Nonmotoric Translation Processes in the Preparation of Discrete Finger Responses: A Rebuttal of Miller’s (1985) Analysis

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Miller (1982) found a same-hand advantage for precuing discrete finger responses and assumed that the advantage was a motoric, response preparation effect. In a series of experiments, Reeve and Proctor (1984) examined the precuing procedure used by Miller and concluded that the same-hand advantage is due to nonmotoric decision (stimulus–response translation) processes. Miller (1985) questioned our conclusions on the grounds that our procedures introduced new response sets and that the translation explanation cannot account for the full set of his results. These arguments are evaluated in the present observation and are found not to be supported strongly. Miller also proposed a reinterpretation of our results that attributes the advantage to spatial coding of responses. Although his coding account is very similar to the explanation that we previously proposed, his account attributes the coding operations to response preparation processes, whereas our account assigns such operations to decision processes. Miller reported a new precuing experiment that he interpreted as support for his response preparation account. However, we derived differential predictions from the response preparation and translation accounts and found Miller’s data to be more consistent with our translation account. Therefore, our conclusion still is that the same-hand advantage is attributable to nonmotoric processes.

Continuous models of human information processing (e.g., McClelland, 1979) imply that partial stimulus information prepares corresponding responses, whereas discrete stage models (e.g., Sternberg, 1969) suggest that it does not. Tests of these predictions are possible if an effect is found whose presence can serve as a reliable indicator of response preparation. Miller (1982) concluded that such an effect occurs for the preparation of discrete finger responses.

Miller’s (1982) conclusion was based on an experiment in which pairs of responses from the index and middle fingers on each hand were precued. The hands were placed with the fingers on four response keys assigned compatibly to four equally spaced, horizontal locations on a display screen. Precues consisted of plus signs in either two (the prepared conditions) or four (the unprepared condition) of the positions. When only two positions were indicated, they corresponded to either the index and middle fingers of the same hand (the prepared: hand condition), the same finger on different hands (e.g., the left and right index fingers; the prepared: finger condition), or different fingers on different hands (e.g., the left middle and right index fingers; the prepared: neither condition). The target was a single plus sign that occurred in one of the precued locations following a variable interval.

Precuing was beneficial only when the two cued responses were on the same hand (i.e., in the prepared: hand condition). Miller (1982) interpreted this same-hand advantage as reflecting a characteristic of the motor system (pp. 276 and 279), with finger responses on the same hand being prepared more efficiently than those on different hands. The same-hand advantage was then used as a criterion effect in partial information experiments (Miller, 1982, 1983) designed to discriminate between continuous and discrete models.

Because Miller’s (1982) conclusions regarding the preparation of discrete finger responses are inconsistent with the majority of movement precuing studies (which have found that advance information can be used to prepare any related responses; Goodman & Kelso, 1980; Larish, 1980;
Rosenbaum, 1980, 1983), Reeve and Proctor (1984) scrutinized Miller’s procedure for nonmotoric artifacts. On the basis of three experiments, we concluded that any combination of finger responses can be prepared in advance equally well. Our results suggested that the same-hand advantage obtained by Miller is an artifact of nonmotoric decision processes involved in translating between stimuli and responses. If this interpretation is correct, the evidence obtained by Miller in his partial information experiments lacks validity.

Miller (1985) questioned the conclusions drawn by Reeve and Proctor (1984) on two grounds. First, he proposed that all of the obtained precuing effects can be explained “in terms of response preparation, because response preparation could favor different pairs of fingers in different conditions” (p. 225). Second, he argued that the translation account noted by us “could account for at most a small number of the results reported by Miller (1982)” (p. 222). Miller (1985) also reported an experiment intended to obtain support for his response preparation account. In this experiment, he manipulated hand placement and key distance (hand separation) with stimulus–response arrangements intended to approximately equate movements for the different conditions. The experiment showed a small same-hand advantage, which Miller interpreted as support for his contention that the advantage is a response preparation effect. The present article addresses Miller’s (1985) criticisms of our study and evaluates his new experiment. Our conclusion, again, is that the same-hand advantage most likely is attributable to nonmotoric processes.

The Reeve and Proctor Experiments

Reeve and Proctor’s (1984) experiments closely followed Miller’s (1982) precuing procedure, with some crucial changes. Experiment 1 increased the precuing interval from a 1-s maximum used by Miller to 3 s. The 3-s value was selected because most precuing studies have used long intervals (e.g., Rosenbaum, 1980) and because at short intervals response preparation may be confounded with the time to identify and select the precued responses. With the 3-s interval, all combinations of precued responses showed equivalent benefits, suggesting that the same-hand advantage obtained at shorter intervals is due to nonmotoric processes.

Converging evidence that nonmotoric processes are involved at short precuing intervals was obtained in Experiment 3. This experiment used two hand placements, an adjacent placement similar to the placement used in the earlier precuing experiments and an overlapped placement for which subjects placed one hand over the other, with fingers alternated. With the overlapped placement, the left-to-right ordering of fingers on the keyboard thus was right index, left middle, right middle, and left index. The manipulation of hand placement allowed the spatial relations of the specific stimuli and response keys to be dissociated from the preparation conditions. More specifically, the stimuli and keys assigned to the prepared: hand and prepared: neither conditions were switched for the two hand placements. When the hands were overlapped, the advantage was obtained for the prepared: neither condition and, therefore, followed the spatial, stimulus–response relations and not the hand distinction. This finding is inconsistent with the hypothesis that responses on the same hand have a response preparation advantage. Rather, it suggests that the precuing effects reflect nonmotoric “response-selection decisions . . . that occur prior to response preparation” (Reeve & Proctor, 1984, p. 552).

Miller’s (1985) Reinterpretation of Our Results


Is Miller’s spatial coding explanation a reinterpretation? The spatial coding explanation provided by Miller (1985) “is that responses are coded with respect to spatial position (e.g., left or right of body midline) as well as hand (Nicoletti, Anzola, Luppino, Rizzolatti, & Umiltà, 1982; Wallace, 1971)” (p. 225). Accordingly, “response preparation depends primarily on the match between the cue and a spatial code for a subset of the responses” (p. 231).

Although Miller (1985) considers his spatial coding account to be a reinterpretation of the Reeve and Proctor (1984) results, it bears a strong resemblance to the account that we initially proposed. For example, we stated that “clearly the left-right relationship is the critical factor” (p. 552), with the precuing advantage being “associated with the spatial relationships of the stimulus and response locations involved in the respective preparation conditions” (pp. 550–551). More recently (Proctor & Reeve, 1984), we elaborated this conclusion, indicating that “subjects apparently code the stimuli to responses on the basis of the salient characteristics of each,” with the coding often “in terms of the left–right spatial relationship” (p. 5).

Thus, the spatial coding explanation proposed by Miller is basically a restatement of our account, with one important exception.
The exception is that whereas we consider coding to be a nonmotoric operation having its influence in decision (i.e., stimulus–response translation) processes, Miller (1985) considers coding to be a motoric operation having its influence in response preparation processes. This distinction is crucial because, as Miller states, if the advantage did not arise “in the process of response preparation,” then he may have “erred in using the advantage to infer that response preparation was caused by preliminary information about a stimulus attribute” (p. 224).

The assignment of coding operations by Miller (1985) to response preparation is inconsistent with most general models of human information processing, which distinguish between “perceptual, decision, and response processes” (Miller, 1982, pp. 273–274) or stimulus identification, response selection, and response programming (Schmidt, 1982). Effects that are due solely to stimulus properties or solely to response properties are attributed to perceptual and response processes, respectively, whereas effects that are due to the correspondence between stimuli and responses typically are attributed to decision processes. For example, Schmidt indicates that “the response selection stage is a translation between input and output” (p. 111) and that effects reflecting “the nature of the relationship between the stimuli and the associated responses” (p. 107; i.e., stimulus–response compatibility effects) are attributable to this stage.

The spatial coding accounts proposed by ourselves (Proctor & Reeve, 1984; Reeve & Proctor, 1984) and by Miller (1985), as well as those proposed by Wallace (1971) and Nicoletti et al. (1982) for stimulus–response compatibility effects, emphasize the relation or match between stimuli and responses as being crucial. Miller (1982) previously regarded such spatial coding accounts (i.e., compatibility accounts) as alternative explanations of the effects that he attributed to response preparation (see the discussion, Alternative Interpretations of the RPE, i.e., response preparation effect, in Miller, 1982, pp. 284–285). He briefly described control experiments intended to discriminate between response preparation and spatial compatibility accounts. Miller interpreted the results of these experiments to be “exactly as predicted by the idea of response preparation” and “embarrassing for an S-R compatibility explanation of the RPE, since compatibility effects depend on the assignment of stimuli to response position rather than response limb (Wallace, 1971, 1972)” (p. 285). That Miller (1985) has embraced a spatial coding account of the precuing results subsequent to our strong evidence for such an account (Proctor & Reeve, 1984; Reeve & Proctor, 1984), in turn, is embarrassing for his response-preparation interpretation.

Is response preparation specific to hand placement? Miller’s (1985) second argument against the Reeve and Proctor (1984) interpretation is that the overlapped hand placement we used may not be an appropriate control for nonmotoric processes. Because responses were approximately 220 ms slower overall with the overlapped placement than with the adjacent placement, Miller argued that different responses may have been used (i.e., that the movements may have differed). He suggested that “if overlapping the hands introduced new movements, albeit with the same fingers, it could certainly have introduced new types of preparation as well, and these new types of preparation may have favored different pairs of fingers” (p. 226).

To support the argument that response preparation may have favored “different pairs of fingers in different conditions” (p. 225), Miller (1985) cited a study by Sternberg, Monsell, Knoll, and Wright (1978). However, Sternberg et al. noted the possibility that the programming of response elements may not be invariant within different movement sequences. It seems unlikely that response processes would be affected by hand placement when only a single, discrete finger response is required. In fact, the logic that preparation patterns should not vary with hand placement is so compelling that Miller (1982, p. 285) used various response sets (index fingers crossed; three fingers from one hand and one finger from the other) as his primary manipulation that was intended to evaluate stimulus–response compatibility explanations.

The evidence also argues against the suggestion that response preparation patterns varied with response sets (hand placements). First, studies of response programming suggest that programming occurs independently of the specification of particular muscles (Klapp, 1977; Zelaznik, 1981). Second, results showing that spatial relations are the crucial factors also have been found when the two hands were crossed completely, thus making the response set similar to that used when hands were uncrossed (Nicoletti et al., 1982; Wallace, 1971, 1972). Third, although the overlapped placement used by Reeve and Proctor (1984) increased the overall reaction times, the benefit obtained for the left–right spatial patterns when the hands were overlapped (50 ms) was equivalent to that obtained for the same spatial patterns when the hands were adjacent (49 ms). Thus, the effects of hand placement (adjacent, overlapped) and spatial relations were additive, suggesting that the effects were on different processes (Sternberg, 1969). The likelihood is small that it was “just chance” (Miller, 1985, Footnote 1, p. 225) that the different response sets
used in our experiment produced the same pattern of results. Apparently, Miller does not find the movement-specific response-preparation argument to be very convincing, either, because he also concluded that all of our effects (Reeve & Proctor, 1984) can be explained by a spatial coding account (pp. 229–230).

Can Nonmotoric Processes Account for Miller’s (1982) Results?

Another argument Miller (1985) raised about our conclusions is that nonmotoric processes can account for only a small number of his (Miller, 1982) results. To support this argument, he cited three examples.

The hand advantage for alternative stimulus sets. First, Miller (1985) stated that “one shortcoming of this alternative explanation is that it does not address the hand advantage observed with other stimulus sets (e.g., BE, BO, ME, MO; s, S, T, and T), in which cuing stimuli and preparation conditions could be counterbalanced to eliminate cuing stimulus artifacts” (p. 226). These stimulus sets, which were used in Miller’s (1982) partial information experiments, do allow control for stimulus artifacts. However, our argument is not that the primary artifact is in the encoding of the stimuli, but that it is “in the decision processes that relate the stimulus to the appropriate response” (Reeve & Proctor, 1984, p. 546), or what is often called stimulus–response translation (Larish, 1980).

The stimuli used in Miller’s (1982) partial information experiments do not necessarily control for these translation processes. Although there is no direct spatial relation between the alphabetic stimuli and the responses similar to that in the precuing experiments, the opportunity for confounding from translation processes increases when the stimulus–response relation is indirect (Goodman & Kelso, 1980; Kerr, 1978; Larish, 1980). Our account of the precuing results implies that the spatial arrangement of responses is critical to the translation process. In Miller’s partial information experiments, the same-hand advantage occurs when the salient characteristics of the stimuli distinguish the two left-most and two right-most responses. Thus, the same-hand advantage obtained with indirect stimulus–response relations is consistent with the translation account (see Proctor & Reeve, 1984).

Lack of precuing effects for prepared: finger and prepared: neither conditions at short intervals. The second example provided by Miller (1985) is that the stimulus–response translation explanation “does not account for the lack of preparation effects in prepared: finger and prepared: neither conditions. . . . If preparation in these conditions simply began later due to difficulty in processing the cues, there should still have been some preparation with a full second between cue and stimulus” (p. 226). However, Miller did not provide any evidence that the time to identify, select, and prepare two finger responses cannot be longer than 1 s. Movement precuing studies consistently use only intervals greater than 1 s (e.g., Goodman & Kelso, 1980; Rosenbaum, 1980), most likely because long intervals are required to assure advance preparation of the precued responses. Consistent with the assumption that more than 1 s may be required in some conditions for preparation to be evident, our Experiment 1 (Reeve & Proctor, 1984) showed an intermediate level of benefit for the prepared: finger and prepared: neither conditions when the precuing interval was 1.5 s.

The time course of the hand advantage. Miller’s (1985) third example is that the time course of the same-hand advantage is inconsistent with the stimulus–response translation account. He argued that if the translation account were correct, the advantage “should develop across preparation intervals long enough to allow recognition of those cues but too short to allow recognition of the other cues” (p. 227). Miller then noted that “the hand advantage continues to increase over several hundred milliseconds” (p. 227), as suggested by the translation account. However, he dismissed this increase as most likely not being due to nonmotoric processes because of the interval over which it occurs. This dismissal of the nonmotoric account depends on Miller’s assumption that for the stimulus–response set used, the time to identify, select, and prepare certain combinations of finger responses cannot be longer than 1 s. If the time can be longer than 1 s, as suggested by our data (Reeve & Proctor, 1984), then the observed increase is consistent with the translation account.

Miller’s (1985) Experiment

Miller (1985) supported his arguments against the Reeve and Proctor (1984) study with a new experiment that also manipulated hand placement to control for nonmotoric factors. However, new diamond-shaped stimulus and response arrangements were used so that the response sets for the two hand placements would be more similar to each other than were those used in Reeve and Proctor’s Experiment 3. The new stimuli were asterisks located above, below, left, and right of a fixation spot, and response positions were arranged in similar patterns. For one hand placement, the right hand was placed on two response keys that corresponded to the lower positive diagonal of the stimulus display, and the left hand was placed on two keys that corresponded to the upper positive
diagonal. For the other placement, the left hand corresponded to the lower negative diagonal and the right hand to the upper negative diagonal. Subjects were tested either with the two hands in close proximity at the center of the keyboard (the near keys condition) or with each hand near the respective edges of the keyboard (the far keys condition). The stated intent of the key distance manipulation was to make spatial coding “more salient in the far condition than in the near condition” (Miller, 1985, p. 228).

Three preparation intervals (400, 1,200, and 3,000 ms) and three preparation conditions (unprepared, prepared: hand, and prepared: finger) were employed. For the prepared conditions, the target occurred in one of two positions indicated by the precue. Fingers on the same hand (the prepared: hand condition) were precued when the two cued positions coincided with one of the diagonals on which the hands were placed, whereas the same fingers on different hands (the prepared: finger condition) were precued when the two positions coincided with one of the remaining two diagonals. By using both the positive and negative hand placements, the specific diagonals used to precue responses were counterbalanced across the prepared: hand and prepared: finger conditions. The primary outcomes were that an overall same-hand advantage of 19 ms was obtained and that the advantage tended to be greater for the far keys condition. Thus, Miller concluded that the same-hand response preparation effect is real.

Could Miller’s (1985) Same-Hand Advantage Be Attributable to Nonmotoric Processes?

Evidence for nonmotoric influences. The 19-ms same-hand advantage obtained by Miller (1985) with the diamond stimulus–response arrangements was considerably smaller than the approximately 50-ms advantage reported by Miller (1982) with the linear arrangements. The primary reason for the smaller advantage in his 1985 experiment was that the prepared: finger condition also showed a substantial preparation effect, whereas previously it had shown none. Thus, both prepared conditions actually showed “a larger overall preparation effect” (Miller, 1985, p. 231) than in the previous study. One explanation for this larger preparation effect suggested by Miller (1985) “is that the cues produced more perceptual facilitation” (p. 231) in his recent experiment because of the physical characteristics of the stimulus display. Thus, Miller (1985) explicitly acknowledges that nonmotoric processes are likely contributors to his precuing effects.

We agree with Miller that nonmotoric processes are involved in his precuing experiments, although we believe that the primary contribution is from the decision processes that we have emphasized, rather than from perceptual processes. That nonmotoric processes influence precuing benefits raises the possibility that any precuing advantage could be attributable to these processes (e.g., Bishop & Harrison, 1983). In attributing the 19-ms same-hand advantage to response preparation, Miller must assume that the nonmotoric processes contribute equally to the prepared: hand and prepared: finger conditions. However, such probably is not the case.

A potential nonmotoric confound. The key distance manipulation used by Miller (1985) may have introduced an additional nonmotoric confound to the precuing procedure. According to Miller (1985), this manipulation influences the “coding of responses in terms of spatial position” (p. 228). The problem with the key distance manipulation arises because “in the far condition the configuration of keys within each same-hand diagonal was maintained even though the keys making up these two diagonals were much farther apart” (p. 228). In other words, the manipulation of key distance varied only the distance between the two hands, with the separation of the two fingers on each hand not being altered. As a consequence, the spatial correspondences between the relevant stimulus and response positions were altered greatly for the prepared: finger condition (for which the two precued fingers were on different hands), but not for the prepared: hand condition (for which the two precued fingers were on a single hand). This differential manipulation of spatial correspondences for the two prepared conditions holds for hand placements on both the positive and negative diagonals. Thus, the spatial confound introduced by the manipulation of key distance is not controlled by counterbalancing hand placement on the positive and negative diagonals.

A Response Preparation Account Versus a Translation Account

Predictions of the accounts. Although Miller (1985) and we both favor coding accounts of the precuing effects, as noted previously, his view is that the coding operations reflect response preparation processes, whereas ours is that they reflect decision (translation) processes. These two accounts can be evaluated in Miller’s experiment because they make different predictions regarding the effect of key distance. According to Miller’s response preparation account, “same-hand preparation could benefit from advance specification of both position and hand codes in the far condition, but only hand codes in the near condition” (p. 228). Thus, Miller’s prediction is that the primary influence
of the key distance manipulation should be on the prepared: hand condition, with responses for that condition being faster and more accurate at the far keys separation.

According to our translation account, however, the primary influence of the key distance manipulation should be on the prepared: finger condition. Moreover, the account makes specific predictions about the pattern of results that should occur for both prepared conditions. First, there should be relatively little difference in reaction time between the prepared: hand and prepared: finger conditions at the near keys separation. This prediction derives from the fact that the spatial relationships between stimuli and responses are similar for the two prepared conditions with the near keys separation. Second, the prepared: hand condition should show comparable results at the near and far keys separations because the distance between the two fingers on each hand is not altered, thus maintaining a similar spatial relationship between the stimuli and responses. Third, the prepared: finger condition should show slower responding at the far keys separation than at the near because the spatial correspondence is less direct for the far keys. Finally, the key distance manipulation should have a greater effect at the short preparation intervals because, with sufficient time to complete translation operations regarding precued responses, any pair of discrete finger responses can be prepared equally well in advance (Reeve & Proctor, 1984).

Testing the predictions of the response preparation and translation accounts with Miller's (1985) results. Overall, responses tended to be faster at the near keys separation than at the far keys separation, with the difference being approximately 22 ms for all conditions and 14 ms for the prepared conditions. A similar effect was evident for Reeve and Proctor's (1984) Experiments 1 and 3, in which the hands were separated and adjacent, respectively, with the linear stimulus–response arrangements. Responses were 63 ms faster for the experiment in which hands were adjacent than for the experiment in which they were separated, $F(1, 38) = 4.29, p < .05$. The positive relation between hand separation and reaction time indicates that responses are faster when the response arrangement corresponds more closely to the stimulus arrangement, consistent with the translation account.

The most crucial data, however, are the preparation effects for the respective separations. In his analysis of the prepared: hand and prepared: finger conditions, Miller (1985) found that key distance interacted with preparation interval, $F(2, 64) = 7.04, p < .01$. He interpreted this interaction as indicating "that there was more preparation in the far-keys condition than in the near-keys condition" (p. 231). This interpretation, were it correct, would be consistent with his response preparation interpretation.

However, the conclusion that there was more preparation in the far-keys condition than in the near-keys condition does not seem to be justified on the basis of Miller's (1985) analysis. The reaction-time means for the Key Distance X Preparation Interval interaction are plotted in Figure 1. As previously indicated, responses for the prepared conditions were faster at the near keys separation than at the far keys separation. Most importantly, though, the functions for the near and far keys do not diverge across preparation intervals, as Miller’s interpretation implies, but they converge. These data suggest, then, that rather than preparation being more in the far-keys condition, as Miller concluded, it actually is less. The benefits of precuing occur more rapidly at the near keys separation than at the far keys separation, with responses at the latter separation becoming as fast as those at the former only at the longest preparation interval. Thus, the pattern of the interaction in Miller's data analyses is consistent with the translation account and not with Miller's response preparation interpretation.

Miller (1985) also noted that there was “a greater hand-preparation advantage” (p. 231) for the far-keys condition (30 ms) than for the near (8 ms). However, the appropriate Preparation Type X Key Distance interaction was not reported by Miller as being significant. Thus, Miller's statements regarding the interaction, as well as our own, must be based on nonsignificant trends. Fortunately, the response preparation and translation accounts predict quite different patterns, thus allowing the trend to differentiate between them.

The Preparation Type X Key Distance interac-
tion trend is shown in Figure 2. Several aspects of the plotted figure are relevant to discriminating between the accounts. According to Miller's (1985) response preparation account, the effect of key distance should occur primarily for the prepared: hand condition because a spatial code, as well as a hand code, can be specified for this condition with the far keys separation (see Miller, 1985, p. 228). However, Figure 2 shows that there is little or no effect of key distance on the prepared: hand condition. This lack of effect of key distance for the prepared: hand condition is predicted by the translation account because the correspondence between the stimuli and responses are not altered greatly for this condition. Moreover, also as predicted by the translation account, key distance had its primary effect on the prepared: finger condition. Reaction times for this condition at the near keys separation were similar to those for the prepared: hand conditions, but increased at the far keys separation. Thus, rather than precued responses on the same hand being faster when the hands were separated, as Miller's response preparation account implies, precued responses on different hands were slower.

Although Miller (1985) did not include the unprepared condition in his data analyses, this condition also showed slower reaction times at the far keys separation than at the near (mean difference approximately 38 ms). Because subjects also must distinguish between fingers on the two hands when responding in the unprepared condition, as they must do when responding in the prepared: finger condition, the slower responding at the far keys separation is consistent with the translation account.

In summary, Miller (1985) attributed the same-hand advantage to coding in the response preparation process. However, predictions drawn from his account are not supported by the trends in his data, although the results are in close agreement with the predictions of our translation account.

Conclusions

Miller (1982, 1983) has argued that the "same-hand" advantage is a response preparation effect. To the contrary, we have argued that the advantage reflects decision processes involved in translating between stimuli and responses (Proctor & Reeve, 1984; Reeve & Proctor, 1984; the present observation). This distinction is important not only because of its implications for motor control, but also because of its implications regarding the appropriateness of using the advantage to test between continuous and discrete models of information processing (Miller, 1982). Because "discrete models could be reconciled with the results by attributing the effect to something other than response preparation" (Miller, 1982, p. 285), the "same-hand" advantage must reflect response preparation processes for it to be a valid criterion effect.

That the "same-hand" advantage "depends on a match between cuing information and a spatial response code" (Miller, 1985, p. 232) poses serious problems for interpreting the advantage as a response preparation effect. Benefits associated with the relation between stimuli and responses typically are attributed to nonmotoric translation processes (Schmidt, 1982; Welford, 1976). All of the major differential precuing effects in the studies of Miller (1982, 1985) and Reeve and Proctor (1984), including those of preparation type, preparation interval, hand placement, and hand separation, can be explained succinctly by a translation account. To explain the same effects in terms of response preparation, Miller (1985) has proposed that response coding operations, perceptual facilitation, movement-specific preparation processes, and strategic components for response preparation all may operate in the precuing of discrete finger responses. Although Miller (1985) may find that his results and interpretation provide reassurance regarding the use of the same-hand advantage to test between discrete and continuous models of information processing, we do not.

References


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