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The Effect of Contextual Similarity on Negative Priming*

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This study examined the impact of contextual similarity on negative priming. In Experiment 1, we replicated a previous study by manipulating the presence and absence of an exclamation mark in the prime-probe couplet. The results showed negative priming and yet failed to show the influence of contextual similarity. In Experiment 2, we increased the distance between the target and the distractor to the same distance as was in a study that showed the effect of contextual similarity. The results showed neither negative priming nor the influence of contextual similarity. The results from these two experiments support the inhibition account of negative priming and are inconsistent with the prediction of the memory retrieval account.

Keywords: *negative priming, contextual similarity*

To function properly without being overwhelmed by the voluminous information in the environment, one must ignore irrelevant information and focus on the relevant stimuli. How this is achieved through selective attention has been an important issue in cognitive psychology.

Early theories of selective attention tend to view selective attention as a filter that eliminates irrelevant information. More recent research on negative priming, however, seems to indicate that selective attention not only enhances target information, but suppresses interfering information as well (Houghton & Tipper, 1994, Neill, 1977, 1989; Tipper, 1985). Because of this inhibitory function, previously unattended information becomes a less viable stimulus when it becomes the new target. Negative priming is a consequence of this inhibitory process of selective attention.

In a typical negative priming experiment, prime and probe appear sequentially in a trial (see Figure 1). Within both the prime and the probe, there are distractors and targets. Partici-

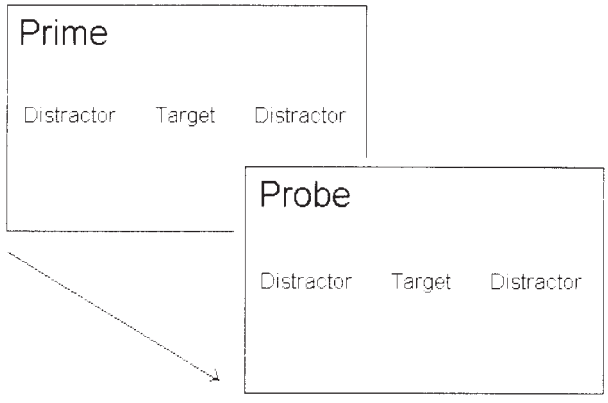

Figure 1: Display formats of prime and probe.

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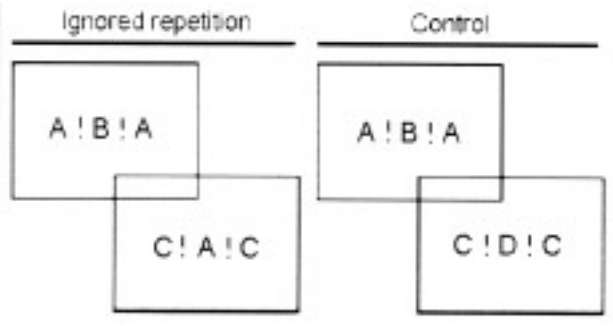

Figure 2: Display formats for ignored repetition and control condition, with same context.

pants are required to respond to the targets and ignore the distractors. When a distractor of a probe is identical to the target of a prime in a negative priming study, it is usually called the experimental condition or the ignored repetition condition.

For the control condition, both the target and the distractors of a probe are different from those of the prime (see Figure 2). When an experimental condition is compared to the controlled condition, if responses of the former are slower than the latter ones, then negative priming is said to have occurred. That responses to a formerly suppressed item become slower was first observed in Stroop test (Dabrymple, Alford & Budayr, 1966). In a typical Stroop task, participants must respond to the color of a color word instead of its meaning. For example, when a participant saw the word "green" written in red, he/she must say "red" and suppress the tendency to say green. Subsequently, if "yellow" was written in green color, the same participant must respond with "green" (i.e. the formerly suppressed response). In the controlled condition, participants first saw "red" written in blue, then saw "yellow" written in green. Participants were often slower when responds in the ignored-repetition condition than in the controlled condition.

Pursuing a similar line of research, Tipper, Lortie and Baylis(1992) set up nine lighted key and a starting button. Participants must first place their fingers on the starting button and respond by pressing a specific lighted key if a target color (e.g. red) appears on that key. Reaction time was longer, when there were distractors (e. g. yellow light). Furthermore, if a previous distractor became the new target, reaction time would be even longer than that under distraction, thereby demonstrating another instance of negative priming. In addition, negative priming can be demonstrated with alphabets (Tipper & Cranston, 1985), non-sense figures (Deschepper & Treisman, 1996), and words (Malley & Strayer, 1995). It can also be demonstrated in other tasks, such as naming (Neill, 1977), judgment of spatial location (Yeh, Huang, & Chao, 2000) and classification (Tipper & Driver, 1988).

Regarding the mechanism underlying negative priming, there are inhibition theory (Houghton & Tipper, 1994; Neill, 1977, 1989; Tipper, 1985) and retrieval theory (Neill, 1997; Neill & Valdes, 1992). The former theory proposes that selective attention involves a double-mechanism of enhancing target in formation and inhibiting distracting information simultaneously. According to this theory, negative priming is the result of the attention system trying to overcome the existing inhibition when it is responding to the previous distractor. On the other hand, the retrieval theory explains the same phenomenon in terms of conflicting responses, in that the previous distractor carries with it a "do not respond" memory trace which conflicts with the current command of "respond" to the same stimulus. (Dalrymple-Alford & Budayr, 1966; Tipper, 1985).

From Tulving's retrieval theory (Tulving, 1972, 1983), similarity in retrieval context should facilitate memory. Thus negative priming should become more pronounced under more similar retrieval context, if negative priming is indeed due to conflict between memory trace of previous command and the current response command. On the contrary, according to the inhibition theory, similarity in retrieval context should have no apparent effect on negative priming. Therefore, similarity in retrieval context can be utilized to determine which of these two predictions is correct.

Based on the reasoning given above, Wong (2000) presented three English alphabets and asked participants to respond to the middle alphabet. Context similarity was manipulated by the appearance (or non-appearance) of exclamation marks between the alphabets. When both the probe and the prime contained exclamation marks, the context was more similar than when exclamation marks appeared only in one of those conditions. Results from this study showed that context similarity bas no effect on negative priming. A slightly different manipulation (i.e. having crosses "+" above or below the targets) yielded essentially the same results. Wong (2000) consequently concluded that retrieval theory could not account for negative priming.

However, Chao (2000) in a series of studies found that context similarity did indeed enhance negative priming. He presented three Chinese characters with the middle character being the target item. Similarity of context was manipulated via the spatial arrangement of these characters which were either presented horizontally or diagonally. When both the probe and the prime had identical spatial arrangement, the similarity was stronger than when they had different spatial arrangement of the presented characters. Chao (2000) found that negative priming was bigger when similar in context was stronger.

Careful comparison between these two studies revealed that they differed not only in stimulus material (English alphabet vs Chinese characters), task (key pressing vs naming), and context similar manipulation, but also in the visual angle between the target and the distractors. In Wong's (2000) study, this visual angle (i. e. distance) was 1.1 degree while it was 2.1 degree in Chao's (2000) study. This difference may turn out to be a crucial factor in accounting their conflicting results. When attention is focused on a target, attentional resources are spatially distributed around the target (Kim & Cave, 2001); therefore, when a target, its distractors and cues are spatially close, they have a higher probability of being grouped together. Thus, it's hard to segregate and process cues from them, so context similarity cannot facilitate memory retrieval. On the other hand, when targets and distractors were far apart, the probability of them being grouped together is low. Therefore context effect would more likely occur and thereby affect negative priming.

The first experiment of the present study was a replication of Wong's (2000) study. The second experiment tested directly the effect of spatial distance between the target and the distractors. Because the inhibition theory and the retrieval theory make quite different predictions regarding context effect, the present study should provide useful experimental evidence to determine which of these predictions is in fact correct.

Experiment I

This experiment is a replication of Wong's (2000) study. As mentioned earlier, if the retrieval theory is correct, context similarity should influence the strength of negative priming. On the other hand, if the inhibition theory accurately accounts for negative priming, then context manipulation should have no effect on negative priming.

Method

Participants. Twenty four university students with normal vision (after correction for some participants) participated in this 90-minute study. They received NT 100 dollars (about US 3 dollars) as compensation.

Design and stimuli. There are two within participant variables: condition (experimental/control) and context similarity (similar/dissimilar). Both prime and probe were constructed with three English alphabets arranged horizontally. The central alphabet was designated as target. Capital A, B, C, and D were used with two of these four letters randomly chosen as the target (one letter in the center) and the distractors (another letter to the felt and the right of the

target). In the experimental condition, a distractor in the prime would later appear as the target in the probe; while in the control condition, distractors in the prime were unrelated to the target in the probe.

Context similarity was manipulated by the appearance (or non-appearance) of exclamation marks between the English letters. In the similar condition, the prime and the probe either both had exclamation marks between the letters or both without them. In the dissimilar condition, either the prime or the probe had the exclamation marks but not both.

Participants sat approximately 60 cm from the computer monitor which showed white stimuli against a black background. Each English letter had a visual angle of 0.48° × 0.48° . Separation between the target and the distractors was 1.10° degree. Exclamation marks when appeared, were equal distance from the target and the distractor. Control of stimuli presentation and recording of response data were handled by DMDX software package (Forster & Forster, in press). The study was conducted under natural lighting in a laboratory room at the university. All of the 12 combinations of two letters from the set of four letters (i.e. A, B, C, D) were used in the prime. When this was used with the probe, 24 different sets of stimulus material were obtained. These 24 sets, when multiplied by 4 (i.e. 2(similar/dissimilar) x 2 (with/without exclamation marks)) resulted in 96 different couplets. Each of these 96 couplets produces a total of 192 trials. Among these trials, each of the four letters (A, B, C, and D) used in this study had an equal probability of appearance, with each letter having the same probability of being a target or a distractor. Specific paring of target and distractor for each trial was completely random.

Procedure. Each participant redundant see the previous page was requested to respond to the target as fast as possible by pressing a key. Each couplet was consisted of a prime trial and a probe trial. A trial began with a short altering sound, then a cross appeared in the middle of the screen for 300 ms followed by the stimulus. Inter trial interval was 3000 ms, and the interval between a probe and a prime has 480 ms, these timing intervals were identical to Chao's (2000) study. There were eight practice trials before each experiment. The experiment proper was divided into four blocks of 24 couplets redundant each, and it took about twenty-minute to complete the experiment.

Participants were required to use both right and left hand to press the key on a random schedule in both the prime and the probe trial of the study. However, no statistical analyses were performed on handedness data due to our belief that negative priming essentially is an internal response selection which should be immune to differences in external response (e.g. Tipper, MacQueen & Brehaut, 1988).

Results and discussion. Reaction time and response error were analyzed. An error was defined either as pressing the wrong key or as reaction time exceeded 3000 ms. Median reaction time was analyzed for the various experimental manipulations when a mistake was made in the prime, the probe was automatically regarded as an error, regardless of the response. Results of a two (experimental/control) by two (similar/dissimilar) Anova performed on reaction time (median) are shown on Table 1. As can be seen from Table 1, reaction time of the experimental condition was significantly longer than control condition ($F(1,23) = 6.39$, $MSE = 3845.29$, $p < .05$), and context effect was nearly significant ($F(1,23) = 3.53$, $MSE = 2003.90$, $p < .07$). Interaction between the two factors was not significant

Table 1

Means of Median Correct Probe Response Times (RT; in milliseconds), Error Rates (ER) with Near Distance in Experiment 1

	Same		Different	
	RT	ER	RT	ER
Control	564.6	93.6	552.7	94.6
	(59.7)	(5.6)	(54.8)	(5.3)
Ignored repetition	574.5	93.1	568.1	94.1
	(64.7)	(5.4)	(60.7)	(5.8)

Note. Standard deviations are indicted in parentheses.

($F(1,23) = 0.28$, $MSE = 647.03$, $p > .05$). the result was fairly clear in that negative priming was apparent when a previously suppressed item became the new target, but this negative priming was not much affected by context.

A two way Anova performed on response error showed that neither the experimental condition ($F(1,23) = 0.42$, $MSE = 6.51$, $p > .05$), nor the context manipulation ($F(1,23)=1.68$, $MSE = 26.04$, $p > .05$), nor their interaction was significant.

Experiment II

Experiment I essentially replicated Wong's (2000) results, however Chao's (2000) experiments did show context effect on negative priming. Experiment II will manipulate the spatial location of contextual marks to determine whether spatial factor can partially account for this discrepancy.

Since Chao (2000) found significant negative priming which was affected by contextual information; and furthermore, it is almost certain that under spatial conditions reported in his study, the distractors were processed by the participants. One may predict that under spatial conditions similar to Chao's(2000) study, the retrieval theory would find support. On the other hand, when spatial separation between target and distractors is large, distractors are unlikely to be processed, and both the inhibition theory and the retrieval theory would probably make similar predictions.

Method

Participants. Twenty-one university students with normal vision (after correction for some participants) participated in this study. They received NT$ 100 (about US$ 3) for their participation.

Design. Stimulus materials were identical to Experiment I, except the distance between the target and the distractors was 2.10° (degree) in visual angle. There were 16 practice trials and 192 prime-probe pairs. This is twice as many trials as those in Experiment I. Increased trials were implemented to increase the power of inhibition of the distractors when they became the targets. Increased trials should increase the activation level of the stimuli that would in turn increase its response competition when it is used as a target. According to Strayer and Grison (1999), inhibition of distractors can only occur when response to distractors strongly compete with a target. Moreover, according to Tipper (2001) negative priming occurs because memory of inhibition of the distractors is retrieved during probe. Therefore if context similarity helps memory retrieval of previous inhibition of the distractors, then the more similar the context is, the greater should be negative priming.

Table 2

Means of Median Correct Probe Response Times (RT; in Milliseconds), Error Rates (ER) with far distance in Experiment 2

	Same		Different	
	RT	ER	RT	ER
Control	546.4	95.7	547.0	96.4
	(51.6)	(2.8)	(55.4)	(3.6)
Repetition priming	552.6	95.4	543.8	96.2
	(54.6)	(4.1)	(48.2)	(3.2)

Note. Standard deviations are indicted in parentheses.

Results and discussion. A two way (repeated measure) Anova on the median values of reaction time yielded the following results (see Table 2): (1) negative priming was not significant ($F(1,23) = 0.09$, $MSE = 54.81$, $p > .05$), (2) contextual effect was not significant ($F(1,23) = 1.28$, $MSE = 392.02$, $p > .05$), and (3) interaction between negative priming and contextual effect was not significant ($F(1,23) = 2.24$, $MSE = 532.87$, $p > .05$). When probability of correct response was analyzed by Anova, no significant effect was found. These results indicated that when distractors were placed away from the target, both negative priming and contextual effect seem to disappear.

General Discussion

Results from this study support predictions by the inhibition theory of negative priming. This theory explains negative priming in terms of inhibition of distractors to protect the target from interfering stimuli when attention is selectively focused on a target. Thus, subsequently when a distractor becomes the new target, it requires additional activation to overcome previous inhibition, and thus negative priming occurs. According to this theory (Houghton & Tipper, 1994; Neill, 1977, 1989; Tipper, 1985) the relative activation level of a target and its distractors determines negative priming. Since context is unrelated to the relative activation level of a target and its distractors; contextual similarity could not affect negative priming (see Tipper, 2001 for an integrated view). In Experiment I, context similarity had no effect on negative priming, bust as the inhibition theory predicted. In Experiment II, we found that when the target and its distractors were further apart, negative priming disappeared all together. This result is in general agreement with Fox's (1994) study which found that as the distance between a target and distractors increases, negative priming tends to disappear.

The inhibition theory can account for the disappearance of negative priming by the notion that selective attention needs not inhibit distractors when they are at a distance from the target, because the target and the distractors are clearly separable. Moreover, when attention is focused on the target, distractors are less likely to be in the sphere of the focused attention if they are at a substantial distance from the target. Therefore when distractors are farther away from the target, they need not be inhibited, since they are not really interfering with the target during the priming phase of the task. In the probe phase, the new target (i.e. the previous distractors) shows no negative priming effect because there is no previous inhibition associated with the new target.

According to the alternative retrieval theory, similarity in context should facilitate retrieval, therefore when there exists context similarity in the prime and probe phase of the task, negative priming should become more pronounced. But results from Experiment I failed to find supporting evidence for this position. Furthermore, retrieval theory would predict that regardless of the size of spatial separation between the target and the distractors, if the distractors were encoded in memory, they can be retrieved, which should induce negative priming. In Experiment II, distractors were two degrees (visual angle) from the target and were repeated many times. There is no reason to believe that they were not encoded in memory. Yet, there was no negative priming in Experiment II.

Nevertheless, contextual effect on negative priming has been reported before (Stolz & Neely, 2001). In addition to the difference in the distance between target and distractors, other differences between our study and previous reports may also be responsible for the discrepant findings. First of all, in order to replicate Wong's (2000) study, the response stimulus interval (RSI) and the previous response interval (PRIS) were 480 ms and 3000 ms respectively for the probe in our study. Theoretically, both the strength and the discriminability of memory trace can affect memory retrieval. If RSI is shorter than PRSI, then the discriminability of the memory traces is high which would facilitate the retrieval of memory traces of the prime (Neill & Valdes, 1992). Compared to the condition of equal RSI and PRSI at 500 ms, when RSI and PRSI were set at 500 ms and 4000 ms respectively, Neill and Valdes (1992) found higher negative priming.

In the present study, the RSI and PRSI values seem to ensure a high discriminability of memory traces that would facilitate accurate retrieval of encoded materials. This may result in retrieval ceiling effect which would render contextual manipulation superfluous. In other words, when items in prime trials are highly discriminable, memory traces can be retrieved

through other channels without involving context information thereby making contextual similarity irrelevant.

Secondly, in Chao's (2000) study, context similarity effect on negative priming was demonstrated only under very pronounced similarity. For example, when similarity of context was based on identical color in the prime and the probe, or on arrangement of target & distractors in horizontals or vertical layout, there was no context effect. However, when prime and probe items were contrasted by horizontal and cross shaped layout, or linear vs no-linear arrangement, there was apparent context effect. Therefore, the lack of context effect in our study could also be due to insufficient strength of similarity manipulation.

Finally, the stimulus set size in our study was quite different from previous studies. Wong (2000) used four English letters (A, B, C and D) repeatedly in his study while Chao (2000) used fifteen Chinese characters as targets and distractors. When a few stimuli are used repeatedly both as targets and distractors, any specific stimulus would have both "respond" and "do not respond" command stored with it in memory. The key factor that minimizes possible response confusion is the latest command in memory (Neill & Mathis, 1998). This latest command should be the command associated with the distractors in the last prime trial. When a few letters are used repeatedly as in Wong's (2000) study, a participant not only can easily remember the stimulus material, he/she did not even have to encode the context (exclamation marks and crosses) to be able to respond correctly. Therefore, it is quite likely that participants in Wong's study by and large ignored the context. In contrast, participants in Chao's (2000) study could not ignore context which was the spatial layout of the target and distractors. Therefore, context effect was apparent in Chao's (2000) study, but not detectable in Wong's(2000) study.

Results from the present study agree with predictions by the inhibition theory (i.e. context similarity does not affect negative priming). However, as discussed above, there are other possible reasons for the non-apparent contextual effect on negative priming in the present study. When conditions under which contextual effect becomes apparent can be further clarified in future studies, the relation between selective attention and memory retrieval in negative priming could clarified as well.

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Appendix

情境相似性對負向促發的影響

楊婷媜　葉怡玉　趙軒甫

負向促發是指當之前干擾物變成目標物時，反應時間變慢的現象。學界對於此效果的成因持有抑制論與記憶提取論兩種觀點。其中，記憶提取論認為此現象是由於對目標物提取出之前「不反應」的記憶痕跡，而與當下反應互相干擾所造成。由於，情境相似性影響記憶提取，其對負向促發效果的影響可驗證此理論。本研究即探討情境相似性對負向促發的影響。實驗一重複之前的研究，對英文字母做按鍵反應作業，以驚嘆號是否出現於目標物與干擾物之間操控促發項及偵測項的情境的相似性，結果顯示負向促發效果，但此效果不受情境相似性的影響。實驗二加長目標物與干擾物的距離，則沒有負向促發效果出現，情境相似性亦無效果。本研究發現，目標物與干擾物距離短時，會出現負向促發效果，且不受情境相似性的影響。而當目標物與干擾物距離長時，不會出現負向促發效果。因此，本研究結果支持抑制論的觀點，而違反記憶提取論的預測。

關鍵詞：負向促發、情境相似性。

環境中總是充斥著許多資訊。爲了不使個體迷失在其中，因此我們必須選擇出適當的訊息並且忽略不相關的訊息。而認知系統是如何藉由選擇注意力來達到此目的，便成了認知心理學家所感興趣的一項重要課題。

早期關於注意力的研究認爲選擇性注意力僅讓目標訊息受到進一步處理，而過濾掉干擾訊息（Broadbent, 1958）。但近年負向促發（negative priming）的研究卻反映選擇性注意力不但增強了目標訊息，也對干擾訊息進行抑制（Houghton & Tipper, 1994; Neill, 1977, 1989; Tipper, 1985）。由於抑制，當之前忽略的訊息變成目標訊息時，其反應會比較慢或比較不正確，負向促發派典即展現此選擇性注意力機制的運作。

在典型的負向促發實驗中，以先後出現的促發項和偵測項做爲一組，當作一個實驗嘗試，如圖一。在促發項和偵測項中，各有目標物和干擾物。要求實驗參與者對於目標物反應，並盡量忽略干擾物。負向促發現象，會出現在促發項的干擾物與偵測項的目標物相同的情況，此情況被稱爲負向促發研究的實驗組或干擾物重複組（ignored repetition）。而在控制組中，促發項的目標物和干擾物與偵測項的目標物和干擾物均不相同，見圖二。透過兩組偵測項反應的比較，倘若出現實驗組的反應時間較控制組爲慢的現象，即乃負向促發的展現。

這種對於之前需要忽略的刺激做反應，而速度變慢的現象，最早在 Stroop 作業中得到（Dalrymple, Alford & Budayr, 1966）。在 Stroop 色字命名作業中（Stroop, 1935），以不同色彩呈現代表某種顏色的字。實驗參與者需要對於字的顏色做出命名反應，而盡量忽略字的意涵。舉例而言，當實驗組中的促發項先出現紅色的「綠」字後，實驗參與者要對「紅色」做出反應，而忽略綠的語意。在偵測項接著出現一個綠色的「黃」字，實驗參與者要對「綠色」做出反應，即是剛才的忽略訊息。而在控制組中的促發項先出現藍色的「紅」字，在實驗參與者對「藍色」反應後，偵測項出現黃色的「綠」字，此時，實驗參與者要對「黃色」做出反應。他們發現實驗參與者在實驗組偵測項的反應會比控制組還要來的慢。

而在 Tipper、Lortie 及 Baylis（1992）的取物實驗中，在板子上安置九個有燈號的按鈕以及一個起始按鈕，要求實驗參與者將手放在起始按鈕，當其中一個按鈕的燈亮起紅色的燈號，實驗參與者必須盡快按下那個按鈕。以黃色燈號作爲干擾物，發現若有干擾訊息出現，實驗參與者必須花費更多的時間反應。而當之前嘗試的干擾物變成目前嘗試的目標物時反應會更慢，出現負向促發效果。此外，負向促發效果亦在字母（Tipper & Cranston, 1985）、無意義圖形（DeSchepper & Treisman, 1996）、字（Malley & Strayer, 1995）等不同刺激材料及命名（Neill, 1977）、位置判斷（葉怡玉、黃金蘭及趙軒甫，2000）、分類（Tipper & Driver, 1988）等作業中出現，顯現出負向促發效果並非侷

限於某些特定刺激或作業。

關於負向促發展現的機制，主要有抑制論（Houghton & Tipper, 1994; Neill, 1977,1989; Tipper, 1985）及記憶提取論（Neill,1997; Neill & Valdes, 1992）對其提出解釋。其中，抑制論認爲，選擇性注意力包括了雙重機制，其一爲對於目標訊息增加處理，而對於干擾訊息則是抑制其心理表徵，以促使對目標物成功的處理。而負向促發的出現，則是因當對原干擾物反應時，需要克服先前的抑制效果，而導致反應速度變慢。而記憶提取論則認爲，負向促發是由於當要對偵測項目標物作出反應時，認知系統提取出其原爲促發項之干擾物之「不反應」的記憶痕跡，而與當下反應互相衝突，因此認知系統需要較多時間以解決這個問題（Dalrymple-Alford & Budayr, 1966; Tipper, 1985）。

依照記憶提取論的觀點，由於情境相似性能使記憶提取較爲容易（Tulving, 1972, 1983），因此，負向促發效果在情境相似時應會更明顯。就抑制論而言，決定負向促發效果的重要因素是干擾物與目標物兩者的競爭。情境相似性並不影響此競爭歷程，因此，情境相似性不影響負向促發。由於兩派理論對情境相似性的影響產生不同的預測，情境相似性對負向促發效果的影響便成爲驗證理論的重要方式。

在關於情境相似性對負向促發影響的研究中，Wong（2000）在一個實驗裡呈現三個英文字母並要求受試者針對中間的目標刺激做按鍵反應。除了典型的負向促發操控偵測項裡的目標刺激與促發項的干擾刺激的對應關係，也利用三個字母之間是否出現驚嘆號來操控情境線索。當促發項與偵測項均有此情境線索時，視爲情境相似組；當其中一項有驚嘆號而另一項沒有時，視爲情境不相似組。結果顯示，負向促發效果顯著，且不受情境相似性的影響。Wong 於實驗一（2000）操弄「+」落在三字母的左右兩側或目標刺激的上下方，亦得到情境相似性不影響負向促發效果的結論。因此，他認爲記憶提取論無法解釋所有的負向促發效果。

但在趙軒甫（2000）的一系列研究中，發現情境線索相似性可以影響負向促發。在此系列中，他呈現三個中文字並要求受試者唸出中間的目標字。同時，他也操控了刺激整體的知覺脈絡，例如：有時三個中文字以線性排列，而有時以非線性的直角方式排列。當促發項與偵測項的排列方式相同時視爲情境相似組；當當促發項與偵測項的排列方式不同時，視爲情境不相似組。結果發現，情境相似顯著影響負向促發效果。當情境相同時，負向促發效果量較大。

仔細探討兩系列研究之差異，發現除了刺激材料（一爲英文字、一爲中文字）、作業（一乃按鍵反應、一乃命名作業）、及情境相似性的操弄方式（一採不同的知覺線索、一採不同的空間配置）等不同之外，兩實驗之目標物與干擾物間的距離視角相差約一倍。Wong（2000）所用的間距爲 1.1 度而趙軒甫（2000）所用的間距爲 2.1 度。或許，間距的遠近可以影響與目標物和干擾物無關的情境線索在訊息處理時的影響。選擇注意力在處理目標物時，會分配資源於目標物體知覺屬性所在的空間範疇（Kim & Cave, 2001）。當目標物與干擾物間距較近時，偵測項裡的干擾物與目標物被一起處理（grouped）的機率較高，因此不易將線索分離單獨處理，使得驚嘆號的存在與否或「+」符號的位置所在對記憶提取沒有幫助。反之，當目標物與干擾物的間距較遠時，干擾物與目標物被放在一起（grouped）的機率較低，使得位於它們之間的情境線索有機會成爲提取記憶的線索，而進一步地影響負向促發效果。因此本研究在實驗一試圖重複 Wong（2000）的研究，並在實驗二探討遠距離對負向促發所產生的影響。由於抑制論與記憶提取論的兩種理論觀點對情境相似性是否影響負向促發有決然不同的預測，我們認爲本研究的結果可以提供理論驗證，或提供日後研究可能的方向。

實驗一

本實驗的目的爲藉 Wong（2000）的實驗方法，操弄促發項與偵測項的情境相似性。如果記憶提取論是正確的，則情境相似性會影響負向促發效果的展現。反之，情境相似性並不會影響抑制機制的運作。若負向促發反映抑制機制運作的後果，情境相似性應不會影響負向促發。

方法

參與者。二十四位大學或大學以上學歷學生。他們視力均爲正常或矯正後爲正常。參與實驗後，均給予新台幣一百元。實驗需時約二十分鐘。

設計與刺激材料。此實驗包含兩個受試者內變項，分別爲組別（實驗組／控制組）和促發項與偵測項之情境相似性（相同／相異）。偵測項與促發項均由三個英文字母組成，三字母呈一橫排，中央的字母爲目標物，而以另一個字母呈現於目標物兩邊作爲干擾物。英文字母以大寫英文字母 A、B、C、及 D 之中兩個分別作爲目標物與干擾物。在實驗組中，促發項的干擾物即爲隨後出現之偵測項的目標物；而在控制組中，促發項與偵測項之目標物與干擾物均無關。以促發項和偵測項的三個英文字母之間是否出現驚嘆號操弄情境相似性，在情境相同組中，促發項和偵測項的三個英文字母之間均出現或均不出現驚嘆號；而在情境相異組中，促發項和偵測項其中一項的呈現中，三個英文字母之間有

驚嘆號，而另一項則無。

實驗參與者距離電腦螢幕約六十公分，而螢幕上均爲白色刺激呈現於黑色背景，每英文字母視角爲 0.48° × 0.48° ，而目標物與干擾物的距離爲 1.10° ，驚嘆號呈現於目標物與干擾物之間中央處。刺激之呈現與實驗資料記錄由 DMDX 軟體（Forster & Forster, in press）於電腦上進行控制。實驗於正常光線之電腦實驗室中進行。

四個字母的 12 種組合均出現在促發項，搭配偵測項爲控制組或干擾物重複組成爲 24 種配對，再乘以四種情境組合（促發項有驚嘆號 / 偵測項有驚嘆號、促發項沒有驚嘆號 / 偵測項沒有驚嘆號、促發項有驚嘆號 / 偵測項沒有驚嘆號、促發項沒有驚嘆號 / 偵測項有驚嘆號）。每種排列出現二次，共 192 嘗試，96 對促發與偵測嘗試。四個字母出現機率相等，各爲 1/4，因此每個字母重複次數爲 96 次。每個字母作爲目標物與干擾物的機率相等。本實驗以全隨機的方式呈現不同的配對組合。

程序。請實驗參與者在實驗中維持距離螢幕約 60 公分的距離，盡量快速且正確地對三個字母中的正中央字母作按鍵反應，並忽略兩旁的字母及有時會出現的驚嘆號。每個嘗試由促發項和偵測項所組成。每次受試者會聽到「叮」一聲，並在螢幕正中央呈現十字形約 300 毫秒，之後螢幕中央出現刺激材料。促發項出現於實驗參與者對上一嘗試反應後 3,000 毫秒，而偵測項出現於對促發項反應後約 480 毫秒，與趙軒甫（2000）所採用之時距雷同。以左手中指和食指分別按鍵盤上的 F 鍵與 V 鍵，兩按鍵上貼紙標明分別對應的字母 A 與 B；以右手中指和食指分別按鍵盤上的 J 鍵與 N 鍵，亦標明分別對應的字母 C 與 D。在實驗正式開始之前，共有 8 次的練習嘗試。在練習過後，開始共 96 次的正式實驗。每 48 次有一次休息時間。實驗歷時約 20 分鐘。

就按鍵反應而言，本實驗包括了各情況下偵測項與促發項以同手或異手進行反應的嘗試，且以全隨機的方式出現。但本實驗並未特別針對促發項與偵測項採用同手或異手反應此一變項進行檢驗。由於負向促發討論的層次在於內在反應選擇（internal response selection）歷程，外在反應行爲的差異對於負向促發效果不會有特別的影響（如：Tipper, MacQueen, & Brehaut, 1988）。

結果與討論

本實驗以反應時間（毫秒）與正確率（百分比）進行分析。以中位數進行反應時間的分析，計算成功反應的時間。而錯誤率的計算方式，爲實驗參與者按鍵錯誤或反應時間超過 3,000 毫秒爲錯誤。在偵測項的分析上，若促發項反應錯誤，則縱使偵測項反應正確，亦作爲錯誤，而不併入計算。

以 2（實驗 / 控制組）x 2（情境相似性）二因子重複量數變異數對中位數反應時間進行分析。結果如表一，發現實驗組的反應時間顯著的慢於控制組，$F(1,23) = 6.39$，$MSE = 3845.29$，$p < .05$，情境效果達邊緣性顯著，$F(1,23) = 3.53$，$MSE = 2{,}003.90$，$p = .07$，而交互作用不顯著 $F(1,23) = 0.28$, $MSE = 647.03$，$p > 0.5$。此結果顯示在這個實驗中，當促發項干擾物成爲偵測項目標物時，負向促發效果出現，但這個效果不受到情境相似性的影響。以二因子重複量數變異數對正確率進行分析。結果發現負向促發的主要效果不顯著，$F(1,23) = 0.42$，$MSE = 6.51$，$p > .05$，情境效果不顯著，$F(1.23) = 1.68$，$MSE = 26.04$，$p > .05$，且交互作用也不顯著。

實驗二

實驗一的結果重複驗證了 Wong（2000）的結果，但在趙軒甫（2000）的一系列研究中，卻反映了情境相似性對負向促發效果的影響。爲了進一步釐清導致此兩系列研究結果不同的原因，以探討情境相似性在何種實驗操弄下會影響負向促發，因此，實驗二將實驗刺激距離增加，與趙軒甫（2000）的實驗刺激距離相同，藉此探討遠距離對於情境相似影響負向促發的效果。

由於趙軒甫（2000）的實驗結果發現顯著的負向促發效果，且情境相似性可以影響負向促發效果量的大小，我們可以確認在他使用的距離間距之下，干擾物確實被登錄。否則，遠距離可能造成注意力比較容易集中於中間目標物，使得干擾物被登錄的機率降低，而使得它們成爲偵測項目標物時無法提取之前的訊息。若如此，遠距離的情境下，抑制論與提取論會產生相同的預測。但趙軒甫（2000）的結果意涵干擾物有被登錄，且在其成爲偵測項目標物時延宕反應時間。因此，記憶提取論應預期情境相似性會影響負向促發效果。

方法

參與者。二十一名大學或大學以上學歷學生。他們視力均正常或經矯正過爲正常，參與實驗後，均給予新台幣一百元。

設計。刺激材料與實驗一相同，只是實驗二使用的目標物與干擾物之間的距離較長，爲 2.10° 。本實驗的練習嘗試次爲 16 次，而正式嘗試數 192 對，爲實驗一的兩倍，每 48 對有一次休息時間。嘗試次數的增加是希望更加強每個刺激的激發量，使其在成爲干擾刺激時有非常高的競爭力。根據 Strayer 與 Grison（1999）的看法，抑制機制只有在干擾刺激爲強力競爭者時才會啓動。而根據 Tipper

（2001）的整合模式，只有當偵測項可以提取出促發項情節的抑制歷程時，負向促發效應才會展現。如果情境相似性啓動記憶提取，而提取出促發項裡抑制機制的強力運作，情境相似性應影響負向促發效果。

結果與討論

以二因子重複量數變異數對中位數反應時間進行分析。結果如表二，發現負向促發的主要效果不顯著，$F(1,23) = 0.09$，$MSE = 54.81$，$p > .05$，情境效果不顯著，$F(1,23) = 1.28$，$MSE = 392.02$，$p > .05$，而交互作用也不顯著，$F(1,23)= 2.24$，$MSE = 532.87$，$p > .05$。以二因子重複量數變異數對正確率進行分析。結果發現負向促發的主要效果不顯著，$F(1,23) = 1.74$，$MSE = 5.56$，$p > .05$，情境效果不顯著，$F(1.23) = 0.24$，$MSE = 0.78$，$p > .05$，且交互作用也不顯著，$F(1,23)= 0.02$，$MSE = 0.09$，$p > .05$。此結果顯示，在遠距離時，負向促發效果沒有展現，而情境相似性的操弄對反應時間與正確率亦沒有影響。

綜合討論

本研究所得到的結果支持抑制論對負向促發的觀點。抑制論認爲，負向促發是因認知系統爲了保護目標物處理不受干擾而主動抑制干擾物的心理表徵所造成。使得當干擾物成爲目標物時，需要更多的激發才能做出正確反應。根據抑制論（Houghton & Tipper, 1994; Neill, 1977, 1989; Tipper, 1985），偵測項裡的目標物與干擾物的相對激發量是決定負向促發出現的重要因素。而由於情境相似性與偵測項裏的目標物和干擾物的相對激發量無關，因此不影響抑制效果的運作與展現（另外，可見 Tipper, 2001 的整合性觀點）。在實驗一中，得到的結果與抑制論的觀點符合，即情境相似性對負向促發沒有影響。而實驗二的結果則顯示在遠距離的情況下負向促發沒有出現，與 Fox（1997）發現負向促發隨著距離增加而消逝的結果一致。抑制論可解釋遠距離時負向促發不發生的原因。當目標物與干擾物距離較遠時，選擇機制不會將目標物與干擾物視爲一體，且當選擇性注意力將焦點放在目標物時，干擾物進入注意力焦點內的機率較兩者距離近時爲低。在此情況下，促發項時，干擾物的干擾效果低而無須被抑制；偵測項時，由於干擾物的激發量低，而難以影響目標物的處理。因此，遠距離的實驗情境下，負向促發沒有發生。

而依照記憶提取論，由於情境相似性會幫助記憶提取，因此，促發項與偵測項的情境相似性應會介入影響負向促發，使得負向促發效果在情境相似的情況下更爲明顯。但在實驗一並未顯示情境相似性對負向促發效果有影響。另外，依照記憶提取論，當目標物與干擾物均被登錄時，它們之間距離的遠近不應影響記憶提取，而對負向促發效果應不造成影響。由於實驗二所用的距離約爲二度，且少數刺激不斷重複，因此我們沒有理由認爲干擾物有不被登錄的可能。但綜合實驗一與實驗二的結果，增加目標物與干擾物的距離，負向促發消逝。

但情境相似性的確在許多研究中均展現出對負向促發效果的影響（Stolz & Neely, 2001）。爲探討情境相似性在何種實驗情境下會對負向促發造成影響，發現除上述目標物與干擾物距離之差異外，本研究和之前研究還有幾點不同之處。第一、在刺激呈現時距的操弄上，本研究爲了重複 Wong（2000）的研究，偵測項出現於對促發項反應後（response stimulus interval, RSI）480 毫秒，而促發項出現於實驗參與者對上一嘗試反應後（previous response stimulus interval, PRSI）3,000 毫秒。根據記憶提取理論，記憶痕跡的強度以及記憶痕跡的分辨度均能影響記憶提取。若促發項至其下一個偵測項的時距（RSI）比偵測項至下一個促發項的時距（PRSI）來得短時，使得記憶痕跡的分辨度高，而有利於記憶提取出之前促發項所留下的痕跡（Neill & Valdes, 1992）。Neill 與 Valdes（1992）的研究提出，相較於偵測項與促發項時距（PRSI）及促發項與偵測項時距（RSI）相同時，偵測項出現於對促發項反應後（RSI）500 毫秒，而促發項出現於反應後（PRSI）4,000 毫秒的情況中，較能夠幫助記憶提取，故有較高的負向促發效果。

在本研究中，可能因時間上的操弄使得促發項的分辨度高而可迅速提取出促發項的記憶痕跡，使得記憶提取效果已經達到天花板效應，而讓情境相似性的效果無法顯現。亦即，記憶提取可由不同管道達成。當促發項的分辨度高使其迅速被提取時，其它如情境相似所提供的記憶提取便不會涉入。只要一個管道啓動記憶提取，就可回溯促發項裡的抑制歷程或不適當反應的訊息，而造成負向促發效果。在本實驗的情境脈絡下，或許因爲促發項的分辨度可以完成記憶提取的啓動，而無須情境相似性涉入。

第二、在情境相似度的操弄上，趙軒甫（2000）的研究發現情境相似性的效果只有在該情境相同的組合突顯時才會出現。在他的研究系列中，若單純以水平線與垂直線的排列模式操弄情境相似性，或單純以干擾物色彩在促發項與在偵測項的同異操弄相似性，兩者的結果均沒有發現情境相似性的效果。但，若以水平線與十字形排列模式的同異，或以線性與非線性的排列模式同異來凸顯情境相同的組合，則情境相似性會影響負向促發。因此，本研究的結果可能來自情境相似性操弄的強度

不足以凸顯情境相同的組合。

第三、本研究與之前研究所用的刺激材料數目（stimulus set size）有所差異。Wong（2000）所使用爲 A、B、C 及 D 四個字母，在實驗中反覆出現；而趙軒甫（2000）的研究中，則由 15 個字重複當作可能出現的目標物與干擾物。當少數刺激重複作爲目標物與干擾物時，記憶痕跡裡存在對一個刺激同時有「反應」與「不反應」的兩類紀錄。因此，在提取之前偵測項時產生混淆。就記憶提取論而言，關鍵點在於最近一次的記憶痕跡（Neill & Mathis, 1998），亦即在促發項裡是干擾物的記憶痕跡。因此，兩類痕跡並存的影響並不列進考量。

然而，Wong（2000）不斷重複四個英文字母可能產生另一個影響。由於驚嘆號與「+」的符號與受試者的作業完全無關，而英文字母辨認簡單，受試者可能採用了完全忽略驚嘆號的出現與否或忽略「+」符號所在的位置。因而，情境相似性效果無法展現。但在趙軒甫（2000）的研究中，他利用目標物與干擾物的排列來操控情境相似性，受試者必然處理情境，而使得情境相似性效果出現。

本研究結果與抑制論對負向促發的觀點互相符合，即情境相似性對負向促發不產生效果。但如上述所提，仍有許多可能性造成情境相似性未能在本研究中對負向促發產生影響。未來若能釐清情境相似性在何種情況下會介入影響負向促發效果，則能進一步瞭解選擇注意力與記憶提取在負向促發現象裡的運作。