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Matching analysis of socially appropriate and destructive behavior in developmental disabilities

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Abstract

This study examined socially appropriate and destructive behavior in unconstrained natural environments using a matching law analysis (MLA) of real time observational data. The participants were two school-age children and one adult with mild to moderate cognitive disabilities. Event lagged sequential analysis (SQA) provided the obtained rates of staff attention to socially appropriate and inappropriate behaviors, which were then used in the matching law equations. For one participant the matching analysis showed a high (72%) variance-accounted-for (VAF) in behavior allocation in response to attention. For a second participant, matching analysis conducted on behavior allocation in response to staff attention showed lower (50%) VAF by staff attention. In the third case, the MLA also showed high (94%) VAF by attention. Suggestions for future extensions of matching analysis to clinically significant behavior and the limitations of the MLA for evaluating functional relationships in natural environments are discussed.

Keywords: Matching law; Sequential analysis; Lag sequential analysis; Descriptive analysis

The matching law is a mathematical description of response allocation (Pierce & Epling, 1983). The proportional form of the matching law equation shows that the relative rate of responding will equal the relative rate of reinforcement on two concurrently available alternatives (Pierce & Epling, 1999). The proportional matching law was first described by Herrnstein (1961) using pigeons, but since has been applied to human behavior in experimental settings and some non-experimental contexts (McDowell, 1989).

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The proportional matching equation is written as

$$\frac{r^1}{r^1 + r^2} = \frac{R^1}{R^1 + R^2} \quad (1)$$

where r^1 refers to the rate of behavior on the first alternative, while r^2 refers to the rate of behavior on the second alternative. R^1 is the rate of reinforcement for behavior r^1 while R^2 is the rate of reinforcement for the second alternative. In addition to the proportional version of the matching equation there are other versions of the matching equation (McDowell, 1989). The power matching equation adds constants to the proportional equation to account for two systematic departures from matching, bias and indifference. Bias refers to a preference for one alternative despite the reinforcement ratios favoring the other alternative. Bias may result from differences in the immediacy or quality of reinforcement (Baum, 1974). Bias can be derived from the intercept of the least squares line in log plots of the proportional equation (McDowell, 1989). Indifference occurs when more or less behavior is produced than would be predicted from the matching equation (referred to as overmatching or undermatching, respectively). Overmatching is commonly found in human matching studies (Baum, Schwendiman, & Bell 1999). In experimental studies, researchers increase penalties for switching between the rich and lean alternatives using change-over-delays, to reduce indifference or show overmatching (Baum et al., 1999).

The matching law has been extensively studied in laboratory and analogue settings but has been rarely used in natural settings without experimental manipulation. The majority of matching law applications with people consider button press responding or academic responding (see McDowell, 1989; Pierce & Epling, 1983 for review of human experimental studies; Billington & DiTommaso, 2003 for a review of matching law applications to academic responding). These studies suggest that matching is a robust phenomenon in experimental and naturalistic studies for both academic responding and verbal behavior. Kollins, Newland, and Critchfield (1997) reviewed eight studies that applied the matching law to non-experimental situations in humans, and, of these studies, three were conducted to examine matching with destructive behavior. Since this review two additional studies were found. In the following section studies that applied specifically the matching law to destructive behavior are reviewed.

1. Single alternative applications

McDowell (1981) used the single alternative of the matching equation to compare the verbal attention an 11-year-old non-disabled boy received for skin picking to the attention he received for all other behaviors. A previously conducted functional analysis had shown the boy's skin picking was maintained by positive reinforcement in the form of reprimands from his parents during TV watching in the family's home. McDowell used an iterative estimation procedure which maximized the fit of the equation to the data to estimate the maximum rate of responding the boy could maintain and found that the matching equation accounted for over 99% of the variance in the boy's scratching behavior. This study suggests that the matching equation may be used to quantify response–reinforcement relations in complex unprogrammed environments and may be used on observational data without experimentally manipulating the natural environment.

Martens and Houk (1989) applied the single alternative matching equation in a non-experimental study examining the disruptive behavior of an 18-year-old woman with moderate cognitive disabilities in a high school special education classroom. Staff behaviors that co-occurred with participant behaviors and that were correlated with longer durations of the