

PRELIMINARY SUGGESTIONS AS TO A FORMALIZATION  
OF EXPECTANCY THEORY <sup>1</sup>

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In the present paper we shall try to indicate one direction in which a rigorization of expectancy theory might move, concentrating wholly upon what we believe are the major constructs of such a theory. In a previous paper (Meehl & MacCorquodale, 1951), we discussed briefly the question, "How may an expectancy theory of learning be identified as such?" We took the position that several features in the thinking of expectancy theorists (e.g., Tolman) are not logically entailed by the admission of an expectancy construct, and we suggested that one (and perhaps *the*) crucial differentiator between an expectancy and a non-expectancy theory is the form of the acquisition postulates. One particular type of acquisition postulate, providing for the strengthening of the basic learning element in a special way, we called the "Inference Postulate," listed as Number 4 below.

While the presence of such a postulate generates many properties in the theory which are absent without it, strictly speaking it is always the entire *system* of postulates which does the generating. The inference postulate, for example, cannot lead to the desired deductions concerning latent learning unless the role of the expectancy construct in activating behavior is also indicated (our postulate 12). This latter indication in turn requires some subset of postulates defining motive-incentive constructs (as our postulates 6, 7, 9, 10, 11), and so it goes. Ideally, the implicit definition of these constructs would be given by the entire, "complete" postulate system; their empirical meaning would be, so to say, exhibited, *shown forth* by the interdigitation of the propositions with one another and with the behavioral theorems they jointly entail.

In what follows we shall present an *incomplete, tentative*, and certainly *nonsufficient* set of propositions which, however, begin to define at least one important kind of expectancy theory. This formulation has a major affinity with that of Tolman because it contains an inference postulate, and (what in turn makes *this* possible) because its fundamental cognitive unit, the "expectancy" ( $S_1RS_2$ ) is

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<sup>1</sup> This paper grew out of discussions at the Social Science Research Council-subsidized Dartmouth Conference on Learning Theory (1950). Although they are in no sense to be considered as endorsing our formulations, the other members of the Conference—Drs. W. K. Estes, C. G. Mueller, S. Koch, W. N. Schoenfeld, and W. S. Verplanck—contributed both stimulation and criticism.

designated by three notational elements rather than the two which specify Hull's  $S_H R$ . In this set, then, the basic construct of learning specifies not only the  $S_1$  in the presence of which the organism emits  $R$ , but in addition it specifies what is expected when  $R$  follows  $S_1$ .

On the other hand, this formulation differs from Tolman's in several respects; of these differences we currently consider only one to be clearly fundamental. The fundamental difference is our inclusion of an  $R$  reference in the notation specifying the basic cognitive unit, the "expectancy." In this sense the construct lies somewhere between the constructs of Tolman and those of Hull, since it includes the  $S_2$  reference (unlike Hull) but also the  $R$  reference (unlike Tolman). It is true that in some of his discussions (e.g., Tolman, 1932, pp. 10-12, 82) Tolman seems to include the response reference in his idea of an expectancy; but his more recent emphasis on perception and the "map" metaphor have deflected attention from the  $R$  term. This sort of emphasis leads him to have some difficulty in *getting to behavior*, which is expressed in Guthrie's well-known gibe about Tolman's leaving the rat "buried in thought." We try to solve the problem by including an  $R$  reference as part of the expectancy construct from the beginning. Let us emphasize, however, that this *must not be understood to mean that an expectancy IS a "response"* if the word response means an effector-event-class; nor does it mean that the arousal of an expectancy is an effector-event, albeit a damped or attenuated one.

The facets of Tolman's approach which we do not see as crucial or differentiating were merely listed in our previous paper (Meehl & MacCorquodale, 1951, p. 230). Professor Tolman informs us (personal communication) that he agrees with us about four of them, but he feels that two of them, the "Gestalt-configural stress" and the "specification of reaction-class by reference to position, direction, or locomotion (rather than by effector properties)," are integral features of his view. Space does not permit us the detailed consideration of these two points which would be necessary to do them justice, but this whole question will be treated in detail in a subsequent publication.

We cannot stress too strongly that the following is *not* offered as a full-fledged "postulate set." The postulates represent our first attempts to nail down the expectancy view. They are obviously incomplete even if the theorem system required were a "miniature" one, e.g., confined to rat behavior in the Skinner box. The great mass of data regarding temporal effects, for instance, is left quite untreated. The notion of "similarity" between two stimulus configurations is left unclarified; there is no attempt to treat the entire area of facts and concepts usually called "inhibition," or the allied phenomena of non-extinctive work decrement. The postulate of need strength is not clearly supported by current evidence on alimentary drives and there is no good evidence that for other "higher-order"

need variables it should be expected to hold at all. There are no postulates regarding the very important question of interaction among expectancies to yield some compromise  $R$  strength. We have not felt it propitious even to make guesses about the exact *form* of functions, at this point. But anyone who wishes to substitute, e.g., “simple positive growth function” wherever we have written “increasing decelerated function” can easily do so.

Since one of the constantly reiterated complaints against expectancy theorists for almost twenty years has been the extreme sketchiness of their formulations, we perhaps do not need to apologize for the present effort if it succeeds in reducing this sketchiness even slightly.

Furthermore, the present article aims merely to *present* the incomplete set and to *illustrate* its workings by deriving some semiquantitative consequences. No attempt is made to *defend* our particular decisions as to formulation, or to develop the thinking behind each. This more extended treatment will appear in a subsequent publication.

Pending detailed treatment, we shall merely say that in what follows the term *stimulus* may include a physical situation of any describable complexity or patterning. That is, if “triangularity” is the property needed to yield a response-inferred stimulus equivalence, the relational features between three points are, of course, included in the specification of  $S$ . It is not suggested that there are no unsolved problems here; but since, like Skinner, we are unconvinced of the definitive role of “configural properties” as marking out kinds of learning theories, we have ignored these issues for present purposes. In the same way, we mean by *response* a class of effector activities which produce environmental effects within a specified range of values, e.g., “turning left,” “pressing lever,” and the like. (Cf. Estes, 1950, pp. 95-96; Skinner, 1938, pp. 33-43.) Again, this summary treatment springs from an acute awareness of the terrible difficulties in the response concept rather than a naive belief that they have been solved.

The postulates are as follows:

1. *Mnemonization*: The occurrence of the sequence  $S_1 \rightarrow R_1 \rightarrow S_2$  (the adjacent members being in close temporal contiguity) results in an increment in the strength of an expectancy ( $S_1R_1S_2$ ). The strength increases as a decelerated function of the number of occurrences of the sequence. The growth rate is an increasing function of the absolute value of the valence of  $S_2$ . If the termination by  $S_2$  of the sequence ( $S_1 \rightarrow R_1$ ) is random with respect to nondefining properties of  $S_1$ , the asymptote of strength is  $\leq$  the relative frequency  $P$  of  $S_2$  following  $S_1 \rightarrow R_1$  (i.e., a pure number). How far this asymptote is below  $P$  is a decelerated function of the delay between the inception of  $R_1$  and the occurrence of  $S_2$ .

2. *Extinction*: The occurrence of a sequence ( $S_1 \rightarrow R_1$ ) if not terminated by  $S_2$  produces a decrement in the expectancy if the objective  $S_2$ -probability has been

1.00, and the magnitude of this decrement is an increasing function of the valence of  $S_2$  and the current strength of  $(S_1R_1S_2)$ . Such a failure of  $S_2$  when  $P$  has been  $\neq 1$  is a *disconfirmation* provided  $(S_1R_1S_2)$  was nonzero. If the objective probability  $P$  shifts to a lower  $P'$ , and remains stable there, the expectancy strength will approach some value  $\leq P'$  asymptotically.

3. *Primary Generalization*: When an expectancy  $(S_1R_1S_2)$  is raised to some strength, expectancies sharing the  $R$  and  $S_2$  terms and resembling it on the elicitor side will receive some strength, this generalized strength being a function of the similarity of their elicitors to  $S_1$ . The same is true of extinction of  $(S_1R_1S_2)$ .

4. *Inference*: The occurrence of a temporal contiguity  $S_2S^*$  when  $(S_1R_1S_2)$  has nonzero strength, produces an increment in the strength of a new expectancy  $(S_1R_1S_2^*)$ . The induced strength increases as a decelerated function of the number of such contiguities. The asymptote is the strength of  $(S_1R_1S_2)$  and the growth rate is an increasing decelerated function of the absolute valence of  $S^*$ . The presentation of  $S_2$  without  $S^*$  weakens such an induced expectancy  $(S_1R_1S_2^*)$ . The decrement is greater if the failure of  $S^*$  occurs at the termination of the sequence  $S_1 \rightarrow R_1 \rightarrow S_2$  than if it occurs by presentation of  $S_2$  not following an occurrence of the sequence.

5. *Generalized Inference*: The occurrence of a temporal contiguity  $S_2S^*$  produces an increment in the strength of an expectancy  $(S_1R_1S^*)$  provided that an expectancy  $(S_1R_1S'_2)$  was at some strength and the expectandum  $S'_2$  is similar to  $S_2$ . The induced strength increases as a decelerated function of the number of such contiguities. The asymptote is a function of the strength of  $(S_1R_1S'_2)$  and the difference between  $S_2$  and  $S'_2$ . The growth rate to this asymptote is an increasing decelerated function of the absolute valence of  $S^*$ .

6. *Secondary Cathexis*: The contiguity of  $S_2$  and  $S^*$  when  $S^*$  has valence  $|V|$  produces an increment in the absolute cathexis of  $S_2$ . The derived cathexis is an increasing decelerated function of the number of contiguities and the asymptote is an increasing decelerated function of  $|V|$  during the contiguities, and has the same sign as the  $V$  of  $S^*$ . The presentation of  $S_2$  without  $S^*$ , or with  $S^*$  having had its absolute valence decreased, will produce a decrement in the induced cathexis of  $S_2$ .

7. *Induced Elicitor-Cathexis*: The acquisition of valence by an expectandum  $S_2$  belonging to an existing expectancy  $(S_1R_1S_2)$  induces a cathexis in the elicitor  $S_1$ , the strength of the induced cathexis being a decelerated increasing function of the strength of the expectancy and the absolute valence of  $S_2$ .

8. *Confirmed Elicitor-Cathexis*: The confirmation of an expectancy  $(S_1R_1S_2)$ , i.e., the occurrence of the sequence  $S_1 \rightarrow R_1 \rightarrow S_2$  when  $(S_1R_1S_2)$  is of nonzero strength, when  $S_2$  has a certain valence, produces an increment in the cathexis of the elicitor  $S_1$ .

This increment in the elicitor-cathexis by *confirmation* is greater than the increment which would be *induced* by producing a valence in  $S_2$  when the expectancy is at the same strength as that reached by the present confirmation.

9. *Valence*: The valence of a stimulus  $S^*$  is a multiplicative function of the need  $D$  and the cathexis  $C^*$ . (Applies only to cases of positive cathexis.)

10. *Need Strength*: The need ( $D$ ) for a cathected situation is an increasing function of the time-interval since satiation for it.

Note: Upon present evidence, even basic questions of monotony and acceleration are unsettled for the alimentary drives of the rat, let alone other drives and other species. There is no very cogent evidence that all or even most "needs" rise as a function of time since satiation, although this seems frequently assumed. Even the notion of satiation itself, in connection with "simple" alimentary drives, presents great difficulties. This proposition can, therefore, hardly be taken as having any generality even tentatively.

11. *Cathexis*: The cathexis of a stimulus situation  $S^*$  is an increasing decelerated function of the number of contiguities between it and the occurrences of the consummatory response. The asymptote is an increasing function of the need strength present during these contiguities. (There may be some innately determined cathexes, however.)

12. *Activation*: The reaction potential  ${}_sE_R$  of a response  $R_1$  in the presence of  $S_1$  is a multiplicative function of the strength of the expectancy ( $S_1R_1S_2$ ) and the valence (retaining sign!) of the expectandum. There are momentary oscillations of reaction potential about this value  ${}_sE_R$ , the frequency distribution being at least unimodal in form. The oscillations of two different  ${}_sE_R$ 's are treated as independent, and the response which is momentarily "ahead" is assumed to be emitted.

As a sample of "derivation" from these, let us consider first a study by Kendler (1946) which yielded somewhat puzzling results from the Hullian point of view. Rats were run in a single T maze when both hungry and thirsty. On one side the goal box always contained food, on the other water, and in both boxes the consummatory response occurred repeatedly during the first phase. On the test run, some animals were made thirsty, the others hungry. "Appropriate" choices were made to a pronounced extent. Kendler points out that since both left and right choices had been consistently reinforced during the training runs, and since both hunger and thirst were present as cue variables for choices in both directions, it is not clear on Hullian principles why the differential choice is shown on the one-drive test runs. He discusses two possibilities, one in terms of the fractional goal response (suggested by Spence) and the other involving a rather radical modification of the usual Hullian reinforcement principles, such that the only drive cues which get connected to  $R$  are those which are reduced by the reinforcing operation that strengthens the  ${}_sH_R$  in question (Guthrie?). The finding

would be treated within the present frame as follows:

$S_C$ : Choice-point stimulation

$R_R$ : Right turn (leads to food)

$R_L$ : Left turn (leads to water)

$S_{RF}$ : Stimulation in right goal box, including that of eating

$S_{LW}$ : Stimulation in left goal box, including that of drinking

Then during the first phase we have the sequences:

$$S_C \rightarrow R_R \rightarrow S_{RF}^*$$

$$S_C \rightarrow R_L \rightarrow S_{LW}^*.$$

Repetitions of these in balanced amounts lead to increased strengths of two expectancies

$$(S_C R_L S_{LW}) \doteq (S_C R_R S_{RF})$$

according to (1). Unless the two drives are unequal or the number of exposures unbalanced, these two expectancies will rise at the same rate; toward the end of the first phase they should, on the average, be equal in cumulated strength. Assuming hunger and thirst drives to be equal, at this stage, by (10), (11), and (12), we have

$${}_s E_{R(L)} = (V_W) (S_C R_L S_{LW}^*) \doteq (V_F) (S_C R_R S_{RF}^*) = {}_s E_{R(R)}$$

so no “preference” is manifested. On the test run, we satiate for food and keep the animals thirsty. That is,

$$(V_W) \gg (V_F)$$

so that

$${}_s E_{R(L)} = (V_W) (S_C R_L S_{LW}^*) \gg (V_F) (S_C R_R S_{RF}^*) = {}_s E_{R(R)}$$

By (12) the probability of a left turn is then much higher than for a right. It is instructive to ask where we find the *locus* of the difference that generates the derivation for us more readily than for Kendler. It evidently lies in the fact that *our activation postulate makes reference to the expectandum*, and this reference mediates a “control” over the strength of  $R$  which cannot be readily talked about in a notation designating the basic cognitive element by reference to  $S_1$ , the elicitor, and  $R$  only. Thus, the acquisition phase in Hullian terms is strengthening  ${}_{S(C)}H_{R(R)}$  and  ${}_{S(C)}H_{R(L)}$  equally, since turns both ways are reinforced. When it comes to predicting the test run, manipulating drive can only affect a multiplier of these  ${}_s H_R$  elements, and the “forward-pointing” reference of the expectandum term is lacking or must be smuggled in by invoking  $r_g$ . In short, the Hullian frame makes the incentive important only “historically,” i.e., in determining how much  ${}_s H_R$  is cumulated. The expectancy frame retains the reference to the expectandum in the basic cognitive element ( $S_1 R S_2$ ), and thus a reference to this third thing can be packed into the activation postulate in a way that allows subsequent drive manipulations a ready control over the response strength.

Consider next the experiment reported by Tolman and Gleitman (1949). After a first phase in which they ran either to left or right to readily discriminable goal boxes, in each of which they were allowed to eat, the rats were then *placed* (not following a run) in one of the goal boxes where they were allowed to eat. Each rat was also placed in the other goal box, where a shock was administered. On the test run the rats chose appropriately to a very striking extent. Suppose shock is administered in the left-hand goal box during Phase II, and food given in the right. Let the entire stimulus complex involving eating food be designated  $S_F^*$  and that involving shock by  $S_{Sh}^-$ . Then the reported effects could arise as follows:

I. Status at end of Phase I:

- a.  $(S_C R_L S_L) \doteq (S_C R_R S_R)$  By (1)  
 b.  $(S_C R_L S_F^*) \doteq (S_C R_R S_F^*)$  By (1)  
 c.  $V_{S(L)} \doteq V_{S(R)}$  By (6)

II. Status at end of Phase II:

- d.  $(S_C R_L S_L) \doteq (S_C R_R S_R)$   
 e.  $(S_C R_L S_F^*) < (S_C R_R S_F^*)$  By (4)  
 f.  $(S_C R_L S_{Sh}^-) \gg (S_C R_R S_{Sh}^-)$  By (4) and (5), inference  
 and incomplete generalization  
 g.  $V_{S(L)} \ll V_{S(R)}$  By (6), both through extinction of the  
 linkage  $S_L S_F^*$  and establishing that of  $S_L S_{Sh}^-$

III. On the test run, considering the resulting potentials,

- h.  $sE_{R(L)} = (V_{S(L)})(S_C R_L S_L) \ll (V_{S(R)})(S_C R_R S_R) = sE_{R(R)}$  By (12) with (g)  
 i.  $sE_{R(L)} = (V_{S(F)^*})(S_C R_L S_F^*) < (V_{S(F)^*})(S_C R_R S_F^*) = sE_{R(R)}$  By (12) with (e)  
 j.  $sE_{R(L)} = (V_{S(Sh)^-})(S_C R_L S_{Sh}^-) < (V_{S(Sh)^-})(S_C R_R S_{Sh}^-) = sE_{R(R)}$  By (12) with (f)

Now whatever may be the laws of summation for reaction potentials sharing elicitor and  $R$  term, so long as it is some increasing function of the components, it is clear that

$$sE_{R(L)} < sE_{R(R)}$$

which is the desired result.

Consider as a final example the Spence-Lippitt type of latent-learning design reported as positive by those authors in 1940 (Spence & Lippitt) and by us in 1947 (Meehl & MacCorquodale). Rats are run in a satiated state to goal boxes which, however, contain food or water. On the test run a state of either hunger or thirst is induced, and the appropriate choice tends to occur. Suppose food is on the right, water on the left. Then the sequences which occur during the satiated phase are

$$S_C \rightarrow R_R \rightarrow S_R S_F^*$$

$$S_C \rightarrow R_L \rightarrow S_L S_W^*$$

which will mnemonize two expectancies ( $S_C R_R S_R S_F^*$ ) and ( $S_C R_L S_L S_W^*$ ) provided that “removal” is reinforcing (using [6] and possibly [7]). An additional contribution to the growth parameter might be made if we interpret (9) to mean a function of the form  $V = a + b(D)(C^*)$  rather than of the form  $V = b(D)(C^*)$ , so that some valence persists for a cathected stimulus even when the need or drive variable is effectively zero. This is the approximate analogue in an expectancy theory to the claim in S–R-reinforcement theory that a stimulus retains its secondary reinforcing properties when the primary drive is satiated. That question, formulable in either system, is presently awaiting clear-cut solution experimentally (cf. Estes, 1949a,b; MacCorquodale & Meehl, 1949; Myers, 1949; Sheffield & Roby, 1950).

So after  $N$  trials of about equal runs to both sides,

$$(S_C R_L S_L S_W^*) \doteq (S_C R_R S_R S_F^*) \quad \text{by (1).}$$

And, since

$$(V_{S(W)}^*) \doteq (V_{S(F)}^*)$$

(assuming approximately equal pre-experimental experience with food and water and current near satiation for each) we have by the activation postulate

$${}_s E_{R(L)} = (V_{S(L)S(W)}^*) (S_C R_L S_L S_W^*) \doteq (V_{S(R)S(F)}^*) (S_C R_R S_R S_F^*) = {}_s E_{R(R)}$$

We now manipulate drive, making the animal very hungry but not thirsty.

Then

$$V_{S(W)}^* \ll V_{S(F)}^* \quad \text{By (9)}$$

since

$$V_{S(W)}^* = (D_W)(C_W)^* \ll (D_F)(C_F)^* = V_{S(F)}^*$$

assuming from past history and (11) that

$$C_W^* \doteq C_F^*.$$

Then, by the activation postulate,

$${}_s E_{R(L)} = (V_{S(L)S(W)}^*)(S_C R_L S_L S_W) < (V_{S(R)S(F)}^*)(S_C R_R S_R S_F) = {}_s E_{R(R)}.$$

There are certain additional consequences of the derivation that are of interest. To mention some of them briefly:

1. For a given valence the difference in  ${}_s E_R$  is a function of the magnitude of the expectancies, since

$${}_s E_{R(L)} - {}_s E_{R(R)} = (V_L - V_R)(S_C R S)$$

where

$$S_C R_R S_L = S_C R_R S_R = S_C R S.$$

*a.* But the magnitude of the expectancy increases with occurrences of the sequence, so that the percentage of appropriate responses on the test run should be less for rats who have had fewer “latent” runs during the satiated phase

*b.* The growth rate of each expectancy depends on the valence of its expectandum (Mnemonization Law). For a constant number of cognition runs, the expectancy levels reached should be raised by any procedure that raises the

valence of the goal boxes, even though *equally*. Thus, if another rat or home cage or preferred illumination is found in *both* boxes during the latent phase, this should raise the percentage correct on the test run.

However, plotting percentage “correct” on the test run against *number* of runs for groups differing in the valence of goal boxes should yield a family of curves of different slope but all approaching the same asymptote.

c. If the two goal boxes are varied from run to run so that the “modal” goal box on a side occurs randomly with a frequency  $P$  (and the presentation of food and water occur consistently in this box) the percentage of correct choices on the test run is a function of  $P$ . The members of the family of curves in this case should approach different asymptotes.

2. For a given magnitude of expectancy the  ${}_sE_R$  difference is a function of the valence difference. If both valences are small,  ${}_sE_{R[R]} - {}_sE_{R[L]} = (V_R - V_L)(S_1RS_2)$  will be smaller than if one valence is large and the other small.

By the Law of Cathexis (11), both the cathexis of food and water will be minimal for rats that have never been on deprivation schedules for these commodities. As a result of this, by the Law of Mnemonization (1), expectancies for food on one side and water on the other will grow very slowly for such “naive” rats, and a short series of latent runs will, therefore, leave them with weak expectancies. Finally, by the Law of Valence (9), the valences of these expectanda will be minimal for such rats; and this is true both during the acquisition and test phases. Therefore, the  ${}_sE_R$  difference between  $R_L$  and  $R_R$  on the test trial is doubly reduced by minimizing both the expectancy and valence terms in each (cf. Christie, 1951, 1952).

3. On the other hand, the *expectancy* strength approaches the same asymptote although more slowly, even for low valences (mnemonization law). If repeated occurrences of the sequence  $S_1 \rightarrow R \rightarrow S_2$  have brought  $(S_1RS_2)$  close to this asymptote, we can then (outside the maze!) induce a strong cathexis in the alimentary expectanda by use of a feeding cycle. Such rats should (Law of Valence, Law of Activation) show the same per cent correct on a test trial as rats who had been hunger experienced prior to the experiment. But the asymptote of the expectancy  $(S_1RS_2)$  must have been reached.

Thus, for small numbers of “cognizing” runs, an interpolated hunger cycle (after the training series but before the test runs) ought not to bring these rats to the level of the previously hunger experienced. But for larger numbers of cognition runs, it should. The percentage correct on test runs plotted as a function of the number of training runs should approach the same asymptote for the interpolated group. But at the early phases of these curves a large difference is expected.

4. Since part of the valence of both  $S_R$  and  $S_L$  is assumed to be nonalimentary,

based on the reward of removal, removal to a less valenced locus, e.g., mazelike box instead of home cage, or to a slightly negative-valenced locus such as a too-bright white box, should yield a slow growth of both expectancies. So for a small number of satiated runs, each expectancy has a lower value at the test run. Hence we expect less  ${}_sE_R$  difference and more errors.

The obvious Hullian complaint would be, "Here you really admit the importance of the reward *during* the latent (satiated) phase." In a sense this is true. Yet, how does the reward *act* in the present formulation? It is not conceived of as generating a "habit," in favor of the later-to-be-chosen side. Suppose we were to give a *strong* but *equal* reward on both sides. The present derivation assumes that if we consider only rats having no bias to the left during the latent phase, they will still show the advantage in question on the test run. After all, the quantitative results of other studies indicate a very marked effect on response strength when an alimentary drive is raised from near zero to a 24- or 48-hour value. One would presumably be safe in predicting that the parameters of our equations are such that a slight right-going bias (say, 10–20 per cent) manifested during satiated runs will be easily overcome by the valence shift on the test trial. Hullian postulates would in such a case merely raise the multiplication factor  $f(D)$  and the algebraic sign of  $({}_sE_{R(L)} - {}_sE_{R(R)})$  would still be negative. Barring the use of  $r_g$ , the predicted Hullian result is for such "biased" rats to manifest the bias with higher probability on the test run.

A concluding clarification of our own position seems necessary. The preceding has been presented as one way of formulating the expectancy position. We consider ourselves chiefly identified with some form of S–R-reinforcement theory, and our sympathies remain with it. The foregoing development is, therefore, *not* presented as empirically confirmed or even as a strong contender. Actually, the question of its factual adequacy has played almost no part in our thinking, which was directed at explicating one current theory rather than at proposing an empirically supported system with maximal attention to the facts.

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