://pan.baidu.com/s/11_ekB nPTtrVpyvILdC4DSA?pwd=mind).

2.3 Procedure

The procedure was the same as the original study [19]. The participants were asked to confirm the informed consent first. In the experiment, they were asked to look at a random list of words in Chinese first and then was instructed to wear headphones. Participants in the first condition were informed by the text that meditation could improve memory and then saw 100 words one at a time while each word would appear for 1 s. After that, they listened to the 3-min mindfulness exercise. In the second condition, participants were informed that the meditation could help to release their stress after looking at the same 100 words. Then they also listened to the 3-min mindfulness exercise. In the third condition, participants were informed of nothing and then asked to read the words. However, participants in the third condition listened to the historical documentary. After that, they were asked to respond "yes" or "no" to indicate whether the 24 words for recognition, containing both living and non-living words, had appeared in the list of 100 words before listening. At last, they were given the last chance to withdraw from the study and then be debriefed.

2.4 Data Analyses

The design was 3 (exercise type: memory-improving mindfulness exercise, stress-relieving mindfulness exercise, or control) by 2 (animacy type: living items or non-living items) by 2 (test item type: targets or lures). The within-subject variables were the item type and animacy type. The between-subject variable was the exercise type. The proportion of "yes" responses given by participants was archived.

3 Results

The proportion of "yes" responses given by participants in the recognition phase is shown in Table 1. Living words represent living creatures. Target words are the words appeared in the memory phase before, consisting of both living and non-living words. Lure words are chosen to disturb the participants in recognition phase, and they also consist of both living and non-living words. A factorial mixed ANOVA was chosen since participants were randomly allocated into 3 different groups, experienced different exercises, while they saw the same type of words with different animacy, and the words were either target or lures. Therefore, it was a 3 by 2 by 2 (as described in the data analysis) factorial mixed ANOVA carried out by SPSS. The main effect of exercise type was not significant, $F(2, 97) = 1.91$, $p = 0.15$, nor was the main effect of type of test item type, $F(1, 97) = 1.68$, $p = 0.20$. There was a main effect of animacy type, $F(1, 97) = 223.40$, $p < 0.01$. Significantly more "yes" responses were made to living words ($M = 0.54$) compared

Table 1. Mean proportion of "yes" responses in three conditions

	Target		Lure	
Condition	Living	Non-living	Living	Non-living
Mindfulness (memory-improving)	.64 (.04)	.22 (.04)	.58 (.04)	.27 (.05)
Mindfulness (stress-relieving)	.54 (.04)	.18 (.04)	.45 (.04)	.20 (.05)
Control	.55 (.04)	.18 (.04)	.51 (.04)	.19 (.05)
Total	.58 (.04)	.19 (.04)	.51 (.04)	.22 (.05)

Note: Standard errors are in parentheses

to non-living words (M = 0.21). There was no significant interaction between animacy type and condition, $F < 1$, nor between test item type and condition, $F < 1$. A significant interaction was between animacy type and test item type, $F_{(1, 97)} = 8.51$, $p < 0.01$. No significant three-way interaction was found between condition, animacy type, and test item type, $F < 1$.

To investigate the significant two-way interaction between animacy type and test item type, two paired samples t-tests were conducted. It was shown that participants significantly recognized more living words than non-living words when the words were targets, $t_{(99)} = 2.89$, $p < 0.01$, while this phenomenon did not exist when the words were lures. Overall, individuals had better recognition memory for living words compared with non-living words.

4   Discussion

This study explored how a brief mindfulness exercise influences the accuracy of recognition memory and whether the effect would apply to both living words and non-living words. It was found that a 3-min mindfulness exercise did not enhance memory performance. It is consistent with the conclusion of Albert and Thewissen's study that overall memory performance is not improved by mindfulness exercise [9]. This gives a hint that there are certain requirements for the impact of the mindfulness exercise on memory performance. However, it is not consistent with the findings of previous studies [19, 24]. This may be due to some experimental limitations.

This study also found that the participants' recognition of living words was significantly stronger than that of inanimate words, and there was a significant interaction between animacy and item type. It supported the second hypothesis that participants would recognize more animate words compared to non-animate ones. This is consistent with the previous research finding that people are more inclined to remember living words [19]. The result can be complementary to Chinese researchers' research on the memory of words classified in other ways or angles.

Since this study is a replication study in China of the research conducted by Lloyd et al., the study should have directly adopted the three-minute mindfulness exercise, of which the suitability of this length of time for Chinese subjects has been proved in Li's research [19, 23]. However, as the audio address provided in the original study is now

inaccessible, this study was forced to use an alternative version. Additionally, 100 words needed to be memorized in this experimental design with each word presented for 1 s without interval. This is different from Li's research design [23]. Also, this study did not confirm whether this design applies to Chinese subjects. Meanwhile, the recognition rate of the subjects was generally low due to the sheer number of words to be memorized, so the recognition difference between the mindfulness and non-mindfulness practice groups was not shown. These reveal the first limitation of this experiment - the design limitation.

Second, the materials used in the experiments have some limitations. The mindfulness exercise material used in this experiment was directly translated by the experimenter from a video of a mindfulness exercise uploaded online by the Oxford Mindfulness Centre with some written words. Besides, as this experiment was conducted online, the experimenters could not get feedback on the participants' understanding of the Chinese version of the mindfulness exercise in time. Therefore, the exact effect of the mindfulness exercise might be different from the expectation. In addition, the words used in this experiment were also directly translated from the words in the research conducted by Lloyd et al. [19]. In China, experiments have mostly studied the emotional tendency of words, but not the animacy [25–27]. Therefore, there is no Chinese material that is relevant and directly available, and the popularity of the words used in the experiment was uneven. Moreover, the study did not consider the subjects' familiarity with words (especially lures), which might also bring some experimental deviations [28].

This study contributes to both academic theory and practice. In the research field, it not only fills the gap in the research on the animacy of vocabulary in recognition memory in China but also provides a research direction for future research on meditation exercises. For example, researchers can assess the familiarity of Chinese words based on Liu's research, and then select words with similar familiarity for experiments [29]. For Chinese participants, the vocabulary familiarity of "apple", "banana" and "pear" may be similar, while for "trout", "shark" and "crocodile", the familiarity may be quite different. Therefore, researchers could select an appropriate number of words after excluding the influence of word familiarity. Also, memory time and interval time could be considered as the independent variables. Afterwards, it can verify whether the experimental settings of word memory time and interval time will affect the experimental results of the effect of brief meditation exercise on the recognition performance of living words and non-living words. In the future, researchers could also study the brain mechanism of individual memory of living words and non-living words, that is, to explore the physiological reasons for the existence of this phenomenon. In practice, it implies that when doing memory processing, it might be easier for individuals to recognize the content that has been memorized into living content than into non-living content.

To sum up, this study is in the exploratory stage of this field in China. More in-depth research is expected. It is necessary to control more variables to obtain more rigorous theoretical results and find a more scientific explanation for this phenomenon.

5   Conclusion

The findings showed that the proportions of "yes" responses were not significantly different in the three conditions. It also found that participants correctly recognized

more animate words than non-animated words which is consistent with our second hypothesis. There was no significant interaction between any other levels of variables. The findings indicate that a brief mindfulness exercise before retrieval may not strengthen the memory, but the animacy effect exists when coming to recognition of memory for words. Since investigating the interaction between a brief mindfulness exercise and word animacy effect on word recognition is an under-researched area, especially in China, this research fills this gap. However, this study has some limitations regarding the design and the stimuli used as the choice of interval time for words to appear at the memory stage and the memory time lack research, and it is not sure whether the brief mindfulness exercises and word stimuli are suitable for Chinese. Furthermore, it lacks an in-depth explanation of the underlying mechanism for the animacy effect. Therefore, future research could consider the different designs of the study to employ different test stimuli. Also, researchers could potentially investigate the brain mechanism for the memory of words with different animacy.

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