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Time since reinforcer access produces gradations of motivation☆,☆☆

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ABSTRACT

Results: of basic research on motivation suggest that response rates vary as a function of independent variable manipulations such as the an amount of pre-feeding prior to experimental sessions or within-session consumption. Response rates vary from zero or low levels through high levels, depending on the manipulation. In applied research and practice, experimenters and clinicians attempt to manipulate response rates via "motivating operations", which generally consist of deprivation and satiation operations. As a result, motivation is often described as "present" or "absent", as opposed to existing on a continuum, as suggests by basic research. Responding is thus predicted to (and usually arranged to) occur at either low/zero levels or high levels. In this study, we (1) summarize relevant basic research demonstrating a continuum of motivation, (2) provide examples in the applied literature of deprivation and satiation operations designed to evoke or abate behavior, and (3) show results of a translational study demonstrating that motivation is more appropriately conceptualized within the context as a gradient rather than simply present or absent. Results of the current study are consistent with basic research in that they suggest that motivation is a more dynamic and nuanced conceptual system than the current applied literature and language suggests.

1. Introduction

The concept of motivation as an influence on operant behavior has been known at least since Skinner's (1938, 1953) descriptions of the effects of deprivation on behavior and early studies on deprivation (e.g., Gewirtz & Baer, 1958a,b; Skinner, 1932a,b). Practically, motivation is an important topic relative to the assessment and treatment of applied problems like severe problem behavior and acquisition training for socially appropriate alternative behavior.

Results of basic research show that behavior (and by inference, motivation) can be manipulated with respect to independent variable manipulations, such as amount of food consumed on a within-session basis. Aoyama (1998) showed that rats' responding maintained on continuous schedules (fixed-ratio 1) decreased linearly as a function of the number of food pellets consumed. That is, as subjects consumed food pellets, response rates decreased despite the continued availability of reinforcers on a continuous schedule, suggesting that motivation to engage in reinforced responding had been abolished.

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In a similar study, DeMarse et al. (1999) showed that within-session consumption of food produced lower response rates over the course of a session. In Experiment 1, pigeons consumed milo at steady levels over the course of 1-h sessions. In Experiment 2, within-session decreases in responding occurred as a function of food consumption. Similarly, Bizo, Bogdanov, and Killeen (1998) systematically assessed the effects of both reinforcer duration and grain size on within-session response rates maintained by contingent food. These results suggested that satiation produced response decrements, and that fairly minor manipulations produced changes in responding.

Other studies have introduced pre-session manipulations (e.g., amount of pre-session feeding on a between-subjects basis) to assess deprivation levels on subsequent responding (Bokkers, Koene, Rodenburg, Zimmerman, & Spruijt, 2004; DeMarse, Killeen, & Baker, 1999). For example, Aoyama (2000) conducted a study in which "hunger state", defined by the amount of consumed pre-session food, produced differential responding during sessions (deprived rats' responded at greater levels than pre-fed rats). DeMarse et al.'s Experiment 3 and Bokkers et al. similarly demonstrated that either increasing pre-feeding amounts or arranging for differential free-feeding weights produced systematic changes in response rates. The authors interpreted differential response rates as an indication of differential motivation. Together, these studies demonstrate the robust finding that pre-session access to reinforcers disrupts response rates in upcoming sessions relative to deprivation baselines.

These findings are particularly relevant to application in programs for individuals with developmental disabilities. For example, clients may sometimes receive pre-session, response-independent access to session reinforcers (i.e., conceptually similar to pre-feeding in basic research), which may compromise the efficacy of that stimulus as a reinforcer (Sy, Borrero, & Zarcone, 2009; Vollmer & Iwata, 1991). Vollmer and Iwata demonstrated that switch closure and block placement co-varied with deprivation and satiation operations, indicating that the value of the reinforcers was established and abolished and responding was accordingly evoked and abated. Interestingly, although the independent variable manipulations were viewed as attempts to establish or abolish motivation (implying that motivation was present or absent), behavior did not occur at exclusively high or low/zero levels.

Some applied research directly evaluated the effects of motivating operations in the context of acquisition training during noncontingent reinforcement and schedule fading (Goh, Iwata, & DeLeon, 2000; Marcus & Vollmer, 1996). Goh et al. initially treated problem behavior with noncontingent reinforcement. Problem behavior dropped to low levels, as expected. Next, Goh et al. superimposed delayed reinforcement of alternative behavior (DRA) schedules to facilitate acquisition of an alternative response. Participants did not acquire the new responses until the noncontingent reinforcement schedules were thinned. These results are consistent with the basic research described above in that motivation to access reinforcers (and related response rates) was disrupted by the provision of noncontingent access to those stimuli. These studies are particularly relevant to application because they show how noncontingent access to target stimuli might interfere with both target behavior and the acquisition of new responses in the response class.

Interestingly, in applied behavior analysis, deprivation and satiation operations are often implemented with the goal of producing motivational conditions that are "present" or "absent" in assessment and treatment manipulations. Although motivation can only be inferred subsequent to a deprivation or satiation operation, the express purpose of such operations is either to evoke or to abate behavior (see Beavers, Iwata, & Lerman, 2013 and Hanley, Iwata, & McCord, 2003 for assessment examples; see Wallace, Iwata, Hanley, Thompson, & Roscoe, 2012, for a treatment example; see Carr, Bailey, Ecott, Lucker, & Weil, 1998, for an exception). For example, control and test conditions in functional analyses explicitly arrange for the presence or absence of motivation (Beavers et al., 2013; Hanley et al., 2003). In control conditions, putative positive reinforcers are delivered independent of responding, and aversive conditions (e.g., instructions) are withheld. In test conditions, in contrast, putative reinforcers are withheld prior to session and only made available contingent on responding within session. Finally, motivation during treatment conditions is typically maximized (establishing operation) to evoke appropriate behavior or minimized (abolishing operation) to abate problem behavior (Michael, 1982, 1993, 2000). Thus, in practice, motivation is typically arranged to be (1) present, such that responding is likely to be strong or (2) abolished, such that responding is likely to be eliminated.

Motivation has also been evaluated in the context of responding for preferred stimuli during preference assessments (Chappell, Graff, Libby, & Ahearn, 2009; Gottschalk, Libby, & Graff, 2000; Hanley, Iwata, & Roscoe, 2006; Kelley, Shillingsburg, & Bowen, 2016; Klatt, Sherman, & Sheldon, 2000; McAdam et al., 2005) or reinforcer assessments (Sy et al., 2009; Vollmer & Iwata, 1991; Zhou, Iwata, & Shore, 2002) subsequent to manipulations intended to assess changes in behavior (and by inference, motivation). Gottschalk et al. compared preference assessment results for food in three conditions: control, deprivation, and satiation. Deprivation consisted of 48 h of restricted access to the target stimulus, and satiation consisted of 10-min access to the target stimulus prior to the assessment. Choices were consistently higher for foods in the deprivation condition than for foods in the control and satiation conditions. McAdam et al. (2005) replicated and extended the Gottschalk et al. study by assessing the effects of deprivation and satiation on leisure items. Results for leisure items were consistent with the those found by Gottschalk et al. Finally, Klatt et al. (2000) extended these lines of research by providing differing amounts of deprivation as opposed to one level of deprivation. High-and-low preference activities were restricted for 15 min, 2 h, or 14 days. Longer deprivation for the high-preference activities was associated with increased engagement. In a direct test of the effects of deprivation level on preference, Chappell et al. (2009) provided choice opportunities subsequent to four conditions: control, immediate, 10-min delay, and 20-min delay since exposure to a target stimulus. Results suggested that delays functioned as establishing operations. That is, choices for the target item in the preference assessment were more likely as the delay increased.