

THE REINFORCEMENT OF BEHAVIOUR: THEORETICAL AND PRACTICAL ISSUES IN AN EXPERIMENTAL CONCEPT

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Abstract

The principle of reinforcement, which originated with the experiments of Pavlov on reflex responses, and, later, extended to operant behavior by Skinner, was a real scientific advance in the biological formulation of learning phenomena in a broad range of vertebrate and invertebrate organisms. However, the experimental concept of reinforcement for operants, as an analytical principle, has been considerably weakened in both laboratory and non-laboratory practice by calling a reinforcer a *reward*. This prevailing ethos in behavioral psychology of using the term *reward* has had adverse effects: in limiting the analytical potential of the concept of reinforcement and therefore the interpretive possibilities of the science of behavior itself. More importantly, the extensive use of the principle of reinforcement in psychology has tended to amplify certain practices associated with the notion of reward which oftentimes are undesirable. A case is made for adhering to the scientific formulation in order to show that the experimental concept of reinforcement has a versatility, so often demonstrated in the history of science, that is directly applicable to regions of analysis not accessible to the layman's term *reward*. Finally, some basic problems in cognitive and humanistic psychology are seen as related to the technical definition of reinforcement and of behavior as a response of the whole, intact organism.

Introduction

It has been some over fifty years since Skinner (1931), inspired by Ernest Mach's *Science of Mechanics* and P. W. Bridgeman's *The Logic of Modern Physics*, discovered a method for describing the behavior of the whole intact organism as a function of stimuli and environmental operations. The history of the discovery and its subsequent development are described in his *A Case History in Scientific Method* (Skinner, 1958). He found quite by accident the basic idea that a crucial dependent variable in the study of the behavior of the organism is rate of responding. In his formulation, the behavior under study is deliberately simplified, the record of its occurrence is plotted cumulatively and continuously as a function of time, so that the slope of the curve becomes a measure of the strength of the behavior at any given moment. Alternatively, one may state the same idea this way: How strong or probable a response is can be described in terms of frequency of its occurrence in time; the more frequent per unit time, the stronger the behavior; the less frequent per unit time, the weaker the behavior; and the limiting case is zero frequency per

unit time, which means the behavior does not exist within that time.

The above formulation now has become the basis for the systematic study of the effects of various experimental treatments on laboratory animals the most important of which is that of consequating the behavior of the organism with an event, a reinforcer, in order to increase the future frequencies of the behavior. (Skinner, 1983; Morsè, 1966). This is the familiar principle of reinforcement of operant behavior (instrumental conditioning). For example, an animal press on a lever is followed by food, and the rate of the pressing response increases. Or, as in ordinary life, a man comes for a visit and if the visit is appreciated, the subsequent frequency of visits now increases. Thus, in this approach, frequency or rate of responding, thus becomes the fundamental datum in experimental analysis of behavior and is a technical idea which can be applied irrespective of the topography, magnitude or intensity of the response, under a great variety of conditions in time, space, and circumstance, and within a fairly broad range of animal species (Denny, 1970).

Changes in rate of responding are directly observed, they have dimensions appropriate to a scientific formulation, and under skillful experimental control they show the uniformity expected of biological processes in general. (Skinner, 1966)

Now the foregoing is but a thumbnail stroke presentation of a principle out of which a large and complex behavioral science and technology has been spawned in modern times. There are omissions and forshortenings: but all I want to state is the rate of responding as a dependent variable has proved itself to have a versatility and elegant simplicity which has been surprisingly equal to some of the most challenging problems of the laboratory and literally almost all fields of psychology.

No branch of psychology is today untouched by the concepts of operant conditioning. Most obviously, experimental studies of learning and performance have been vastly facilitated by Skinner's box; but the other traditional fields of motivation, emotion, language, and thinking owe as great a debt, although it is as yet largely unrecognized and unpaid. Even students of perception, that obdurately most mental of the disciplines, have insights from the proper formulation of the discriminative functions of the stimulus. Outside the psychologist's laboratory, education and training have been offered hope of revolution by programmed instruction, a direct outgrowth of operant principles. Develop-

ment theorists are increasingly grounding their concepts from the discovery that the consequences of even innate behavior patterns contribute to the form and future fate of such patterns. And the psychotherapeutic process has undergone radical reappraisal in the light of the insistence of operant conditioning that actual changes in patient's behavior are the only valid index of cure or improvement. This basic approach to mental illness has, in fact, crystallized into a successful behavior therapy. (Reynolds, 1968)

Alternative Versions: "Rewards" for Reinforcers

Somewhat later experimental work on learned behavior, also along Pavlovian lines, had formulated the principle of reinforcement in terms of drive or need reduction, i. e. that habit strength is a function of physiological (drive) discharge, such as when food or water is given as a consequence of behavior (Hull, 1943). A very influential generation of students carried on research within a conceptual framework laid out by Hull of Yale University and many others, which stated the principle of instrumental conditioning (operant reinforcement) in terms of rewards instead of the more general concept of reinforcers. Rewards to this group of workers are events that strengthen the connection between stimulus pattern and the response. The important point to note is the use of lay term *reward*. While it is true that this term is defined objectively in terms of laboratory operations and should be understood as thus defined, words such as *reward* have other connotations within the culture which directs or guides scientists and laymen alike in their work of utilization of the concept.

The older experimental statement from the principle of operant reinforcement dates back to Thorndike who formulated the Law of Effect, which states:

Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal will, other things being equal, have their connections with that situation weakened, so that, when it recurs, they will be less likely to occur. The greater the satisfaction or discomfort, the greater the strengthening or weakening of the bond. (Thorndike, 1911)

One need not point out that this formulation is anthro-

pomorphic, subjective and hedonistic. The pleasure-pain principle of course is very much alive in Thorndike's statement and the Hullian term *reward* is but a variation of this idea. Hullians and others worked with mazes and memory drums, and only later, with the free operant in the Skinner box, in recognition of the advantages of the concept of rate of responding as a fundamental datum in experimental work of this type. But they have persisted to use the term *reward* instead of reinforcers for nearly 40 years as almost all of the papers by Hullians in the journals attest to.

The lay term *reward* of course is easier for the layman and scientist to use because this vocabulary is more easily recognized in actual practice, either in the laboratory or in the natural setting. Rewards in the form of food, water, praise, attention, money, candies and the like are given in order to strengthen behavior. In education and clinical practice, rewards tend to be the usual culturally accepted reinforcers such as money, privileges, cigarettes, attention, praise and the like. It was only lately that biofeedback stimulation was recognized to be a reinforcer in an operant conditioning paradigm (Kamiya, 1962), although Lindsley (1962) about the same time was doing work along similar principles under what he termed as *conjugate* reinforcing conditions. In both of these experimental work, forerunners of the biofeedback movement in behavioral medicine, there was continuous reinforcement in a cybernetic loop, but obviously the term *reward* could not be used in place of the more technical and general word *reinforcer*, in this case a continuous feedback reinforcer.

Adverse Impact of "Reward" Orientation

It is only natural that scientific design in laboratory work should simplify experimental situations for the purpose of analysis. This is the very heart of method in the natural sciences: one starts with simpler situations, laboratory analogues of real life processes that are too complex for experimental control. The choice therefore of reinforcer events are of those that are easily identifiable and standardized, such as food, water, or any discrete object or stimuli which can be counted and measured. As analysis progresses into firmer ground, the experiments become more complex. The use of the term *reward* was understandable for identifying these reinforcers, but since the principle had already been extracted and extended rather widely to many other kinds of experimental situations, there was no need to retain the lay term. But in fact it has stayed on.

The flow of knowledge from the laboratory to classroom and field setting has been characterized by a singular obduracy to

being guided by the language of the scientific community. Popular culture in turn has reciprocated in confirming by actual usage its recognition of the pleasure principle embedded in the use of the term *reward*.

It is not any cause for surprise therefore that educated groups in the humanist tradition see in the principle of reinforcement, or operant conditioning, elements of an idea that are associated with aspects of current material culture which are in bad repute. Rewards have been interpreted as bribes. Food, personal recognition, money and sex as rewards generate their own problems. They are reinforcers in the true sense of the word generally, but not always. Token economies work essentially along reward conditions in the foregoing sense, psychotherapies employ attention and praise giving procedures, and clinical visualization techniques implement the pleasure-pain criterion in order to reinforce or condition the human response. Behavior modification in educational settings utilize attention, praise, grades, and graphs and counts as discrete feedback rewards. There is in general perhaps basically no objection to these methods, but they have kept us from realizing some of the deeper significance of the principle of reinforcement in human life. The general definition which states that reinforcement occurs when behavior is followed by events that strengthen behavior should permit us to explore the farther reaches of human reinforcers that are not rewards in the usual sense of that word.

Covert Reinforcers

Reinforcers that had their origins in the external world such as foods, diplomas, person presence, praise, and so forth eventually find a counterpart in the covert, non-observable response of the organism: in imagination, visualizations, fantasy, dreams, and thinking. Cautela (1979) and numerous other workers have shown that one can obtain reinforcing effects by following a response with an imagined reinforcing experience. For example, an hour's work on the typewriter could be reinforced by following it with a visualization of an eating session or a scene on the sunny beach with the cool winds blowing on one's face. Or an aversive experience can be reconditioned by imaginatively pairing it with a pleasant episode in one's life. The point is that this is still the principle of reinforcement operating on covert operants. Thinking, visualizations, problem solving, creative reflection and fantasy are true behaviors or responses because they may, for scientific reasons, be assumed to obey the laws of reinforcement, extinction, reconditioning, discriminative control, and all the concepts of the laboratory in the study of visible, learned overt behavior. And the

chief criterion for this point of view is a pragmatic one: it enables us to handle our data more effectively and to integrate many diverse phenomena into something understandable and controllable.

Extending our Range of Reinforcers

Reference was made previously to modern biofeedback procedures as a reinforcement technique that does not need or deserve to be called a reward. There are many situations of this nature that occur in human life which has the property of strengthening the human response that are generally not recognized as reinforcers, let alone as rewards. For example, when one *recognizes* a match between a tone that one produces with another tone that he has heard elsewhere, there is reinforcing effect on the production of the matching tone. When a problem solver senses a structural fit of a solution to a problem, there is also a reinforcing effect which leads to further problem solving behaviors. The recognition of fit in structure or quality of a response is automatically reinforcing phenomena of this sort are not rewards in the ordinary meaning of that term. They are in fact reinforcers with a complex history of social interaction in the life of the person, but they have achieved a functional autonomy that now seems to separate them from their historical origins.

The list of such kinds of reinforcers are numberless: being able to find your way around in unfamiliar environment, being able to see things more clearly, to recognize a good fit in our perception of apparently disorderly displays, experiencing new perspectives in ordinary routine affairs, being able to manipulate new verbal structures in speech and writing, all these generate high probability responses so long as they are consequent upon these prior responses. It is easy to identify all these as the domain of the artist, of the intellectual and, just as much, of the ordinary person. These of course have not been set up in the laboratory with the appropriate experimental design simply because of the exceeding complexity of the situations represented by these reinforcers. But our account is plausible in that the main outlines of the principle of reinforcement are recognizable. And we only need to try them out for ourselves in order to get some feeling for the reality of this statement.

Old Horizons and the Scientific Temper

We find it easier perhaps to understand some themes from both the traditions of the East and West which have come to us every now and then as persistent echoes from the distant past.

Pain and suffering is a never-ending problem of philosophy in the classical sense, when psychology had not as yet then separated from it as an independent discipline. The ancients several thousand years ago evolved a teaching of indifference or non-attachment to worldly concerns and the fruits of action, all of which are reinforcers or *rewards* within the workaday world of us ordinary men. Success and failure, especially in competition, may thus not affect the person whose belief system does not consider success and avoidance of failure as important to their lives.

By the same token, ego-strengthening procedures, so dear to psychoanalysis and self-concept theories of personality, may not be utilized as reinforcers in belief systems and practices that uphold self-renunciation, because all ego-enhancing behaviors, according to these beliefs, merely multiply problems even if they permit a temporary remission of difficulty or symptom.

So the question is where are the reinforcers of self-renunciation and non-attachment styles of living? You do not get an answer so long as reinforcers are rewards that are objects and proferments of the material culture in the sense that we practice it in the present century. But if the reinforcers are in the recognition of fit in quality and structure of our own educated perceptions, then the principle of reinforcement in operant conditioning may yet be seen as furnishing one possible humanistic insight arising from scientific work with animals.

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**DISCUSSION ON
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Virgilio G. Enriquez, Ph.D., Discussant

A basic theoretical and practical issue which needs to be discussed is whether indeed a reward is not a reinforcer and analogously if a reinforcer is not in effect a reward. In addition, we can talk about the problem of choice of appropriate terminology. The choice of labels naturally involves the question of connotation as a point to consider in developing a technical terminology or any specialized lexicon for that matter. However, the primacy of the denotation in scientific discourse makes it definitely more important than the connotation of a term.

Are we in a position to claim with some degree of certainty that either some reinforcers are non-rewarding or that some rewards are non-reinforcing or both? If in fact it can be shown that indeed we can talk about "rewards" in technical work -- as if we cannot distinguish it from reinforcers, then probably we can say that we do not have a prior ontological problem, it is just that we do not like the word "reward", because of its connotation. Dr. Lagmay gave some examples in his paper which suggest that possibly the two are logically different.

Considering the task of utilizing and developing psychology in the Philippine context, one has to grapple with the problem of terminology in the Filipino language. It makes sense to discuss the term, label or the name itself, and the issues that relate to the name. For practical reasons, a name can be as important as the concept named. The oft-quoted phrase "a rose is a rose by any other name", does not really make psychological sense. If you give people the wrong name, somehow people react to them the wrong way. The name has psychological significance. We know that technically it makes no difference; scientists can agree to call one thing by another name and so long as they are clear about the agreement, no problem ensues. This is just exactly what we do in scientific discourse. However, we have to proceed with caution in as much as we are interested not only in communicating with fellow scientists but also with the layman.

In fact, one can turn the table around and ask why we object to the word "reward", when we have more reason to object to the unwanted connotation of the word "reinforcement." With

“reward” one worries about unintended moral implications. The experimental psychologist is not at all saying that one pigeon is better than another because it pecks at the key and therefore deserves a reward with mongoes. By choosing the word “reinforcer”, we are using a term with another connotation. When one grapples with this problem in Pilipino, the word “pampatibay” comes to mind. Mind you, the word is not a happy one and it is not any better than “gantimpala”.

Ang pagbibigay ng pagkain sa hayop para “tumibay” ang kanyang kilos ay nakakatuwang pakinggan pero tila mali ang gamit ng salitang “tumibay”. Wari’y mas magandang salita talaga ang salitang “gantimpala.” Kapansin-pansin na iba ang konotasyon ng “reward” sa “gantimpala.” Para sa mga Pilipino ang “gantimpala” ay isang bagay na talagang nakukuha sapagkat ito ay hindi lamang nararapat bagkus ay “nakatadhana.” Mayroon kaunting ideya ng “immanent justice.” Ang salitang “reward” ay higit na nauunawaan kapag may taong nakakakontrola sa sitwasyon. Ang taong nakakakontrola ang siyang nagbibigay ng “reward” samantala kapag sinabi nating “napala”, hindi lamang dahil sa ito ang nararapat niyang makuha dahil sa kanyang kagandahang asal kundi iyon talaga ang dapat mangyari sa kanya.

Different cultures have different ways of interpreting what’s “actually” happening when a behavior is reinforced. I agree with Dr. Lagmay that to avoid unnecessary connotations, we must as well avoid using a term such as “reward” which have that excess baggage of “moral” meaning. Similarly, the question: “why use the term “reinforcer” can also be raised. Why can’t we just as well use Braginsky and Braginsky’s term in *Mainstream Psychology* such as “zog” the meaning of which, by the way, is exactly what is meant by “reinforcer” in learning theory. I must thank Dr. Lagmay for his stimulating paper. It makes one think anew regarding the problem. If only by way of a remark, I should like to share with you the decision that seemed feasible in our work. Instead of using “gantimpala” or even “pampatibay”, we simply use the word “reimporsment.” Of course we spell reimporsment with an “m” and a “p”. And it appears in sentences like “Nakakareemporse ka naman” or Nakakareempors and kanyang ginawa”.

Thank you very much.

Horacio R. Estrada, M.D., Discussant

I cannot overemphasize Dr. Lagmay’s plea to return to the old term “reinforcer” instead of the popularly-understood term, reward. I remember two instances during the earlier year of my clinical practice when the term reward got me into serious trouble.

One was before a class of interns and residents, whose background is mainly psycho-analytic (ego — super-ego) — and I was trying my best to impress them with the simplicity, economy, and facility with which behavioral methodology is recorded and evaluated. I did not make any impact on the class because they were immediately put off by my use of the word reward — For such young and idealistic students, UP students at that, such unethical practice cannot be tolerated. They were equating the word reward — with “lagay” — which they claim is a great behavior modifier to many government officials. The second was a patient with matrimonial problems. As I was explaining, the strategy and technic of treatment to the couple, such strategy and technic involved — approach behavior by the wife — for behavior from the husband, I wanted reinforced. I wrongly used the word reward once more, and immediately the hostile and sensitive wife remarked — “kung sino ang may sala, siya pa ang prepremyuhan.” In another part of Dr. Lagmay’s paper, he mentioned the covert reinforcers of “Cautela” and I should share with you — a fortunate circumstance I am in. My office-clinic is quite near the Department of Pathology, wherein is displayed a beautiful museum piece of a lung ravaged by bronchogenic — carcinoma. Without fail, I conducted all my patients who wish to quit smoking for a 3-to 5-minute viewing of said museum piece and monitor very fastidiously with a patient diary — I provide a patient diary card — how obedient they are in following my instructions — to imagine said museum piece everytime they draw a stick of cigarette. I must confess my cases may not be amenable to statistical analysis, but my percentage of success in my few cases have been quite high. Thank you so much.

Jaime Bulatao, S.J., Ph.D., Discussant

Dr. Lagmay’s paper seems to me to be showing a new development of behaviorism. In fact, the first part of his paper also mentions the original formulation of Thorndike, and how it was a very highly mechanistic approach. Behaviorism itself grew out of a certain feeling of inferiority on the part of psychologists, a fear that they were not scientific enough. So they had to insist that they were scientific, which meant at the time that they followed the model of the Physicists. Since that was 1911, the physics that they modelled themselves on was Newtonian physics. This was before the advent of Einstein or of quantum mechanics. So, to make behaviorism “scientific,” they eliminated one big aspect of human life, namely *consciousness*.

But then as behaviorism developed, we find this growing need continually, somehow or other, to bring back by the backdoor the very element which they had eliminated in the first play. Thus, when first formulated, it was SR, Stimulus Response. In time, cognitive behaviorism came in and we got a new formula, SOR: Stimulus-Organism-Response, because of the fact that the organism itself modifies the response. Dr. Lagmay then brings in the Cautela approach where he has man reinforcing himself by images which he himself creates. We begin to see here how behaviorism has changed and developed from the old Thorndike thing to a new approach which seems to want to include consciousness.

Now what Dr. Lagmay has done in his paper is to make this approach even more concrete where, for example, he says that a sound for a child is reinforcement. When a child seeks to imitate a sound he is reinforced when he can make a sound similar to it. Now I am glad to see behaviorism developing this way. However, under these circumstances, is it economical still to use the conditioning model, rather than another which could be more economical. In the case for example of the sound for the child, should we use the conditioning model to understand that phenomena of the child imitating the sound or should we use the social psychologists' idea of "modelling?" Or in the Cautela experiment, should we use the conditioning model or should we use rather the transpersonal model. Cautela's students (cf. Fareyt, J.P. (Ed.). *Behavioral Treatment of Obesity*. Oxford: Pergamon Press. 1977.) did experiments to try to find the answer to this particular question: In behavioristic treatment of obesity, was it the conditioning with an image that made that person give up overeating or was it the relaxation that accompanied the imagery? The result of that particular experiment was it was more than relaxation that brought it about. I bring this up because there are new aspects that are coming up very strongly on this matter of consciousness that one could still explain by conditioning but only at the price of forcing the data into rigid categories. Take for example, the Simonton research (Simonton, O. Carl; Mathews-Simonton, Stephanie; and Creighton, James. *Getting Well Again*. Los Angeles: Tarcher, 1978.) on terminal cases of cancer, where he has a patient put himself in the very relaxed state and then imagines his own blood cells like soldiers fighting the cancer. Such a process could still be conceived as reinforcer, i.e., you could sort of say that you are reinforcing the killing of cancer cells. But you could conceive it another way, the way the consciousness people do it now: just as Einstein saw that mass and energy are continuous, so also now we begin to conceive of mind and matter as continuous and that

therefore the mind has control over the body. A limited control, of course, but there is something it can effect. Consciousness has an important part to play and need not be eliminated as in the behavioristic model.

These are some of the questions, then, that I would like to bring up because the behavioristic model has some shortcomings. For instance, freewill according to Skinner simply does not exist. He envisioned Utopian societies which were motivated solely by the manipulation of what he called positive and negative reinforcements. The problem then, is that one can become very pessimistic. In fact, that was what happened to Skinner himself in his old age. Here is the recent interview of Skinner by the New York Times with the headline: "B.F. Skinner Now Sees Little Hope for the World's Salvation."

This interview comes only ten years after he wrote "Beyond Freedom and Dignity" which he still believed in the possibility of world change by reinforcing the good and deinfencing the bad. Now, in his interview he says---well people just won't take it up. People react rather than initiate. Dr. Skinner finally concludes that people will not act to preserve the world until it is too late. "I don't see any hope for it"—those are his own words.

To sum it up, I am wondering if maybe—in the course of the development of behaviorism—it is reaching the point where it is incorporating consciousness into its paradigm. If it does so, I think it will be a real advance. And it will be a big change because up to now, psychology is known in the freshmen's textbooks as "the science of human behavior." But is moving towards "psychology, the science of mind."