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Abstract: Nevin & Grace's primary argument against theory and research on behavioral momentum is that preference and resistance to change may not covary. The method for evaluating preference and resistance to change seems problematic. Moreover, the theory fails to account convincingly for effects of average overall time to primary reinforcement on choice and preference for unsegmented schedules.

In their target article, Nevin & Grace (N&G) suggest that the metaphor of behavioral momentum is productive in guiding basic research on a discriminated operant. First, they advance a view that rate of response reflects performance, whereas resistance to change characterizes response strength. Then they propose a view that preference and resistance to change should covary because they are construed as convergent measures of a single construct, that is, response strength that results from a history of reinforcement.

I fully support the former view that rate of response and resistance to change are independent dimensions of behavior. As reviewed in the target article, there is ample evidence indicating that response rate depends on response-reinforcer relations whereas resistance to change is positively related to the total frequency of reinforcement.

The latter view, on the contrary, leaves me with more questions than answers. First, comparisons of results obtained with concurrent-chain schedules and multiple schedules (Grace & Nevin 1997) might not be an adequate method for evaluating preference and resistance to change. This method is based on the notion that contingencies between responding and reinforcement are different between multiple schedules and concurrent-chain schedules. In multiple schedules, presentations of component schedules are not contingent on subjects' behavior, whereas in concurrent-chain schedules presentations of component schedules are contingent on subjects' choice. However, as suggested by Neuringer (1967), results obtained from choice and nonchoice procedures might depend not only on such a difference in contingencies but also on another controlling variable, the frequency of shift between different reinforcement conditions.

Choice procedures generally produce larger effects on behavior of different reinforcement parameters, such as frequency, magnitude, and immediacy of reinforcement, than do nonchoice procedures. However, this might be partly because the frequency of shift is generally greater in choice procedures than in nonchoice procedures, because subjects usually change over between two alternatives very frequently in choice procedures.

It is therefore possible that multiple schedules with high fre-

quencies of shift (multiple schedules with relatively short durations of each component, say 5 seconds) produce distinct effects of different reinforcement parameters on responding. On the other hand, multiple schedules with extremely low frequencies of shift (multiple schedules with relatively long durations of each component, say 10 minutes) might produce no effects of different reinforcement parameters on responding. Based on this view, Neuringer (1967) compared effects of different reinforcement magnitude on responding in initial links (choice situations) and responding in terminal links (nonchoice situations) with the number of shifts kept identical.

Hence, one needs to examine preference in initial links and resistance to change in terminal links of concurrent-chain schedules with the frequency of shift kept identical between them before general conclusions can be reached about relations between preference and resistance to change.

Second, N&G ignored effects of T on preference when they derived Equation 12 from Equation 7. This implies that their model is restricted to a situation in which average initial-link and terminal-link durations are kept constant. However, even when we follow the contextual choice model (Grace 1994), there remains empirical evidence that choice is affected by the average durations of delay to primary reinforcement at the beginning of initial links (T). In other words, a possibility still remains that different values of T produce different preference in concurrent-chain schedules, but resistance to change in multiple schedules does not vary at all with manipulations of T.

Third, Mandell (1980) confirmed strong preference for a VI x-sec schedule to a FI x-sec schedule but found no difference in resistance between the FI and VI schedules. That is, there is distinct evidence against the notion that preference and resistance to change covary. The reason for this exception is unknown at the present. However, as mentioned in the target article, it is well known that a long exposure to a simple FI schedule engenders an initial pause and rapid responding before reinforcement. Thus, it is possible that after an extended period of training, a simple FI x-sec functions as chained FI y-sec FI z-sec with $(y + z)$ equal to x. If this conjecture is correct, it is suggested that the results obtained from Mandell (1980) have close relation to findings obtained from previous studies on schedule segmentation that used concurrent-chain schedules to examine choice between schedules with and without stimulus changes (for a review, see Takahashi 1996).

For example, Duncan and Fantino (1972) indicated that pigeons preferred unsegmented schedules (a simple FI) over segmented schedules (chained FI FI) with equivalent durations. Moreover, when subjects are required to choose between two segmented FI schedules, "responding in the initial links sometimes cease entirely" (Duncan & Fantino, 1972, p. 31; for a theoretical analysis of this phenomenon, see Takahashi 1996). What is important is that in concurrent-chain schedules, choosing a segmented schedule produces a fixed period of extinction situation (a first segment of the segmented terminal link) that is worse than a situation in initial links. In multiple schedules, on the other hand, responding produces a consequence that is better than a consequence following behavior other than responding. It is accordingly suggested that preference in initial links of concurrent-chain schedules is determined by comparing terminal links with initial links. N&G should also take into account these findings on schedule segmentation.

In conclusion, the metaphor of behavioral momentum is powerful in describing empirical findings on resistance to change and rate of response in terms of response strength. However, its prediction of agreement between preference and resistance to change remains a critical question for future research. The strength of the metaphor is estimated when it is disrupted by a wide variety of empirical findings.