BRIEF REPORTS

Spatial stimulus–response compatibility and negative priming

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According to Kornblum's (1992) dimensional overlap model, when an incongruent response to a stimulus is required, automatic activation of the congruent response must first be inhibited. Shiu and Kornblum (1996a) provided evidence for such inhibition in an incongruent symbolic *negative priming* task. Reaction time was longer when a trial's correct response was the name of the stimulus from the previous trial than when it was not. We report three experiments that test this inhibition hypothesis for spatial stimuli and responses. In Experiment 1, which used a spatial mapping analogous to the symbolic mapping used by Shiu and Kornblum (1996a), a similar negative priming effect was found. However, in Experiments 2 and 3, which used mappings that were conducive to simple transformational rules, a positive priming effect was obtained. The results suggest that inhibition in response selection may depend on the complexity of the relations between the stimuli and responses.

The majority of research evidence places both stimulus–response (S–R) compatibility and negative priming (NP) effects at the response selection stage of human information processing (Proctor & Reeve, 1990; Tipper & Milliken, 1996). *S–R compatibility* refers to the finding that responses are faster and more accurate when the stimuli and responses correspond than when they do not. *NP* refers to the finding that reaction times (RTs) are longer when the target stimulus on the current trial (probe) has served as the distractor on the previous trial (prime) as compared with trials for which the probe target is unrelated to prime trial events.

Since its discovery, NP has been associated with inhibitory mechanisms of selective attention (Neill & Westberry, 1987; Tipper, 1985). Likewise, inhibition has been postulated as a mechanism in S–R compatibility (De Jong, 1995; Kornblum, 1992; Stoffels, 1996). Recently, Shiu and Kornblum (1996a) have demonstrated NP without distractors using a symbolic choice reaction task. Their experiment was based on Kornblum's dimensional overlap model, according to which a stimulus automatically activates its corresponding (i.e., compatible) response whenever the stimulus and response sets share perceptual, conceptual, or structural features. If the automatically activated response conflicts with the task-defined response,

the automatic response must first be inhibited before the correct response can be made, which results in slower RTs for incompatible mappings than for compatible mappings.

In Shiu and Kornblum's (1996a) experiment, the stimuli were four line drawings (a bike, a car, a boat, and a plane) and the four written words corresponding to the pictures, with a single picture or word presented as the stimulus on alternating trials. Each picture–word pair was assigned an incongruent vocal naming response from the same set (e.g., the picture and word CAR were assigned the response *plane*). There were four possible types of trial pairs: (1) S–CR (prime trial stimulus–probe trial correct response), in which the name of the prime trial stimulus was the correct response on the probe trial (e.g., respond *plane* to the picture or word CAR, followed by *car* to the picture or word BIKE); (2) CR–S (prime trial correct response–probe trial stimulus), in which the correct prime response was the name of the probe stimulus (e.g., respond *bike* to the picture or word BOAT, followed by *car* to picture or word BIKE); (3) CR–CR (prime trial correct response–probe trial correct response), in which the correct response on the prime trial was also the correct response on the probe trial; and (4) control, in which there was no relation between the prime and probe trials (e.g., respond *boat* to PLANE, followed by *car* to BIKE). The responses were slower for S–CR trials than for control trials, which Shiu and Kornblum interpreted as an NP effect reflecting suppression of the prime congruent response. They suggested that inhibition in standard NP tasks and suppression of the automatic response in S–R compatibility tasks may share the same or similar mechanisms.

In Kornblum's (1992) dimensional overlap model, RTs for an incompatible mapping can vary depending on the

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complexity of task requirements, but under no circumstances can activation of the corresponding response be bypassed. According to this view, because the corresponding response must be inhibited for all incompatible mappings, an NP effect should occur regardless of the specific mapping rule or rules implied by task requirements. However, several manipulations of S–R compatibility have questioned both the conditions under which the corresponding response is activated and inhibited and the role of control processes in general (e.g., Ehrenstein & Proctor, 1998; Hommel, 2000). In particular, various findings suggest that an incompatible response is not always contingent on suppressing activation of the corresponding response (e.g., Stoffels, 1996), and explanations have been concerned with the role of intention as influenced by associations implied through S–R properties and task requirements (e.g., Ehrenstein & Proctor, 1998; Logan, 1980). Other accounts of S–R compatibility have disregarded inhibition, suggesting that delays in RT depend on the complexity of a transformational rule (Duncan, 1977). What these authors and others (e.g., Tagliabue, Martignago, & Simion, 1996) have tried to address is the changing balance of facilitation and inhibition witnessed in various paradigms.

The Present Study

Shiu and Kornblum's (1996a) experiment is atypical in the S–R compatibility literature, in that most studies have used spatial stimuli and responses. Therefore, it is important to determine whether their findings extend to spatial compatibility.¹ In the present study, we describe three experiments in which we tested whether NP occurs in four-choice tasks with spatial stimuli and keypress responses and whether it generalizes across incompatible mapping variations. In Experiment 1, we used an S–R mapping analogous to that used by Shiu and Kornblum, in which the stimuli and their assigned responses were not related by a simple rule. Of most concern was whether an NP effect would be observed, as it was in their study.

A key assumption of Kornblum's (1992) model is that a stimulus activates its corresponding response regardless of the S–R mapping, and that this response must be inhibited unless it is correct (i.e., the mapping is compatible). An alternative is that inhibition is restricted to situations in which the relation between stimuli and responses cannot be characterized by a simple rule (e.g., Duncan, 1977) and the subject must focus on the task-defined individual associations between stimuli and responses to select a response. Therefore, Experiments 2 and 3 also used

Figure 1. Sequence and timing for each prime-probe trial pair in Experiments 1, 2, and 3. The prime stimulus was preceded by a fixation point and location markers on a black background for approximately 500 msec. The prime stimulus then appeared above one of the four markers and remained on the screen until the subject's response. Approximately 500 msec after the subject's response, the probe stimulus appeared above one of the markers. Following the probe response, the screen was blank for 500 msec before the next prime-probe trial began.

incompatible S–R mappings, but the mappings followed a simple rule (in Experiment 2, *respond opposite*; in Experiment 3, *respond opposite* within hands). From the viewpoint of a rule-based account (e.g., Duncan, 1977), Experiments 2 and 3 involved a simpler mapping than that for Experiment 1. If, as Shiu and Kornblum (1996a) posited, an incompatible response is necessarily contingent on suppression of the congruent response, then NP should be observed in all three experiments.

GENERAL METHOD

Apart from the mapping conditions, the method was the same for all three experiments. Therefore, the general method will be described here and only the mapping conditions will be described for each experiment.

Subjects

Twenty-five different students from introductory psychology classes at Purdue University participated in each experiment for course credit. All the subjects reported having normal or corrected-to-normal vision.

Stimuli and Apparatus

The stimuli were presented on a 14-in. VGA color monitor of a personal computer. Four equal signs served as location markers on the 11th print line. An asterisk (*) served as a focus point in the center of the 10th print line. The target was the letter “X,” 0.64 cm (0.67°) high and 0.32 cm (0.33°) wide, presented in white on the 10th print line, directly above the location markers. The combined height of the target letter and location marker was 0.95 cm (0.99°). The stimuli and fixation point were separated by three print spaces (0.96 cm, or 1.0°). The subjects responded by pressing the “S,” “C,” “M,” or “L” computer keys, which were marked in blue to avoid any association among the letters and the stimulus locations. The presentation of stimuli and recording of responses were accomplished with the Micro Experimental Laboratory (MEL 2.01) software.

Procedure

The subjects sat in a dimly lit room, approximately 55 cm from the computer screen, and placed their index and middle fingers on the marked keys in their natural positions. They were instructed about the task, with speed and accuracy of responding emphasized equally.

The prime–probe trial sequence is illustrated in Figure 1. All stimuli and conditions were presented randomly, with equal probability. The subjects received 17 blocks (1 practice and 16 test) of 16 prime–probe pairs. The order of trial pairs was randomized between subjects, with the stipulation that there were no more than three successive trial pairs from the same condition. During practice, feedback for errors was given with a 400-Hz tone and the word *error* presented on the screen during the 500-msec intertrial interval. In addition, error trials were repeated. For the actual test condition, the subjects received only the tone as feedback for errors.

EXPERIMENT 1

The mapping condition for Experiment 1 was spatially analogous to Shiu and Kornblum’s (1996a; see Figure 2) symbolic task, resulting in the same four trial pairs. The prime–probe pairings are illustrated in Figure 3.

Results

To ensure that the subjects were attentive on the prime trial, only the probe trials following a correct prime response were used for the analyses. For this and subse-

quent analyses, probe RTs were trimmed, with RTs beyond three standard deviations from the mean excluded (< 2%).² Comparisons between individual pairs of means were performed using the Newman–Keuls procedure ($p < .05$).

Mean correct probe RTs were submitted to analysis of variance (ANOVA), with trial pairs treated as a within-subjects factor (see Table 1). This analysis resulted in a significant main effect of trial pair [$F(3,72) = 117.7$, $MS_e = 3,581$, $p < .0001$]. Mean RTs for CR–S and S–CR trials were similar and significantly slower than those for neutral trials, with mean RT significantly faster for CR–CR trials than for all other trial pairs. Hence, an NP effect of 78 msec occurred for the S–CR trials. The mean RT for CR–S trials was also 68 msec longer than that for control trials.

The ANOVA for percent error (PE) also resulted in a significant effect of trial pair [$F(3,72) = 13.7$, $MS_e = 10.5$, $p < .0001$]. The means for PE followed a pattern similar to that for RTs (CR–S, S–CR > neutral > CR–CR).

Discussion

The results of Experiment 1, in which spatial location stimuli and responses were used, replicated those of Shiu and Kornblum (1996a), in which vocal responses to alternating pictures and words were used. In agreement with their interpretation that a stimulus activates its corresponding response and this response must be inhibited, the S–CR trial pairs showed NP.

The RTs for CR–S trial pairs were also significantly slower than those for control trial pairs. In Shiu and Korn-

Figure 2. The spatial mapping used in Experiment 1 and its analogy to Shiu and Kornblum’s (1996a) symbolic mapping. Each stimulus–response (S–R) alternative is independent of the other S–R alternatives.

Figure 3. Examples of prime-probe trial pairs in Experiment 1. S-CR, the position of the prime target stimulus is also the position of the correct probe trial response (analogous to the ignored-repetition trial type in an NP task). CR-S, the correct prime trial response position is also the probe target stimulus position. CR-CR, the prime target and response are repeated on the probe trial. Control (or neutral), no relation between the prime and probe target or response.

Table 1
Mean Probe Reaction Time (RT) and Percent Error (PE)
by Trial Pair

Trial Pair									
CR-CR		S-CR		CR-S		Control		Priming Effect	
RT	PE	RT	PE	RT	PE	RT	PE	RT	PE
614	0.6	894	5.8	884	5.0	816	2.6	-78	-2.4

Note—CR-CR, prime trial correct response-probe trial correct response; S-CR, prime trial stimulus-probe trial correct response; CR-S, prime trial correct response-probe trial stimulus; control, no relation between the prime and the probe trials; priming effect is the performance difference between control and S-CR trial pairs.

Figure 4. The stimulus-response mapping for (A) Experiment 2 and (B) Experiment 3.

blum's (1996a) experiment, RTs were slower for CR-S than for control trial pairs for word probes, although not for picture probes. What distinguishes CR-S and S-CR trial pairs is the relationship to prime events. For CR-S trial pairs, because the actual prime response is also the probe congruent response, it is possible that its previous activation causes conflict on the probe trial. Inhibitory accounts are not constrained to one facet of action selection, and in this case, the delayed RT may reflect inhibition that occurs at probe target onset.

EXPERIMENT 2

In Experiment 2, we investigated whether results consistent with Kornblum's (1992) model would be obtained when the mapping rule was changed. The S-R mapping for this experiment was similar to that used by Duncan (1977) in a series of experiments involving compatible and incompatible mappings in both mixed and pure blocks (see Figure 4A). Duncan found that when S-R pairings shared the same mapping relationship, RT was

Figure 5. Examples of prime-probe trial pairs in Experiment 2.

Table 2
Probe Reaction Time (RT) and Percent Error (PE)
by Trial Pair for Experiments 2 and 3

Experiment	Trial Pair							
	Repeat		Ignored Repetition		Neutral		Priming Effect	
	RT	PE	RT	PE	RT	PE	RT	PE
2	579	1.0	678	3.5	708	5.5	+30	+2.0
3	576	0.9	627	2.5	668	1.8	+41	-0.7

Note—The three types of prime–probe trial pairs are described in the text. The priming effect is the performance difference between the neutral and the ignored-repetition trial pairs.

faster than when mapping between S–R pairings was inconsistent. In the case of consistent mappings, Duncan argued that a response could be made through selection of a simple transformational rule (i.e., *respond opposite*).

This simpler mapping condition created three possible types of prime–probe pairs: (1) repeat, (2) neutral (control), and (3) ignored repetition (see Figure 5). For the ignored-repetition trial pairs, the probe target occupied the position of the prime target response and required a response that corresponded to the prime target's position. If, as Kornblum (1992) argued, the corresponding response must be suppressed for incompatible mappings, an NP ef-

fect should occur. Alternatively, if suppression of the corresponding response under these simplified mapping conditions is not necessary, then NP should not occur.

Results

The ANOVA for RT showed a significant effect of trial pair [$F(2,23) = 72.0$, $MS_e = 1,587$, $p < .0001$; see Table 2]. Unlike in Experiment 1, when the prime congruent response became the required response on the probe trial, RTs were significantly faster than they were on neutral trials, reflecting a 30-msec positive priming effect.

The ANOVA for PE showed a significant effect of trial pair [$F(2,23) = 20.5$, $MS_e = 6.1$, $p < .0001$]. PE followed the direction of RT (neutral > ignored repetition > repeat).

Discussion

In Experiment 2, the task was much easier when mapping conditions shared a similar relationship (*respond opposite*), as was reflected in the significantly faster overall RT (655 msec) than the overall RT in Experiment 1 (802 msec) [$t(49) = 7.3$]. When the mapping followed a simple translation rule, there was no evidence of NP. Instead, a positive priming effect was obtained. This outcome is inconsistent with the view that the congruent response is always activated and, consequently, must be inhibited

Figure 6. Examples of prime–probe trial pairs in Experiment 3.

when it is incorrect. Otherwise, an NP effect should have been observed with the mapping used in this experiment, as was reported with the mappings used in the present Experiment 1 and in Shiu and Kornblum's (1996a) study.

EXPERIMENT 3

Experiment 3 was conducted to determine whether the results of Experiment 2 would be replicated when mapping was changed but still required a simple rule (see Figure 4B). Therefore, the mapping for Experiment 3 required an opposite response but within rather than across hands (see Figure 6).

Results

For the RT data, the effect of trial pair was significant [$F(2,23) = 18.0$, $MS_e = 2,963$, $p < .0001$; see Table 2]. Similar to the results for RT in Experiment 2 under the simpler mapping conditions, the RTs in Experiment 3 reflected a positive priming effect (41 msec).

For PE, the effect of trial pair was significant [$F(2,23) = 3.2$, $MS_e = 4.9$, $p < .05$]. PE for ignored-repetition and neutral trials was similar and significantly greater than PE for repeat trials.

Discussion

In Experiment 3, we successfully replicated the results of Experiment 2. That is, when a simple transformational rule can be applied, RTs for ignored-repetition trial pairs are faster than those for control trials. In agreement with Experiment 2, this outcome implies that when a simple rule is applicable, the corresponding response does not have to be inhibited.

GENERAL DISCUSSION

In Experiment 1, we reproduced the mapping conditions of Shiu and Kornblum's (1996a) experiment, but with the use of spatial stimuli and responses. The major finding of their study was replicated: An NP effect occurred when the prime stimulus position (and the position of the prime congruent response) corresponded to that of the probe response. However, the less demanding tasks of Experiments 2 and 3 yielded positive priming effects. Although the finding of slower RTs for the S-CR trials than those for the control trials in Experiment 1 is consistent with the view that the corresponding response must be inhibited, these results combined with the findings of Experiments 2 and 3 join a large body of literature that questions the role of inhibition in S-R compatibility tasks.

Implications for S-R Compatibility

The differences in priming effects between Experiment 1 and Experiments 2 and 3 suggest that NP is a function of the complexity of the relation between stimuli and responses. When the S-R mapping is relatively complex, as in the present Experiment 1 and in Shiu and Kornblum's

(1996a) experiment, subjects cannot perform the task through application of a simple rule and must rely on the associations between individual stimuli and responses defined for the task. Because each stimulus is also strongly associated with its corresponding response, activation of this response is likely to engender response conflict, which would require inhibition. By contrast, in both Experiments 2 and 3, the S-R mapping was conducive to a simple transformational rule (make the opposite response, either within or across hands). Consequently, a task set could be established whereby the rule, rather than the individual associations between stimuli and responses, provided a more salient route between perception and action. Under these conditions, any transient activation of the corresponding response would not produce conflict, because the transformational rule took precedence. Hence, when activation on the prime trial was positively related to probe events, as with other priming paradigms, RT was facilitated. According to this view, inhibition is a reactive process (Neill, Valdes, & Terry, 1995) dependent on the amount of interference with current task goals.

Alternatively, it could be argued that the positive priming effects in Experiments 2 and 3 occurred because the stimuli and responses grouped into two subsets (inner vs. outer in Experiment 2 and left vs. right in Experiment 3). Consequently, the prime and probe trials were from the same subset for the ignored-repetition condition but different subsets for the control condition. In other words, the RT advantage for the ignored-repetition condition could reflect repetition of the S-R subset. This interpretation not only discounts the need for inhibition of the corresponding response, but also questions whether that response is even activated.

Implications for Negative Priming

The results of Shiu and Kornblum's (1996a) experiment show that the presence of distractors is not necessary for NP to occur (see also, e.g., Neill, 1979; Tipper & Milliken, 1996). NP can result from covert response conflict from the prime trial. In Experiment 1, we demonstrated that Shiu and Kornblum's findings could be replicated with an analogous design using spatial stimuli and responses.

The combined results of the present experiments also have important implications for inhibitory accounts of NP. In the NP literature, an analogy to the present experiments can be drawn from a study by Tipper, Weaver, and Houghton (1994), who suggested that inhibition is a flexible process dependent on task demands and the resulting behavioral goals of the subject. They reported three experiments in which the shared properties of identity, location, and color between the target and distractor were independently manipulated. Color discriminated the target from the distractor, and responses were either to location (manual responses) or to identity (verbal responses). NP varied by the dimensions most relevant to behavioral goals and task difficulty. In their Experiments 1 and 2, a positive priming effect occurred when

the target color was precued and the target and distractor shared all three properties. By contrast, in their Experiment 3, when task demands were increased by the elimination of the precue and the target and distractor shared all three properties, an NP effect occurred.

The results of the present study are consistent with the hypothesis that inhibition is dependent on behavioral goals. For the ignored-repetition trials of Experiments 2 and 3, the probe target occupied the prime response position and required the congruent prime response. With the less demanding conditions of Experiments 2 and 3, as compared with those of Experiment 1, inhibition was not directed toward these properties, and what activation did occur aided response selection.

However, as can be found in the literature regarding S–R compatibility, the present results can be explained with an alternative account that does not emphasize inhibition. The TIPTAP model of Neill and Mathis (1998) relies on retrieval processes that occurred on the probe trial. According to this view, RT is affected by two parallel processes: cued retrieval or a controlled algorithmic process. Whether retrieval affects performance depends on the faster of these two processes. It could be argued that NP occurred in Experiment 1 when the internal representation of the probe response activated events on the prime trial in which it was an inappropriate response. Because the rule was easily applied in Experiments 2 and 3, the response could be generated before conflict from retrieval could occur.

Conclusions

Shiu and Kornblum (1996a) demonstrated the utility of the NP paradigm for understanding symbolic S–R compatibility effects. The present study extends application of their paradigm to spatial S–R compatibility. However, NP occurred only when stimuli and responses were not related by a simple rule, which suggests that NP is dependent on the complexity of the task. The combination of S–R compatibility and NP offers a productive approach toward developing a comprehensive theoretical account of response selection, including the role played by inhibition.

REFERENCES

- DE JONG, R. (1995). Strategic determinants of compatibility effects with task uncertainty. *Acta Psychologica*, **88**, 187–207.
- DUNCAN, J. (1977). Response selection errors in spatial choice reaction tasks. *Quarterly Journal of Experimental Psychology*, **29**, 415–423.
- EHRENSTEIN, A., & PROCTOR, R. W. (1998). Selecting mapping rules and responses in mixed compatibility four-choice tasks. *Psychological Research*, **61**, 231–248.
- HOMMEL, B. (2000). The prepared reflex: Automaticity and control in stimulus–response translation. In S. Monsell & J. Driver (Eds.), *Control of cognitive processes: Attention and performance XVIII* (pp. 247–273). Cambridge, MA: MIT Press.
- KORNBLUM, S. (1992). Dimensional overlap and dimensional relevance in stimulus–response and stimulus–stimulus compatibility. In G. E. Stelmach & J. Requin (Eds.), *Tutorials in motor behavior II* (pp. 743–777). Amsterdam: North-Holland.
- LOGAN, G. D. (1980). Attention and automaticity in Stroop and priming tasks: Theory and data. *Cognitive Psychology*, **12**, 523–553.
- NEILL, W. T. (1979). Switching attention within and between categories: Evidence for intracategory inhibition. *Memory & Cognition*, **7**, 283–290.
- NEILL, W. T., & MATHIS, K. M. (1998). Transfer-inappropriate processing: Negative priming and related phenomena. In D. L. Medin (Ed.), *The psychology of learning and motivation: Advances in research and theory* (Vol. 38, pp. 1–44). San Diego: Academic Press.
- NEILL, W. T., VALDES, L. A., & TERRY, K. M. (1995). Selective attention and the inhibitory control of cognition. In F. Dempster & C. Brainerd (Eds.), *Interference and inhibition in cognition* (pp. 207–261). New York: Academic Press.
- NEILL, W. T., & WESTBERRY, R. L. (1987). Selective attention and the suppression of cognitive noise. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, **13**, 327–334.
- PROCTOR, R. W., & REEVE, T. G. (1990). Research on stimulus–response compatibility: Toward a comprehensive account. In R. W. Proctor & T. G. Reeve (Eds.), *Stimulus–response compatibility: An integrated perspective* (pp. 483–494). Amsterdam: North-Holland.
- PROCTOR, R. W., & VU, K.-P. L. (2002). Eliminating, magnifying, and reversing spatial compatibility effects with mixed location-relevant and irrelevant trials. In W. Prinz & B. Hommel (Eds.), *Common mechanisms in perception and action: Attention and performance XIX* (pp. 443–473). Oxford: Oxford University Press.
- SHIU, L.-P., & KORNBLUM, S. (1996a). Negative priming and stimulus–response compatibility. *Psychonomic Bulletin & Review*, **3**, 510–514.
- SHIU, L.-P., & KORNBLUM, S. (1996b). Negative priming without distractors. *Abstracts of the Psychonomic Society 37th Annual Meeting*, **1**, 63.
- STOFFELS, E. J. (1996). On stage robustness and response selection routes: Further evidence. *Acta Psychologica*, **91**, 67–88.
- TAGLIABUE, M., MARTIGNAGO, N., & SIMION, F. (1996). La codifica della dimensione spaziale dello stimolo in età evolutiva: Compatibilità spaziale ed effetto Simon. *Giornale Italiano di Psicologia*, **23**, 645–673.
- TIPPER, S. P. (1985). The negative priming effect: Inhibitory priming by ignored objects. *Quarterly Journal of Experimental Psychology*, **37A**, 571–590.
- TIPPER, S. P., & MILLIKEN, B. (1996). Distinguishing between inhibition-based and episodic retrieval-based accounts of negative priming. In A. F. Kramer, M. G. H. Coles, & G. D. Logan (Eds.), *Converging operations in the study of visual attention* (pp. 337–363). Washington, DC: American Psychological Association.
- TIPPER, S., WEAVER, B., & HOUGHTON, G. (1994). Behavioral goals determine inhibitory mechanisms of selective attention. *Quarterly Journal of Experimental Psychology*, **47A**, 809–840.

NOTES

1. Shiu and Kornblum (1996b) presented a poster in which an experiment using spatial stimuli and responses was briefly described. They obtained a significant NP effect, but the conditions they reported did not allow an analysis parallel to that of their experiments with symbolic stimuli. In addition, the method involved mixing trials for which responses were based on stimulus location with trials for which responses were based on the color of a central rectangle, a procedure that is known to affect response selection processes (Proctor & Vu, 2002).

2. For Experiment 1, we also analyzed the data with RTs trimmed within each condition, a method similar to that used by Shiu and Kornblum (1996a). However, the results were not significantly different from when the present method was used.

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