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TIMEOUT FROM REINFORCEMENT: RESTORING A BALANCE BETWEEN ANALYSIS AND APPLICATION

TIEMPO-FUERA DEL REFORZAMIENTO: RESTAURANDO UN BALANCE ENTRE ANÁLISIS Y APLICACIÓN

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ABSTRACT

Timeout from reinforcement is one of the most successful technologies to emerge from basic behavioral research, yet surprisingly little is known about its principles of operation. The majority of research on the topic of timeout has been technological—demonstrating *that* timeout works—rather than analytical—*why* it works. This essay calls for a greater emphasis on the functional characteristics of timeout, the conditions under which it serves an aversive function, and for grounding empirical work in a theoretical framework. Such a return to the functional roots of timeout from reinforcement will advance not only the science of timeout but its successful application as well.

Key words: Timeout from reinforcement, aversive control, punishment, negative reinforcement.

RESUMEN

El tiempo-fuera del reforzamiento es una de las tecnologías mas exitosas que han emergido de la investigación conductual básica, pero sorpresivamente se sabe poco sobre sus principios de operación. La mayoría de la investigación sobre el tópico del tiempo-fuera ha sido tecnológico—demostrando

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que el tiempo fuera funciona—en vez de analítico—*porqué* funciona. Este ensayo llama a un mayor énfasis sobre las características funcionales del tiempo-fuera, las condiciones bajo las cuales tiene una función aversiva, y a fundamentar el trabajo empírico en un marco teórico. Tal retorno a las raíces funcionales del tiempo fuera del reforzamiento hará que avance no sólo la ciencia del tiempo-fuera, sino también sus aplicaciones exitosas.

Palabras clave: Tiempo-fuera del reforzamiento, control aversivo, castigo, reforzamiento negativo.

In this essay we consider some issues arising from the study of timeout from reinforcement. As part of the larger domain of aversive control, timeout has something of a checkered past. First defined by Ferster and Skinner (1957) as a signaled extinction period, timeout had been described by Skinner years earlier as a consequence for incorrect responses on a matching-to-sample task (Skinner, 1950). By the mid-1960s, timeout had emerged as a subfield within aversive control, as evidenced by coverage within the seminal work on punishment (Azrin & Holz, 1966), and as the topic of a review in its own right (Leitenberg, 1965). Leitenberg's review asked whether timeout from positive reinforcement is an aversive event. After critically reviewing the evidence for and against this proposition, he concluded that, although the evidence was sometimes conflicting and difficult to interpret, timeouts can serve aversive functions—at least under some circumstances. Leitenberg recommended a more thorough characterization of these circumstances; as he put it "...finding independent variables having a functional relationship with the aversive properties of [timeout]" (p. 439).

At the time of publication, timeout from reinforcement fell within a range of issues central to operant theory and application, and seemed poised to flourish into a systematic research area. This did not happen; the research agenda outlined in Leitenberg's review was not fully realized. Perhaps this decline was part of the more general decline in research activity in all areas of aversive control. Even during peak years of research activity, however, the study of aversive properties of timeout comprised only a small piece of the research on aversive control more generally. If little is known about aversive control in general, even less in known about timeout effects.

This diminished laboratory research on timeout is especially problematic given the widespread use of timeout in the applied realm. From the mid 1970s to the present, timeout has become the most widely used behavioral technique in applied settings, and, indeed, in everyday life—used routinely in classrooms and homes as well as clinics. Although early applied research was clearly in the spirit of an experimental analysis, once the applied benefits of timeout were recognized, research on timeout began to drift from its basic laboratory roots. The research agenda came increasingly to be governed by

demonstration-type questions—showing that timeout procedures applied to yet another problem or setting, often in combination with other variables in treatment packages—rather than by discovery-type questions—understanding how timeout works by isolating the effective variables.

As a result, while we now know a great deal about timeout effects, much of what we know is technological rather than analytic, rules of thumb rather than controlling variables. We have a compendium of basic techniques, but we lack a clear understanding of the basic mechanisms of timeout. The most we can say at present is that timeout is effective in a range of settings (often in combination with other procedures), but we still know surprisingly little about its principles of operation—the circumstances under which timeout does and does not serve an aversive function. Four decades after it was posed, we are still unable to provide a satisfactory answer to Leitenberg's question.

We believe clear answers to such a question are as important now as ever, both as a foundation for application and as a topic of scientific interest in its own right. Progress will be most rapid if guided by an overarching theoretical framework, and we can think of no better place to begin than with Azrin and Holz's (1966) seminal review of punishment. Azrin and Holz identified 8 variables related to the effectiveness of punishment procedures, which have become the benchmark for assessing aversive procedures. Exploring timeout effects within this framework would enable comparisons to more conventional aversive stimuli, providing critical data on the aversive functions of TO. Some of the variables on Azrin and Holz's list are related to characteristics of the aversive event itself—immediacy, intensity, punishment schedule, and manner of introduction—and it is these variables which have received the most attention in laboratory studies of punishment with both shock and timeout.

Other variables on the list are related to broader contextual variables that modulate the efficacy of the aversive event, such as reinforcement schedule, motivational conditions, and availability of non-punished alternatives. Although receiving less empirical attention, these latter variables are of particular importance in timeout studies, where the aversive functions of timeout depend critically on the contingencies prevailing during the timein environment. One might reasonably assume that any variables that contribute to the reinforcing efficacy of timein would also increase the aversiveness of the timeout, though this is a largely unexplored topic. In one of the few studies along these lines (Kaufman and Baron, 1968), rats' lever presses were punished by timeout from a fixed-ratio food schedule across variations in food deprivation (70%, 80%, and 90% of free-feeding weights). Greater deprivation might be expected to increase the reinforcing efficacy of the food schedule, and with it, the aversiveness of the timeout. Inconsistent with this expectation but consistent with comparable findings with electric shock (Azrin, Holz, & Hake, 1963), response suppression varied inversely with food deprivation: the higher the

deprivation the less the response was suppressed. It appears then that, like shock, timeout acts directly on the punished response rather than indirectly through changes in the efficacy of the food reinforcement schedule.

In other cases, however, the aversiveness of timeout is clearly related to variables operating within the timein reinforcement context. For example, Solnick, Rincover, and Peterson (1977) found that enriching the timein environment enhanced the effectiveness of timeout as a punisher. The timeout was used to punish problem behavior in two children with developmental disabilities. In one experiment, a timeout followed each instance of a problem behavior (tantrums). Paradoxically, tantrums increased. Subsequent reversal and control conditions revealed that timeouts provided an opportunity to self-stimulate, and efficacy of timeout as a punisher was only maintained when the child was restrained to prevent self-stimulation during timeout. In a second experiment, conducted with a different child, timeouts were used as consequences for spitting and self-injurious behavior. Initially, the timeouts increased rates of problem behavior. Then, instead of manipulating the timeout parameters, the experimenters altered the reinforcer quality of the timein environment. In some conditions, labeled “impoverished timein,” the child was given access to one of a fixed set of six toys after correct responses on a discrimination task. In other conditions, labeled “enriched timein,” the child was allowed access to a variety of new toys, and extensive social interaction with the therapist. The timeout punished behavior more effectively in the context of the richer timein environment.

Taken together, the results are mixed. Kaufman and Baron showed that timeout acted directly on the punished behavior, whereas Solnick et al. showed that timeout effects depended in part on the reinforcing efficacy of the timein environment. These results are not necessarily in conflict. Instead, they reflect the myriad circumstances that determine the behavioral functions of timeout as a stimulus event. At minimum, the timein environment must be more reinforcing than the timeout environment if timeout is to be an effective punisher. Otherwise, timeouts will cease to be aversive, and timeouts may function as reinforcers, as in the first subject in the Solnick et al. study. Parallel effects have been reported under laboratory conditions in which it has been shown that animals will escape from stimuli associated with lean periods of reinforcement (Appel, 1963; Azrin, 1961; Dardano, 1974).

The specific function or functions of timeout therefore depend upon the establishing operations and contextual factors at work in the current environment. Timeout and timein are interdependent: The timeout is defined as aversive in relation to timein contingencies, and timein contingencies are defined as reinforcing in relation to timeout contingencies. For example, DeLeon, Neidert, Anders, and Rodriguez-Catter (2001) compared tangible reinforcers with response-produced timeout (escape from a schedule of instructional de-

mands) in a 10-year old autistic child. When compliance produced tangible reinforcement and problem behavior produced timeout, escape-maintained behavior predominated. In a second phase in which positive and negative reinforcers (tangibles and escape, respectively) were arranged concurrently, preference depended on the costs of obtaining them. At low fixed ratios, tangibles were consistently preferred to escape. As the ratio increased escape became more likely, generating mixed preferences. The authors speculated that the higher ratios might have increased the value of timeout as a negative reinforcer by reducing the reinforcer rate in timein.

The interdependence between timein and timeout environments poses some interpretive challenges, however, in its blurring traditional distinctions between positive and negative reinforcement. In the realm of timeout-avoidance, for example, in which behavior postpones or cancels timeouts, changes in frequency of timeouts are confounded with changes in the frequency of positive reinforcers available during timein (D'Andrea, 1971; Ferster, 1958; Galbicka & Branch, 1983; Hackenberg, 1992; Thomas, 1965). That is, because reducing the frequency of timeout necessarily increases the time spent in the timein environment, timeout-avoidance can be viewed either in terms of negative reinforcement (postponing timeouts) or positive reinforcement (increasing the overall density of positive reinforcement by extending timein periods).

What is needed to resolve this interpretive quandary are procedures that separate short-term postponement of timeout from the overall frequency of timeouts and food reinforcement. Using a discrete-trial procedure modeled after an analogous shock-avoidance procedure by Hineline (1970), Pietras and Hackenberg (2000) found that pigeons' key pecking was maintained when it postponed a timeout to a later part of a trial but did not cancel it. This trial structure held constant the overall frequency of timeout and food reinforcement available during timein. Avoidance responding was maintained even under conditions in which such responding increased timeout duration, a manipulation that substantially reduced the overall frequency of food reinforcement.

Yet even here a positive reinforcement account is possible; an avoidance response produced shorter delays to food and food-correlated stimuli. Such dual interpretation is inevitable with timeout procedures, as the timeout is defined as aversive only in relation to the accompanying timein. If there were no difference in the delay, duration, or rate of timeout, then timeouts would cease to be aversive. Behavior maintained by postponing or reducing timeouts is also, by definition, behavior maintained by extending or increasing timein-correlated stimuli.

Such interdependence between positive and negative reinforcement will always be the case with timeout contingencies, and at the boundaries clear

distinctions may be difficult. At a conceptual level, we may even consider abandoning the distinction between positive and negative reinforcement altogether (Michael, 1975). At some levels of abstraction, differences in directionality may be irrelevant: Reinforcement is reinforcement, whether it is presented or removed, and the distinction can be safely ignored. At the more practical levels of experimentation and application, however, the distinction remains useful. For one thing, it suggests important variables to manipulate. When timeouts are presumed aversive, certain operations are suggested (e.g., TO-punishment, TO-avoidance). When timeouts are instead presumed to act as reinforcers, different operations are suggested (e.g., TO-presentation schedule). Finally, when timeouts are presumed to exert indirect effects on positive reinforcement variables, still other operations are suggested (e.g., reinforcement density in timein).

To be sure, there will be fuzziness at the boundaries, where the distinction between presentation and removal will sometimes be difficult. But even so, the directionality of the stimulus change is only one aspect of the problem of characterizing timeout effects. Others include the types and ranges of events that function as reinforcers and punishers. Useful here will be procedures designed to assess the efficacy of qualitatively different reinforcers (DeLeon & Iwata, 1996; Fisher, Piazza, Hagopian, Owens, & Slevin, 1992; Ivancic, 2000). Recent studies of reinforcer preference have shown that reinforcer value depends both on the cost of obtaining the reinforcer and on the availability of concurrent sources of reinforcement (DeLeon et al., 2001; Perry & Fisher, 2001; Tustin, 1994). Such results underscore importance of assessing reinforcers in relation to a broader economic context—the array of reinforcers, punishers, and establishing operations that determine the behavioral functions of stimulus events. To date, this research has mainly focused on positive reinforcers with only ancillary attention to timeout. Expanding the range of timeout (and timein) manipulations on these procedures would provide an important source of parametric data on the efficacy of timeout and how it varies as a function of other classes of variables, both direct (timeout frequency, magnitude, etc.) and indirect (timein reinforcer density).

Work along these lines has the potential to rapidly advance our understanding of timeout effects, bringing within reach key variables for a functional analysis. It would also yield tangible applied benefits. To take just one example, a potential outcome of a reinforcer assessment procedure is that a timeout would serve as a punisher in the context of a rich schedule of social reinforcement and as a reinforcer in the context of an instructional demand situation. Such an outcome would have clear treatment implications, delineating the conditions under which a timeout would be most effectively deployed. Unlike the more purely technological goals that have characterized most applied research on timeout, however, this type of discovery-driven research

would advance a functional analysis of timeout effects of the sort envisioned by Leitenberg some four decades ago. At the same time, it may also help restore a more effective balance between a technological understanding of timeout—*that* it works—with an analytic understanding of timeout—*why* it works.

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