"Tandemness" in Research and Practice

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Like the proverbial bicycle built for two, tandem arrangements in behavior analysis involve events operating in conjunction with one another. Perhaps most-well known in behavior analysis is the tandem schedule of reinforcement, in which two or more schedule requirements must be completed successively, with reinforcement occurring at the end of the last of those requirements. Unlike its chained schedule counterpart, the tandem schedule provides no distinct stimuli associated with the successive schedules in the sequence.


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Tandem arrangements are not limited to sequenced reinforcement schedules, however. In last month's column, I described Ogden Lindsley's adaptation of the ordinary wrist counter to counting events. I noted that the wrist counter's only limitation was "its upper limit of a count of 100. ... Multiples of 100 presumably were accommodated by recording elsewhere successive blocks of 100 responses." In reflecting on this in a conversation with my friend and colleague Jon Katz, I remembered something about the "elsewhere" recording of the successive 100-response blocks. I recall seeing Og at conferences wearing not one, but two of these counters, the second being to record the 100-response blocks. By using two 100-count golf counters in tandem, such that every 100 counts on one golf counters was counted as 1 count on the second, one could expand the counting system from one hundred responses to 100 x 100 counts, or 10,000 counts, a quite impressive number. With multiple pairs of such tandemly operating counters, it was possible to record up to 10,000 instances of several different responses simultaneously. Indeed, Og often wore more multiple pairs of golf counters.

When I mentioned this tandem programming of golf counters to Jon, he reminded me of another important tandem arrangement from the history of the experimental analysis of behavior. From the beginnings of operant conditioning until the widespread use of digital computers in the laboratory circa 1990s, electromechanical relays were used to control operant conditioning experiments. There was a type of electromechanical relay, called a stepping relay or a telephone stepping relay (many electromechanical devices used in operant laboratories were imported from electronic telephone message-relaying systems), which on successive operations stepped a single input through a series of connections, one at a time. A common such relay, a type of which is shown in Figure 1, contained 33 positions. Using such a "stepper," for example, one could arrange a fixed-ratio schedule requiring up to 33 responses by having each successive response pulse the stepping relay until the 33rd position was reached, at which time the input could be sent to operate the reinforcement device. On reaching the 33rd position, the stepper reset to the start position and the FR requirement began anew. Such a 33-position stepper is why in several early experiments involving ratio schedules published in the *Journal of the Experimental Analysis of Behavior*, FR 33s – a seemingly odd number for a ratio requirement - were used. To achieve higher ratios, multiple steppers could be programmed in tandem. Thus, with two such 33-position steppers programmed in tandem, a ratio schedule as high as 33 x 33, or 1089 could be achieved.

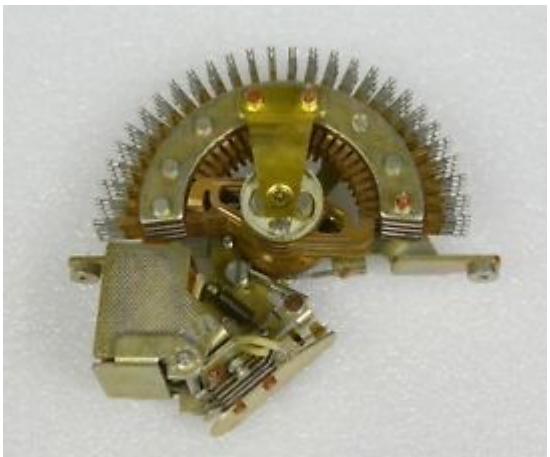

Figure 1. A telephone stepping relay similar to the one described in the text. These relays typically were mounted on a board, or panel as they were called, that was in turned mounted on a rack containing other programming panels wired together with snap leads to yield a program for controlling the schedules used in an operant conditioning experiment.