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The effects of Encoding based on Hierarchical Structure of Needs on Incidental Memory

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Abstract

Thirty participants were asked to rate objects in terms of their importance to survive (survival encoding), their importance in being close to others (friendship encoding), or their pleasantness (pleasantness encoding) in an orienting task, followed by an unexpected recall test. Survival and friendship encoding led to better recall performance for all words than pleasantness encoding, but no difference between the former two encodings was observed. For objects rated as more important, survival encoding led to better recall than friendship encoding. These results suggest the importance of survival encoding (Nairne et al., 2007), and the possibility of that encoding based on the hierarchical structure of needs (Maslow, 1962) is critical in determining the effectiveness of elaboration in facilitating recall.

Key Words：survival, friendship, elaboration

1．Introduction

Recall of targets is determined by how they are encoded, and encodings are determined by how targets are processed. Several types of encodings have been investigated with respect to memory performance. According to Jacoby and Craik (1979), elaboration in memory is to add information to each target: elaboration is a result of processing a target. Toyota (1998) reviewed the research on elaboration in memory and conclude that some types of encodings facilitate memory performance, such as semantic encoding (Craik & Tulving, 1975), self-reference encoding (Rogers, Kuiper, & Kirker, 1977), autobiographical encoding (Warren, Chattin, Thompson, & Tomsky, 1983), and bizarre encoding (McDaniel, Einstein, Delosh, & May, 1995). Although these encodings involve different manipulations, all are distinctive. That is, distinctive encodings facilitate memory performance (Hunt, 2006).

However, another type of encoding, namely survival encoding, has been investigated in memory research. Nairne, Thompson, and Pandeirada (2007) compared a survival-encoding condition with a pleasantness-encoding condition (control condition) in an incidental memory task. In the survival encoding condition, participants were asked to rate targets on their relevance to survival (e.g., securing water and food). In a subsequent unexpected recall test, survival encoding led to better recall than the pleasantness encoding. This survival encoding advantage has been replicated in several studies (Kang, McDermott, & Cohen, 2008; Nairne & Pandeirada, 2008; Nairne, Pandeirada & Thompson, 2008). Nairne *et al*. (2007) proposed the unique idea that memory systems evolved to help us remember information relevant to survival or fitness-relevant information. In this framework, memory systems contain information relevant to living a successful and happy life. Such information appeared to be activated by the drive to live or be alive. This basic need is one of the lower hierarchical classes in Maslow's model (Maslow, 1962). In his model, each human need is located in a hierarchical structure, in which a need located at a higher level is not aroused if a need located at a lower level is not satisfied.

According to Maslow (1962), survival encoding is

based on a need that is located in the lowest hierarchical class of his model. Other needs may be located in higher hierarchical classes, such as the need to be close to others (i.e., friendship). If Maslow's model is applicable to memory performance, survival encoding should be stronger than encodings based on other needs because survival encoding forms the lowest hierarchical class. No previous studies examined to compare the effectiveness of survival encoding and other type of encodings based on Maslow's model, such as friendship encoding. Thus, the present study compared the effectiveness of three types of encodings, namely, survival, friendship and pleasantness (control). If Maslow's model applies to memory performance, survival encoding should lead to better recall than friendship and pleasantness (control) encodings. The present study tested this prediction.

2. Method

2. 1. Participants

Thirty nursing school students (5 male and 25 female) with a mean age 20.9 years participated in the experiment.

2. 2. Design

Three types of encoding were manipulated within participants. They consisted of survival, friendship, and pleasantness encodings. Participation was voluntary and there was a debrief upon completion of the experiment.

2. 3. Materials

The thirty target words were selected from Japanese Kanji norms a normative set used in a previous study (Kitao, Hatta, Ishida, Babazono, & Kondo, 1977) and used in the previous studies (Toyota, 2013, 2015). Each target word was written in a Japanese Kanji character, which that was familiar to the participants. Familiarity of these target words range from 4.1 to 5.8, and concreteness of these words do from 81 to 98%. Two orienting word lists were provided. Ten target words were assigned to three orienting encoding conditions (survival, friendship, and pleasantness). each of the survival, friendship, and pleasantness conditions. The assignment of target words to each condition was counterbalanced across the three different lists. Each target word was placed on its own page in a 32-page booklet (30 targets and 2 fillers). Each participants was asked an orienting questions corresponding to each encoding condition. In the survival encoding condition, the question was "Do you need the object that the above Kanji indicates to live?" In the friendship encoding condition, the question was "Do you need the object that the above Kanji indicates to be close to others?" and in the pleasantness encoding condition, the question was "How do you feel about the object that the above Kanji indicates?" The possible answers were the numbers 1 through 6 where 1 indicates "never necessary/most unpleasant" and 6 indicated "most necessary/most pleasant." For each list of target words, two different, counterbalanced orders were constructed.

2. 4. Procedure

All participants took part in an incidental memory task, as follows. First, the participants were told that the task was a pilot test to gather information about Japanese Kanji characters. The procedure used in the present study was similar to that used in the previous studies (Toyota, 2013, 2015) except that the target words were not repeated.

2. 4. 1. Orienting task

Each participant received a booklet, and the task was explained using an illustration of a booklet page displayed on a board at the front of a classroom. Participants were then given the following orienting instructions: "A Kanji word is shown in the upper part of each page [pointing to the example on the white board]. The task is to answer the question mentioned above corresponding to each encoding condition (survival, friendship, and pleasantness) using a 6-point scale." Participants were given 10 seconds per page to complete these tasks.

2.4.2. Interpolated task

Each participant was given an interpolated task for 3 minutes as delay interval. A sheet of paper with Japanese words, printed in Hiragana character, was given to each participant, and the participant was then required to quickly circle as many of the nouns that contained more than three letters as they could.

2. 4. 3. Free recall test

After receiving a response sheet for the recall test, each participant was required to recall, and write down as many of the targets as possible. Three minutes were allowed for this test.

Table 1 Proportions of Correct Free Recall as a Function of Type of Encoding

Measure	Type of Encoding					
	Survival		Friendship		Pleasantness	
	M	*SD*	*M*	*SD*	*M*	*SD*
Recall of targets	.46	.17	.41	.18	.34	.18
Recall of effectively elaborated targets	.56	.30	.33	.35	.42	.28

3. Results

The mean percentage of targets correctly recalled is shown as a function of the type of encoding (survival vs. friendship vs. pleasantness). An analysis of variance revealed that the main effect of type of encoding approached significance, $F_{(2, 58)} = 2.67$, $p < .08$, $\eta^2 = .06$. Multiple comparison using Ryan's method indicated that targets for the survival and friendship encodings were recalled more often than those in the pleasantness encoding control, $t_{(58)} = 2.30$, $p < .03$, but the difference between the survival and the friendship encodings, $t_{(58)} = .97$, and between the friendship and the pleasantness encodings were not significant, $t_{(58)} = 1.33$.

As a strong association between a target and its processed information is critical to the effectiveness of encoding (Toyota, 1997), the targets rated 5 or 6 (i.e., targets that had a strong association with the processed information, namely, survival, friendship, or pleasantness) were assumed to be encoded effectively. The mean percentage of these targets correctly recalled is shown as a function of the type of elaboration (survival vs. friendship vs. pleasantness) in the lower part of Table 1. An analysis of variance revealed a significant main effect of type of encoding, $F_{(2,58)} = 3.79$, $p < .05$, $\eta^2 = .09$). Multiple comparison using Ryan's method indicated that targets in the survival condition were recalled more often than those in the friendship, $t_{(58)} = 2.72$, $p < .01$) and pleasantness conditions, $t_{(58)} = 1.73$, $p < .09$), but the differences between the latter two conditions was not significant, $t_{(58)} = 1.00$). The above results were consistent with the prediction.

4. Discussion

This study examined the prediction that survival encoding would lead to better recall than friendship and pleasantness (control) encodings. The survival elaboration led to better recall than the pleasantness elaboration, but the survival and friendship elaborations did not differ in recall performance. This result mentioned above did not support the prediction. However, the two types of elaboration based on need (survival and friendship) led to better recall performance than the control pleasantness elaboration. We interpret this as showing that the encodings based on a type of need are more effective than control encoding.

Regarding the recall performance of the targets that were encoded effectively, the survival condition led to better recall than the friendship and control conditions. This result is consistent with our prediction mentioned above. According to the model of Maslow (1962)'s hierarchical structure of needs, survival encoding is based on a need located in lowest hierarchical class of his model, whereas the need for friendship is located in a higher hierarchical class. If the lower the hierarchical level of the need, the greater its importance for recall performance, then survival encoding would be most important because it is the lowest class of the hierarchy. Therefore, based on the model of Maslow (1962), we appear to predict the high recall performance.

In contrast, the above results are also consistent with the concept of adaptive memory proposed by Nairne *et al.* (2007). As mentioned above, Nairne *et al.* (2007) indicated that survival encodings are powerful drivers of memory performance. According to the concept of adaptive memory, the human memory system exists to support life and survival. This system encourages each human to memorize information important for survival. The present results also replicated the previous studies showing the superiority of the survival encoding to the control conditions (Kang *et al.*, 2008; Nairne & Pandeirada, 2008; Nairne *et al.*, 2008; Toyota, 2014).

Finally, the most important results of the present

study is that survival encoding is more effective than friendship encoding. The difference between the two encodings could be explained by the adaptive memory proposed by Nairne *et al*. (2007). However, the need to be close to others is important in daily life. Thus, friendship encodings might be expected to be effective, in addition to survival encodings. Although the present study showed the superiority of survival versus friendship encodings, effectiveness of the friendship encoding was also found in comparison with the pleasantness encoding. Further research is needed to compare the effectiveness of encodings based on different types of need, by using other stimuli.

References

(1) Craik, F. I. M., & Tulving, E. (1975). Depth of processing and retention of words in episodic memory. *Journal of Experimental Psychology: General*, 104, p.268-294. doi: 10.1037/0096-3445.104.3.268

(2) Hunt, R. R. (2006). The concept of distinctive-ness in memory research. In R. R. Hunt & J. B. Worthen (Eds.), *Distinctiveness and memory*. New York: Oxford University Press. p.3-25. doi: 10.1093/acprof:oso/9780195169669.001.0001

(3) Jacoby, L. L., & Craik, F. I. M. (1979). Effects of elaboration of processing at encoding and retrieval: In L. S. Cermak & F. I. M. Craik (Eds.), *Levels of processing in human memory*. p.1-20. Hillsdale, N. J.: Lawrence Erlbaum Associates.

(4) Kang, S. H. K., McDermott, K. B., & Cohen, S. M. (2008). The mnemonic advantage of processing fitness-relevant information. *Memory & Cognition*, 36, p.1151-1156. doi: 10.3758/MC.36.6.115

(5) Kitao, N., Hatta, T., Ishida, M., Babazono, Y., & Kondo, Y. (1977). Concreteness, hieroglyphicity, and familiarity of Kanji (Japanese form of Chinese characters). *Japanese Journal of Psychology*, 48, p.243-249. (In Japanese with English abstract)

(6) Maslow, A. (1962). *Toward a psychology of being*. Princeton: D. Van Nostrand Company.

(7) McDaniel, M. A., Einstein, G. O., Delosh, E. L., & May, C. P. (1995). The bizarreness effects: It's not surprising, it is complex. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21, p.422-435.

(8) Nairne, J. S., & Pandeirada, J. N. S. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59, p.377-385. doi: 10.1016/j.jml.2008.06.001

(9) Nairne, J. S., Pandeirada, J. N. S., & Thompson, S. R. (2008). Adaptive memory: The comparative value of survival processing. *Psychological Science*, 19, 176-180.doi: 10.1111/j.1467-9280.2008. 02064.x

(10) Nairne, J. S., Thompson, S. R., & Pandeirada, J. N. S. (2007). Adaptive memory: Survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33, p.263-273. doi: 10.1037/0278-7393.33.2.263

(11) Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference in the encoding of personal information. *Journal of Personality and Social Psychology*, 35, p.677-688. doi: 10.1037/0022-3514. 35.9.677

(12) Toyota, H. (1997). Effects of between-item elaboration, within-item elaboration, and autobiographical elaboration on incidental free recall. *Perceptual and Motor Skills,* 85, p.1279-1287. doi: 10.2466/pms.1997.85.3f.1279

(13) Toyota, H. (1998). A review of the effect of self-generated elaboration on memory. *Japanese Psychological Review*, 41, p.257-274. (In Japanese with English abstract)

(14) Toyota, H. (2013). Significance of autobiographical episodes and spacing effects in incidental memory. *Perceptual and Motor Skills*, 117, p.402-410. doi: 10.2466/22.10.PMS.117x19z1

(15) Toyota, H. (2015). The spacing effects in memory and individual differences in emotional intelligence. *Bulletin of Nara University of Education*, 64, p.25-32.

(16) Warren, M. W., Chattin, D., Thompson, D. D., & Tomsky, M. T. (1983). The effects of autobio-graphical elaboration on noun recall. *Memory & Cognition*, 11, p.445-455.doi: 10.3758/BF03196981

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【日本語要旨】

偶発記憶に及ぼす欲求階層構造に基づく符号化の効果

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本研究は，Maslow（1962）による欲求階層構造に対応して偶発記憶成績が規定されるか否かを検討した。30名の参加者は，小冊子によって記銘リストが提示され，各ページに印刷された語（漢字1字）が示す対象に対して，生存欲求処理条件では「生きるために必要ですか？」，親和欲求処理条件では「人と親しくなるために必要ですか？」，快－不快処理条件では「どんな印象ですか？」に対して6段階評定（生存及び親和条件では，とても必要～全く必要でない；快－不快条件では良い感じ～嫌な感じ）で該当する数字を選択していった。このような方向づけ課題を行った後，挿入課題を行い，その後に偶発自由再生テストを実施した。その結果，全体の再生率においては生存欲求処理条件と親和欲求処理条件が快－不快処理条件よりも再生率が高かったが，生存欲求処理と親和欲求処理条件間に差はなかった。また，評定値が5及び6であった語（有効な精緻化がなされた語）の再生率においては，生存欲求処理条件が親和欲求処理条件よりも再生率が高かったが，他の条件間に差はなかった。これらの結果は，Nairneら（2007）が提唱するサバイバル処理（本研究における生存欲求処理）による符号化の有効性を示唆するとともに，Maslow（1962）の欲求階層構造に対応して記憶成績が規定される可能性を示唆した。