Discrimination of Systolic Blood Pressure

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The ability of humans to discriminate systolic blood pressure (BP) was investigated in two experiments. In Experiment 1, 14 normal subjects were asked to make estimates of their systolic BP while performing both BP-elevating and BP-lowering tasks. They were given intermittent feedback throughout all 10 45-min sessions. Results indicated significant correlations and small absolute differences between estimated and measured BP for all subjects in almost all sessions. Experiment 2, undertaken 6 months after Experiment 1, assessed whether estimation accuracy by subjects who had available both external and interoceptive cues surpassed that of subjects which access to external cues only. Three subjects from the original group who showed consistently high motivation, and who improved in accuracy across the 10 sessions in the previous experiment, made estimates of BP while performing novel tasks with no feedback. Correlations between estimated and measured BP remained high for 2 of the 3. These results were compared with the accuracy of control subjects (3 for each experimental subject) who were asked to estimate experimental subjects' BP using only the cognitive information available to the experimental subjects. Control subjects also had high correlations between their estimates and the

1This paper is based in part on a doctoral dissertation submitted by the first author to Wayne State University. Data were actually collected at the Edsel Ford Institute, Detroit, Michigan.
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experimental subjects' measured BP but at lower levels than two experimental subjects. These findings are discussed in relation to subjects' possible use of interoceptive information.

Since 1968, numerous studies have shown that humans can learn to control both systolic and diastolic blood pressure (BP) using biofeedback methods, and clinical applications for hypertension reduction have been tested (see, for example, the review by Olton & Noonberg, 1980). In both the clinical and nonclinical studies, however, very little attention has been given to the possible role of BP estimation and discrimination. For the feedback-trained hypertensive patient, an ability to estimate BP might be of great use in determining when to apply his learned techniques.

By "estimation" we mean the individuals' statement of BP level based on any factor other than an instrument reading. Such factors could be interoceptive cues, stimuli from the external environment, or even "calculations" based on a knowledge of their BP range and current environmental conditions. In this paper, we distinguish between the general term estimation and "interoceptive discrimination" based exclusively on the use of internal physiological stimuli.

The question of BP discrimination has obvious theoretical importance. Is it possible for one to utilize stimuli arising from the physiological substrate involved in BP regulation, and if so, what are the specific stimuli involved? Work with animals has clearly demonstrated that an organism can discriminate stimuli that are artificially applied to the gastrointestinal tract (see Bardos & Adam, 1978). In humans, a number of studies involving estimation of physiological variables other than BP have been performed. These include heart rate (Brener & Jones, 1974; Epstein & Stein, 1974; Epstein, Cinciripini, McCoy, & Marshall, 1977), gastric motility (Briggs & Stunkard, 1964), galvanic skin response (Diekhoff, 1976), and blood alcohol (Bois & Vogel-Sprott, 1974; Silverstein, Nathan, & Taylor, 1974; Huber, Karlin, & Nathan, 1976; Lansky, Nathan, & Lawson, 1978).

Most of these studies have shown that subjects can learn to estimate physiological variables when they are provided with feedback, and in some cases can continue to report accurately after feedback has been withdrawn. Although these studies have suggested that interoceptive cues are important if accuracy is to be maintained over long periods, in most cases the subjects' descriptions of internal cues were vague. Furthermore, in only two studies (Huber et al., 1976; Lansky et al., 1978) were internal and external cues independently manipulated so that interoceptive cues could be clearly identified in long-term discrimination.