THE CHANGE SEEKER INDEX AND RESPONSE
TO A REPETITIVE MOTOR TASK

By

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J.H.R.

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CHAPTER I

INTRODUCTION

A fundamental issue in organizational and industrial psychology concerns the motivational bases of job performance and job satisfaction, with many reviewers suggesting a "pervasive relationship" between job satisfaction and performance. Yet it is not at all clear what factors affect satisfaction (Marsteller & Slocum, 1972; Wofford, 1971). Obviously aptitude and skill are important components, but increasingly interest is being shifted to personality variables such as values, interests, needs, traits, and self-concepts as potential sources of insight into the nature of the modern worker, particularly the one afflicted with the restless dissatisfaction commonly referred to as "blue collar blues" (Super & Bohn, 1970).

Alienation from work has frequently been attributed to blue collar workers engaged in repetitive production-line tasks, a topic recently publicized by mass media programs and articles (Siassi, Crocetti, Spiro, & Piscataway, 1974). Nicholson (1973), for example, in a lengthy <u>Newsweek</u> magazine article, suggested that "while people have been complaining about work since it was invented, there is a widespread feeling that there is something different about today's discontent" (p. 79).

In another lengthy magazine article (Boredom spells trouble on the line, 1972) it was noted that industrial boredom was not even discussed five years earlier, but that it had since become a major industrial issue. Absenteeism in the automobile industry, for example, was up to 13% from only 3% a few years earlier, the increase being attributed to boredom. One observer noted that in the past the American industrial worker didn't want to "have to think" while he worked, but now can't tolerate a job which does not encourage some kind of intellectual involvement. Since most jobs in the automobile industry can be learned in about thirty minutes, the future of "thinking on the job" seems dim. Nevertheless, the industry has been searching for alternatives to present systems.

Nicholson (1973) also reported that not everyone agrees that there is a problem with industrial boredom, and states that eight out of ten Americans, according to a Gallup poll, are indeed satisfied with their jobs. Such a point of view is supported by a field survey conducted by Siassi, Crocetti, Spiro, and Piscataway (1974) among automobile assembly line workers which revealed no more evidence of unrelatedness, loneliness, boredom, life-dissatisfaction, work dissatisfaction, or depression than among their spouses. Yet Siassi and his coworkers qualified their results by indicating that their population of workers was somewhat atypical in being older, having lived in the same place for many years, and having experienced a steady growth in their income, a point which is discussed more fully below.

Super and Bohn (1970) contribute a great deal to the clarification of this issue in their discussion of the definitions of satisfaction commonly used in research on the subject. They describe a study by Hoppock (1935) in which people were asked essentially, "Do you like your job?" The results indicated that most workers, regardless of socio-economic level, were relatively satisfied. Super and Bohn (1970) emphasize, however, that different ways of asking about job satisfaction can produce different results.

> While responses to the direct question about liking a job would imply that as many as nine out of ten workers are satisfied, responses to the less direct question--offering the possibility of reliving or reshaping careers--led to the conclusion that fewer people are happy in their work (p. 76).

Sheppard and Herrick, in their book Where Have All the Robots Gone (1972), concluded that one-third of the 400 male union workers studied, particularly the young ones, were alienated from their jobs and could not be properly compensated with the typical rewards of more money, shorter hours, or longer vacations. Further, Sheppard and Herrick's position is supported by a December, 1972 report issued by the Department of Health, Education, and Welfare which stated that the American work force is changing and more workers are growing restless because of "dull, repetitive, seemingly meaningless tasks, offering little challenge or autonomy" (p. 80). In any event, it is clear that a specific occupation cannot be classified as being either "boring" or "interesting" in itself. People respond differently to identical circumstances, and a report of "bored" is certainly the result of a complex interaction between the individual and the situation. That some individuals are more susceptible to monotony than others, however, appears an obvious contributing factor.

While it has long been recognized that individuals vary in their susceptibility to monotony (see, for example, Burtt, 1948), measuring the boredom susceptibility trait and using such knowledge effectively has proven difficult. For example, Burtt (1948) suggested that intelligence tests seemed a promising technique for measuring boredom susceptibility with high intelligence workers showing the "production curves" typical of "monotony" and the low intelligence group showing no such pattern. While general intelligence requirements may place a lower limit on entrance into a particular occupation, intelligence appears to be only moderately related to later job success (Super & Bohn, 1970).

A different kind of theoretical construct which has received wide attention in recent years and seems particularly promising in its application to problems of industrial boredom is that of "need for stimulation" and a derivative concept, "optimal level of stimulation" (see, for example, Leuba, 1955; Fiske & Maddi, 1961). Of particular interest to the present investigation is the use of optimal-level-of-stimulation theory to explain the effects of sensory deprivation. A wide range of individual differences in tolerance for sensory deprivation or sensory restriction conditions has been explained in terms of differences in the individual's optimal level. Zuckerman (1972) formalized the explanation in Postulate III of his presentation of the theory which states, "Every individual has characteristic optimal levels of stimulation (OLS) and arousal (OLA) for cognitive activity, motoric activity, and positive affective tone" (Zuckerman, 1972, p. 1). Individuals with a low OLS could supposedly tolerate conditions of low stimulation more readily than could individuals with a high OLS.

Several paper and pencil tests have been devised to measure the hypothesized OLS. They include, among others, the Change Seeker Index (CSI; Garlington & Shimota, 1964), the Novelty Experiencing Scale (NES; Pearson, 1970), the Stimulus Variation Seeking Scale (SVSS; Penney & Reinehr, 1966), and the Sensation-Seeking Scale (SSS; Zuckerman, Kolin, Price, & Zoob, 1964). It would seem reasonable that if measures of OLS are in any way predictive of behavior under conditions of sensory restriction, they should also be in some way predictive of behavior under conditions of industrial monotony.

While Zuckerman (1972) has pointed out that the ability to predict reactions to sensory deprivation or sensory restriction conditions has been limited, some success has been evidenced. Zuckerman, Persky, Link, and Basu (1968), for example, found a significant negative relationship between scores on the SSS and such subject reactions as depression and tedium stress resulting from a social confinement situation in which two subjects were together in a lighted, sound-proof room where travel slides and/or recorded music were available. Need for stimulation has also been found to relate to responses such as cognitive and perceptual disorganization, discomfort, quitting behavior, and restless body movement (Brownfield, 1966; Zuckerman, Persky, Hopkins, Murtaugh, Basu, & Schilling, 1966).

Despite the finding that prediction of stress responses to sensory restriction has been only moderately successful, there is further evidence to suggest that need for stimulation may be a useful predictor of behavior in an assembly-line situation. For example, Kish and Donnenwerth (1969) found significant negative correlations between need for stimulation, measured by the SSS, and occupational interest in fields judged to be low in flexibility, novelty, and intellectual stimulation. Further, evidence that stimulus need might be related to performance on a repetitive industrial task was provided by Siassi et al. (1974) in a discussion of the results of their field survey on loneliness and job dissatisfaction. They described the participants in their interview as follows:

> The typical respondent is white, 40 years old, and lives in his own row house. He has a ninth grade education, was born in Baltimore [the city in which the survey was conducted] or lived there for many years, has been married for over 16 years, and lives on a family income close to $9,000 per year" (p. 261-262).

Several of the characteristics mentioned in this survey have been found to relate to a relatively low need for stimulus variation, for example, age (Garlington & Shimota, 1964; Brownfield, 1966; Kish & Busse, 1968; Thorne, 1971), educational level (Kish & Busse, 1968; Kish & Donnenwerth, 1972; Penney & Reinehr, 1966), and living in the same geographic area for a long period of time (Jacobs & Koeppel, 1973).

Schultz (1965) has suggested that conditions of sensory deprivation, in which attempts are made to reduce total sensory input to an absolute minimum, and conditions of sensory restriction, in which only meaningful variation of stimulation is reduced, are basically the same condition and will produce the same effects, described subjectively as "boredom." It appears then that there may be a strong similarity between the experimental condition of sensory restriction and conditions often encountered in "dull, repetitious, seemingly meaningless" tasks. In both cases meaningful sensory variation is limited. An example from an actual industrial situation illustrates this point.

Industrial Example: The Tire Builder

During a two-year period as an engineer with the Dayton Tire and Rubber Company, this investigator observed 1,200 industrial workers in a recently constructed tire plant in Oklahoma City, Oklahoma. Of particular interest to the present study was a body of workers known as tire builders (TB's). Numbering about 300, each TB worked independently at his own tire building machine assembling objects known as green tires which resembled open-ended beer kegs made of rubber. The green tires were subsequently transported to another area where they were molded into the more familiar donut shape. The TB stood before a large machine and rarely moved from one spot except to take a break about every two hours or to reload his machine with stock material. His task was to assemble, layer by layer, ply by ply, the green tire as quickly as he could and place it on a nearby conveyor. The amount of time required for the construction of each green tire varied according to the type of tire being made and the individual TB's proficiency, but averaged about two minutes.

On the surface, the job of the TB might have seemed to be the most attractive of all the plant assignments. He was the highest paid, received an additional bonus for production above established norms, and worked in the only air-conditioned section of the production area. In spite of the obvious advantages, the TB's had the highest turnover, lowest morale, and were the most active in campaigning for plant unionization. Management considered the latter to be the most reliable sign of dissatisfaction.

Selection procedures for the TB trainees consisted of a background investigation to verify data on the job application, a manual aptitude test, and an interview. The new TB trainee then received up to three months training. When each individual reached a certain rate of production, training was deemed complete. Many trainees qualified for full TB status in only six to eight weeks.

Some of the more promising new TB's who completed training in less than average time would ultimately prove unsatisfactory in that assignment. Management personnel, most of whom were recently transferred from older tire plants in the northern and northeastern United States, where TB's tended to be older and better established in their occupation, usually ascribed the high rate of TB failure to what they considered to be the lackidaisical Oklahoma attitude toward work. However, a frequent pattern of TB failure seems to suggest other possibilities.

Enthusiastic at first, probably because of the novelty of the new job, high pay, and prospects for the future, many new TB's developed skill quite rapidly. From a few weeks to a few months after training, their individual production was high and steadily increasing. Then, quite suddenly, some would evidence erratic production output patterns, working perhaps for several hours or days at satisfactory levels, then slowing down to far below average rates. Supervisory corrective action, usually threatening and aversive for the TB, seemed to help, and steady, high output was resumed for a while. Soon, however, there were more erratic periods and more threatening talks with the supervisors. The pattern of high and low production periods would usually continue briefly, to be ended by termination of the TB. Sometimes the TB would simply disappear after receiving a bi-weekly paycheck.

The surviving TB's seemed to fall into two groups. One group, usually the older workers, expressed little dissatisfaction and quietly pursued their work. The other group was frequently complaining of working conditions and alleged unfair management practices. The latter group formed the nucleus of workers who were campaigning for unionization of the new plant--a campaign which management tenaciously resisted.

Standing in one spot, the TB performed a highly repetitive task, producing a green tire about every two minutes. Steps within the cycle were very similar. Except for occasional contact with supervisory personnel, interpersonal activity was minimal. The noise level in the plant was moderate, but generally void of information. The situation of the TB was one of low stimulus variability. The different responses by various TB's to these conditions might possibly have been better understood by considering differences in OLS.

The lower OLS TB's might have been those who tolerated the work with little difficulty. The TB's with a higher OLS might have been those who failed and were terminated, or remained on the job but expressed intense dissatisfaction. Management personnel of the plant refused to participate in a study which would have explored these possibilities.

Statement of the Problem

Thus far Ruder (1974) appears to be the only investigator who has explored the possibility that need for stimulation may be predictive of performance in a monotonous situation. In her study subjects were presented with a highly repititious cognitive task, which consisted of a number of simple multiplication problems, for a period of three hours. The subjects were allowed to determine their own work rate and pattern. The major finding was that subjects scoring near the mean on the CSI (the measure of OLS used in her study) persisted at the task for longer periods than did subjects scoring either high or low on the CSI.

The present study was designed as a modified replication of the Ruder study, with two major changes. The first change was that a motor coordination, industrial-type task was employed, as opposed to a cognitive task. The second was that measures of behavior with profit and loss implications similar to those actually encountered in industry were included among the dependent variables.

A major difficulty in research of this type is that a definitive criterion for boredom has not been established (Berlyne, 1967). Self-report scales, for example, may be useful, but are often considered unreliable (Anastasi, 1968). Actual performance measures would appear to be helpful since it is likely that a bored person would produce less than a non-bored person provided all other variables remained equal.

Burtt (1948) has suggested a possible early indicator of boredom, i.e., the bored worker is often identified by wide variations in his rate of production. Burtt contends that "workers who are slowing down to compensate for the monotony occasionally realize that they are not doing so well and have spasmodic bursts of speed. This makes for more ups and downs in production through the day" (p. 587). The case of the tire builder certainly supports Burtt's contention. That performance time variance is indeed important to industrial production rate is illustrated by a study by Kala and Hitchings (1973) in which the effects of station service time variance on the operating characteristics of an assembly line were examined. Station service time is the length of time taken to perform a single assembly step, such as installing spark plugs in an automobile engine. Time required for some assembly steps varies more than it does for others. Kala and Hitchings (1973) found, for example, "that assignment of the higher station service time variances at the end of the line tends to make for a more efficient production rate and less accrued idle time" (p. 351). Since variability of production may be a good early indicator of boredom, and since variability of production can also have a great impact on the total industrial output, such measures were included in the present study and were related to subjects' need for stimulation as measured by the Change Seeker Index.

CHAPTER II

METHOD

Subjects

The Change Seeker Index was administered to 177 introductory psychology students at Oklahoma State University. From this subject pool thirty were selected and assigned to one of three groups, each composed of five males and five females. The first group was made up of subjects scoring highest on the CSI (High CSI Scorers). The second group was composed of subjects with CSI scores nearest the overall mean (Medium CSI Scorers). The third group consisted of subjects scoring lowest on the CSI (Low CSI Scorers). Table 1 shows the means and standard deviations for each of the CSI groups. Subjects were not aware of the basis for their selection and no reference to the previously administered CSI was made.

The subject-selection procedure employed helped to maximize the differences in mean CSI scores among the three groups and avoided possible volunteer bias effects. Zuckerman, Schultz, and Hopkins (1967), for example, found that volunteers for some types of experiments had higher preferred levels of stimulus input than did nonvolunteers. The most desirable candidates, having been identified from among the subject pool of 177, were vigorously recruited under the pretext that their names had been randomly selected.

Table 1

Means and Standard Deviations of High,
Medium, and Low CSI Groups

CSI Group	M	SD
High	70.90	3.66
Males	70.00	4.06
Females	71.80	3.42
Medium	53.00	.67
Males	53.00	.71
Females	53.00	.71
Low	32.60	4.81
Males	33.60	3.36
Females	31.60	6.19

Subjects were debriefed at the close of the session and received a small credit toward their final course grade for participating in the experiment.

The Change Seeker Index

The Change Seeker Index is a self-report inventory designed to measure one's need for stimulation from both cognitive and external sources (Garlington & Shimota, 1964; see Appendix A). It consists of 95 true-false items scored in the direction of high change seeking. The Change Seeker Index was selected from among the various self-report inventories due to its reasonably well established reliability and validity. A detailed discussion of the reliability and validity of the CSI may be found in Garlington and Shimota (1964) and Ruder (1974).

Apparatus and Experimental Task

The apparatus consisted of a simplified pinball machine (see Figure 1). The device was equipped with a spring-mounted, manually operated plunger for propelling steel balls of about 40 mm diameter. The balls were manually loaded and propelled by withdrawing the plunger handle and then quickly releasing it. Spring compliance was such that withdrawing the plunger 1 cm required 250 gms of force. A withdrawal of about 6 cm required a force of about 1,500 gms and would propell the ball through a trajectory passing between the two target points which were visible to S. If the ball passed between these target points, it made contact with two brass strips completing an electrical circuit scoring a correct trial or "hit." Excessive plunger withdrawal force caused the ball to overshoot

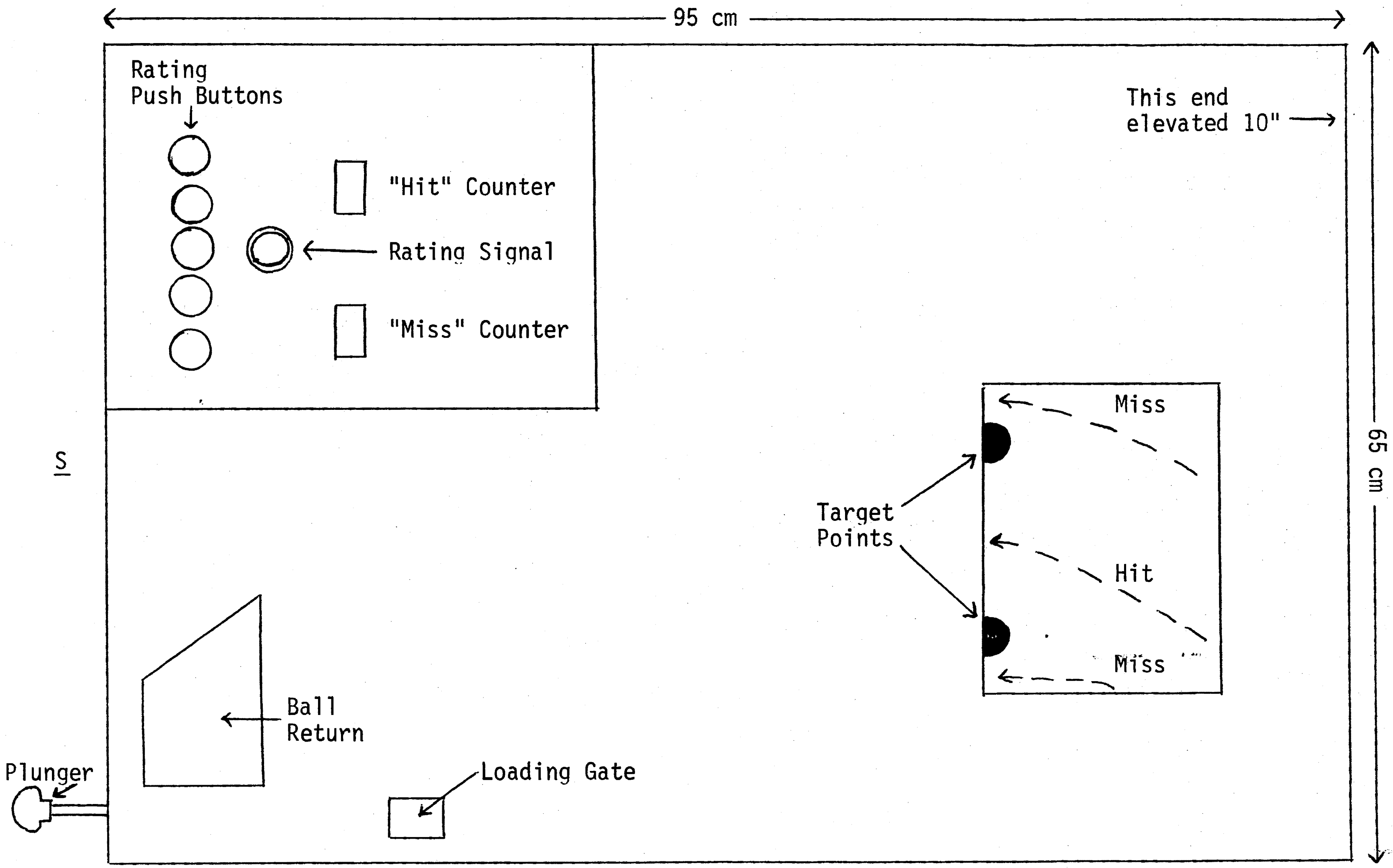

Figure 1. Pinball Device

the target points and was scored as an incorrect trial or "miss." Insufficient force, causing the ball to undershoot, was also scored as a miss. Care was taken in the design of the apparatus to insure that only a moderate plunger force would be required to operate the device. Such a precaution was intended to reduce the likelihood of a serious physical fatigue problem and to avoid a sex effect based solely on differences in physical strength.

After each trial, the ball returned to an open slot near S to be available for another trial. Two balls were provided to allow a high rate of activity. The second ball could be loaded while the first was completing its course through the device.

The apparatus and experimental situation were intended to simulate frequently encountered assembly line situations. The ball represented a part being added to the assembly; a hit represented a correct assembly, a miss represented an incorrect one. The task was both simple and highly repetitious and was thus expected to induce a boredom response in the subjects, especially those having a lower tolerance for a potentially boring task.

Mounted near the subject was a row of five push-button switches with each button corresponding to one point of a five-point scale which S used to rate the degree of interest he felt in the task. Each button was clearly labelled with adjectives appropriate to the corresponding point on the scale (see Appendix B). Nearby was a panel light which at regular intervals signalled the S to select and push one of the buttons to make an affect rating. The panel light automatically went out when S completed each rating. Near the affect rating push buttons were two counters, visible to S, which indicated the total number of hits and misses S had accumulated.

To reduce the stimulus value of the task itself, several precautions were taken. The device was securely mounted on a heavy table to prevent tilting and was securely sealed so as to resist tampering. During a trial the ball was visible only for a moment through a small Plexiglas-covered window near the target points. Padding was used inside the device to reduce noise. Except for apparatus essential to the present experiment, the cubicle was empty. There were no windows in the cubicle, however, the door was equipped with a one-way mirror.

S performed all work with his right hand since his left hand was constrained by the attachment of electrodes. The electrodes gathered skin resistance data for a separate study, the results of which will be reported elsewhere.

In an adjacent cubicle E was stationed with recording and control equipment consisting of the following:

1. Power supply circuitry.

2. A variable timing device to turn on the verbal rating light in S's cubicle at intervals of 10 minutes.

3. Counters showing cumulative hits and misses.

4. An event recorder with five channels activated to record S's verbal rating responses.

5. A data recorder with two event channels recording hits and misses and a third channel recording the skin resistance data. In order to coordinate the data on the two different recorders, the action of the rating light was superimposed on the miss channel of the data recorder. (Misses during the time the rating light was on were therefore not

recorded. It was felt that any resulting loss of data would be insignificant.)

Procedure

Ss were tested individually for a three-hour work session. Upon arrival S was seated, given initial instructions and then told he could use the restroom or get a drink of water before beginning the session. Upon S's return the instructions were completed and S was given a few practice trials before beginning work for record. Briefly, S was told the study concerned work habits in a factory type situation and was instructed to get as many "hits" and as few "misses" as possible. Explicit permission for S to work at his own pace and to rest occasionally was included in the instructions (see Appendix C). Approximately the first 10 minutes of the actual work session was used to stabilize skin resistance activity, and behavioral data from that period were recorded, but not analyzed. The S worked for three hours and was then dismissed. S was alone in the cubicle during the entire session. For more detailed information on procedure see Appendix C.

Dependent Variables

It was recognized that no single measure of an individual's productivity would be relevant to all types of industrial situations. For this reason several different measures were developed. The first four dependent measures are special-case forms of a measure it seemed reasonable to call the Production Index. Production Index (PI) was defined as a constant x correct responses (hits) + another constant x incorrect responses (misses). Stated in algebraic form this becomes PI = (A) x (hits) + (B) x (misses). This general form is applicable to a wide range of industrial situations if particular values for A and B are considered. The four PI dependent measures used were:

Production Index 1 (PI_1): A = +1, B = 0; or PI_1 = hits. This measure would be most meaningful in industrial situations where only hits are of importance and misses add a negligible cost (other than that of time delay); for example, tasks where errors or misses do not consume materials.

Production Index 2 (PI_2): A = 0, B = -1; or PI_2 = misses. This represented another extreme case, one in which misses are so costly that they overshadow all else, e.g., diamond cutting.

Production Index 3 (PI_3): A = +1, B = +1; or PI_3 = hits - misses. This measure struck a middle position relating the value of hits and the cost of misses. PI_3 probably approximates a situation which would apply in most industrial cases where materials and/or a large amount of time are lost when errors occur.

Production Index 4 (PI_4): A = +1, B = +1; or PI_4 = hits + misses. This is a measure of total activity which might be useful during training, i.e., before peak accuracy is reached.

Based on comments made by Burtt (1948) regarding the variability of production already discussed in Chapter I, four variability measures, each relating to the PI's were used. The entire work session was divided into five-minute intervals and PI_1, PI_2, PI_3, and PI_4 scores for each interval were determined. The standard deviation of the scores throughout the entire work period was calculated. Variability measures (standard deviation of each PI) were designated as follows:

VP_1: Variability of PI_1

VP_2: Variability of PI_2

VP_3: Variability of PI_3

VP_4: Variability of PI_4

The ninth dependent variable was the verbal ratings of interest or boredom. These were collected every ten minutes on the five point scale ranging from "very bored" to "very interested" (see Appendix B).

Due to the absence of literature relating need for stimulation to performance under conditions of low stimulus variation but repetitive motor activity, no a priori predictions were made.

CHAPTER III

RESULTS

Statistical Analysis

Nine analyses of variance were completed. Five were based on a 3 x 2 x 4 factorial arrangement (High, Medium, and Low CSI Scorers x Sex x four Time Periods of 45 minutes each), with repeated measures on the last factor. These five three-way analyses of variance were performed with respect to the four PI variables and verbal ratings. The remaining four analyses of variance were of a 3 x 2 factorial arrangement (High, Medium, and Low CSI Scorers x Sex) and were performed with respect to the variability measures. Since it was not possible to randomize the factor of periods, reduced degrees of freedom, according to the Greenhouse-Geiser procedure (Winer, 1971) were employed to prevent a possible positive bias to the F test of the periods factor.

It was noted that any of the PI's might show significant variability for one or both of two separate reasons. First, a given PI might steadily increase or decrease over the entire three-hour period. Second, a given PI might vary from five-minute period to five-minute period but not show any overall upward or downward trend. The 3 x 2 arrangement (CSI x Sex) would not have differentiated between these two possibilities. It was decided, therefore, that if any of the 3 x 2 factorial analyses of variance (CSI x Sex) performed with respect to VP_1, VP_2, VP_3, or VP_4 indicated a significant main effect or interaction a further examination would be in order. Graphical display of PI cell means for each five-minute period would have been plotted and examined visually to determine the nature of any possible variability. Further statistical analyses might then have been performed, if indicated by the visual examination of the plotted data.

The mean CSI score for the original subject pool (N = 177) was 53.03 (*SD* = 11.49). In a similar study, Ruder (1974) reported a group mean of 54.66 (*SD* = 12.39). It should be noted that these scores are higher than the mean CSI score originally reported by Garlington and Shimota (1964) of 47.70 (*SD* = 13.00). McCarroll, Mitchell, Carpenter, and Anderson (1967), however, have reported a mean comparable to that obtained in the present investigation (*M* = 54.70).

Performance Index 1, 2 and 3 (PI_1, PI_2 and PI_3)

The analyses of variance (ANOVA) for PI_1, PI_2 and PI_3 indicated no significant differences for any of the three factors examined, CSI group, Sex, or Periods. There were also no significant interactions among the variables (Tables 2, 3 and 4).

Performance Index 4 (PI_4)

The ANOVA for PI_4 resulted in no significant main effects. A single significant interaction between CSI and Sex was found, however ($p < .05$; Table 5). Figure 2 depicts the relationship between CSI and Sex and suggests that, for Low CSI groups, males outperform females, while in the High CSI group the females scored higher than the males (Table 6). A test of simple main effects, however, revealed no significant differences (Table 7).

Table 2

Summary of the Analysis of Variance of Performance Index 1 (PI_1 or Hits)

Source	df		MS	F
Between Subjects	29			
CSI	2		692.82	1.12
Sex	1		493.65	< 1
CSI x Sex	2		1,390.21	2.24
Subjects Within Groups	24		619.44	
	Conventional	Conservative		
Within Groups	90			
Periods	3	1	171.67	1.17
CSI x Periods	6	2	68.63	< 1
Sex x Periods	3	1	125.22	< 1
CSI x Sex x Periods	6	2	194.61	1.33
Periods x Subjects Within Groups	72	24	146.22	

Table 3

Summary of the Analysis of Variance of Performance Index 2 (PI_2 or Misses)

Source	df		MS	F
Between Subjects	29			
CSI	2		13.59	< 1
Sex	1		433.46	3.48[a]
CSI x Sex	2		316.80	2.54
Subjects Within Groups	24		124.69	
	Conventional	Conservative		
Within Groups	90			
Periods	3	1	13.99	1.63
CSI x Periods	6	2	6.32	< 1
Sex x Periods	3	1	2.33	< 1
CSI x Sex x Periods	6	2	4.77	< 1
Periods x Subjects Within Groups	72	24	8.60	

[a] $p < .10$

Table 4

Summary of the Analysis of Variance of Performance Index 3 (PI_3 or Hits Minus Misses)

Source	*df* Conventional	*df* Conservative	*MS*	*F*
Between Subjects	29			
CSI	2		651.00	< 1
Sex	1		1,852.36	2.32
CSI x Sex	2		899.21	1.13
Subjects Within Groups	24		798.31	
Within Groups	90			
Periods	3	1	156.56	1.36
CSI x Periods	6	2	91.16	< 1
Sex x Periods	3	1	109.10	< 1
CSI x Sex x Periods	6	2	145.15	1.26
Periods x Subjects Within Groups	72	24	115.53	

Table 5

Summary of the Analysis of Variance of Performance Index 4 (PI_4 or Hits Plus Misses)

Source	df		MS	F
Between Subjects	29			
CSI	2		762.47	1.10
Sex	1		2.50	< 1
CSI x Sex	2		2,531.03	3.67*
Subjects Within Groups	24		690.13	
	Conventional	Conservative		
Within Groups	90			
Periods	3	1	218.35	1.12
CSI x Periods	6	2	56.90	< 1
Sex x Periods	3	1	142.45	< 1
CSI x Sex x Periods	6	2	257.55	1.32
Periods x Subjects Within Groups	72	24	194.56	

*$p < .05$

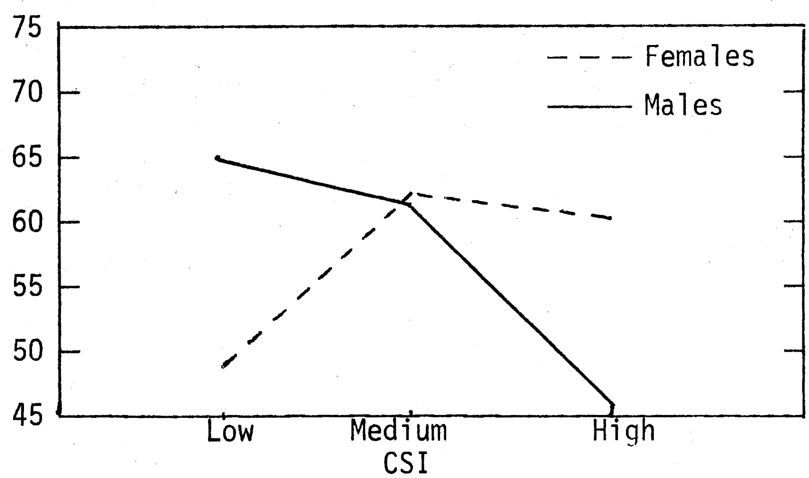

Figure 2. Performance Index 4 as a Function of Subject's Sex and CSI Level

Table 6

PI_4 Cell Means for CSI x Sex Interaction

CSI Group	Male	Female
Low	65.08	48.58
Medium	61.50	61.84
High	45.31	60.60

Table 7

Summary of Test of Simple Main Effects for CSI x Sex Interaction on PI_4

Source	df	MS	F
Between CSI Groups Within Male	2	2,219.29	3.22[a]
Between CSI Groups Within Female	2	1,072.82	1.55
Between Sexes Within High CSI	1	2,337.84	3.39[a]
Between Sexes Within Medium CSI	1	1.16	< 1
Between Sexes Within Low CSI	1	2,722.50	3.94[a]
Subjects Within Groups	24	690.13	

[a] $p < .10$

Variabilities of PI_1, PI_2, PI_3 and PI_4

The ANOVAs for VP_1, VP_2, VP_3 and VP_4 resulted in no significant differences (Tables 8 through 11). It was therefore unnecessary to add Periods as a factor for further analysis.

Verbal Ratings

The ANOVA for verbal ratings indicated a single significant main effect for the Periods factor ($p < .01$). No significant interactions were found (Table 12). Means for verbal ratings showed a steady decline over the four periods (3.41, 2.37, 1.83 and 1.63).

Table 8

Summary of the Analysis of Variance of
Variability of PI_1 (VP_1)

Source	*df*	*MS*	*F*
CSI	2	36.53	< 1
Sex	1	112.87	2.24
CSI x Sex	2	6.96	< 1
Within Groups	24	50.46	

Table 9

Summary of the Analysis of Variance of
Variability of PI_2 (VP_2)

Source	*df*	*MS*	*F*
CSI	2	.03	< 1
Sex	1	9.25	2.23
CSI X Sex	2	5.72	1.38
Within Groups	24	4.16	

Table 10

Summary of the Analysis of Variance of Variability of PI_3 (VP_3)

Source	df	MS	F
CSI	2	20.30	< 1
Sex	1	15.18	< 1
CSI x Sex	2	18.89	< 1
Within Groups	24	43.81	

Table 11

Summary of the Analysis of Variance of Variability PI_4 (VP_4)

Source	df	MS	F
CSI	2	69.94	1.10
Sex	1	195.13	3.30[a]
CSI x Sex	2	12.95	< 1
Within Groups	24	59.18	

[a] $p < .10$

Table 12

Summary of the Analysis of Variance
of Verbal Ratings

Source	df		MS	F
Between Subjects	29			
CSI	2		.99	< 1
Sex	1		1.50	< 1
CSI x Sex	2		.31	< 1
Subjects Within Groups	24		3.47	
	Conventional	Conservative		
Within Subjects	90			
Periods	3	1	19.15	72.56**
CSI x Periods	6	2	.09	< 1
Sex x Periods	3	1	.06	< 1
CSI x Sex x Periods	6	2	.24	< 1
Periods x Subjects Within Groups	72	24	.26	

**p < .01

CHAPTER IV

DISCUSSION

Change Seeking and Sex Differences

No significant main effects for CSI scores or sex were found. In this respect the results of the present study differ from those found by Ruder (1974) which indicated that for both sexes the middle CSI scorers might be the best workers. It should be noted, however, that when the results shown in Figure 2 are collapsed across sexes the trend, though falling short of significance, is similar to that found by Ruder (1974).

Figure 2 indicates that the low and middle CSI males performed about the same with regard to PI_4 (total activity), while the high CSI males were somewhat lower. The apparent lower total of the high CSI males might have been expected, as the task would probably fail to provide sufficient stimulation to maintain interest among this group. The performance of the females with respect to total activity shows the middle and high CSI Ss to be about equal and above the low CSI females. Possibly the task provided excessive stimulation for the low CSI females. At any rate, an apparent sex difference is indicated. However, since this is the only result which indicated $p < .05$ out of 28 F tests, replication, perhaps with a larger number of subjects is in order before greater reliance is placed on this result.

A possible explanation of the sex difference might be that some aptitude or personality variable upon which performance on this particular task depends relates to change seeking differently for males than for females. Several studies have indicated such sex differences, for example, Kish and Donnenwerth (1972) found that several variables related significantly to optimum level of stimulation as measured by the SSS, for males, but not for females. Among these variables were authoritarianism-dogmatism, composite aptitude, English aptitude, mathematics aptitude, natural science aptitude, and social sciences aptitude (all but the first were measured by the American College Testing program). Penney and Reinehr (1966) report that quantitative aptitude and verbal aptitude as measured by the College Entrance Examination Board Scholastic Aptitude Test relate to optimum level of stimulation as measured by the SVSS significantly for males, but not for females. In a factor analytic study of the SSS, Zuckerman (1972) found that a subscale labelled "Boredom Susceptibility" showed odd-even reliability for males but not for females. Zuckerman (1972) further found that the subscale scores for males were higher than for females.

Kish and Donnenwerth (1969) have reported that optimum level of stimulation, as measured by the SSS, correlates significantly with woman's scores on the "housewife" scale of the Strong Vocational Interest Blank ($\underline{r} = -.47$, $\underline{p} < .01$). Based upon this moderately strong negative correlation, it would seem reasonable to suggest that few low CSI females willingly leave the home to enter industrial occupations. Most females who do occupy industrial occupations would therefore be more likely to be middle or high CSI scorers who, according to the results shown in Figure 2, perform in a repetitive motor task better than the low CSI females and about as well as the best of the male groups. Such a finding may suggest a possible explanation for the legendary superiority of females in performing repetitive tasks, since the poorer prospective female workers (that is, those with lower CSI scores) tend to remain in the home. A study might readily explore the possibility. CSI scores of a sample from the general female population might be compared to the CSI scores of a group of working females. Support for the purported superiority of females in performing highly repetitive tasks, however, might be more difficult to come by, as the present study failed to indicate a significant overall sex difference.

Variability Measures

The present study failed to reveal a significant effect of CSI level or sex on any of the dependent measures of performance variability. A similar study conducted over an extended period of at least several weeks might possibly show such a difference. In the cited example of the tire builder, erratic performance rarely became detectable until after the six to twelve week training period. During the three-hour period of this experiment, it may be that potential performance variability due to optimum level of stimulation differences was masked by the effects of other motivational variables.

Period Effects

Verbal ratings of affect showed a pronounced decline over time, demonstrating that the task chosen for the present study had a distinctly boring quality for the Ss. There were, however, no other period effects. The study by Ruder (1974) suggested the presence of a possible practice effect. The differences between the task used in the earlier study and that used in the present investigation probably account for the difference in results. One might conclude that the subjects were more willing to persist at playing "pinball" than to solve simple multiplication problems.

Remarks on the Study

A more successful independent variable for a study such as the present one might be based on a specific subscale such as the Boredom Susceptibility subscale of the SSS (Zuckerman, 1972) or a similar subscale derived from the CSI. The large set of variables probably measured by the CSI may have contributed to the large error terms which prevented significant findings, particularly on the variability measures.

The small cells (n = 5) used in the present study may also have contributed to the failure to show significant differences. A single extremely atypical subject in a cell may have caused a major increase in the error term. For example, one high scoring male on the CSI showed only slight variability. Following the experiment this subject likened the task to his experience driving a tractor. He disliked doing it, but by what appeared to the experimenter as a strong incorporation of the work ethic, the subject expressed an obligation to work hard. A high CSI female also displayed little variability. This subject reported making a "war game" of the task which helped maintain interest.

As previously mentioned, the relatively short time period of three hours used in the present study is probably much too short to demonstrate effects of boredom on such a task. The administrative problems of using longer time periods with university student subjects pose a severe limitation. Perhaps a more practical approach would be to gain the cooperation of industry and gather observational data on industrial workers employed in highly repetitious tasks. The subjects could be tested at the time they are hired and observed for several months. As mentioned in Chapter I, a major industrial corporation was approached for help with such a study, but declined to participate due to fears of violating current laws and regulations limiting the testing of employees. Department of Health, Education and Welfare regulations, however, would not have precluded such a project as a purely scientific inquiry (H.E.W., 1972).

Possible Application

Department of Health, Education and Welfare regulations on testing might preclude the direct use of the CSI, SSS, or SVSS as a selection device. Inventory questions such as those relating to breaking laws would certainly be objectionable to some applicants. Another factor against these testing instruments would be the strong likelihood of prospective employees answering in the direction of highest social acceptability. Farley (1967) found that social desirability was not a factor in students' responses to the SSS, however, a similar study conducted with unemployed job applicants, with the questionnaire being presented by the prospective employer, might produce a vastly different result.

There are other possibilities for arriving at some estimate of OLS, however, in light of the many behaviors which correlate with, for example, the CSI (Brown, Ruder, Ruder, & Young, 1974). Some alternate measure of OLS might be more useful in industry for assigning newly hired personnel than in making hire or not-hire decisions.

Whatever the method of incorporating the findings of scientific research to industrial situations, the existence of a serious industrial problem is undeniable. Called the "Job Blahs" and the "Blue-Collar Blues," the problem affects millions of workers directly and everyone indirectly (Boredom spells trouble on the line, 1972). The growing number of mechanically repetitious jobs, combined with a possible increase in the average optimum level of stimulation over time foretells an even greater future need to deal with the problem.

A few attempts by industry to deal with industrial boredom are noteworthy. The use of work teams and occasional shifting of duties within the work team have been used by some with success; both techniques serve to raise the potential stimulation level of the work task. Production efficiency sometimes suffers with the workteam approach, however, and in this time of marginal corporate profits, management may be understandably reluctant to place employee morale above profit efficiency (Nicholson, 1973). As in cases of working conditions and right to organize conflicts, state or federal legislation may be in order.

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APPENDIX A

THE CHANGE SEEKER INDEX

1. I think a strong will power is a more valuable gift than a well-informed imagination.

2. I like to read newspaper accounts of murders and other forms of violence.

3. I like to conform to custom and to avoid doing things that people I respect might consider unconventional.

4. I would like to see a bullfight in Spain.

5. I would prefer to spend vacations in this country, where you know you can get a good holiday than in foreign lands that are colorful and "different."

6. I often take pleasure in certain non-conforming attitudes and behaviors.

7. In general, I would prefer a job with a modest salary, but guaranteed security rather than one with large, but uncertain earnings.

8. I like to feel free to do what I want to do.

9. I like to follow instructions and to do what is expected of me.

10. Because I become bored easily, I need plenty of excitement, stimulation, and fun.

11. I like to complete a single job or task at a time before taking on others.

12. I like to be independent of others in deciding what I want to do.

13. I am well described as a meditative person, given to finding my own solutions instead of acting on conventional rules.

14. I much prefer symmetry to asymmetry.

15. I often do whatever makes me feel cheerful here and now, even at the cost of some distant goal.

16. I can be friendly with people who do things which I consider wrong.

17. I tend to act impulsively.

18. I like to do routine work using a good piece of machinery or apparatus.

19. People view me as a quite unpredictable person.

20. I think society should be quicker to adopt new customs and throw aside old habits and mere traditions.

21. I prefer to spend most of my leisure hours with my family.

22. In traveling abroad I would rather go on an organized tour than plan for myself the places I will visit.

23. I like to have lots of lively people around me.

24. I like to move about the country and to live in different places.

25. I feel that what this world needs is more steady and "solid" citizens rather than "idealists" with plans for a better world.

26. I like to dabble in a number of different hobbies and interests.

27. I like to avoid situations where I am expected to do things in a conventional way.

28. I like to have my life arranged so that it runs smoothly and without much change in my plans.

29. I like to continue doing the same old things rather than to try new and different things.

30. I would like to hunt lions in Africa.

31. I find myself bored by most tasks after a short time.

32. I believe that it is not a good idea to think too much.

33. I always follow the rule: business before pleasure.

34. I enjoy gambling for small stakes.

35. Nearly always I have a craving for more excitement.

36. I enjoy doing "daring," foolhardy things "just for fun."

37. I see myself as an efficient, businesslike person.

38. I like to wear clothing that will attract attention.

39. I cannot keep my mind on one thing for any length of time.

40. I enjoy arguing even if the issue isn't very important.

41. It bothers me if people think I am being too unconventional or odd.

42. I see myself as a practical person.

43. I never take medicine on my own, without a doctor's ordering it.

44. From time to time I like to get completely away from work and anything that reminds me of it.

45. At times I have been very anxious to get away from my family.

46. My parents have often disapproved of my friends.

47. There are several areas in which I am prone to do things quite unexpectedly.

48. I would prefer to be a steady and dependable worker than a brilliant but unstable one.

49. In going places, eating, working, etc., I seem to go in a very deliberate, methodical fashion rather than rush from one thing to another.

50. It annoys me to have to wait for someone.

51. I get mad easily and then get over it soon.

52. I find it hard to keep my mind on a task or job unless it is terribly interesting.

53. For me planning one's activities well in advance is very likely to take most of the fun out of life.

54. I like to go to parties and other affairs where there is lots of loud fun.

55. I enjoy lots of social activity.

56. I enjoy thinking up unusual or different ideas to explain everyday events.

57. I seek out fun and enjoyment.

58. I like to experience novelty and change in my daily routine.

59. I like a job that offers change, variety, and travel, even if it involves some danger.

60. In my job I appreciate constant change in the type of work to be done.

61. I have the wanderlust and am never happy unless I am roaming or travelling about.

62. I have periods of such great restlessness that I cannot sit long in a chair.

63. I like to travel and see the country.

64. I like to plan out my activities in advance, and then follow the plan.

65. I like to be the center of attention in a group.

66. When I get bored I like to stir up some excitement.

67. I experience periods of boredom with respect to my job.

68. I admire a person who has a strong sense of duty to the things he believes in more than a person who is brilliantly intelligent and creative.

69. I like a job that is steady enough for me to become expert at it rather than one that constantly challenges me.

70. I like to finish any job or task that I begin.

71. I feel better when I give in and avoid a fight, than I would if I tried to have my own way.

72. I don't like things to be uncertain and unpredictable.

73. I am known as a hard and steady worker.

74. I would like the job of foreign correspondent for a newspaper.

75. I used to feel sometimes that I would like to leave home.

76. I find my interests change quite rapidly.

77. I am continually seeking new ideas and experiences.

78. I like continually changing activities.

79. I get a lot of bright ideas about all sorts of things--too many to put into practice.

80. I like being admist a great deal of excitement and bustle.

81. I feel a person just can't be too careful.

82. I try to avoid any work which involves patient persistence.

83. Quite often I get "all steamed up" about a project, but then lose interest in it.

84. I would rather drive 5 miles under the speed limit than 5 miles over it.

85. Most people bore me.

86. I like to find myself in new situations where I can explore all the possibilities.

87. I much prefer familiar people and places.

88. When things get boring, I like to find new and unfamiliar experience.

89. If I don't like something, I let people know about it.

90. I prefer a routine way of life to an unpredictable one full of change.

91. I feel that people should avoid behavior or situations that will call undue attention to themselves.

92. I am quite content with my life as I am now living it.

93. I would like to be absent from work (school) more often than I actually am.

94. Sometimes I wanted to leave home, just to explore the world.

95. My life is full of change because I make it so.

APPENDIX B

SELF-RATING SCALE

5. very stimulated, interested, enthused, engrossed, enlivened, etc.
4. moderately stimulated, interested, enthused, engrossed, enlivened, etc.
3. neither interested nor uninterested, etc.
2. moderately bored, uninterested, apathetic, dull, humdrum, etc.
1. very bored, uninterested, apathetic, dull, humdrum, etc.

APPENDIX C

INSTRUCTIONS FOR EXPERIMENTAL TASK

The following procedure was used with each subject:

*1. Clean skin resistance (SR) electrodes with rubbing alcohol.

2. Check plugs A and B.

3. Feedback switches to "on" position.

4. Set all counters to zero.

5. Plug in large plug and cube tap.

6. Turn timer on and push Interval Switch down.

7. Check dials on timer (should read: 5, 4, x10).

8. Turn on power supply.

9. Turn on verbal rating signal lights.

10. _S_ arrives.

11. Seat _S_ and take his wristwatch, placing it in observer's cubicle.

12. Read the following to _S_:

    This experiment is designed to study work habits in a factory-type situation. I want you to pretend that the situation is similar to that of an industrial worker who is assembling a product in a factory. These steel balls [point to balls] are the parts you are adding to the assembly. Your job is to insert them [point to window] using a plunger device [point to plunger].

    To do this, you load the plunger [demonstrate], and then withdraw it and fire to complete the assembly. You'll note that correct force is critical. Too little force--which is controlled by the distance the plunger is withdrawn--will fail to insert the ball. Furthermore, pretend that excessive force will damage the assembly. It is important therefore that you use the correct amount of force--you will know when you have done so when the ball passes between these two points [point]. Insufficient force will of course cause the ball to undershoot [point] and too much force will cause the ball to overshoot [point].

    The balls will return here [point]. The counters [point] will record your correct insertions or _hits_ and your incorrect insertions or _misses_.

    From time to time this light [point] will come on. This will be a signal for you to perform a rating of how you feel about the

*Starred items relate to separate skin resistance study.

task at that moment. To perform the rating you select the button above the words which best describe your feeling about the task and give that button a sharp, fast jab [demonstrate]. As you can see, the light will then go out. If you hold the button down or touch it at any other time, the equipment will not function properly. Remember, therefore, to make a sharp, fast jab!

If the light should go on while you're making an insertion, you should complete the insertion and then rate promptly. After rating you may then resume working.

You are free to select your own work rate and pattern. Do not be afraid to take an occasional rest if you wish, but we would prefer that you remain in this room when you do so.

Do you have any questions?

Since you may be in this room for up to four hours you should take this opportunity to get a drink of water or visit the restroom. In fact, it is essential for reasons I'll explain in a few minutes that your hands be very clean. I would be grateful, therefore, if you would now go and wash them as thoroughly as possible.

13. S returns from restroom.

*14. Hook up electrodes.

15. Read the following to S:

During the experiment you must use your right hand for all work and button-pressing, because you will have these electrodes on your left hand [attach electrodes]. The electrodes record the galvanic skin response, a physiological event, but be assured that you will not be shocked or receive any painful stimuli of any kind. For the electrodes to record properly it is important that your left hand be kept as still as possible during the entire work period. You might therefore try a few positions so as to find the one which is most comfortable for you [lap, table--allow S to find comfortable position].

Short of an emergency or equipment malfunctions, we would be very grateful if you remainedin this room until you are asked to leave. The door, however, will never be locked. You will not be under constant observation, but we may look in to see how things are going from time to time.

Remember, now, you are allowed to choose your own working rate and pattern. And remember, too, that you should keep your left hand still throughout the experiment.

To make sure you understand the procedure, please insert several balls and try to get them between these two points [point, and allow S to practice until he gets a total of 3 hits]. That should be enough practice.

How do the electrodes feel? [Adjust as necessary].

I will now reset the counters [reset]. Please try not to touch them during the experiment.

Remember, now, keep your left hand still; make sharp, fast jabs when giving your ratings; and get as many hits--and as few misses--as you can.

Okay, we're ready to begin. I'm going to close the door now and I want you to wait for the light to come on before starting. When the light comes on, make your first rating and then commence work. I will let you know when the experiment is over. Do you have any questions?

16. Go to observer's cubicle and check lock on power plug of Datagraph.

17. Turn Interval Switch up.

18. Turn on verbal rating light and S begins.

19. Wait 10 minutes before proceeding.

*20. Set SR sensitivity control on zero.

*21. Set SR mode switch to STBY.

*22. Turn SR power switch on.

*23. Center SR pen with position control.

*24. Turn SR mode switch to MULTIPLEX.

*25. Increase SR sensitivity control to 1 or 2 and rebalance with Subject Resistance controls (begin at about 50 KΩ) and lock.

*26. Mode switch on Calibrate and advance Sensitivity Control as needed using calibrate push button deflection desired (AC component) (Tentatively--5,000 ohms/2 cms. or even 1 cm).

*27. (Rebalance where necessary using the Subject Resistance controls; don't use Balance Control. Mark on tape any rebalancing.)

*28. Mode switch on Multiplex, and place DC MPLX control on desired sensitivity (wait for BSR excursion to adjust sensitivity--the lower the more accurate, but 50 probably safest).

29. Calculate and note the exact time to dismiss S.

30. Indicate starting position on tape, S's name, starting time.

*31. Indicate MPLX DC, Subject Resistance, and AC calibration (e.g., 5,000 ohms./cm.).

*32. Mark balance line.

33. Mark Esterline-Angus tape and encircle first response; record name.

34. After n hours mark tape, place on STBY, and record counter totals.

35. Turn power off on Datagraph.

36. Turn off Power Supply.

37. Turn off Timer.

38. (Turn off white noise generator).

39. Unplug two plugs.

40. Return watch to S.

41. Ask questions, ask S not to discuss experiment, thank S, and dismiss.

42. Push affect button to discharge capacitors.

43. (Go to Ortec instructions).

44. Mark Esterline-Angus tape and encircle last response--provide small margin.

45. Check ink wells.

46. Check paper supply.

2

VITA

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