

THE EFFECTS
OF
SALIENT AND NON-SALIENT STIMULI
ON SUBJECTS' SELF REPORT
OF A
LEARNING TASK

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Submitted by: Margaret A. O'Hara

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ABSTRACT

This study addressed the hypotheses proposed by Nisbett and Wilson (1977) that 1) people do not have direct access in memory to the causes of their own behavior, but rather base their verbal reports of such causes on assumptions of plausible causal relationships, which are subject to various attributional bias, and 2) therefore, verbal reports on one's own behaviour are not necessarily any more accurate than those of an observer, provided with the same information regarding external stimuli (causes) and observable behaviours (effects). Sixty subjects participating in pairs in a learning experiment were assigned to one of 3 list conditions. The lists were designed to instill an expectation that either the color of the letters (black vs. colored) or the order of the letters (meaningful vs. meaningless anagrams) is a potent variable in learning, or that both may be potent. Subsequently, subjects participated in a second test condition as learners or observers, then made attributions of causal impact to both the letter arrangement (a highly potent variable) of letter strings and/or color (a highly salient but less potent variable). The results supported both an anti-introspectionist and a pro-introspectionist position. On one hand, they supported the hypothesis that subjects would base their verbal reports on assumptions generalized (erroneously) from the first list. On the other hand, the results indicate that subjects' attributions were not erroneously generalized from one phase to the other but subjects, in fact, made separate and accurate attributions to each learning phase. The hypothesis regarding the similarity of attributions of observer and learner subjects was not supported, due largely to problems with the

procedure. In particular, it is not clear whether observer subjects actually observed learners in the manner expected. Recommendations for future research are suggested.

In recent years there has been a reemergence of interest in the self perception of cognitive processes (Nisbett & Valins, 1971, Nisbett & Wilson, 1977). Researchers have been particularly interested in whether individuals are aware of the factors or stimuli underlying our behavioral responses.

Historically, the act of perceiving one's own psychological processes was called introspection. According to Boring (1973) classical introspection was defined "as the common belief that the description of consciousness reveals complexes that are constituted of patterns of sensory elements" (p. 171). One of the first psychologists to attempt to study introspection empirically was Wilhelm Wundt. Essentially, Wundt thought that by applying the concepts of physics to psychology, one could learn about the mind. He believed that introspection revealed immediate experience and that one therefore gained access to consciousness by looking inward. In his experiments subjects underwent vigorous training before participating. In fact, what subjects were to attend to was specified by Wundt in advance. He was criticized for this method and as a result introspection became suspect.

Partly because of the dubious status of introspection, Watson's behaviorism came to dominate the field of psychology. Watson (1913) was strongly opposed to the idea of mentalistic concepts, including consciousness, sensation and image. He rejected the method of introspection, and in the place of mentalism substituted a stimulus - response psychology. Watson claimed behaviourism to be a more objective psychology, as it dealt exclusively with observable events. Due to his influence, the method of introspection and its significance to psychology

was temporarily submerged.

Recently, Nisbett and Wilson (1977) have argued that introspection had never died. For example, during the late 19th century when psychopathology was being studied from a psychological orientation, the method used was introspection. To this day, the psychoanalytic method focuses on having people turn inward, to determine what is in consciousness and to bring to awareness unconscious forgotten material which may be contributing to the mental disorder. Essentially, psychodynamic - oriented psychopathologists investigate consciousness through introspection and presume to learn about the unconscious through relatively inferential rather than empirical techniques. Thus, it seems that introspection has enjoyed widespread use without ever being shown to be an effective or accurate tool.

Since Watson's famous critique of introspection (1913), the method has been widely regarded as unreliable and unscientific by experimental psychologists, although still used by many clinicians. Ironically, it was a behavioural psychologist who reintroduced a modified form of introspection into modern psychology. Daryl Bem (1972), in a Skinnerian attack on the cognitive dissonance literature (Festinger & Carlsmith, (1957), maintained that people assess their own attitudes through a self perception process, although such perceptions focus on behaviours rather than the so-called contents of consciousness. Bem (1972), being strongly influenced by Skinner, proposed that people learn about themselves through their own behavior. Specifically, he claimed:

Individuals come to know their attitudes, emotions

and other internal states particularly by inferring them from observations of their own overt behavior and/or the circumstances in which this behavior occurs. Thus to the extent that internal cues are weak, ambiguous or uninterpretable, the individual is functionally in the same position as an outside observer, an observer who must necessarily rely upon those same external cues to infer the individual's inner states" (Bem, 1972, p. 2)

On the assumption that people are introspectively unaware of mental processes, he attempted an empirical demonstration.

He developed his hypothesis from a reinterpretation of the influential work of Festinger and Carlsmith (1957). For example, if a person is exposed to a situation whereby he is forced publicly to state a belief that differs from his own private belief, ambivalence results. Ambivalence refers to the state whereby an individual experiences simultaneous conflicting feelings toward a person or thing. According to Festinger and Carlsmith this is an uncomfortable state and consequently motivates the person to change it. Initially the person will look to the environment for cues to justify his behavior, but if unsuccessful he will look inward. If his private belief or attitude cannot explain his behavior then he will work on changing his attitude so as to be congruent with his behavior.

Festinger and Carlsmith (1957) demonstrated that subjects' attitude change depended upon whether or not there was external

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justification for their behavior. In their research, subjects took part in a rather boring task and were subsequently asked to inform other subjects the task was interesting. Three groups took part in the study. One group was given \$20.00 to do this and a second group was given \$1.00. The results showed that the group given \$20.00 showed no attitude change and their attitude was similar to subjects in the control group, who took part in the hour long experiment but received no remuneration. Attitude change was evident for subjects given the \$1.00 reward. This group believed the task to be interesting. The results lend support to Festinger's theory. He claims that because the \$1.00 group had little external justification for stating the task was interesting, a state of cognitive dissonance occurred. In order to change this aversive state, individuals changed their internal attitude toward the task, believing, as well as stating, that it was in fact interesting. This phenomena is known as cognitive dissonance.

Bem reinterpreted the cognitive dissonance theory. Applying Heider's theory of the psychology of interpersonal relationships, he claimed that individuals utilize the same strategies to understand their own behavior. Heider proposed that individuals respond to the overt behavior of others and the controlling variables of which their behavior appears to be a function.

Bem extended this to the individual. For example, taking the viewpoint of an outside observer one would consider another individual's behavior and the context in which the behavior was occurring. Bem suggested that individuals in the Festinger & Carlsmith experiment behaved similarly to an observer. They infer their attitudes or beliefs about a situation from looking at their own behavior and the context in

which it occurred.

When reinterpreting cognitive dissonance experiments Bem suggested a partial identity between self and interpersonal perception. Taking the viewpoint of an outside observer who a) hears the individual make statements about the task and b) is aware that the individual was paid either \$1 or \$20 and subsequently asked to state the attitude of the individual, he would probably consider both of these factors. In the case of the individual paid \$1, the observer would rule out financial gain as being the motivating factor and infer the individual must hold the attitudes he is expressing. On the other hand, the individual who was paid \$20 for making such statements was highly motivated by external reward and thus the observer would infer little or nothing about his actual attitude as the \$20 reward is sufficient justification to explain his overt behavior.

Nisbett and Valins (1971) broadened the causal self analysis theory. They proposed an information processing model similar to that of Bem; however, they suggested that in some cases a brief sample of behavior is not sufficient to produce an inference and results only in attribution instability and information seeking. An important consideration is whether the inference is a statement of fact or a statement that is more like a hypothesis and will spur an individual on to seek out more information to confirm or disconfirm their hypothesis. This has important implications for the self attribution theory and research. Nisbett & Valins (1971) point out problem areas. Firstly, the overt behavior of individuals may be a reflection of the individual's internal state. Secondly, individuals may need to validate their inferences before they can be

transmitted into attitudes, beliefs or feelings. Finally, as a result of inference validation subjects, through watching their behavior in a similar situation may disconfirm their inferences.

A review of all the research in the Cognitive Dissonance and Self Attribution areas was undertaken by Nisbett and Wilson (1977). It became evident from this review that although behavioural changes were noted, there were no concomitant self reports of these changes (Bem & McConnell, 1970; Goethals & Reckman (1973)).

As a result of Nisbett and Wilson's (1977) thorough review of both Insufficient Justification and self perception research they concluded that a) subjects sometimes do not report the evaluational and motivational states produced in these areas of research; b) when they do report such states they may not report a change has taken place in these states; and c) behavioural changes are evident without concomitant verbal self reports that these changes occurred. Nisbett and Wilson therefore concluded that individuals do not have access to higher mental processes.

To summarize, Nisbett & Wilson (1977) claimed that people can be unaware of the existence of stimuli that influences a response, can be unaware of their response, and can be unaware of the effect of stimuli on their response. They believe that access to higher mental processes is not based on an examination of memory for that process, but rather on implicit or explicit a priori cause/effect theories which may be found in the culture of subculture the individual lives in. Nisbett & Wilson (1977) also claim that when individuals are asked to report on cognitive processes, they will do so with a high degree of confidence. This confidence appears to be due more to an illusion of having access rather than an awareness of

underlying processes of judgement and problem solving.

The a priori causal theories referred to by Nisbett and Wilson were first investigated by Tversky and Kahneman (1971; 1973; 1974). These researchers have demonstrated that when persons make intuitive judgements of probability they do not utilize such factors as prior probability or base rate, frequency, regression or sample size; rather they tend to utilize heuristic principles. Heuristic principles are factors used by persons when they are making predictions or judgements. Examples of judgemental heuristics include a) representativeness or similarity, which means that an event is judged probable to the extent that it represents the essential features of its parent population or generating process, b) availability, which means that people assess the frequency of a class or probability of an event by the ease with which instances or occurrences can be brought to mind, and c) adjustment or anchoring, which means that people make estimates by starting from an initial value that is adjusted to yield the final answer. According to Tversky and Kahneman the reliance on such heuristic principles can lead to severe and systematic biases in judgment.

Nisbett and colleagues also contended that an individual's self report is no more accurate than a report given by observers about the same situation. Nisbett & Bellows (1977) demonstrated that when people are asked to report on how a particular stimulus influenced a response, they do not interrogate a memory of the event but rather apply implicit or explicit theories about causality. In this study, subjects were asked to make judgements about a job applicant's a) intelligence, b) likeability, c) sympathy toward feelings of others and d) flexibility in solving problems

subsequent to reading an individual's job application folder. Observer subjects were also included in the study. These subjects were not given an applicant's folder to read but were asked how they thought certain factors would influence certain judgements; that is, the observer subjects made judgements based on very little information. As stated previously, the results indicated similar judgements made by both observer subjects and the subjects who actually took part in the experiment. Three of the four judgements made by both observer and actor subjects were inaccurate. The intelligence judgement, however, was accurate. The authors proposed that these results lent further support to their theory of the use of a priori causal theories as opposed to any introspective ability on the part of subjects. The intelligence judgement was presumed to be accurate because of explicit rules that exist within the culture regarding factors such as a person's verbal ability, that should influence an intelligence judgement. The authors suggested that judgement similarity between observer and actor subjects was so great that only the application of the appropriate rule would account for this factor.

In summary Nisbett and Wilson (1977) asserted that a) individuals are unaware of the cognitive processes underlying their judgement, attitudes and feelings. Rather than interrogating a memory for the event in question, they apply a priori causal theories that can be found in the culture or subculture in which they live; b) their reports are no more accurate than those of observer subjects supplied with the same information about antecedent events; and c) when accurate causal reports are made it is due to the application of the correct causal theory.

Smith & Miller (1978) and White (1980) have criticized Nisbett and

Wilson's (1977) research on both theoretical and methodological grounds. Theoretical criticisms include a) lack of a clear definition for process and content of mental events; Nisbett & Wilson stated no criteria by which to discriminate content from process; b) The verbal report measure is made at some distance from the process, failure of subjects' reports to be informed by the process may have been due to a failure of memory for the process rather than a lack of awareness of cognitive processes.

The verbal report is based on a subset of information stored in memories. Thus, due to the limited capacity of short term memory only the most recent information is accessible directly. Ericsson & Simon (1980) point out the inaccessibility of the process may be due to either an over taxation of short-term memory which was not transferred to long term memory or possibly the information requested was not heeded or attended to.

They propose that a self report may occur at three levels. The first level, direct verbalization involves information verbalized in the form in which it was acquired. The second and third levels, referred to as indirect verbalization involves one or more mediating processes occurring between attention to the information and its delivery. These intermediate processes include a) information attended to is encoded initially on a non verbal form and thus needs to be translated into verbal form; b) scanning or filtering information heeded to determine if it matches the information requested, and c) inference or generative process - subjects may not have attended to information requested and thus inferences are made. This is particularly evident when studies use retrospective verbalization, where subjects must report about their thought processes in experiments with

many trials and thus must synthesize all available information after selective recall. Ericsson and Simon claimed this is where Tversky and Kahneman (1973) research fails. They asserted that cognitive and memory factors must be discerned before one can determine how much heuristic principles account for the data in verbal reports.

In addition, Smith & Miller (1978) have argued that a failure of verbal self report need not indicate a lack of introspective access. They noted that verbal responses are subject to various outside influences such as social desirability, evaluation, apprehension and demand characteristics. Thus, subjects' verbal reports may be hindered by these factors.

The present research focuses primarily on methodological issues. Smith and Miller (1978) and White (1980) have made the following criticisms: Nisbett and Wilson's research is heavily biased against the possibility of detecting accuracy in self reports, because subjects are exposed to only one level of the independent variables in a between subject design. Smith and Miller (1978) and White (1980) claim that for a subject to accurately report on the causal stimulus, they would have to first identify the independent variable being manipulated and then infer what other levels of the independent variable would be like. They suggested that a within subjects design with repeated measures would be more appropriate.

Hill and Stickney (1979) attempted to resolve these issues by establishing the accuracy (or inaccuracy) of self report data within a cognitive-psychological paradigm. They hypothesized that subjects would report perceptually salient, but causally irrelevant, dimensions on a verbal

learning task as having more causal impact than less salient but relevant dimensions. It was also predicted that subjects would make more accurate self reports after experiencing some variation in both the relevant and irrelevant stimulus dimensions.

The study involved two experiments using verbal learning tasks.

In the first study, subjects were exposed to only one level of the independent variable, either redundant or random, and either color-coded or not color-coded strings of letters. Subsequent to this subjects were requested to write down as many of the strings of letters as they could remember. Each list of strings of letters was presented for a total of 10 trials.

Once learning of the lists was completed, subjects filled out a questionnaire, asking them to indicate on an 11 point rating scale how much they thought arrangement of the letters helped in their ability to learn the list and/or how much they thought color affected their ability to learn the list.

The results indicated that subjects remembered many more redundant than random strings. It was also evident that significant improvement over trials occurred for redundant list but not random list condition. The self report data revealed that subjects who learned the redundant list rated the influence of letter arrangement more highly than subjects who learned the random list. However, for those subjects who rated the causal impact of both color and arrangement, they attributed nearly equivalent levels of causal influence to both color and arrangement despite the fact that arrangement only had facilitated learning.

Subjects who learned the random list attributed higher causal

impact to color than to arrangement, although the results showed a similarity in learning between the color list and the non-colored random list.

The results of Experiment I suggest that when exposed to only one level of the independent variable, subjects may be able to identify the causal factor, so long as it has some degree of salience. However, when exposed to both a salient non-influential factor and non-salient influential factor, subjects may be misled into thinking the non-salient factor also had some causal impact.

In a second experiment a within subjects design was used where subjects were exposed to both color redundant lists and non-colored random lists. Similar to the first experiment, subjects were asked to evaluate the causal impact of the two dimensions, but also taking into consideration their performance on the first task. The self report data following the second task demonstrated that subjects attributed more causal impact to color. Self reports of causal impact to structure remained at about the same level as the first task. Thus, color attributions were significantly higher following the second task.

It was evident following the second study that subjects experienced a large decrease in their ability to learn the list as a result of the change from redundant structure to random structure and from color coded to black letters. Hill & Stickney asserted that the change from color to black was much more salient than the change in structure and thus, subjects concluded that the highly salient dimension of color must have been quite important. This interpretation is consistent with Nisbett and Wilson's (1977) assertion that most people believe that small causes cannot

produce large effects. In the Hill and Stickney study people were confronted with a large effect, that is, a significant decrease in their recall of the strings of letters, and thus concluded that a dramatic change or cause must have occurred to explain this.

A further study done by Hill (1984) showed that subjects were consistently accurate when reporting the causal impact of the potent factor, but overestimated the role of the salient irrelevant one. Similar to the Hill & Stickney (1979) study, subjects were exposed to both levels of the stimulus factors. The results show that rather than increase the accuracy of verbal reports, exposure to both dimensions decreased it, particularly when evaluating the role of the salient factor of letter color.

The results of this study put to rest some of the criticisms made by Smith & Miller, mainly, that subjects are more likely to have accurate self reports when exposed to more than one level of the independent variable.

Although Hill and Stickney's (1979) research may have vitiated two of the criticisms made by Smith and Miller (1978), there are other questions left unanswered. One criticism made by Smith and Miller (1978) and White (1980) is that participants were not informed of the report stage prior to engaging in the task. Critics of the theory believe that if this were to happen, participants may attend more closely to their own processes and be able to report on them at a later stage. Kraut and Lewis (1982) investigated this factor. Their study demonstrated that individuals may be able to assess the causal influences on their judgements and do so more accurately than could predictions based on a priori theories of causation made by observer subjects. The study involved having subjects view videotaped interviews of people going through customs. The

participants in the study were asked to judge an individual's friendliness, intelligence and deceptiveness. Observer subjects were also included in the study. They did not view the videotapes of the interviews, but were given a complete description of how the tape was made, and contents of the interviews. The results indicated that self awareness could not be totally accounted for by a priori theories nor by introspection. Kraut and Lewis (1982) concluded that judges' beliefs are the result of combining several sources of information. These sources include introspection, a priori theories, co-variation detection, strategy driven judgements, delay and cue type. At this point, it is difficult to determine how much of one factor or how many factors play a role in a person's judgement; however, they asserted the focus should be more on when individuals have access to their cognitive processes as opposed to all or nothing claims as professed by Nisbett and colleagues.

Adair & Spinner (1981) have reinterpreted the research supporting the claim of no access to cognitive processes by subjects (Nisbett & Wilson, 1977) and concluded that their studies are selective and incomplete and do not withstand a demand characteristic analysis. Despite the problems with verbal reports, these writers asserted that psychology is not yet in the position of abandoning them. The authors claim that verbal reports must be researched using new and innovative approaches.

The present research attempted to discern some of the assumptions put forth by Nisbett & Wilson (1977). More specifically, the research investigated whether or not subjects utilize implicit theories as suggested by Nisbett and colleagues.

It has been demonstrated (Hill & Stickney, 1979) that subjects will attribute causality to salient but noninfluential factors. In their research subjects were exposed to two experiments. In the first experiment subjects learned either a redundant or a random list of strings of letters and either a color coded or black list. The results of the self report data revealed that a) subjects who learned the redundant list rated the influence of letter arrangement more highly than subjects who learned the random list and b) subjects who learned the random list attributed higher causal impact to color than to arrangement despite the fact there was a similarity in learning between the color and black random list.

In the second experiment subjects were exposed to both levels of the independent variable. As Smith & Miller (1978) have indicated it is difficult for subjects to be accurate about the causal effects on their responses if they are only subject to one level of the independent variable. To vitiate that criticism, Hill & Stickney exposed subjects to both levels of the independent variable.

The self report data of the second experiment demonstrated that subjects attributed more causal impact to color with attributions of causal impact to arrangement remaining at the same level as in the first task.

Hill & Stickney concluded that following the second study subjects experienced a large decrease in their ability to learn the list as a result of the change from redundant to random structure and from color to black letters. The change from color to black was much more salient than the change in structure. Consequently subjects concluded that the highly salient dimension of color must have been quite important.

This interpretation is consistent with Nisbett & Wilson's assertion that most people believe that small causes cannot produce large effects. In the Hill & Stickney study people were confronted with a large effect, that is, a significant decrease in their recall of the strings of letters and thus concluded that a dramatic change or cause must have occurred to explain this.

Similarly Hill (1984) demonstrated that subjects were consistently accurate when reporting the causal impact of the potent factor but overestimated the role of the salient irrelevant one. Again, in this study subjects were exposed to both levels of the stimulus factors color and arrangement. The results show that rather than increase the accuracy of verbal reports, exposure to both dimensions decreased it particularly when evaluating the role of the salient factor of letter color.

Nisbett & Wilson (1977) proposed that individuals are unable to interrogate a memory of the process, but rather apply implicit rules found in the culture or sub-culture they are a part of. The aforementioned researchers explain such illusory memory as being due to the application of a rule or assumption about cause-effect relationships that the subject believes is appropriate. Such rules may be based on implicit assumptions gained through experience or when no relevant cause-effect rule can be applied on the general assumption that large effects must necessarily have large causes. Consequently the accuracy of such memories is determined solely by the application of the appropriate rule rather than actual recall of a stimulus effect during cognitive processing.

It has been demonstrated that subjects will erroneously attribute causal impact to salient but impotent factors (Hill & Stickney, 1979, Hill

1984). However the hypothesis that subjects apply an implicit rule when reporting stimulus impact has not been directly investigated. It has been proposed (Smith & Miller, 1978) that this hypothesis may be impossible to test because we can never predict which (if any) heuristic subjects would use when making a verbal report.

The most compelling support for such a hypothesis would be provided by a demonstration that subjects will generalize a rule that has been experimentally induced in one situation to another situation. Such a demonstration is a major goal of the proposed research.

In addition, if subjects apply a rule rather than recall a cognitive process when describing the causal impact of a stimulus then subjects who do not actually experience the cognitive process (e.g. observers of a problem-solving experiment) should apply the same cause-effect rule that is used by those subjects who actually participate in the experiment (Nisbett & Bellows (1977).

The present research addressed two issues relevant to the Nisbett & Wilson (1977) position. Firstly, people who actually process information toward arriving at some decision or judgement have no advantage in verbally reporting on such processes over non-processors who merely observe the antecedent stimulus conditions and consequent behavior. Secondly, Nisbett and Wilson claimed that verbal reports of mental processes are based on inferences rather than memory retrieval per se. Such inferences, may be subject to a multitude of errors due to salience effects, availability and various erroneous beliefs about stimulus effects.

The first issue was addressed by running experimental subjects in pairs, one of whom was a learner in a memory task, while the other was a

yoked - control or observer subject. The second issue was addressed by attempting to manipulate which heuristic or rule subjects would use in making their verbal reports by instilling one on a prior task.

Therefore, the present study hypothesizes a) that a rule will be induced in the first learning task of the research b) the rule induced in Phase I will erroneously generalize to the learning task presented in Phase II of the study and c) causal attributions of the learner will be no more accurate than those of the observer subjects.

Method

Overview and Hypothesis

The present experiment was divided into two phases. In the first phase a rule was induced using a learning task. In the second phase subjects experienced another similar task to determine whether the rule induced in Phase I generalized to Phase II.

A learning task was utilized to induce the rules. It involved learning lists of strings of letters that varied on two dimensions and arranged according to the Isolation Effect developed by Cimbalá (1978). This effect refers to the technique whereby a different or unusual item is introduced into a set of common items. Consequently the different item normally results in better retention than a comparable item in a homogeneous list.

Two dimensions were manipulated in this study. The first dimension was color. There were two levels of the color factor: a) colored strings of letters and b) black strings of letters. The second stimulus

dimension was arrangement. Again, there were two levels of this; a) meaningful anagrams and b) meaningless anagrams which were variations of the meaningful ones. One of the most firmly established principles of verbal learning is that meaningful combinations of letters are much less difficult to learn than non-meaningful combinations (McGeoch, 1930; Underwood & Schulz, 1960).

The present research involved two phases. In the first phase three conditions from the color x arrangement matrix included a) color/meaningful condition b) color/meaningless condition and c) black/meaningful condition. Each of these conditions comprised of 5 lists with 16 strings of letters on each list. There were 4 target strings and 12 filler strings. A black meaningless condition was not included as it was decided this would not reveal any vital information. After being exposed to the stimulus subjects were asked to do a Free Recall Test. Following presentation of all stimuli and the Free Recall Tests subjects were asked to rate what was, in their opinion, the influential factor contributing to their ability to learn the lists. It was expected that following the first phase of the study a rule that both color and arrangement were important would be induced for the color meaningful condition; a rule that color was important for the color meaningless condition, and finally a rule that arrangement was important for the black meaningful condition.

A primary hypothesis was that assumptions about the rules induced in Phase I would generalize (erroneously) to Phase II for the color meaningless and black meaningful conditions.

In Phase II of the study, all subjects were exposed to a color meaningful condition, similar in dimensions to the color meaningful

condition of Phase I but differing in content. Following presentation of this condition and a free recall test, subjects will again be asked to report on the causal factor that contributed to their ability to learn the lists.

Prior to beginning Phase II of the study subjects were randomly assigned to be either a learner or observer subject. It was hypothesized that learners would have no introspective advantage over observers when assessing the respective causal roles of arrangement vs. color. Subjects from the color meaningless and black meaningful conditions will be erroneously influenced by the particular rules induced in Phase I of the study and generalize these rules to Phase II. This hypothesis follows from the research of Nisbett & Bellows (1977).

Subjects:

Sixty undergraduate psychology subjects, 30 males and 30 females, participated as subjects in the study.

Apparatus:

A stop watch was used for time exposure of stimulus cards to subjects.

Test Materials:

There were two phases to the study. Materials used in Phase I will be described first. The subjects were exposed to a learning task. The task involved presenting subjects with lists of strings of letters, either meaningful or meaningless anagrams and either color coded or black. The

meaningless anagrams were variations of the meaningful ones. The meaningful anagrams were randomly selected from the Merriam - Webster Dictionary. The Thorndike - Lorge Dictionary (1968) was employed to control for the frequency of the words. All words used in the experiment occurred at least fifty to one hundred times per million.

There were three types of lists, five lists in each type, consisting of 16 strings of letters each. Hereafter, the three types of lists will be referred to as Condition I, Condition II and Condition III.

In Condition I, the four target strings of letters (i.e. strings expected to be easiest to memorize) were meaningful words printed in color, while the twelve filler strings in each list were meaningless anagrams of the target words printed in black ink.

The lists in Condition II were four non-meaningful target words printed in color. Each of the target words were interspersed by three black meaningless fillers for a total of twelve fillers.

The lists in Condition III were four meaningful target words printed in black. Each of the target words were interspersed by three colored meaningless fillers for a total of twelve fillers. In a similar paradigm as described above Hill (1984) demonstrated that, although the arrangement of the letters greatly affects the ease with which strings can be remembered, when strings are printed in color (a variable that is salient but has much less impact on learning) subjects have a tendency to overestimate the causal role of color.

The content of the three types of lists were similar, only differing in dimension. The arrangement of the color and meaningful strings of letters was developed according to the Isolation Effect of Cimbala (1978).

Colors used in the lists were red, green, yellow and blue. A example of lists can be found in Appendix A. The lists were made on 3 x 8 inch index cards from Helvetica, Medium, Uppercase Letraset, 7 - 9 mm.

In Phase II of the study, all subjects in the three conditions of Phase I were exposed to the same type of lists, colored meaningful lists. The format of these lists was similar to that used for Condition I in Phase I, only differing in content. For a description of the lists, the reader is referred to Condition I.

Procedure:

There were two phases included in the experiment. They will be explained sequentially.

Phase I

Two subjects participated in the research at a time. Subjects were randomly assigned to one of the three groups before entering the room. Subjects were seated across from the Experimenter. A sample stimulus card was presented to the subjects to aid in the explanation of the task. The sample card and explanation can be found in Appendix B.

Following this, subjects were given verbal instructions which can be found in Appendix C. When subjects indicated understanding of the instructions, the learning task proceeded.

There were two sets of five stimulus cards developed for each condition. The stimulus cards were randomly presented to each of the subjects for three trials at the rate of one per ten seconds. Following the presentation of each stimulus card, subjects were given a pencil and paper

and asked to do a free recall test. They had thirty seconds to do the recall test. This procedure was followed for each of the five lists over three trials.

Following this subjects were given a questionnaire, on which they were asked to rate each stimulus dimension separately on a 10 point rating scale. An example of the questionnaire can be found in Appendix D. The first two questions were counterbalanced as well as being counterbalanced when presented to the subjects. There were three questions. The first two questions required that subjects make ratings, about the color and arrangement dimensions, ranging from "0 - Not Important at all", to "10 - Extremely important". The third question asked subjects to identify any other factor in the stimuli that may have had some importance for their ability to learn the lists. The ratings assigned by subjects to the stimulus dimensions, color and arrangement were used as dependent measures.

Phase II

A five minute break was taken between Phase I and II with subjects not leaving the room. During the break subjects were randomly assigned to be either an observer or learner subject. Following this separate instructions were given to the observer and learner subjects. These instructions can be found in Appendix E. Learner subjects were then randomly presented five lists over three trials at the rate of one per ten seconds. Observer subjects were instructed only to observe the learner studying the lists. Following each presentation of the lists both types of

subjects were asked to do a free recall test. The reason observers were given this test was to control for any possible learning that may have taken place. Once this was completed both subjects were again asked to fill-out a questionnaire similar to that used in Phase I. All subjects were then thanked for their participation in the study and debriefed.

Results

Hypothesis One

It was hypothesized that a rule would be induced in the first learning task of the research. More specifically it was proposed that a) subjects exposed to the color meaningful strings of letters would attribute causality to both color and arrangement. This group represented controls in that they were exposed to target words that were both meaningful and color, thus providing ambiguity regarding the relative causal impact of the two dimensions. b) subjects exposed to the color meaningless strings of letters would attribute causality to color and finally c) a rule of arrangement would be induced for subjects exposed to the black meaningful condition

Learning

A 3 (Conditions) x 2 (Type: Learners or Observers) x 2 (Strings: Filler vs. Target) x 2 (Phase) x 3 (Trials) ANOVA, with repeated measures on the last three factors, was conducted on the learning data, with

numbers of strings correctly recalled serving as the dependent variable. The results demonstrated that conditions emerged as a significant factor ($F_{2,54} = 16.17, p < .001$). (See Appendix F for ANOVA Summary table).

This analysis reveals that subjects in Phase I recalled significantly more meaningful than meaningless strings of letters. Furthermore, the results demonstrate that subjects exposed to the color meaningful strings ($m = 5.19$) of letters recalled significantly more strings than subjects exposed to either the color meaningless ($m = 2.14$) or black meaningful conditions ($m = 4.25$). As expected, the results indicated that meaningfulness enhanced subjects' ability to learn the list. However, not predicted was the finding that color further increased this ability.

The interaction between condition (color meaningful, color meaningless, or black meaningful) and Phase (Phase I vs Phase II) was significant ($F_{2, 54} = 25.25, p < .001$). To further clarify these results a Duncan's Multiple Range Test was performed on the cell means (See Table I for means, S.D., and p. values of learning data).

TABLE I
Mean Number of Strings Recalled for List Conditions in Phase I

Condition	Phase I
Color Meaningful	
Mean	5.19 ^{a*}
S.D.	2.50
Color Meaningless	
Mean	2.14 ^{b*}
S.D.	1.37
Black Meaningful	
Mean	4.25 ^{c**}
S.D.	3.25

Note: Higher means indicated more strings of letters recalled. Using Duncan's Multiple Range Test the three conditions differed from each other at * $p < .005$ and ** $p < .001$

Verbal Report

A 3 (Conditions) x 2 (Type: Learner vs. Observer) x 2 (Phase) x 2 (Cause: Color vs. Arrangement) ANOVA, with repeated measures on the last two factors, was conducted on the verbal report data, with attributions of causal impact to either color or arrangement serving as the dependent measure (See Appendix G for ANOVA Summary table).

Upon further analysis of the cell means, using the Duncans Test, the results show that, as predicted in Phase I, subjects exposed to the color meaningful condition attributed causality equally to color and arrangement and subjects exposed to the black meaningful strings of letters attributed

higher causal impact to arrangement ($p < .05$).

Unexpectedly, subjects exposed to the color meaningless strings of letters attributed causality more to arrangement than color. Fourteen of the twenty subjects in this group, when responding to the third question of the questionnaire, stated that they rearranged the letters of the strings to give them meaning, which subsequently enhanced their memory recall. For example with the anagram TSOP, subjects reported rearranging the letters to STOP. (See Table II for means, standard deviations and p levels).

TABLE II

Mean Ratings and Standard Deviations of Causal Impact of Letter Arrangement and Letter Color for Phase I of the Experiment.

Condition	Phase I	
	Factor Rated Arrangement	Color
Color Meaningful N = 20		
Mean	6.95 _{a1}	5.30 _{b1}
S.D.	3.32	3.40
Color Meaningless N = 20		
Mean	7.70 _{a2}	5.45 _{b2}
S.D.	1.69	3.24
Black Meaningful N = 20		
Mean	8.50 _{a3}	3.15 _{c3}
S.D.	1.96	2.87

Note: Higher means indicated higher causal impact. Means with the same subscript are not significantly different. Means with different subscripts differed at the following levels:

a ₁ and b ₁	N.S.
a ₂ and b ₂	$p < .05$
a ₃ and c ₃	$p < .001$
b ₁ and c ₃	$p < .05$

b_2 and c_3 $p < .005$

Hypothesis Two

It was hypothesized that the rule induced in Phase I would erroneously generalize to the learning task presented in Phase II for the color meaningless and black meaningful conditions. More specifically it was proposed that;

1) Individuals exposed to the color meaningful condition in both phases would attribute causality equally to color and arrangement;

2) subjects exposed to the color meaningless condition in Phase I, where a rule of color was induced, would erroneously generalize this attribution to the learning task in Phase II, and

3) subjects exposed to the black meaningful condition in Phase I, where a rule of arrangement was induced, would erroneously generalize this attribution to the learning task in Phase II.

Learning

In Phase II of the experiment all subjects were exposed to the same type of list, namely color meaningful. The results of the data analysis indicate a significant increase in learning for all three groups from Phase I to Phase II. Again, subjects in the color meaningful condition in Phase I recalled significantly more strings of letters in Phase II as compared to the color meaningless and black meaningful conditions in Phase II. Since this particular group was exposed to the same list in both Phase I and

Phase II, a practice effect is the most probable explanation for the results. The increase in the number of strings recalled for the color meaningless condition is due to exposure to meaningful words in Phase II.

Two explanations are offered for the significant increase in recall of strings of letters from Phase I to Phase II for the black meaningful condition. Firstly, this finding could be interpreted as further support for the influence of color on subjects ability to learn the lists. Secondly, the increase could simply be due to a practice effect. No significant difference was found in Phase II between the color meaningless and black meaningful conditions of Phase I (See Table III for means, standard deviations and p. levels)

TABLE III
Mean Number of Strings Recalled for List Conditions in Phase II

Condition	Phase II
Color Meaningful	
Mean	5.89
S.D.	1.34
Color Meaningless	
Mean	5.32
S.D.	3.03
Black Meaningful	
Mean	5.37
S.D.	2.68

Note: Higher means indicate more strings of letters recalled on the free recall test. Using Duncans Multiple Range Test the color meaningful condition recalled significantly more strings than the color meaningless condition ($p < .05$). A marginal significance ($p < .10$) was found between the meaningful conditions.

Verbal Report

The results of the univariate analysis indicated that subjects, regardless of the condition they participated in. In Phase I, in Phase II attributed causality equally to arrangement and color. The Duncan's Test indicated no significant difference among the three conditions, with regard to their attributions to arrangement but a significant difference was evident with regard to color. (See Table IV for means, standard deviations and p. levels)

TABLE IV
Mean Ratings and Standard Deviations of Causal Impact of Letter Arrangement and Letter Color for Phase II of the Experiment.

Condition	Phase II Factor Rated	
	Arrangement	Color
Color Meaningful N=20		
Mean	6.90 _{a1}	5.65 _{a4}
S.D.	3.06	3.31
Color Meaningless N=20		
Mean	7.50 _{a2}	7.25 _{b1}
S.D.	2.35	2.87
Black Meaningful N=20		
Mean	6.55 _{a3}	5.50 _{a5}
S.D.	2.20	3.95

Note: Higher means indicated higher causal impact. Means with the same subscript are not significantly different. Means with different subscripts differed at the following levels:

_{a4} and _{b1} p. < .10
_{a5} and _{b1} p. < .10

The research demonstrates that in Phase II subjects exposed to the color meaningless condition in Phase I attributed marginally higher causal impact to color than either of the meaningful conditions of Phase I ($p < .10$). This finding is interpreted as demonstrating that subjects were influenced by the color factor in Phase I and this affected their attributions in Phase II of the study. The learning data for this condition showed that color was influential for subjects ability to learn the lists in Phase I despite their lack of awareness of it as indicated by their verbal reports.

The findings of greater interest are the comparison of causal attributions between the phases within each group (See Table V for means and standard deviations and p. levels).

TABLE V
Mean Ratings and Standard Deviations of Causal Impact of Letter Arrangement and Letter Color for Phase I and Phase II of the Experiment.

Condition	Phase I Factor Rated		Phase II Factor Rated	
	Arrangement	Color	Arrangement	Color
Colored Meaningful N=20			Color Meaningful N=20	
Mean	6.95	5.30	6.90	5.65
S.D.	3.32	3.40	3.06	3.31
Colored Meaningless N=20			Color Meaningful N=20	
Mean	7.70	5.45	7.50	7.15
S.D.	1.69	3.24	2.35	2.87
Black Meaningful N=20			Color Meaningful N=20	
Mean	8.50	3.15	6.55	5.50
S.D.	1.96	2.87	2.20	3.95

Note: Higher means indicated higher perceived causal impact

With regards to the color meaningful condition, subjects attributed causality equally to color and arrangement in both Phase I and Phase II, with no significant difference noted between their attributions.

Interestingly, the results indicate that subjects in the color meaningless and black meaningful conditions apparently reevaluated their attributions for Phase I after experiencing the color meaningful condition of Phase II. For subjects in the color meaningless condition, attributions of causal impact to arrangement remained at the same level in Phase I and Phase II whereas a reevaluation of causal attribution to color occurred. There was a significant increase in attribution of causal impact to color in Phase II ($p < .05$). Subjects in the black meaningful condition showed a significant decrease in their causal attributions to arrangement and a significant increase in their causal attributions to color.

Contrary to predictions, there was no significant main effect for condition, but this variable did interact with other variables as discussed above.

Hypothesis Three

It was hypothesized that no difference would be found between the causal attributions of learner and observer subjects. This finding was demonstrated. Both types of subjects attributed causality equally to color and arrangement.

Post Hoc Analysis

Learning

The 5 way ANOVA revealed a main effect for phase ($F_{1, 54}=119.38$, $p<.001$), a main effect for string ($F_{1, 54}=848.63$, $p<.001$) and a main effect for trial ($F_{2, 54}=104.78$, $p<.001$). The results demonstrate that more strings of letters were recalled in Phase II than Phase I. Also, a greater number of target strings of letters were recalled as opposed to filler strings thus replicating the robust phenomena of the isolation effect. The trials' main effect indicated that subjects had improved their recall scores significantly from the first to the third trials. (See Table VI for means and standard deviations)

TABLE VI
 Mean Number of strings Recalled for List Conditions Across Trials and Phases

Condition	Trial	Phase I			Phase II		
		I	II	III	I	II	III
Color Meaningful N=20		Color Meaningful					
Target							
Mean		8.07	9.36	10.11	9.91	11.25	11.46
S.D.		2.90	2.34	2.25	2.25	.95	.82
Filler							
Mean		.63	1.27	1.68	.36	.92	.82
S.D.		.30	.61	.70	.32	.68	1.07
Color Meaningless N=20		Color Meaningful					
Target							
Mean		2.53	3.51	3.84	8.94	10.05	9.99
S.D.		.98	1.41	1.72	2.89	3.14	3.07
Filler							
Mean		.63	1.01	1.32	.55	1.01	1.40
S.D.		.41	.58	.93	.55	.78	1.03
Black Meaningful N=20		Color Meaningful					
Target							
Mean		6.33	7.80	8.16	9.00	9.99	10.50
S.D.		2.95	3.43	3.36	2.85	2.97	2.22
Filler							
Mean		.66	1.07	1.48	.42	.93	1.35
S.D.		.46	.60	.75	.55	.94	1.38

Note: Higher means indicated more strings of letters recalled on free recall test.

There was a significant condition x string x type interaction ($F_{2,54} = 3.88, p < .05$). Learner subjects exposed to the color meaningful condition in both phases ($m = 11.00$) recalled significantly more target strings of letters than observer subjects ($m = 8.98$) exposed to the color meaningful condition in both phases. Also, learner subjects ($m = 11.00$) exposed to the

color meaningful condition in both phases recalled significantly more target strings than learner or observer subjects exposed to either the color meaningless or black meaningful conditions in Phase I and the color meaningful condition in Phase II. Means for the learner subjects are 6.26 and 8.01 respectively. Means for the observer conditions are 6.70 and 9.25 respectively. There was a difference in number of strings of letters recalled between learner subjects who experienced the color meaningless condition ($m=6.26$) and learner subjects who experienced ($m=8.01$) the black meaningful condition in Phase I and the color meaningful condition in Phase II at the .001 level of significance.

With regard to the observer subjects, the findings revealed that observers exposed to the color meaningful condition in both Phase I and II ($m=8.98$) or the black meaningful condition in Phase I and the color meaningful condition in Phase II ($m=9.25$) recalled significantly more target strings of letters than both the observers ($m=6.70$) and learner subjects ($m=6.26$) exposed to the color meaningless condition of Phase I and the color meaningful condition of Phase II. Interestingly, there was no difference between the observer subjects exposed to either the color or black meaningful conditions of Phase I and the color meaningful condition of Phase II. Means for these conditions were $m=8.98$ and $m=9.25$ respectively.

Correlational Analysis

The Pearson Product Moment Correlation Coefficient was utilized to determine if a relationship existed between a) the learning and verbal reports for learners and observers across phases, b) the learning and verbal reports for the three conditions across phases, and finally c) the learning and verbal reports for the two phases across conditions.

The correlational data lacked consistency and consequently were not interpretable. They can be found in Tables VII, VIII, and IX, in Appendix H.

Discussion

The purpose of this research was to investigate whether or not individuals can identify the stimulus(i) influencing their responses. Nisbett & Wilson (1977) propose that individuals are unable to interrogate a memory of the process for an event, but rather apply implicit rules or heuristics found in their culture or subculture. The aforementioned researchers explain such illusory memory as being due to the application of a rule or assumption about cause - effect relationships that the individual believes is appropriate. It was demonstrated (Hill 1984; Hill & Stickney, 1979) that subjects will attribute causality to salient but non-influential factors, however the hypothesis that subjects apply an implicit rule has not been examined directly. The present research addressed this issue.

More specifically, it was hypothesized that a rule or heuristic would be induced in one learning situation which would erroneously generalize to a second learning situation. In addition, if in fact subjects do apply a rule rather than recall a cognitive process when describing the causal impact of a stimulus(i) then subjects who do not actually experience the cognitive process (observers of a problem solving experiment) should apply the same cause effect rule that is used by those subjects who actually participate in the experiment (learners of a problem solving experiment).

The results of the present research support both a pro-introspectionist and anti-introspectionist position. Firstly I will present the results supporting an anti-introspectionist position.

The results demonstrated that when subjects were exposed to the one dimensional stimuli of color they were unable to report on it and erroneously attributed causality to arrangement despite the fact that the learning data showed color to be the impactful variable.

Also, subjects who experienced the color only condition in Phase I showed significant increase in their attributions of causal impact to color following Phase II. This finding is interpreted as demonstrating that the causal influence of color in Phase I generalized to Phase II despite subjects lack of awareness of its causal influence in Phase I. In addition, in Phase II subjects in the color meaningless condition of Phase I showed higher attributions of causal impact to color than either the black or color meaningful conditions. This finding lends further support to the influential role of color despite a lack of awareness of it. The findings described above support the position taken by Nisbett & Wilson (1977) that individuals can be unaware of the stimuli(i) effecting their responses.

The following findings support a pro-introspectionist position.

Secondly, it was demonstrated that subjects exposed to the highly potent factor of arrangement in isolation successfully identified its causal influence. Subjects' learning data for this condition concurs with their attributions.

Also, in Phase II of the research, all subjects showed an increase in the number of strings of letters recalled after being exposed to the color meaningful condition. Their verbal reports demonstrated they attributed causality equally to color and arrangement. For subjects in the black meaningful condition significant decrease in causal attributions to arrangement with a significant increase in causal attribution to color was

noted. Both of these findings suggest that subjects were aware of the factors influencing their responses.

Firstly, when subjects were exposed to both color and arrangement, they identified both factors as being influential. The learning data corroborates with subjects' attributions demonstrating that color and arrangement were both influential for subjects' ability to learn the lists. For example, in Phase I individuals in the color meaningful condition recalled significantly more strings of letters than either the color meaningless or black meaningful conditions of Phase I. Similarly, in Phase II, these same individuals showed significantly better recall than either of the color meaningless or black meaningful conditions of Phase I. In addition subjects in the one dimensional conditions of Phase I, recalled significantly more strings of letters in Phase II following exposure to the two dimensional condition of color and arrangement. The verbal report data indicated subjects were aware of the causal impact of these factors as they attributed equal causality to both. These results would suggest that individuals are aware of the factors influencing their responses and are able to report on them. These results support the assertion made by Smith & Miller (1978) and Adair & Spinner (1971) that psychology needs to focus on when subjects are able to accurately report on the stimulus(i) effecting their responses.

The purpose of this research was to investigate whether or not subjects can accurately identify the stimulus factors influencing their responses. The results do not support one position but rather indicate that we can be accurate under certain conditions and inaccurate under others. These conditions have been specified above. These results support Smith

& Millers' position that psychology needs to look at when individuals are able to accurately report on the stimulus(i) effecting their responses.

An anomalous finding was demonstrated which is counter to the findings of Hill (1984) and Hill & Stickney (1979). Firstly, Hill & Stickney (1979) demonstrated that subjects will attribute causal impact to a highly salient but non-influential factor. Hill (1984) demonstrated that subjects are consistently accurate when reporting the causal impact of a potent factor but over estimate the role of a salient irrelevant one. In the present research it was demonstrated that subjects, when exposed to both the color and arrangement dimensions, will attribute causality equally to both factors. More specifically, in Phase I it was demonstrated that subjects in the color meaningful condition recalled significantly more strings of letters than either the color meaningless or black-meaningful conditions. The verbal report of these individuals showed that they attributed causal impact equally to color and arrangement. The results of the learning and the verbal report data suggest subjects were influenced by the color dimension for their ability to learn the lists and were aware of its influence. Similarly in Phase II of the study, following exposure to the color meaningful condition, subjects in the three groups of Phase I showed a significant increase in the number of strings of letters recalled.

The verbal report of all subjects demonstrated they attributed causality equally to both color and arrangement. The learning data coupled with the verbal report suggest that color was influential and subjects were aware and able to report on its influential role. This finding needs to be addressed as part of the present research was based on the results of these studies.

Finally subjects in the black meaningful condition were able to identify the influential role of this factor in Phase I but following exposure to the color meaningful condition in Phase II subjects significantly decreased their causal attributions to arrangement and significantly increased their causal attributions to color. This finding would lend further support to the influential role of color and subjects' ability to identify it.

The present results do not support the Hill (1984) and Hill & Stickney (1979) interpretation of the color factor. On the contrary, the results showed that color played an influential role for subjects ability to learn the lists. Because this is a new finding and runs counter to previous research it is difficult to infer whether color operated as a pseudo factor which allowed subjects to focus easily on the strings. Before any conclusions or generalizations can be made it is important that further research be carried out to determine the actual role color played for subjects' learning ability.

Another finding that needs to be addressed is the observer and learner factor. It was hypothesized that learner subjects would be no more accurate about their causal attributions than observer subjects in Phase II of the study. The results of the data analysis demonstrated no significant difference between the causal attributions made by observer and learner subjects. Both types of subjects attributed causality equally to color and arrangement. The difficulty comes in the interpretation. It could be inferred from the above results that individuals are no more accurate about the stimulus(i) that influence their responses than observer subjects who merely observe the antecedent condition and the

response.

This interpretation is misleading as there were difficulties with the procedure. With regard to having two subjects participate as a time, it was found that many subjects had an apparent tendency to compete with each other. Consequently when the observer subjects were instructed to only observe they appeared to experience difficulty doing so. Sixty-one per cent of the observer subjects reported having tried to remember the strings, particularly the target strings.

Methodological Problems and Suggestions for Future Research

This study suffers from some methodological limitations. Firstly, with regard to the color meaningless condition, problems with both the stimulus cards and the questionnaire would explain the difficulty in obtaining the predicted effect in Phase I. The stimulus cards presented all meaningless strings, with color being the discriminating factor between the target and filler strings of letters. This factor possibly influenced subjects responses on the questionnaire with regard to the arrangement question. That is, seventy per cent of the subjects in this condition reported they rearranged the letters to give them meaning and this consequently improved their recall. They may not have been clear as to the meaning of the experimenters use of the word arrangement. In future studies it is recommended that the filler strings are meaningful words so a contrast exists between the color meaningless target words and the black meaningful filler words.

Secondly, with regard to having two subjects participating at a time. As mentioned previously the results demonstrated that many of the observer subjects had difficulty following instructions and had an apparent tendency to compete with learner subjects. Rather than observe the learner subjects studying the lists as instructed, these subjects would look at the lists and study the target words. Sixty-one per cent of the observer subjects reported having tried to remember the target strings.

The procedure used in the present research is definitely questionable. More specifically, the instructions were not sufficient to guarantee clear differences in the response of learners and observers. It is recommended that in future studies the physical proximity between the subjects be increased so as to reduce their tendency to compete.

Thirdly there is some ambiguity regarding interpretation of the color factor, particularly when it is combined with meaningfulness. The results of this study demonstrate that it was influential for subjects exposed to both stimulus dimensions as they recalled significantly more strings than either the color meaningless or black meaningful conditions. This runs counter to the research by Hill (1984) and Hill & Stickney (1979). It is recommended that future research look at if and how the color factor influences subjects' ability to learn the lists and discover whether it is actually influential or acting more as a pseudo factor, allowing subjects to focus easier on the words printed in color. A further study is needed to confirm or disconfirm the present findings.

Finally, the present study did not include a black meaningless condition as it was thought it would not give enough information to warrant its inclusion. Hindsight dictates that inclusion of this group

would have been helpful, particularly in understanding and explaining the results of the color meaningless condition. More specifically it would have shed light on the role color played for subjects ability to learn the lists. It is recommended that it be included in future research.

The above recommendations are specific to the present study whereas the following recommendations are related to the problems of verbal reporting generally.

As Adair & Spinner (1981) have pointed out, it is important for psychology not to focus on all or nothing claims but rather to try to determine the conditions when we do and do not have introspective access to our higher mental processes. The present research suggest that there are conditions whereby individuals are able to accurately report on the stimulus(i) influencing their responses.

These researchers suggest various methodological changes that may increase the chances of accurate reporting. Their suggestions include the following a) investigating subjects' reports of their mental processes at length and in depth, b) phrasing the questions and instructions used in the methodology to motivate subjects and provide them with a better set for introspective reporting and , c) using concurrent thinking and think aloud procedures, which enables the investigators to access subjects' reports from another perspective. The use of concurrent probing would reduce the memory problem and the use of inference based reporting. More specifically, subjects would be able to report on their strategies or hypotheses and this would reduce some of the distortions of memory that influence retrospective reporting as well as the tendency for intermediate inferential processing.

Conclusion

The theme of this research is introspection. Can individuals know the stimuli effecting their responses? According to Nisbett & Wilson (1977) individuals are not aware of the factors or stimuli influencing their responses. They propose that individuals apply implicit or explicit a priori cause and effect rules that are learned in the culture or subculture they are a part of.

The present research addressed this issue by attempting to induce a rule in one learning task and then determine if that rule generalized to a second learning task.

The results support both an anti-introspectionist and a pro-introspectionist position. On one hand, they demonstrate that under certain conditions we can be aware of the factors influencing our responses. For example, when individuals are highly successful at learning and experience the highly potent factor of arrangement in isolation they show accurate introspective ability. On the other hand, the results show that we are not aware of the stimuli effecting our responses. More specifically, when the stimuli are unclear and there is minimal success at learning individuals have difficulty identifying the stimulus factors.

The present results support Bowers', (1981) recommendation that psychological research continue to utilize self report data, not to determine causality but to enhance our comprehension and understanding of causal influences operating on thought and action. As Hume asserts, we cannot observe causality directly but we can observe the antecedent

conditions and consequences and explain them through inferences.

Similarly the present results are consistent with the recommendation made by Adair & Spinner (1981), Ericsson & Simon (1980) and Smith & Miller (1978) that researchers need to focus on the question of when individuals are able to have access to their higher mental processes as opposed to the question of whether individuals are able to have true awareness of the factors influencing their responses.

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TMOH

TORN

OTRN

NRTO

ROTN

LICK

IKLC

KLIC

CLKI

CHAP

PHAC

HPCA

APCH

Group 1:

Colored - meaningful target word with
black - meaningless fillers.

OTSP
OSTP
TSOP
PTSO
WTES
TSWE
ETWS
SWTE
IMTE
MTIE
TMEI
EITM
SRTA
ASRT
RSTA
ARST

Group 2 :

Colored - meaningless target "words" with
black - meaningless fillers.

POST
OSPT
TSOP
OTSP
WEST
WTES
TSWE
ETWS
TIME
TMEI
MTIE
IMTE
STAR
SRTA
ASRT
RSTA

Group 3 :

Black - meaningful target words with
colored - meaningless fillers.

Appendix B

Explanation of Experiment

The experiment involves learning lists of strings of letters. Within each list the strings of letters will be arranged differently. For example, in this list, you will notice that the first string of letters is ABC and the second CBA. The next string is XYZ and so on. Also some strings of letters in the lists will be colored and some will be black. The colors used in the lists will be green, red, blue, and yellow. The lists used in the experiment will be similar to this one except they will be longer.

Appendix B

Example of Sample List

ABC (Blue)

CBA (Black)

XYZ (Red)

ZYX (Black)

LMN (Green)

NLM (Black)

FGH (Yellow)

HFG (Black)

Appendix C

Instructions for First Learning Task.

I am going to present to you 5 lists of strings of letters. I want you to study the lists. You are not to just look at the list but learn it. It is very important to this experiment that you try to remember as many as you can. Following each presentation of a list, you will be given a memory task. I will provide you with paper and pen. You are to write down as many strings of letters as you can remember. There are five lists. Each list will be presented three times. I want you to try your best. We will begin now.

Appendix D

Questionnaire

It is very important for me to know what affect the color of the strings and the arrangement of the strings of letters had on your ability to learn the lists. For example, (Experimenter will show subject sample card to explain Questionnaire) what affect do you think color had on your ability to learn the list. Look at this sample list and notice the colors. How do you think they affected your ability to learn the list? Now, what affect do you think the arrangement of the letters had on your ability to learn the list. Look at this sample card and notice the arrangement of letters. How do you think they affected your ability to learn the list. Now, I want you to fill out this questionnaire. There are three questions and you are to indicate your response to them on the rating scale. It is an 11 point

scale, ranging from -5 to +5. If you think color or arrangement greatly hindered your ability to learn the list, you would mark -5. If you think it greatly helped your ability to learn the list you would mark +5. If you think neither color nor structure had any affect then you would mark 0 (no affect on learning). The third question asks you to identify and rate any other factor(s) in the stimuli that you think may affect you ability to learn the list. Think very carefully of the two tasks you have just completed and try to answer these questions as accurately as you can.

Appendix E

Instructions given to Learner group in second task

The task is similar to what you did in the first part of this research; only you will be presented more lists. I am going to present to you 10 lists of strings of letters. I want you to study the lists. You are not to just look at the list but to learn it. It is very important to this experiment that you try and remember as many as you can. Following each presentation of the list you will be given a memory task. I will provide you with paper and pen. You are to write down as many strings of letters as you can remember. Each list will be presented three times. I want you to try your best. We will begin now.

Instructions to Observer group

In this part of the experiment, I want you to observe another person studying the lists. You may look at the lists but I do not want you to study them. There will be 10 lists presented, 3 times each. It is very important that you do not study the lists but observe the other person learning the lists.

Appendix F

Analysis of Variance of Learning Data

Source	SS	DF	MS	F	P
Condition	369.79	2	198.39	16.17	0.0
Type	19.20	1	19.20	1.56	.216
Condition x Type	87.95	2	43.97	3.58	.04
Within	662.62	54	12.27		
Phase	500.76	1	500.67	119.37	0.0
Condition x Phase	211.76	2	105.88	25.24	0.0
Type x Phase	.60	1	.60	.14	.70
Condition x Type x Phase	1.60	2	.80	.19	.82
Within	226.47	54	4.19		
Trial	188.94	2	94.47	104.78	0.0
Condition x Trial	4.43	4	1.08	1.20	.313
Type x Trial	1.17	2	.59	.65	.525
Condition x Type x Trial	1.20	4	.30	.33	.855
Within	97.37	108	.90		
String	9777.04	1	9777.04	848.63	0.0
Condition x String	371.16	2	185.58	16.11	0.0
Type x String	6.73	1	6.73	.58	.45
Condition x Type x String	89.58	2	44.75	3.89	.03
Within	622.13	54	11.52		

Appendix G

Analysis of Variance for Verbal Report Data

Source	S _g	DF	MS	F	P
Condition	45.03	2	22.52	1.48	.24
Type	4.82	1	4.82	.32	.58
Condition x Type	.43	2	.22	.01	.99
Within	819.40	54	15.17		
Phase	8.07	1	8.07	3.16	.08
Condition x Phase	4.43	2	2.22	.87	.43
Type x Phase	3.27	1	3.27	1.28	.26
Condition x Type x Phase	1.03	2	.52	.20	.82
Within	137.70	54	2.55		
Cause	236.02	1	236.02	19.28	.00
Condition x Cause	44.63	2	22.32	1.82	.17
Type x Cause	10.41	1	10.42	.85	.36
Condition x Type x Cause	48.53	2	24.27	1.98	.15
Within	660.90	54	16.24		
Phase x Cause	72.60	1	72.60	12.20	.001
Condition x Phase x Cause	38.70	2	19.35	3.25	.05
Type x Phase x Cause	4.80	2	2.40	.40	.67
Within	321.40	54	5.95		

Appendix H

TABLE VII

Correlations between learning and verbal reports for learners and observers across phases.

		Subjective Data			
		Phase I		Phase II	
		Color	Arrangement	Color	Arrangement
<i>Objective Data</i>	Learners	.08	-.08	.27*	-.12
	Observers	.08	.12	.09	.20

* $p < .07$

TABLE VIII

Correlation between Learning and Verbal reports for the three conditions across phases.

		Subjective Data			
		Phase I		Phase II	
		Color	Arrangement	Color	Arrangement
<i>Objective Data</i>	Group I	.52*	.02	.07	-.08
	Group II	.17	.21	.43**	.15
	Group III	.07	.17	.27	-.11

* $p < .01$

** $p < .05$

TABLE IX

Correlation between learning and verbal reports for the two phases across conditions

Objective Data	Subjective Data			
	Color	Phase I Arrangement	Color	Phase II Arrangement
	.09	.01	.23*	.01

*p <.05