TECHNICAL INFORMATION

A PROCEDURE FOR USING BONUS COURSE CREDIT TO ESTABLISH POINTS AS REINFORCERS FOR HUMAN SUBJECTS

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One of the continuing challenges of conducting experimental analyses of human behavior lies in locating effective reinforcers. Primary reinforcers are appealing conceptually, but difficult to arrange. For example, humans can respond for food, but experimenters do not control the establishing operations that make food reinforcing (e.g., Galizio & Buskist, 1988). Humans can be placed into a cold room and respond to illuminate a heat lamp (Silberberg, Thomas, & Berendzen, 1991), but most investigators will not have the specialized facilities needed for this kind of arrangement. Perhaps because of the practical difficulties associated with arranging primary reinforcers, many studies have employed points as the primary consequence of performing experimental tasks. Although humans sometimes work hard for points alone (e.g., in video games; see also Weiner, 1963), it is unclear how reliable or robust this effect may be in the context of the typical experiment. Thus, many studies have made points exchangeable in a way that presumably establishes them as conditioned reinforcers. This, too, raises practical concerns, because the commodities for which points might be exchanged (e.g., money) can be in short supply.

We have developed a procedure for establishing points as reinforcers using a commodity that is available in ample quantities in most college settings and is in great demand among college students, namely course credit. At most colleges and universities, ethical taboos against coercion preclude making research participation a direct course requirement, but many institutions allow bonus credit to be awarded for research participation. Unfortunately, as normally devised, bonus-credit procedures reward only attendance at experimental sessions, and thus contribute little to the moment-by-moment operation of operant tasks. With the use of a small deception, however, course credit can be used to motivate operant performance across several hours of participation.

The informed consent agreement that we use indicates that, by performing the experimental task, subjects can earn "seconds" of participation time, and that a subject's participation is documented, for bonus credit purposes, in terms of these "seconds" rather than in terms of time actually spent in the lab. Below is a relevant excerpt from one of our consent agreements.

> For participating, you can earn credit in courses the offer bonus credit for research participation. We will be happy to document your participation, but arranging for credit is between you and your instructor, and the amount of credit that you receive depends on course rules set by your instructor. Here is how your participation will be documented. At times, the actions that you take during the experimental task will earn points worth seconds of participation time. The participation time documented for your instructor is measured in terms of these seconds, not necessarily in terms of how much time you spend in the lab. If you accrue seconds quickly, you could earn 10 hours of participation time in as little as about 8 hours spent in the lab. If you accrue seconds slowly, you could work in the study for 10 hours but receive less participation credit. For example, if you worked for 10 hours, but received only 8.5 hours in points, you would receive documentation of working for only 8.5 hours. In the past, most participants in our research have received seconds roughly commensurate with their actual involvement in the study. But your point earnings depend on your performance, so we can make no guarantees about what you will actually receive.

In reality, all subjects receive credit for all time spent in the research. But the instructions in the consent agreement establish a clear (if bogus) relationship between points accrued in the study and points applied toward a course grade.

Applications

We have used this procedure successfully with approximately 200 subjects in studies involving response-independent reinforcement (e.g., Ecott, 2000), concurrent reinforcement schedules of both positive and negative reinforcement, and stimulus equivalence and other forms of stimulus control (e.g., Innis, Lane,

Miller, & Critchfield, 1998; Lane, Clow, Innis, & Critchfield, 1998; Schlund, 1996). Casual observation suggests that most of our subjects care a great deal about accumulating "seconds." Below we offer two examples of the control engendered by these reinforcers.

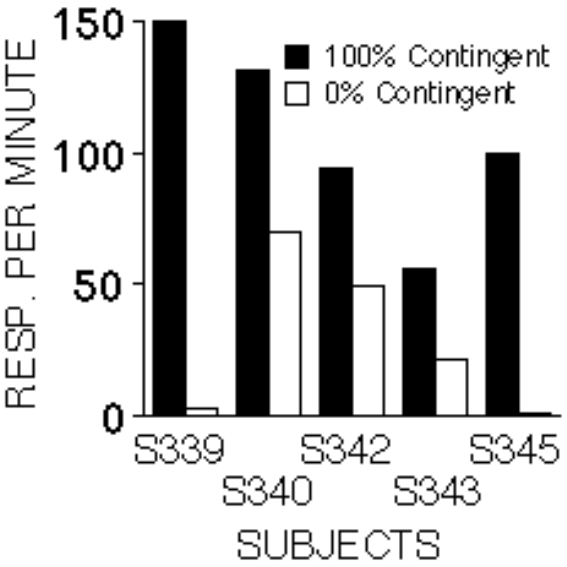

Figure 1

In one study (Ecott, 2000), baseline performances were instated using a two-ply concurrent variable-interval (VI) schedule with a programmed reinforcement ratio of 3:1. The reinforcer consisted of seconds as described above. During the baseline, the proportion of responses allocated to the rich alternative ranged across subjects from 0.65 to 0.92, values broadly consistent with predictions of matching theory and the results of previous human matching experiments (e.g., Kollins, Newland, & Critchfield, 1997). The concurrent schedule was used as a context in which to evaluate effects of response-independent reinforcement. Across several conditions, some or all of the rich-side reinforcers were converted to response-independent point deliveries. Some of the effects are summarized in Figure 1, which compares rich-side response rates in the 100% response-dependent baseline to those in the 0% response-dependent condition (replications have been averaged). Removal of the contingency reduced rich-side response rates markedly for all subjects, closely paralleling findings in previous studies using more typical reinforcers with both nonhumans and humans (Lattal, 1995). Because response-independent reinforcers could follow either behavior, obtained reinforcement rates were free to vary from programmed rates, and the results thus were amenable to analysis according to conventions of the generalized matching law (Baum, 1974). As the data from a representative subject illustrate (Figure 2), log response ratio was a linear function of log reinforcement ratio, as usually seen with other types of reinforcers (Kollins et al. 1997).

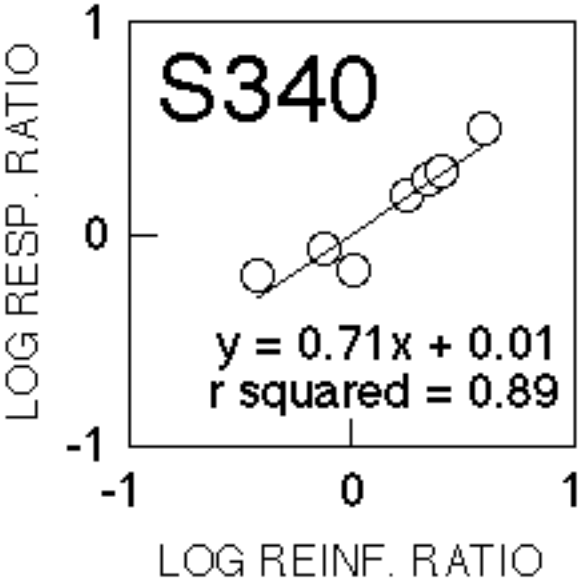

Figure 2

In a second study, subjects worked on concurrent VI VI schedules with the programmed reinforcer ratio fixed at 1:1. Across conditions, the number of "seconds" earned per reinforcer in each of the two schedules was manipulated to produce reinforcer-magnitude ratios ranging from 1:1 to 9:1. Data from a representative subject (Figure 3) show that log response ratio was a linear function of log reinforcer-magnitude ratio.

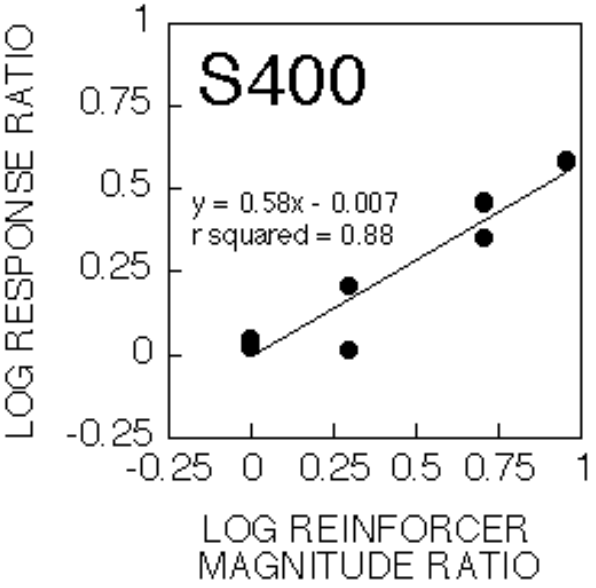

Figure 3

Taken together, these examples suggest sensitivity of behavior to contingencies involving "seconds" as reinforcers. In the first example, our results are consistent with those obtained with other reinforcers. In the second example, sensitivity to reinforcement (i.e., the slope of the matching function) may be superior to that seen in a previous study of human matching to reinforcer magnitudes in which money served as the reinforcer (Wurster & Griffiths, 1979).

Practical Considerations

Although the procedure described here has proven useful in our research, and may be useful to others, several ambiguities and limitations must be acknowledged. First, as is the case with other forms of conditioned reinforcement, the underlying establishing operations are likely to vary across subjects. For example, individual instructors, not investigators, control the rules by which research participation is converted into bonus credit, and, different subjects will have different degrees of need for this bonus credit. Investigators rarely know these details. In our view, however, this renders "seconds" no less reliable as reinforcers than money (e.g., investigators rarely know much about subjects' financial status).

Second, because most institutions place limits on how much research participation can be applied toward bonus credit, our procedure can support studies of only short to moderate duration. At Auburn University during the period in which the procedure was developed, Psychology students could apply up to 10 hours of research participation per academic term toward bonus credit in a course. Within this duration of participation, we have completed a number of stimulus equivalence studies, plus pilot research promoting the development of lengthier investigations on other topics. The lengthier investigations have required money reinforcers, and it is encouraging that, so far, our pilot results (with "seconds" as reinforcers) have adequately predicted what was found subsequently (with money as reinforcers). Moreover, our pilot work has sometimes suggested economical designs for the main research, thereby saving money.

Third, our procedure places a great premium on accurately estimating the rate at which reinforcers will be earned. All of the studies in which we have applied the procedure employed time-based (e.g., variable-interval or variable-time) schedules and/or discrete-trials procedures with fixed trial duration. Thus, in each study, we knew in advance roughly how many reinforcers could be earned per unit of time, and set the reinforcer magnitude to allow "seconds" accrued to roughly match time actually spent in the study. This is important because debriefing even one subject during the course of an experiment may destroy the deception regarding "seconds" for future participants. Among the many subjects who have experienced the procedure in our research, earnings have fallen short of actual participation time for only a few, and in most cases this problem was detected early enough in a subject's participation to allow the scheduling of a special, reinforcer-rich condition to alleviate the shortfall. Occasionally, due to time constraints, these special conditions have replaced ones called for in the experimental design, requiring the subject ultimately to be dropped from the experiment, but that seemed a cost worth paying under the circumstances.

Ethical Concerns

Institutional Reviews Boards (IRBs) must be alert to participation inducements that could create coercion, and course credit is a concern when research participation is a strict course requirement. But our procedure employs bonus credit procedures only. Bonus credit raises ethical concerns if its value is excessive, or if non-research alternatives are not available to those who wish to earn bonus credit without serving as a subject. To the extent that these issues are addressed in local subject-pool policies, our procedure is unremarkable.

When reasonably charged, IRBs have the dual role of protecting both human subjects and an institution's capacity to conduct ethically-defensible research. From this perspective, it is worth noting that typical academic subject-pool policies, which assign bonus credit merely for attendance, can be harmful to the scientific mission of operant research because they arguably undermine motivation in experimental tasks. Our procedure establishes a within-study motivational system that is effective enough to support good science but unlikely to create coercion.

The deception inherent in our procedure will attract special scrutiny by the local IRB, and will require post-experimental debriefing of subjects to rectify the deception. By any standards, however, the deception is relatively minor. Subjects are not exposed to conditions that may challenge important beliefs about themselves, as in the infamous Milgram studies, and they ultimately receive fair "compensation" for their participation.

Originally, the Auburn University IRB was somewhat cautious about our procedure, and we were required to debrief each subject about the deception. This concerned us because of the likelihood that social interactions among volunteers and potential volunteers would ruin the deception for future participants. After some negotiation with the IRB, we were permitted to

debrief by mail at the end of each academic term, except when a subject's total of "seconds" earned fell far short of actual participation time (in such cases, immediate debriefing remained necessary). Eventually, when we could document that nearly all subjects earned "seconds" commensurate with their actual duration of participation, the IRB concluded that, in functional terms, no deception was occurring for most subjects, and we were no longer required to debrief those subjects whose credit earned closely matched their time invested in the study. Obviously, however, the procedure's acceptability will depend on the local IRB's attitudes toward deception.

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