DEMAND CHARACTERISTICS AS DETERMINANTS OF BEHAVIOR: AN UNCONSCIOUS EFFECT

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Abstract

The environmental setting and the willingness to participate in a study may contain within themselves enough information to unconsciously influence the performance of subjects. A 2 X 2 factorial experiment to test these hypotheses is reported. Results support both hypotheses.

Introduction

An extensive body of literature has accumulated concerning demand artifacts in behavioral research (Rosenthal and Rosnow, 1969). Only recently have consumer researchers (Sawyer, 1975; Reingen, 1976) concerned themselves with Orne's (1962) proposition:

...a subject's behavior in any experimental situation will be determined by two sets of variables: (a) those that are traditionally defined as experimental variables and (b) the perceived characteristics of the experimental situation.

The latter variables, demand characteristics or artifacts, are additional unspecified factors that may affect a subject's performance in an experiment and thus pose serious threats to both internal and external validity (Campbell, 1957).

What are these unspecified determinants and how do they affect performance? Initially, Orne (1962) identifies them as the totality of cues which cover an experimental hypothesis to the subject. Later, Orne (1969) gives recognition to the influence of a subject's role when he states:

"Insofar as the subject cares about the outcome, his perception of his role and of the hypothesis being tested will become a significant determinant of his behavior."

According to this perspective, the totality of cues influence behavior when three conditions are met. First, the cues, to have any influence, must be perceived by the subject. Second, these perceived cues must convey an experimenter's hypothesis. Third, the perceived cues must define the role of a subject because the response of a subject is a function of the role created.

Empirical research on demand characteristics has focused on these conditions.

Research on the "cues" aspect of demand characteristics has concerned itself with identifying their nature and occurrence in an experiment. The cues that increase the probability that a subject has recognized and interpreted the experimenter's hypothesis have been found to occur before, during and after an experiment.

Rosenthal and Rosnow (1969) suggest that a subject's prior knowledge about an experiment, past experimental experience, and pre-treatment instructions or measurements have the potential of being used to identify an experimental hypothesis prior to the subject's participation in the actual experiment.

Cues that may convey the experimenter's hypothesis during an experiment take many forms. Grice (1966) shows that the use of a particular research design (within-subjects) suggests change to subjects. Silverman's (1968) results show that the atmosphere of the experimental setting is a potential demand characteristic. The use of deception during the experiment (Kelman; 1967), if obvious, generates greater recognition of the experimental hypothesis. Rosenthal (1969) in his study of the experimenter-subject interaction found that the sex, age, race and gestures made by an investigator led to increased awareness of the hypothesis in question. The message, source and content effect on suspiciousness of experimenter's intent has been found to have some effect on the recognition level of subjects (Rosenthal and Rosnow, 1969).

Post-experimental cues may affect a subject's awareness of the intended hypothesis. Upon completion of the subject's participation in an experiment, the inquiry instrument has the potential to suggest an experimenter's hypothesis (Stang, 1974). Further, because subsequent questioning of these subjects often shows an unwillingness to disclose their suspicions, the researcher is, at times, unsure of any demand bias in their performance.

Research on the "role" aspect of demand characteristics has concerned itself with identifying the role a subject may adopt in an experiment. In all cases, it is assumed that the subject is suspicious of the experimental hypothesis.

Orne's (1962) original statements were based on the observations and behaviors of cooperative volunteer subjects. He assumed that the goals of science in general and the success of an experiment in particular were enough to motivate the volunteer to comply with any and all experimental instructions. In this case, the subject might adopt a "good" subject role and confirm what she/he believes to be the experimental hypothesis.

Three other roles with different effects have been identified. In a study to test the effects of deception on an incidental learning task, Fillenbaum (1966) found no significant differences among deceived and control group. This led him to conclude that characteristically a subject is "faithful." Because a subject does not act on his/her suspicions, a faithful subject role occurs. Agryis (1968) suggests that second-guessing and beating the researcher at his own game may be commonplace in experiments. The "negative" subject role occurs when a subject tries to disconfirm the suspected hypothesis by performing in a random or contrary manner. The effects of a fourth subject role was characterized by Rosenberg (1969) as the "apprehensive" subject. This subject approaches an experiment with the expectations that his/her performance will be evaluated. If the subject's initial suspicion is confirmed in the early stages of the experiment, the subject will perform in such a manner that it will result in a positive, or at least no negative, evaluation.

In an attempt to capture the substance of the literature and provide a better understanding of how the totality of cues affect behavior, Rosnow and Aiken (1973) developed an integrative artifact model.

Using role theory and McGuire's (1968) information processing theory of social influence their model states:

"Our central thesis is that there is a trichotomy of mutually exclusive and exhaustive states of behavior (compliance, noncompliance and countercompliance) which can be seen as the end product of three conjoint mediators (receptivity, motivation and capability), and that artifact independent variables affect the ultimate outcomes of experiments by indirectly impinging on the behavioral states at any of the mediating points."

According to their model, demand artifacts will influence behavior only when (1) the subject has adequate reception of the demand characteristics - or perceives the cues, (2) is motivated to respond positively or negatively - or adopts a role, and (3) is capable of expressing the motivation behaviorally. In all other cases, behavior is overtly unaffected by the demand characteristic.

The purpose of this study is to determine if subjects may be unaware of demand artifacts and yet influenced by them. Two demand artifacts, environmental setting and willingness to participate, are operationalized as independent variables and their unconscious effect on performance is examined.

According to the Rosnow and Aiken (1973) model, at the point of reception the major concern is with conditions that affect the subject's adequate reception of information concerning experimental cues and expectations. Accordingly, the artifactual variable environmental setting is chosen and dichotomized to scientific setting and non-scientific setting. At the point of motivation, the second mediator in the chain, the subject's willingness to participate is believed to represent acquiescent motivation, while unwillingness to participate represents counteracquiescent motivation. The willingness to participate is dichotomized to volunteer subject and non-volunteer subject. Finally, at the point of capability, the subject must be able to manifest his motivation behaviorally. To give direction to the subject's behavior a statement of consensus findings concerning the length of a Volkswagen relative to a Grand Prix Pontiac accompanies one of six questions in a survey. The subject is asked to indicate his/her perception of the relative length of these automobiles. The subject may agree or disagree, if so motivated, with the consensus statement and manifest this agreement or disagreement behaviorally.

Hypothesis

We know little about how the environmental setting affects a subject's behavior. However, the fact that the physical surroundings suggest "science" should heighten the subject's reception to information. Indirectly, Weber and Cook (1972) provide some evidence that scientific setting is likely to activate a good subject role. The research on non-scientific setting is limited to studies of attitude change. Silverman (1968) did find that subjects are more acquiescent to a persuasive message when it is presented in the context of a psychological experiment than when it is presented in a naturalistic setting. Although studies on environmental setting are few in number, they do suggest that setting may differentially influence a respondent's behavior.

We hypothesize that when subjects are placed in a scientific setting they are more likely to be unconsciously affected by the atmosphere and respond differently than those subjects in a non-scientific setting.

In an excellent review by Rosenthal and Rosnow (1969) the volunteer subject has been shown to characteristically differ from the non-volunteer. However, as the authors suggest, little is known about the effect of using volunteer subjects. Orne (1962) in his study on demand characteristics worked with volunteers. They appeared to be so cooperative that he termed them good subjects. One way of assessing the magnitude of volunteer bias in a study is to use non-volunteers in the same study. That is, although volunteers are solicited, both volunteers and non-volunteers are actually used.

We hypothesize that volunteers are more likely to be unconsciously affected by their perceived role and respond differently than those subjects who do not initially volunteer.

As mentioned earlier, subjects must be capable of expressing their motivation behaviorally. To accomplish this, subjects were asked to indicate the length of a Volkswagen relative to a Grand Prix Pontiac. This question was accompanied by a statement of consensus findings (you might be interested to know that most students believe the VW is 70% as long as the Grand Prix). An earlier pretest on this question ensured us that the subjects were able to estimate 70% of a line with significant accuracy. The dependent variable in this study was defined as the mean of the absolute deviation of a slash (made by S_S) from a point that was 70% (105mm) from one end of a line.

Because we sought to measure the unconscious effect of the two artifacts on performance, we had to eliminate those subjects who were capable of "verbalizing" our hypothesis. For the remaining subjects, we interpret a small deviation from 70% as an unconscious attempt to validate the experimenter's hypothesis.

Therefore, hypothesized in this study are the following:

Hypothesis 1: Volunteers are more likely to be unconsciously affected by their perceived role than are subjects who do not initially volunteer. Thus, volunteers are more likely to validate the experimental hypothesis by deviating less from a point that is 70% from one end of a line, than are subjects who do not initially volunteer.

Hypothesis 2: Subjects who are placed in a scientific setting are more likely to be unconsciously affected by the environment than are subjects who are placed in a non-scientific setting. Thus, subjects in a scientific setting are more likely to validate the experimental hypothesis, by deviating less from a point that is 70% from one end of a line, than are subjects in a non-scientific setting.

Procedure and Methodology

To establish a benchmark measure, a pretest of 48 subjects' perceptions regarding the length of a VW relative to a Grand Prix was conducted. In addition, to determine how accurately the subjects could indicate various lengths on a line, they were asked to estimate 66 2/3%, 70% and 75% of a line. Based on the pretest, most subjects estimated the VW to be 104.2 mm which is approximately 70% of a 150 mm line. Further, the subjects were able to estimate 70% of a line with a mean absolute deviation of 3.8 mm.

Sample

On the basis of a brief request for volunteers made by a graduate assistant (the same person in all cases), subjects were clustered into groups of five and

assigned to either a scientific setting (psychological consultation laboratory) or a non-scientific environment (large classroom). Subjects who did not initially volunteer were also assigned to one of the two settings. The request for volunteers and the instructions given to the subjects were identical. A total of 100 male and female undergraduates were assigned to one of four treatment groups.

Procedure

A male source introduced the study as the first part of a two part study designed to identify what they as individuals thought about one topic - the automobile. They were asked to answer questions regarding (1) their experience with any of sixteen named automobiles, (2) most important features considered prior to purchasing an automobile, (3) rank order in importance, fuel-economy, performance, size of car, (4) the length of a VW relative to a Grand Prix, (5) their agreement on one of two statements dealing with the relationship of horsepower and fuel economy, (6) their awareness of advertising campaigns for any of sixteen named automobiles. After the study was completed, subjects were given a post-experimental questionnaire. They were asked about the suspicions they may have had regarding the purpose of the study.

Research Design

A 2 X 2 factorial, consisting of two levels of willingness to participate (volunteer vs. non-volunteer), and two levels of environmental setting (scientific vs. non-scientific) was employed. The dependent measure was defined as the mean absolute deviation from a point located 70% along a line (this point was not indicated on the test instrument). A two-way analysis of variance was used to test for main effects.

Results

Although the purpose of the study is to measure the unconscious effect of two artifacts, we began with an analysis of 92 usable responses to observe the change in the results obtained from all subjects and from those who could not verbalize our hypothesis. The mean responses for all the subjects is found in Table 1.

TABLE 1
MEANS OF THE ABSOLUTE DEVIATION
FOR ALL SUBJECTS

	SETTING: SCIENTIFIC	NON-SCIENTIFIC	
NON VOLUNTEER	21.30	16.22	18.76
VOLUNTEER	17.04	23.13	20.09
	19.17	19.67	

An analysis of variance on the mean responses results in a significant interaction effect for experimental setting and willingness to participate ($F = 5.7526$, $p < .01$). The main effect for both artifacts is not significant ($F.3241$, $p < .57$; $F = .0461$, $p < .83$).

On the basis of the post-experimental inquiry, subjects were eliminated from the analysis (VOL/EXP = 4; VOL/NAT = 7; NVOL/EXP = 9, NVOL/NAT = 6). They were able to verbalize the intended hypothesis of the study. The mean responses for the remaining 66 subjects were used as a measure of the unconscious effects of two variables. Table 2 shows the mean response for this group.

TABLE 2
ABSOLUTE DEVIATION MEANS FOR SUBJECTS
UNABLE TO VERBALIZE HYPOTHESIS

	SETTING: SCIENTIFIC	NON-SCIENTIFIC	
NON VOLUNTEER	17.43	20.06	18.87
VOLUNTEER	12.53	17.44	14.77
	14.98	18.75	

An analysis of variance on the mean responses is presented in Table 3. The willingness to participate is significant at the .06 level, while environmental setting is significant at the .07 level. Although the joint additive effect is significant at the .02 level, neither main effect is at the conventional .05 level of significance. An examination of the differences between the row means and column means and a sample size of 66 suggests that an error rate of .10 is acceptable.

TABLE 3
ANALYSIS OF VARIANCE ON MEAN
ABSOLUTE DEVIATIONS

SOURCE	SS	df	MS	F	P.
MAIN EFFECTS$_a$	517.69	2	258.85	3.82	0.027
W*	229.15	1	229.15	3.39	0.071
S*	241.41	1	241.41	3.57	0.064
W x S	21.20	1	21.20	.31	0.578
ERROR (W. Cell)	4,197.04	62	67.69		
TOTAL	4,735.94	65			

a = join additive effects of W and S
W* = volunteer, non-volunteer
S* = scientific, non-scientific

Discussion

When all the subjects are included, the analysis suggests that the volunteer subjects across settings respond in the intended manner. The non-volunteers in a non-scientific setting respond contrary to our expectations. In all cases the mean absolute deviations are large, indicating very little willingness on their part to validate our hypothesis. If we assume that all the subjects did not recognize and interpret our hypothesis we are left with an ambiguous interpretation of the interactive unconscious effect of two artifacts. However, when the subjects who recognize and interpret our hypothesis are eliminated from the study, the artifactual variables appear to have an unconscious and systematic effect on their responses.

An analysis of the post-experimental inquiry for the eliminated subjects is revealing. Volunteers who recognize and interpret the hypothesis react contrary to the statement of consensus findings. Their responses are extreme, and appear to represent a reaction to being deceived. The non-volunteers placed in the scientific setting also have extreme responses.

However, their responses are more a reaction to their being coerced into participating in an experiment. Finally, the responses of the non-volunteers in the non-scientific setting are less variable than any other group of subjects. From their post-inquiries they appear to be more concerned with completing the questionnaire than with expressing their true feelings. Unlike, the other non-volunteers, their responses seem to reflect an "I gave you what you were looking for" attitude.

When these aware subjects are eliminated, we are left with the conclusion that subjects who can not verbalize an experimental hypothesis are nonetheless influenced by two artifactual variables.

Volunteers, on the average, have less variability in their response. Likewise, subjects in the scientific setting, on the average, have less variability in their responses. If we assume that smaller absolute deviations are an unconscious attempt to validate an experimental hypothesis and larger absolute deviations an unconscious attempt to invalidate the hypothesis, the data suggests two observations. First, even though subjects are naive about an experimenter's hypothesis the conditions created in this study appear to systematically influence their performance. Second, the environmental setting of a psychological laboratory and the willingness to participate appear to contain within themselves enough information (cues) to cause an unconscious effect.

Conclusion

This study raises important issues with regard to the external validity of laboratory research.

Can we generalize our findings in the scientific setting to non-scientific settings? This study suggests we can't. Can we generalize the findings from volunteer subjects to non-volunteers? This study suggests we can't. What can we say?

In the absence of learning an experimenter's hypothesis, the environmental setting and willingness to participate contain within themselves enough information to unconsciously influence the performance of subjects. For researchers engaged in consumer behavior experiments, being aware of demand characteristics is the first step taken to reduce their influence.

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