A Vigilance Model for Latent Learning

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Abstract—The author proposes a heuristic model for latent learning. It is concluded that to regard academic learning as qualitatively different from other forms of learning is to deny evolutionary continuity. Academic learning is not a unitary process governed by a single set of parameters. In addition, it is observed that the problem of student motivation may very well turn out to be purely academic. The instructional technique for a captive audience of a class may be so structured as to make the direction of attention irresistible, the performance of a response, when needed, compelling, and the acquisition of knowledge inevitable. Vigilance is an instance of innate foundation. Its most striking characteristics are its universality in the animal world, its ready evocation by a wide range of stimuli, and its apparent behavioral and physiological manifestations. The last two are the natural resources for objective investigation, and the first may well be the basis of broad and valid generalizations.

LATENT LEARNING is a phenomenon of acquisition that occurs without overt responding or reinforcement. It is common in everyday life, and it is the dominant pattern in many forms of classroom learning. Because it does not depend on performance or rewards, it presents a challenge to the explanatory principles of S–R formula.

Among the alternative explanatory concepts the more promising are the orienting reflex (Pavlov, 1928) and vigilance (Head, 1923). Though these had independent origins, their current interpretations are similar: both refer to the state of alertness induced by environmental changes. The salient features of such attention are the receptor orientation and neurophysiological arousal—both behavioral events.

Some years ago I had postulated that the level of arousal that accompanies active attention may be represented by the mathematical function \( y = ce^{-kx} \), where \( x \) is the time variable in the exposure to stimulation (Boguslavsky, 1951). I had further assumed that retention of the experience was directly proportional to the cumulative effect of arousal, the latter represented by the integral of the function. The experimental data supported the hypothesis, but only when the subject's orientation was directed to the relevant aspects of the situation. In other words, the receptor-orientation component of vigilance operated as an all-or-none determinant of retention.

Unfortunately, attention to relevant features is not always present inasmuch as fluctuation of attention is an attribute of most learning. In my work with classical conditioning I observed that individual instances of vigilance differed in pattern as well as in direction. All were recognizable as vigilance by their components of orientation and arousal, and some were sufficiently alike to be classified as belonging to a stereotype.

This observation, coupled with an assumption that specific vigilance reactions served as mediating processes, led to the development of a model in which the reactions, abbreviated SVR, are treated as random variables from a finite population \( N \). The progress of learning is assumed to depend on enlisting the several SVR's as cues. Estimates of the progress are obtainable from the formulas of the classical occupancy problem, with the obvious result: the larger the \( N \) the longer the learning (Boguslavsky, 1955).

In a test of the model, selective manipulation of the environment, intended to reduce the animal's field of orientation, led to a significant decrease in the time required to learn to an established criterion (Boguslavsky, 1958). The effect of such manipulation is intuitively understandable, and the transition to other forms of learning is straightforward. Acquisition of knowledge, particularly in the classroom, is enhanced by eliminating irrelevant stimuli competing for the learner's attention, or, in the language of the model, by reducing the value of \( N \). Competition for the learner's attention is particularly severe when a specific detail is to be isolated from a mass of details in a visual display. The common classroom practice is to indicate the detail with a pointer or a beam of light. The technique is generally effective in directing receptor-orientation, but it does little to enhance the level of arousal.

Both objectives, however, may be attained by
sequential changes in figure–ground relation. As the instruction progresses, the contrast between figure and ground may be arranged to change in the same order. The very fact of change is sufficient to maintain the excitatory aspect of vigilance, and the figure–ground effect gives direction to orientation.

In line with this reasoning I postulated that orientation accompanied by arousal is more conducive to acquisition than orientation alone. This proposition was tested under a grant from the U.S. Office of Education, and the present paper is a report on that project (Boguslavsky, 1967).

Test of Hypothesis

Method

The foregoing proposition was tested by controlled comparisons of two instructional methods consisting of tape-recorded lectures and photographic slides. In both methods the lectures were identical, but the slides differed.

Control Slides: These were black-and-white reproductions of conventional textbook illustrations. The various components of each illustration were properly labeled. As the taped narrative described a particular component, the teacher directed a pointer to the corresponding detail in the picture.

Experimental Slides: These, too, were reproductions of textbook illustrations, but done in black, white, and a shade of gray. There was no teacher with a pointer: instead, the detail under discussion appeared with maximal contrast of white against black, while other details remained in lesser contrast of gray against black. As the narrative progressed from one component to another, the maximal contrast shifted accordingly. This basic approach was occasionally varied by the introduction of coloration in order to maximize contrast.

Materials

The materials were prepared with the help of the faculty in Troy High School and Rensselaer Polytechnic Institute, who had volunteered to take part in the project. The areas of study and the topics selected to test the hypothesis are summarized below:

1. High School Biology—two lectures:
   a. Cell Division
   b. The Reproductive Process
2. High School Chemistry—two lectures:
   a. Oxidation–Reduction
   b. Balancing of Equations
3. High School Physics—two lectures:
   a. Wave Motion
   b. Reflection and Refraction
4. High School Geometry—one lecture:
   a. Simple and Compound Loci

Two other topics, statistics and mechanics, had been tested on RPI students. These, however, had not been replicated on other college populations and are not included in the present discussion.

Procedure

Each lecture was about 40 minutes long, recorded on tape by a professional radio announcer. A script was keyed numerically to the narrative for manual changing of the slides. These were presented by Bell and Howell projectors: The #750 specialist projector for the control group and the lap–dissolve tandematic projector for the experimental group. The latter allowed for a gradual shift in figure–ground contrast without affecting topographic relation.

The hypothesis was tested by specially prepared objective examinations administered upon completion of the lecture or lectures. When comparison between treatments was based on only one lecture, the examination was administered on the following day. In courses with two lectures the examination was given on the third day, except as noted hereafter.

Subjects

The subjects were students regularly enrolled in the respective courses. The breakdown is summarized below.

2. Chemistry: 3 classes, total N = 67.
3. Physics: 2 classes, total N = 56.

Each class was divided at random into approximately equal control and experimental groups, and the treatments were administered simultaneously in separate rooms. Though the several classes in an area of study met at different hours, the examination for all classes in the area was given at the same time.

The results are summarized in Table 1. The results support the hypothesis for biology and geometry but contradict it for chemistry and physics. A nonparametric analysis, the rank-order test, shows only one significant difference at the 5% level: the reflection–refraction test difference, contradicting the hypothesis. The lowest level of significance, approaching pure chance, was for the test difference in geometry.

Although the data were inconsistent between areas of study, they were relatively consistent between classes within an area. This suggests