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SOURCES OF REPORTS OF VISUAL AND AUDITORY SENSATIONS IN PERCEPTUAL-ISOLATION EXPERIMENTS [1]

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The review analyzes the experiments on perceptual isolation with special reference to the phenomena of reported visual and auditory sensations. Variables analyzed include: methods of confinement and restriction, conditions of illumination, duration of isolation, set, instructions and suggestions, reporting or verbalization instructions, sleep, subject populations, prior knowledge and expectations, intelligence and personality characteristics of Ss, stress response, and methods of obtaining reported visual and auditory sensations. The relevance of some of the findings to physiological, psychoanalytic, cognitive, and social psychological theories of perceptual isolation are discussed. Variables which seem important in the phenomena discussed are set, verbalization instructions, S's alertness, and E's methods of obtaining responses.

The unexpected reports of hallucinations in the first perceptual-isolation report (Heron, Bexton, & Hebb, 1953) fascinated clinicians, theoreticians, and experimentalists, and stimulated widespread interest in other responses to isolation. From the reports at symposia (Flaherty, 1961; Solomon, Kubzansky, Leiderman, Mendelson, Trumbull, & Wexler, 1961; West, 1962) and reviews of the area (Fiske, 1961; Kubansky, 1961), it is apparent that a decade after the original study the sources of variation in reports of hallucinatory-like phenomena are still unknown. The reasons are the lack of comparability of conditions, subjects (*S*s), and procedures used by the different experimenters (*E*s), as well as the lack of agreed-upon criteria for the response variables. The purpose of this paper will be to relate the situational, subject, and response variables in studies to the reported incidences of visual and auditory sensations. Reported auditory sensations will be less thoroughly analyzed because of the lack of data on this in many studies and for reasons which will be discussed later.

The variation in terminology in this area is symptomatic of the disagreement about the crucial variables in the complex experimental situation. The situation has been called "sensory deprivation," "decreased sensory variation," "sensory isolation," "sensory alteration," "reduced sensory input," "physical iso-

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lation," "perceptual deprivation," and "perceptual isolation." In general, the situations isolate *S* under conditions which prevent or reduce patterned or meaningful perceptions.

The response phenomena in which we are interested are called "hallucinations" by some and "images" by others. We prefer the operational terminology of Murphy, Myers, and Smith (1962) who call the visual phenomena "reported visual sensations." In this article we will use the abbreviation "RVS" for reported visual sensation and "RAS" for reported auditory sensation.

The RVSs may vary in structuredness and meaningfulness from flashes of light to complex integrated and animated scenes. Several systems of classification have been suggested. For the purposes of this review we grouped the RVSs into two categories based primarily on their "meaningfulness": A, Meaningless (e.g., flashes of light, spots, geometric forms)—including Vernon, McGill, and Schiffman's (1958) Types I and II; Murphy and his associates' (1962) Types 1 and 2; and Zuckerman, Albright, Marks, and Miller's (1962) Types *a*, *b*, and *c*; B, Meaningful (e.g., objects, people, scenes)—including Vernon's Type III, Murphy's Types 3 and 4, and Zuckerman's Types *d* and *e*. We believe that the term "hallucination" should only be applied to the B phenomena since the A phenomena may include simple idioretinal responses or illusions while the B phenomena seem to signify a greater cortical involvement.

The RASs were similarly classified for this review. The A category includes the various first-order interpretations of the "noise" described in Zuckerman and his associates' (1962) Category *a*. The B includes the sound of human voices, presence, or music described in Categories *b* and *c*.

It was difficult to obtain the breakdown of the RVSs and RASs in many of the published studies because the authors did not classify them, or in some cases, tell the reader how many of their *S*s reported such sensations. Certain other crucial information, such as the instructions or sets given the *S*s, was lacking in some publications. Because of these deficiencies we sent out forms to the chief investigators in this area asking for specific information about experimental conditions and frequencies of *S*s reporting the A and B types of RVSs and RASs. Unfortunately, not all of our inquiries were returned and some investigators no longer had access to their data so that some studies had to be eliminated or used with partial information.

RVSs

Only three of the studies failed to find at least one *S* giving an RVS. Two of these three studies were from the series of experiments by Vernon, Marton, and Peterson (1961). Six studies failed to find Type A RVSs and four of them were from the studies by these authors. Eleven studies failed to find Type B RVSs and 4 of these were from the aforementioned Princeton group. The six experiments reported by this group utilize a range of experimental conditions and sets so that the paucity of "hallucinators" is difficult to explain. However, these *E*s used more stringent criteria for defining hallucinations than most other *E*s which may account for the difference between their results and those of others. Using the median percentages within groups reporting classifiable RVSs we find 43% of *S*s giving Type A RVSs and 19% giving Type B RVSs.

Method of Confinement and Restriction of Motility

Four general methods of confinement have been used: (*a*) the *S* is confined on a chair, (*b*) the *S* is confined on a bed or mattress, (*c*) the *S* is confined in a tank-type respirator like those used for poliomyelitis patients, (*d*) the *S* is suspended in a tank of water.

The four groups where *S*s were confined in a chair (Cohen, Rosenbaum, Dobie, & Gottlieb, 1959; Goldberger, 1961; Silverman, Cohen, Shmavonian, & Greenberg, 1961) yielded practically no Type B RVSs. Two of these groups were run in darkness and two in diffused or subdued light. The periods of confinement were short, ranging from 40 minutes to 2 hours; but, as will be shown later, the period of confinement cannot account for the lack of Type B RVSs in these groups.

The results in experiments using bed or mattress confinement range from no Type A or B RVSs, as in Vernon, Marton, and Peterson's (1961) first and fifth groups to 57% of the *S*s producing Type B RVSs in the Goldberger and Holt (1958) study. Freedman, Grunebaum, and Greenblatt (1961) have pointed out that in five experiments where motility was restricted RVSs were obtained, while in two experiments (Ruff, Levy, & Thaler, 1961; Vernon et al., 1961) where motility was free or mildly restricted minimal or no RVSs were obtained. Ruff et al. (1961) concede that the lack of restriction on motility may account for their lack of RVSs. Freedman et al. (1961) postulate that the kinesthetic feedback from movement may interefere with activity in the visual modality areas of the brain. This hypothesis is similar to Rorschach's hypothesis of an inverse relationship between external movement and internal fantasy activity as reflected in the perception of human movement (*M*) in the Rorschach blots.

Supporting this restricted motility hypothesis is a significant correlation of .68 between *S*'s immobility and imagery in the Goldberger and Holt (1958) undergraduate group although the correlation was not significant in their actor group (Holt & Goldberger, 1961). Solomon and Mendelson (1962) failed to find differences between RVS and non-RVS *S*s on ratings of movement during the experiments. Bexton, Heron, and Scott (1954) observed that while complex mental activity inhibited RVSs, physical exercise or talking to *S* did not. Doane (1955) put goggles on four of his *S*s but did not restrict their audition or motility. Two of these four *S*s had RVSs and one of them had an RVS while being taken for a walk! In his total isolation group, Doane found that *S*s reported increases in RVSs during periods of activity or discomfort. Courtney, Davis, and Solomon (1961) varied the motility factor by requiring one group to make large body movements every few minutes while another group made small finger movements on the same schedule. Both groups were confined to a bed in diffuse light conditions and told to report any images. The same number of *S*s in each group had RVSs. Except for the Goldberger and Holt (1958) correlation these results fail to support the restricted motility hypothesis. Doane's observations even suggest the opposite hypothesis, that some movement may be conducive to RVSs.

Vernon et al. (1961) found their greatest incidence of Type A RVSs in the group that was taken out and led down a long corridor to go to the toilet. Groups who went to the toilet within the isolation room had few RVSs although some had Type B RVSs which were absent in the prior groups. The *S*s in Goldberger and Holt's (1958) first

study were taken out while *S*s in their second study (Holt & Goldberger, 1961) were confined entirely to the room, but both groups had about the same proportion of *S*s giving Type B RVSs. The *S*s in the Bexton et al. (1954) and Doane (1955) experiments were taken out and both studies had relatively high proportions of *S*s with RVSs. Arnoff, Leon, and Brownfield's (1962) *S*s were taken out but no RVSs were obtained in the study.

The results do not support the restricted motility hypothesis or its converse. It is possible that *S*'s actual position while in the bed may be more important than the amount of occasional exercise. A *S* lying on his back looking up may be more likely to produce RVSs than a *S* lying on his side or stomach simply because the former posture is more closely associated with states of restful alertness and scanning while the latter postures may be more associated with sleep and withdrawal of interest in the environment.

The tank-type respirator restricts gross body activity somewhat more than a bed although *S*s may still flex their arms or legs within the respirator. Experiments by Solomon and Mendelson (1962); Davis, McCourt, and Solomon (1960); Davis, McCourt, Courtney, and Solomon (1961); and Zuckerman et al. (1962) have used this method of confinement. All of these studies have produced some *S*s with Type B RVSs, the proportions varying from 5% to 42%. The lower figure was in the experiment by Davis et al. (1961) where husbands and wives were confined in adjoining respirators. Too much "togetherness" appeared to dampen the RVSs in this group although pairs of strangers in the same situation produced a 30% proportion for the B type RVS. The groups with social as well as perceptual isolation gave figures 18, 27, 20, and 42%. The two studies which suspended *S*s in a tank of water following the Lilly model (Bliss & Clark 1962, also reported by Cambareri 1959, Shurley 1962) also obtained moderate proportions of *S*s with Type B RVSs (25%, 37%).

Although the more severe methods of confinement seem to produce RVSs more consistently the results cannot be definitely attributed to kinesthetic feedback. Perhaps some other aspect of the more confining situations such as the consistent posture of *S*, his total helplessness, or the more unusual nature of these methods of confinement play some role.

Conditions of Illumination

Three types of visual restriction have been used: (*a*) total darkness; (*b*) diffuse light, achieved by semitranslucent eyecups or goggles which admit light but interfere with patterned form perception; (*c*) subdued light with a homogeneous field, achieved by surrounding *S* with a screen or dome-type *Ganzfeld*. In the latter condition, typical of the tank-type respirator studies, the *S* can still see his immediate surroundings and parts of his body.

A number of investigators have varied this aspect of the situation within their own experiments. Heron (1961) put opaque goggles on three *S*s who had been wearing translucent goggles for several days and "hallucinating persistently." When first placed in the dark the RVSs appeared more vivid but within 2 hours disappeared or were greatly diminished. When the translucent goggles were put on again the RVSs reappeared. Two *S*s were run from the beginning with opaque goggles and one of them had RVSs. When translucent goggles were placed on both *S*s near the end of the experiment both reported "vivid" RVSs. Freedman and Greenblatt (1960) ran 10 *S*s under darkness and 10 under

diffuse light conditions. The proportions of *S*s reporting Types A and B RVSs were almost identical in the two groups. Four *S*s were run under both of the two conditions: two had RVSs in both conditions, one in neither condition, and one in darkness only. Cohen et al. (1959) ran four *S*s with blacked-out goggles and six *S*s with frosted goggles admitting diffuse light. Type B RVSs were absent in both groups, and Type A RVSs were slightly more frequent in the diffuse light condition. Ruff et al. (1961) found only two Type B RVSs in 63 *S*s run under varying conditions; one of these occurred in a diffuse light, the other in a darkness condition. Zubek and his associates (Zubek, Aftanas, Hasek, Sansom, Schludermann, Wilgosh, & Winocur, 1962; Zubek, Pushkar, Sansom, & Gowing, 1961) ran one group (sensory deprivation) in darkness and silence and another group (perceptual isolation) with diffuse light and white noise stimulation. Fewer *S*s reporting RVSs were found in the latter group.

Vernon et al. (1961) reported on three groups run in darkness and silence conditions and three groups in diffuse light conditions. At the time when the first three groups were run (Vernon et al., 1958) the authors felt that the greater number of *S*s with RVSs in the second group was due to a failure in the blackout conditions while *S*s were being taken to the bathroom blindfolded. They concluded that nonpatterned visual stimulation might be necessary for producing RVSs. To test this they changed the conditions in the fourth and fifth groups, introducing diffuse light stimulation in the fourth group, adding unpatterned sound stimulation to this in the fifth group, and adding varying unpatterned light stimulation (flashing panel displays) in the sixth group. Type A RVSs were not found in any of these three groups but a few Type B RVS *S*s were found in the fifth and sixth groups. It is just possible that constant visual stimulation may have differential effects on the Types A and B RVSs, decreasing the former and increasing the latter.

Davis et al. (1960) tested the hypothesis that variable nonpatterned stimulation might increase RVSs. They ran a group similar to Vernon and his associates' (1961) Group VI, in which lights were flashed on a random schedule and Rorschach cards were flashed on the wall for brief intervals. Comparing their results with other respirator confinement studies it is obvious that they did not increase RVSs above the usual percentages reported in these studies. Vosburg, Fraser, and Guehl (1960) ran the same *S*s in three conditions in successive hours during the same experiment: darkness and silence, diffuse light and silence, "noise" auditory stimulation and darkness. They found no difference between the sound and visual stimulation hours in the proportion of auditory or visual sensations reported, and only slight differences between the "no stimulation" and "stimulation" hours. The authors' failure to classify their RVSs may have obscured differences in the specific types of RVSs as a function of stimulation.

Is there any difference in the results in groups run in diffuse light conditions, where the visual field is entirely limited to the homogeneous stimulation, and the subdued light conditions where *S* can see parts of the apparatus and his own body in the periphery of the field? Goldberger (1961) found fewer RVSs in a *Ganzfeld* situation than in Goldberger and Holt's (1958) diffuse light perceptual-isolation group. However, the former group was in a different confinement condition (sitting) and was exposed to the visual restriction for a much shorter period of time. The subdued light conditions in the Solomon and Mendelson (1962), Davis et al. (1960,

1961) respirator confinement experiments have produced RVS incidences comparable to the typical results of the diffuse light and darkness condition groups. Zuckerman and his associates' (1962) respirator confinement group was run in darkness and it produced only a slightly higher incidence of Type B RVSs although the difference in the Type A RVSs was considerably higher. Again this points to the possibility of darkness affecting the Type A RVSs more than the Type B RVSs. Pollard, Uhr, and Jackson (1963a, 1963b) ran one group where the total field was restricted by goggles admitting diffuse light and another group restricted by a dome (subdued light). A slightly higher incidence of both types of RVSs was found in the dome group, but the differences are certainly not significant.

It is sometimes assumed that the lack of visual restriction will result in no RVSs. This assumption about the base line for RVSs may be fallacious. It overlooks the role of immobilization and spontaneously occurring RVSs taking place in everyday life. Jackson and Pollard (1963) found that 23% of a group of *S*s responding to a questionnaire reported unusual visual experiences in their history. We do not know how many of these may have occurred in conditions of partial isolation. Zuckerman, Levine, and Biase (1964) ran a control group confined to the isolation chamber without visual restriction and 23% of *S*s reported at least one Type A RVS. None reported Type B RVSs, although these were reported in groups run in darkness, and darkness with sound. Zubek et al. (1962) found that 8% of 40 *S*s in a recumbent-control group, who were not visually restricted except by their position, reported Type A RVSs. This is not significantly different from the 10% reporting Type A RVSs in their diffuse-light group, but it is significantly different than the 56% in their prior-darkness group. In a later study (Zubek, Aftanas, Kovach, Wilgosh, & Winocur, 1963) on the effects of more severe immobilization without perceptual isolation, they confined *S*s to a foam-rubber lined coffinlike box and found that 13% of their 40 *S*s reported Type B RVSs. However, four of these five RVSs occurred during the quiet of the evening when the lights were turned down low so that some degree of perceptual isolation was in effect. RVSs have been found in poliomyelitis patients confined in respirators under similar conditions (Mendelson, Solomon, & Lindemann, 1958).

Duration of Isolation

The isolation periods range from 30 minutes for the Murphy et al. (1962) control group to 2 weeks for the three heroic *S*s in the Zubek, Welch, and Saunders (1963) EEG study. The mean time of the onset of RVSs for *S*s in the Bexton et al. (1954) study was 33 hours and in the Doane (1955) study was 30.6 hours. These authors noted that complex imagery was reported only after long periods of isolation. Since these original experiments, considerable evidence has accumulated indicating that long periods of isolation are not necessary, or even sufficient, to elicit RVSs. Ruff et al. (1961) and Vernon et al. (1961) have reported minimal Type B RVSs in experiments ranging from 48 hours to 6 days of isolation. Zubek et al. (1962) have reported few Type B RVSs in experiments of 1- or 2-week durations. Arnhoff et al. (1962) report no RVSs in a 2-day experiment. On the other hand, Goldberger and Holt (1958), Holt and Goldberger (1961), Freedman and Greenblatt (1960), and Zuckerman et al. (1962) have reported 30–57% of their *S*s giving Type A RVSs within 6–8 hour periods of isolation. Jackson

and Kelly (1962) report a high incidence of RVSs in 1 hour of isolation. They attributed their results to their experimental suggestions, but the results of Zuckerman and Cohen (1964) indicate that comparable results can be obtained in 1 hour without direct suggestion. Zuckerman et al. (1962) plotted the incidence of RVSs in successive hours of a 6-hour isolation period and found that the highest incidence of reports was during the first hour and that RVSs dropped off in succeeding hours. The drop after the first hour was sharper for unstructured RVSs than for structured RVSs which fell off more gradually. These results may have been a function of the generally decreasing verbalizations of *S*s over the 6-hour period. Pollard et al. (1963b) also found fewer verbal reports during the last 3 hours of an 8-hour isolation period, and even fewer verbal reports in a second 8-hour isolation session. Decreasing verbalization over time was also found in social isolation (Walters & Henning, 1962). This decreasing verbalization phenomenon may be an adaptation and stress reduction effect as suggested by Pollard et al. (1963b), or a reduction in interest and motivation in a monotonous environment as suggested by Zuckerman et al. (1962). Perhaps the verbal responding is extinguished because of the lack of social reinforcement from others. But whatever the cause of the phenomenon it is bound to affect the spontaneous reports of RVSs in medium or long-term isolation studies.

Murphy et al. (1962) provide the most crucial study on the effect of the duration of isolation. Instead of allowing continual reporting they interrupted at 48, 72, and 96 hours, asking *S*s to give reports of any visual sensations during 30-minute reporting periods. A control group, who had not been in isolation, was put in for 30-minute periods at the corresponding times. The isolation and control *S*s did not differ in the frequency or complexity of RVSs at any of these periods. In other words, alerted *S*s lying in the dark for 30 minutes with a set to report RVSs produce as many as *S*s who have been lying in the dark for 48, 72, or 96 hours! However, on a postexperimental questionnaire, which asks *S*s to describe their experiences during the entire period of the experiment, isolation *S*s reported more frequent and more complex RVSs than the control group. These authors (Murphy et al., 1962) conclude:

> The important aspect of isolation was that it provided cubicle Ss with lengthy waking periods in the dark during which time more frequent and more complex RVSs occurred than was the case for control Ss whose waking hours took place more often in a lighted, everyday world [p. 54].

Although this explains the differences in results on concurrent and retrospective measures it does not explain why *S*s in other experiments who were exposed to long waking periods in the dark failed to report complex RVSs after emerging from isolation. Another aspect of the data in this study which will be discussed in a later section may cast more light on this puzzle.

Set, Instructions, and Suggestion

Jackson and Pollard (1962) have postulated that the suggestions of the *E*s contained in their instructions to *S*s may be a crucial variable in eliciting RVSs. The *E*s instructions may do this in two ways: (*a*) by alerting *S* to the possibility of such effects by asking him to report them; (*b*) by creating positive or negative attitudes toward the effects, resulting in oversensitization in one case and response suppression in the other.

Myers and Murphy (1962) told one group that RVSs were found only in psychiatric patients and another group

that RVSs were normal. The former group produced significantly fewer and less complex RVSs than the latter, but it is interesting that some *S*s in the former group did report RVSs despite the strong negative connotations attached to such reports. Jackson and Kelly (1962) created a positive set for RVSs by giving their *S*s an extended talk on the expected effects of a new drug (a placebo) which supposedly combined with isolation to produce hallucinations and other changes. They attached various positive values to the ability to produce RVSs. They obtained 86% Type A and 43% Type B RVSs in only 1 hour of isolation. The lack of a control group exposed to isolation without suggestion made their results equivocal with regard to the role of suggestion. Zuckerman and Cohen (1964) used a control group (I), a group given a mild suggestion that they would have RVSs and that these were normal (II), a group given the mild suggestion and a drug (placebo) suggestion (III), and a group (IV) given the extended suggestion and the drug suggestions used by Jackson and Kelly (1962). The only significant difference found was in the Type A RVSs which increased in occurrence from Group I to Group IV. The Type B RVSs showed no response to suggestion.

Pollard et al. (1963b) compared two 8-hour isolation groups given no suggestion except to report "anything unusual," with a 3-hour group given information about RVSs and told that intelligent people report them sooner. More Type A and Type B RVSs were found in the suggestion group. In a later drug experiment (Pollard et al., 1963a) these authors found practically no difference between a group given neutral instructions with a placebo and a group given suggestion with a placebo. Apparently the suggestions "take" with some groups of *S*s and not with others. It may be difficult to generalize about the effects of suggestion without considering the type of *S*s and the specific verbal set used.

It is difficult to account for the results of many of the experiments on the basis of the sets given *S*s. In the original McGill work (Bexton et al., 1954) no one expected RVSs and their occurrence was impressed on the *E*s by spontaneous, nonsolicited reports. Solomon and Mendelson's (1962) *S*s were told that the purpose of the experiment was to see what happens to normal people and were given no special report instructions, but Type B RVSs were obtained. Goldberger and Holt's (1958) *S*s were told to report "thoughts and feelings," but a high proportion also reported Type B RVSs. Arnoff et al. (1962) told their *S*s that "hallucinations" sometimes occurred as a result of isolation, but they obtained no RVSs of any type. Cohen et al. (1959) told their *S*s that they would have visual sensations and some *S*s reported Type A RVSs but none reported Type B RVSs. Zubek et al. (1961, 1962) told their *S*s that they might have "unusual experiences" and to report them. During isolation they also asked *S*s to visualize scenes and describe them. This encouragement of visual imagery could have had suggestive effects on RVSs, but they obtained few *S*s giving Type B RVSs in their two experiments. Zubek does report that *S*s experienced unusually vivid voluntary imagery. Rossi, Sturrock, and Solomon (1963) compared the vividness of voluntary imagery reported by *S*s after hypnosis, placebo suggestion, sensory deprivation, and normal conditions. Although hypnosis enhanced imagery, placebo suggestion had no effect and sensory deprivation resulted in significantly lower vividness of imagery. They conclude that imagery in sensory deprivation cannot be explained by the hypothesis that sug-

gestion enhances visual imagery in isolation.

Another approach to the problem of suggestion is to attempt to suggest sensory changes to *S* while he is in isolation. Walters and Quinn (1960) demonstrated that *S*s exposed to sensory and social deprivation had a greater response to an autokinetic stimulus than *S*s exposed to either social or sensory deprivation only. Zuckerman et al. (1962) found that they could suggest the appearance of a "light" to most of their *S*s at the end of an isolation experiment, but that the latency of reporting the nonexistent light did not correlate with the prior RVSs obtained during isolation. Bexton et al. (1954) found that their *S*s had poor control over their RVSs. Some *S*s were disturbed by them but could not stop or start them at will. There was some control over content; *S* might see some objects suggested by *E* but not always as *E* intended and with some irrelevant RVSs intruding themselves.

Continuous Reporting Instructions

The decreasing number of *S*s giving RVSs in each successive hour of isolation in the Zuckerman et al. (1962), Vosberg et al. (1960), and Pollard et al. (1963b) studies may have been related to the decrease in spontaneous verbalizations in these samples with successive hours of isolation. Since we had verbal productivity measures on *S*s in the Zuckerman et al. (1962) experiment, we correlated this measure with the RVS measure combining frequency and complexity of RVSs. The correlation was .43. Goldberger and Holt (1958) found a .87 correlation between verbal output and imagery in their male undergraduates! In their group of unemployed actors (Holt & Goldberger, 1961), the correlation was insignificant. We analyzed the data in the Pollard et al. (1963b) study and found that in their Dome group, where verbal output is given for individual *S*s, *S*s giving RVSs emitted more than three times the number of words than *S*s not giving RVSs; the difference was significant. Solomon and Mendelson (1962) reported no difference between hallucinators and nonhallucinators on verbalization.

Instructions which forbid, discourage, or limit spontaneous verbal reporting may inhibit RVSs. Vernon et al. (1961) did not permit reporting during their first three experiments and obtained no RVSs of the B type, although a large proportion of *S*s reported Type A RVSs in the second experiment. Silverman and his associates' (1961) *S*s were not told to report during the experiment and they obtained few RVSs. Zubek et al. (1961, 1962) and Arnoff et al. (1962) told *S*s they could report if they wanted to but instructions minimized reporting in these experiments and few Type B RVSs were given. Murphy et al. (1962) found significantly less complex RVSs in groups where no reporting periods were allowed during isolation than in groups where there were reporting periods during isolation; the comparisons were made on a postexperimental questionnaire.

Myers and Murphy (1962) found that prior verbalization encouraged by administering the Rorschach test before isolation had no effect on RVS complexity. Does the verbalization itself stimulate the RVSs or is it only symptomatic of the heightened interest in sensations, images, and feelings? Murphy et al. (1962) ran one isolation group where *S*s signaled RVSs by pulling a lever instead of verbally reporting them. The postexperimental scores for this group were the same as those for *S*s who reported verbally during the experiment. These results suggest that the verbal response per se is not the source of RVSs.

Sleep and Cortical Alertness

Freedman, Grunebaum, Stare, and Greenblatt (1962) feel that the RVSs in isolation are likely to occur in transitional states between sleep and waking, and may represent hypnogogic and hypnocampic imagery. If their contention is correct, then persons who doze and wake frequently during isolation should have more RVSs than *S*s who remain more alert. According to West (1962) the greater the level of arousal during reduced sensory input, the more vivid the hallucination. This theory would suggest that the more alert individual in perceptual isolation would be more prone to have RVSs than the drowsy individuals.

What is the evidence bearing on these speculations? Bexton et al. (1954) reported EEG patterns typical of "alertness" occurring during RVSs. Solomon and Mendelson (1962) reported no differences in rated sleep between RVS and non-RVS *S*s. An analysis of the Pollard et al. (1963b) data reveals no difference in time spent sleeping by RVS and non-RVS *S*s. Goldberger and Holt (1958) did not find a significant correlation between sleep and RVS imagery in their undergraduate group, but they found a −.66 correlation in their (Holt & Goldberger, 1961) actor sample. Zuckerman et al. (1962) found a −.71 correlation between sleep ratings and RVS complexity. These last two correlations indicate that *S*s who slept more frequently reported fewer and simpler RVSs and *S*s who were more alert reported more and more complex RVSs. Murphy et al. (1962) compared three groups: (*a*) an immediate RVS group where *S*s were put into a dark room and asked immediately to report RVSs, (*b*) a delayed RVS group, where *S* spent 30 minutes in darkness before being asked to report RVSs, (*c*) a wake-up group, who also waited 30 minutes in darkness before reporting, but were asked to do mental arithmetic problems for the last 7 minutes of the waiting period to eliminate drowsiness incurred during the waiting period. The delayed-RVS group more frequently reported becoming drowsy or falling asleep, and they reported less complex RVSs than the immediate or the wake-up groups.

In the studies which have found significant relationships between sleep-alertness and RVSs during isolation, alertness is found to be more conducive to RVSs and states of sleeping or drowsiness seem to be inimical to RVSs, particularly the more complex ones. This might explain why some of the long-duration experiments yield few RVSs despite the more extended opportunity to "sample" the visual field. Since the *S*s in these experiments know that they have a long time to spend in isolation, and since there are no restrictions on their position, they may simply sleep as much as they can or remain in sustained drowsy states with little attention paid to changes in their visual fields. Bexton et al. (1954) reported that *S*s tended to spend the earlier part of their experiment in sleep; later they appeared more eager for stimulation. This would explain why RVSs did not appear in the earlier hours of their experiment. In Zuckerman and his associates' (1962) groups, *S*s were noted to be most alert in the earlier hours of the experiment (*S*s were not allowed to sleep in this study) and reported the greater number of RVSs during this early period. The factor of set, used by Jackson and Kelly (1962), may increase RVSs by creating an alert, expectant attitude. If *S* is set to "scan" his visual field he is more likely to report visual sensations. At the physiological level, the relative arousal of the reticular formation may be used to explain the same phenomena.

Population Variables

The population from which *S*s for isolation experiments are drawn is some-

what limited by the fact that only certain *S*s will volunteer when informed of the experimental procedure. One wonders how specific the RVSs are to a population already motivated to experience isolation. Murphy et al. (1962) put their nonvolunteers for prolonged isolation into their control group, but it was possible to compare their RVSs in the 30-minute report periods with controls who had volunteered for isolation. There was no significant difference in the complexity of RVSs.

Within the volunteer samples the motives for volunteering differ. Wexler, Mendelson, Leiderman, and Solomon (1958) found that 5 out of 17 *S*s volunteered to "test themselves" while most of the others volunteered for the money. Four of the 5 self-testers quit the experiment before 8 hours; only 1 of the 11 mercenary *S*s could not make 8 hours. Apparently the self-testers were an unsuccessful counterphobic group. However, no relationship was found between motivation for volunteering and hallucinations (Solomon & Mendelson, 1962).

Ruff et al. (1961) speculated that his failure to obtain many RVSs may have been because his *S*s were older, experienced airmen who were accustomed to stressful activities. Murphy and his associates' (1962) soldiers had many RVSs so a military identification per se is not incompatible with RVSs. Furthermore, Ruff's assumptions that stress resistance is somehow correlated with RVSs is not borne out as will be seen in a later section.

Sophistication is also not incompatible with RVSs. Heron, Doane, and Scott (1956) used themselves as *S*s and all reported complex RVSs. Bliss and Clark (1962) used psychiatrists and psychologists and obtained a moderate proportion of RVSs. Finding RVSs in sophisticated *S*s tends to cast some doubts on the Cambareri (1959) thesis that suggestible *S*s are more prone to give RVSs. Holt and Goldberger (1961) found little difference between college students and actor samples in percentages of *S*s giving Type B RVSs although the actors gave considerably more Type A RVSs.

As with most psychological research, the undergraduate remains the favorite *S* although many *E*s also use some graduate students. No generalizations can be made about national differences since RVSs are frequently given by New York University (Goldberger & Holt, 1958) and McGill students (Bexton et al., 1954) and rarely given by Princeton (Vernon et al., 1961) and Manitoba students (Zubek et al., 1961, 1962). These differences cut across national boundaries.

Because of the theoretical analogy made between isolation and psychotic phenomena (Rosenzweig, 1959), the results of psychiatric populations are of some interest. Cohen et al. (1959) ran four normals and six patients of various diagnoses. Two of the normals and one schizophrenic gave RVSs but none of these were Type B RVSs. The RASs were more common and will be discussed later. Azima, Lemieux, and Azima (1962) reported that 7 out of 18 patients had RVSs ranging from simple to complex. They do not provide a breakdown on the types of RVSs, but the overall frequency is no higher than in most of the studies on normals. This is not surprising since spontaneous RVSs are rarer in patients than is commonly supposed. Malitz, Wilkens, and Esecover (1962) found only a 9% incidence of RVSs in case histories of 100 chronic schizophrenic patients. A case-history survey of normals might reveal a similar percentage. Cleveland, Reitman, and Bentinck (1963) found no significant difference between schizophrenic and nonschizophrenic patients in frequency or intensity of reported perceptual distortions. Schizophrenics who halluci-

nated before also admitted hallucinating in isolation; one said that the sensory deprivation made the sensations louder and clearer.

Most of the experiments have used males. Zubek et al. (1961) found suggestion of a sex difference with 10 of his 12 male *S*s giving RVSs and only 1 of his 4 females. Pollard et al. (1963b) obtained usable data on 22 males and 23 females in three conditions of isolation. Over all conditions, 73% of the males and 61% of the females gave RVSs.

*S*s *Prior Knowledge and Expectations*

Jackson and Pollard (1962) have suggested that the phenomena observed in isolation experiments are self-perpetuating because the publicity given prior studies affects the *S*s expectations and the expectancies affect their reports. Although a number of experimenters have varied experimental suggestions few have inquired about *S*s own knowledge of the area and their expectations for their own reactions before the experiments. Zuckerman and Cohen (1964) did this and found no relationship between prior knowledge and expectation, and RVSs. The *S*s specifically expecting to have hallucinations gave no more RVSs than *S*s not having such an expectation. Jackson and Pollard (1962) argue that *S* must not only expect RVSs but must be motivated to report them. Zubek et al. (1961) note that 5 of the 16 *S*s who had no RVSs were very disappointed in not having had them; surely these *S*s were motivated to report RVSs if they had experienced them.

Intelligence

Goldberger and Holt (1958) found a .59 correlation between intelligence, as measured by the Ohio State Psychological Examination, and imagery in their undergraduate sample. Murphy et al. (1962) found no difference between high and low scorers (within a restricted range of above average) on the General Technical measure of intelligence. There was a difference within the group where the postisolation inquiry was not preceded by reports during isolation. In this subgroup *S*s with high General Technical scores produced less complex retrospective RVSs. Although intelligence was not correlated with other variables in the Zuckerman et al. (1962) study, American Council on Education test scores were available, and an analysis revealed no relationship between American Council on Education measured intelligence and RVS scores.

Personality Characteristics

Holt and Goldberger (1961) have undertaken the broadest personality studies in this area. Unfortunately the generality of their results is limited by the size of the two sample studies (*N*s of 14 and 16 but sometimes dropping as low as 9 for some correlations). If the results of the second group (actors) had replicated the results of the undergraduate group, one might have more confidence in their results. However, in some cases the results were significant in the opposite direction, while in others they simply failed to confirm the correlations found in the first sample. In the undergraduate sample "imagery" in isolation correlated positively with test scores, and test and interview-based ratings, measuring "acceptance of one's passive, feminine side," "intellectual flexibility, breadth and richness," and "freedom from emotional disturbance or constriction." In the actor sample, active, masculine strivings and values correlated positively with imagery. "Intellectual flexibility" correlated with imagery in the actor sample also, but only one measure of it was significantly related in both groups. The number of *M* on the Rorschach, which correlated positively with imagery in undergraduates, failed to correlate significantly in

the actor group. Measures of emotional disturbance or neuroticism correlated negatively with imagery, as in the undergraduate sample, but the only single measure whose correlation was replicated across the samples was the Block Neurotic Under-Control scale. In retrospect it seems unfortunate that Holt and Goldberger did not use another sample similar to their first to replicate their results. If we look only at the Gestalt of the results, intellectual flexibility and freedom from emotional disturbance seem to be related to imagery in both samples while the role of masculinity-femininity and activity-passivity traits seems to depend on other characteristics of the populations.

Solomon and Mendelson (1962) found no differences between hallucinators and nonhallucinators on MMPI or EPPS scales. Zuckerman et al. (1962) found that the only MMPI or EPPS scales correlating with RVSs was the MMPI *Mf* scale. Freedman et al. (1962) found no clear relationship between ego integrity and visual imagery although they did find a significant relationship with a history of hypnogogic imagery. The failure of any of the clinical scales from the MMPI to correlate with RVSs in two studies does not support Goldberger and Holt's relationship between freedom from emotional disorder and RVSs.

Cambareri (1959) administered a battery of "suggestibility" tests to his *S*s and, on the basis of a combined rank score, divided them into suggestible and nonsuggestible groups. Out of his matrix of 45 correlations between the suggestibility tests only two were significant and most were close to zero. There was little basis for combining the tests into a composite score and therefore no basis for labeling the score "suggestibility." Whatever the score represented, 9 of the 10 high-scoring *S*s and only 2 of the 10 low-scoring *S*s reported RVSs on a postexperimental introspective report. No differences between groups were obtained on a questionnaire. It is interesting that the high scorers on the test battery found the situation more comfortable and stayed longer than low scorers.

Silverman et al. (1961) selected 11 field-oriented and 9 body-oriented *S*s, after screening 109 students with the Draw-a-Person and Rod and Frame Tests, and gave them 2 hours of isolation. Four of the field-oriented group experienced visual imagery having specific form and which they believed to come from a source outside of themselves. None of the body-oriented group reported this type of imagery. The results suggest that the field-dependent personality is more prone to RVSs, possibly because he is less able to discriminate internal and external cues in ambiguous situations.

Considering the number of correlations run between RVS scores and personality variables the results are meager and only suggestive at the most. Perhaps personality variables are important only insofar as they affect *S*s cooperation with certain of *E*s instructions, for example, to lie still, to report from time to time, not to sleep, etc. Holt and Goldberger (1961) found that imagery correlated with a group of scales that denote "being a 'good' subject: a wish to cooperate . . . persistence with the task at hand." This may have been what Cambareri was measuring in his various tasks, and would account for the fact that his high scorers remained in the tank longer than low scorers.

Stress Response and RVSs

Much of the initial excitement about the isolation RVSs was due to the assumption that they had something in common with psychotic RVSs. Actually psychotic hallucinations are usually personally symbolic and emotionally charged. While a few *S*s are frightened

by their RVSs, others are interested or amused by them, and RVSs themselves often consist of mundane objects or cartoonlike figures. Solomon and Mendelson (1962) found that in seven RVS *S*s affect was pleasant in two cases, unpleasant in three, and severe anxiety occurred in three. However, their *S*s had not been alerted to the possibility of RVSs. RVS and non-RVS groups in their experiment did not differ in somatic complaints or length of stay, two indicators of stress. They found that the non-RVS group had a larger increase in noradrenalin excretion and urine volume output than the RVS group. This might indicate that the less stressed *S*s report RVSs. Supporting this is Holt and Goldberger's (1961) findings of significant correlations between "imagery" and a cluster of variables which they call "adaptive response" to isolation. The relationship suggests that RVSs may be a self-stimulation coping mechanism rather than the projection of anxiety-laden fantasy. Zuckerman et al. (1962) found no correlation between their RVS score and any of the variables in their stress response cluster. The findings were different for RASs and these will be discussed later. Murphy et al. (1962) found that *S*s who left isolation before 48 hours reported RVSs of the same complexity as *S*s who stayed the full 96 hours. An analysis of the data in the Pollard et al. (1963b) Dome group revealed no differences between RVS and non-RVS groups in time remaining in isolation.

Methods of Reporting RVSs

There are three basic methods for obtaining RVSs: (*a*) reports during the experiment, spontaneously, or during allotted reporting periods; (*b*) a postexperimental interview, usually structured but sometimes free associative; (*c*) a postexperimental questionnaire. Some *E*s have used one, some have used two, and some have used all three methods to define the RVS phenomena. When two or more methods were used to define a phenomenon, we should ask some questions about their relationships. Zuckerman and Cohen (1964) compared RVSs in *S*s reports during the experiment and their replies to questions about RVSs in the postexperimental interview. The correlation between the two methods was .77. Although the two methods are correlated they may still yield different findings. Murphy et al. (1962) found a high order of relationship between the during and postexperiment techniques, but they found no difference between isolation and control groups on complexity of RVSs during the experiment and a significant difference on a postexperimental questionnaire. Many experimenters ignore this problem by using both the during and after reports together; that is, if *S* gives an RVS during the experiment or after the experiment it is counted. Such a procedure will certainly inflate the number of RVSs in the group over what would be obtained by using more rigorous criteria. An analysis of the data in the Zuckerman and Cohen study (1964) indicated that the use of reports appearing in both methods would give a figure of 45% RVS *S*s while the use of reports in either gives a figure of 71%. In Solomon and Mendelson's (1962) study we have a choice between 7% and 25% depending on whether we admit RVSs appearing in retrospective reports only as data. If a third method is added, as in Goldberger and Holt's (1958; Holt & Goldberger, 1961) experiments which use reports during the experiment, a postexperimental interview, and a postexperimental questionnaire, we can expect even higher proportions of *S*s giving RVSs. One is reminded of the results in the verbal conditioning experiments where the more the postexperimental in-

terview was extended, the more *S*s were found to be "aware."

Reported Auditory Sensations

The RASs have not received the attention that RVSs have. Some *E*s do not provide data on them. There are several reasons for this neglect. In rooms which are not soundproof various noises from the adjoining rooms and corridors may be reported by *S*s immediately or in the postexperimental interview. This makes it difficult for *E* to distinguish between sensation, illusion, and hallucination. Even in soundproof rooms certain reported sounds such as "water" noises are typical and may be a reaction to inner-ear noise. Low frequency sounds such as the rumble of passing trains may penetrate the soundproofing. In many experiments some kind of constant background noise such as white "noise" transmitted through earphones, the noise of the intercom system, or the hum of a motor may be used. Some *S*s begin to interpret these sounds and the interpretations may be classified as illusions rather than hallucinations. Human voices or music tend to fall closer to the hallucinatory category. The range of these Type B RASs in the groups reviewed is from 0 to 50%, with the median falling at 15%. A third of the studies report no Type B RASs. Because of the limited data available on RASs we will be somewhat more cursory in our analysis of the variables related to them.

What is the relationship between RVSs and RASs? In general, *E*s who obtained few or no RVSs also obtained few or no Type B RASs. This would suggest that there is a correlation between the two types of reported sensations. Zuckerman et al. (1962) found a .49 correlation between visual and auditory hallucination scores. This would suggest that some of the factors which influence RVSs may also influence RASs.

The RASs have been obtained in all the methods of confinement. They have been obtained under darkness and diffuse light conditions. Zuckerman, Levine, and Biase (1964) ran a group of 12 *S*s with auditory restriction, but without visual restriction, and found that 38% of *S*s gave Type B RASs in contrast to 7% in a visual and auditory restriction group. Perhaps the increased RASs in this group occurred because they were less distracted by RVSs. Pollard et al. (1963b) found fewer RAS *S*s in a subdued light (dome) condition than in a more restricting diffuse light (goggles) situation.

The role of some kind of masking noise in producing RASs was previously suggested. Zubek et al. (1961) found no Type B RASs when they used a soundproof chamber, but they obtained a few when white noise was fed to *S* through earphones (1962). Vernon et al. (1961) did not find any RASs in a group run with "noise" stimulation. Although constant auditory stimulation may play some role in RASs it is not sufficient to explain their occurrence or absence. Zuckerman, Levine, and Biase (1964) used music as sound stimulation for *S*s lying in darkness and found only slightly more Type B RASs than in the total-isolation group.

As was the case for RVSs, the duration of isolation does not seem to be a critical factor in RASs. The RASs are obtained in some 1-hour experiments and are not found in some of the 2-day to 1-week experiments.

The RASs appear more resistant to suggestion than RVSs. Vernon et al. (1961) tried to suggest to their *S*s that they would hear "music" but none of them reported hearing it. Pollard et al. (1963a, 1963b) found no more RASs with suggestion than without it. Zuckerman and Cohen (1964) found no in-

crease in RASs with increasing suggestion.

If meaningful RASs are not a function of external stimulation or suggestion they may represent projections of internal thoughts and therefore may be more closely related to personality factors than are RVSs. Since Malitz et al. (1962) found that RASs were much more frequent in schizophrenics than RVSs, we might expect that RASs would be related to deviant tendencies. Zuckerman et al. (1962) found positive but insignificant correlations between RAS scores and the Validity and Schizophrenia scales of the MMPI; however, the RAS score correlated significantly with verbalized manifest anxiety and increases in a checklist measure of anxiety during isolation. This finding suggests that RASs may reflect the situational anxiety and projective tendencies induced by isolation rather than broader personality characteristics. In the Cohen et al. (1959) study, one of four normals, two of three neurotics, and all of the three schizophrenic *S*s gave RASs. The *N*s in the group are too small to determine if the trend toward increasing RASs with increasing psychopathology is significant. Cohen et al. noted that one difference was that the normals regarded the events as "hallucinations" whereas most of the psychiatric patients regarded them as real. In Azima and his associates' (1962) psychiatric patients consisting of neurotics, depressives, and schizophrenics, only 2 of the 17, or 12% of the group gave RASs. These 2 were both neurotics. Cleveland et al. (1963) found no differences in RAS intensity or frequency between schizophrenic and nonschizophrenic psychiatric patients. In evaluating population comparisons we must again consider the question of the preisolation base line. Jackson and Pollard (1963) found that 31% of a normal sample reported "unusual auditory experiences" outside of isolation.

There was no evidence of a sex difference in RASs in the Pollard et al. (1963b) study where 64% of the men and 65% of the women *S*s gave RASs (of all types).

The comments made about the methods of obtaining reports and verbalization during isolation in relation to RVSs probably apply to RASs since the same studies, which relied mainly on postisolation indices of RASs (Arnoff et al., 1962; Silverman et al., 1961; Vernon et al., 1958; Zubek et al., 1961, 1962), or did not encourage free reporting during isolation, failed to obtain many RASs. The correlation between verbal productivity and RAS score in the Zuckerman et al. (1962) experiment was .77! In the Pollard et al. (1963b) experiment RAS *S*s spoke more words than non-RAS *S*s, but the difference on a score corrected for time in the situation and sleep time was not significant ($t=1.50$).

Theoretical Considerations and Conclusions

There have been four general approaches to the explanation of the phenomena of perceptual isolation: the physiological, the psychoanalytic, the cognitive, and the social-psychological. The physiological explanations point to specific sensory effects and to nonspecific central nervous system effects (Heron, 1961). Several investigators have cited the work of Granit (1955) which shows that spontaneous discharge of the retinal ganglion cells takes place in the dark-adapted eye as well as in the light-adapted eye. This means there is always a random "noise" factor which could furnish the sensory basis for RVSs despite the reduction or elimination of external stimulation. Doane (1955) relates the RVS isolation phenomena to RVSs in cataract cases, and to the

phantom-limb phenomenon in amputees. He suggests that the Cannon and Rosenblueth (1949) law of denervation may account for all of these cases; that is, sensory deprivation may result in a functional denervation of sensory neurons resulting in a sensitization, or lowering of thresholds, of neurons further up in the nervous system. Supporting this theory is the finding that RVSs typically progress from simple to complex (Heron, 1961; Myers & Murphy, 1962; Zuckerman & Cohen, 1964) indicating a possible progression of their site from lower to higher centers in the nervous system.

Evarts (1962) in his "neurophysiologic theory of hallucination" says that the neurophysiologic processes which produce hallucinations are similar to those which occur in dreams during sleep. Scheibel and Scheibel (1962) stress the role of the brain-stem reticular core:

> Normally periods of decreased total input to the reticular core occur only during sleep, but in this case (sensory deprivation) the individual remains nominally awake. The gradual development of n.o.b. (RVS) phenomena may represent simply a normal expression of the physiologic function of brain cells whose modulation by specific sensory and nonspecific reticular input drops below a critical level with consequent changes in cell biasing and concomitant increased "sensitivity" to what is usually "background activity" in intracerebral loops [pp. 29–30].

The former theory would suggest that RVSs occur in stages of light sleep or transitional stages while the latter theory suggests that RVSs would occur in alert, wakeful stages during perceptual isolation. The evidence from EEGs during RVSs (Heron, 1961) and from reported relationships between sleep during isolation and RVS's production (Holt & Goldberger, 1961; Murphy et al., 1962; Zuckerman et al., 1962) support the latter theory. Lindsley (1961) has also stressed the role of the "ascending reticular activating system" which may compensate for reduced sensory input by projecting its own response level upon the cortex.

The psychoanalytic theory of isolation, as delineated by Azima et al. (1962), Goldberger and Holt (1958), Goldfried (1960), and Kubie (1961), states that isolation produces a kind of regression resulting in a decrease in the efficiency of secondary process thinking (logical, problem solving, goal directed) and an increase in primary process thinking (governed by the pleasure principle, alogical). The RVSs could be explained as one aspect of primary process thinking. However, individuals who are severely threatened by primary process may develop anxiety which might interfere with RVS development. Goldberger and Holt (1958) found that a preisolation Rorschach measure of controlled primary process, correlated .45 with imagery during isolation; and controlled primary process, measured from verbalizations during isolation, correlated .88 with imagery during isolation. However, Solomon and Mendelson (1962) found that the hallucinators in their experiments daydreamed less during isolation than nonhallucinators. Perhaps this finding could be explained away by classifying daydreams as secondary process, since they are more under voluntary control than are RVSs. However, most of the imagery reported during isolation is not obviously wish-fulfilling or drive relevant. Also this theory would be hard put to explain the lack of a positive relationship between time of isolation and RVS production since ties with reality would be weakened as a function of time in isolation. The theory might explain the positive relationship between verbalization and RVSs since individuals who free-associate more easily can also release primary process more easily. In general, Goldberger and Holt's formulations are based on correlations rather than actual meas-

ures of changes in thinking during isolation. Research is needed to test the hypothesis that isolation tends to increase one type of thinking as opposed to another. The progressive decrease in verbalization during isolation would suggest that all types of associative thinking are reduced.

A third class of theory is the cognitive theory (Bruner, 1961; Freedman, 1961) which suggests that RVSs may be due to the organism's attempt to maintain "ordered relationships" in its perceptual environment. The RVSs may be the result of the organism's attempt to fit the random noise sensations from the retina, or the inner ear, into previously acquired cognitive schemata. We might deduce from this theory that the content of RVS or RASs would be dominated by the most familiar objects or sounds experienced by *S*s. Research on this theory might attempt to relate the content of RVSs of individual *S*s to their particular schemata.

The fourth class of theory is the social-psychological theory which is excellently developed by Jackson and Pollard (1962). These authors have questioned the prior theoretical interpretations of RVSs and other isolation phenomena on the basis of the fact that some *E*s have failed to obtain them, that manipulation of *S*'s set by suggestion may affect them, and that there are fewer of them during a second exposure to isolation. They advocate an explanation based on: *S*s knowledge of "expected" reactions, his motivation to experience and report, and the use of continuous reporting instructions which have a self-suggestive effect. In our review of this area we have seen that negative or positive values attached to RVSs by *E*s have affected their occurrence in some experiments but not in others. Direct suggestion to *S* that he will experience RVSs, or his expectation or desire to experience RVSs, seem to have little effect. Set probably influences RVSs but the exact role of set has not yet been clearly defined. Jackson and Pollard have used a shotgun type of suggestion, including placebos, and their failure to obtain results in their last experiment (Pollard et al., 1963a) raises questions about the role of specific instructions, in particular contexts. Furthermore, certain types of response indicators may be more sensitive than others, and certain types of RVSs may be more responsive to suggestion than others. The work so far would suggest that set alone cannot explain the RVSs, and certainly not the RASs, in isolation. Continuous reporting instructions and *S*'s responses to them certainly seem to be of crucial importance. The exact meaning of this relationship is open to question.

Most of the theoretical positions discussed above are not incompatible with each other, but could easily incorporate one another. As yet, the theoretical issues are not drawn so sharply that we could pose one theory against another. Hopefully, the next decade of work on perceptual isolation will witness more precise definition of the theories, and experiments more precisely aimed at the theoretical issues.

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