REDUNDANCY IN PSI INFORMATION

Implications for the Goal-Oriented
Hypothesis and for the Application of Psi

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ABSTRACT: The concept of redundancy, defined as multiple or repeated transmission of the same information, underlies most technical methods that have been proposed to increase the reliability of psi. Techniques that employ redundancy of psi include majority-vote procedures, the use of large sample sizes in experiments, and procedures for judging free-response experiments. However, if psi is independent of task complexity, as hypothesized in the concept that psi is a goal-oriented process, the redundancy methods may not generally increase the reliability of psi effects; they may only be adding complexity to the task and thus be irrelevant to the overall psi effect.

   The internal analysis of data from experiments using majority-vote procedures is the best way to investigate these ideas. A previous survey of PK experiments gave evidence favoring the hypothesis that psi is goal oriented. The present paper extends the investigation to the ESP literature. Only one majority-vote ESP experiment has been published in sufficient detail that the needed internal analyses could be carried out. The results were in line with the goal-oriented hypothesis and they also confirmed the suggestion from the PK literature that psi achieves its goals in an efficient manner.

   If redundancy methods are to be successfully used to increase the reliability of psi, some means are needed to focus the psi effects on each redundant bit of information rather than on the final outcome of the experimental project.

The inability to obtain more reliable psi effects in parapsychology is generally thought to be due to a failure to control enough of the many relevant psychological variables. While many researchers think that some progress has been made in this direction (e.g., Honorton, 1977), others (e.g., Parker, 1978) have suggested that the apparent increased reliability of results may be an illusion, since the successful methods do not seem to be generalizable beyond certain experimenters. This reviewer finds himself more aligned with the latter view (see Kennedy, pp. 17-18, in Honorton, Braud, Kennedy, & Stanford, 1978) and has become interested in the possibility that the difficulties in obtaining reliable psi effects may be more properly conceived as a failure to grasp some fundamental aspects of the psi process itself rather than as a failure to control the psychological conditions during experiments.

   The idea that psi is a goal-oriented process (Schmidt, 1974a,

1974b; Stanford, 1977, 1978), in particular, seems to have radical—perhaps devastating—implications for parapsychology, not only on a theoretical level but also on the practical level of designing and interpreting experiments.

According to the goal-oriented view, psi can operate when there is motivation for a particular outcome in situations in which an element of randomness or indeterminacy is involved. It is implied here that the psi effect is independent of the logical or technical complexity of the task, an idea that has its roots in the early discussions of the "diametric" or unitary nature of ESP (Foster, 1940; Rhine, Pratt, Stuart, Smith, & Greenwood, 1940).

As was suggested previously (Kennedy & Taddonio, 1976; Kennedy, 1978), the hypothesis that psi is goal oriented readily leads to the view that psi enters into events of a larger scale than has generally been appreciated. For example, given that an experimenter typically is strongly motivated to obtain a particular outcome on an experiment and that the experimental result is essentially a random phenomenon, psi may affect the overall experimental result as a unit rather than enter into the individual trials or through the individual subjects.

The proper way to conceptualize a psi experiment may be to view the entire experiment as one complex event or trial with the probability of a hit being, for example, .05.[1] The customary evaluations using the trials or subjects as the unit of analysis may be misleading or perhaps even meaningless.

The hypothesis that psi is goal oriented would seem to imply that it may not be possible to investigate either the inner workings of psi or the relationship between psi and other variables, since any such investigations may be susceptible to psi influence and, thus, may fall in line with the researchers' wishes—even if those wishes are only to get "interesting" results. Also, attempts to isolate psi effects may be fruitless because many people may have motivations or wants regarding the outcome of experiments, which may lead to the extreme position that anyone and everyone who has motivations for, or interest in, an experimental outcome may play a role in the results that actually occur. The situation becomes particularly difficult if we assume that psi is truly independent of space

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[1] One way to conceptualize more precisely (and perhaps investigate) this situation is to consider a psi task in which, for each "trial," a computer would simulate a complete psi experiment in a second or so by generating, scoring, and computing the statistical significance of a large amount of data. From the subject's point of view, his task would be to initiate a "trial" with a .05 chance of receiving feedback of a hit. Would one of these "trials" be different in any fundamental way from the more time-consuming task of carrying out a psi experiment?

and time, since there would then seem to be no limitations on who could influence the experimental results or when. Before these extreme ideas are accepted, the evidence for the basic validity and limitations of the goal-oriented psi hypothesis needs to be carefully considered. The assumption that psi effects are independent of the complexity of the task is one of the key issues.

In a previous paper (Kennedy, 1978) the literature relevant to the hypothesis that PK effects are independent of task complexity was reviewed. While topics such as the number of objects influenced simultaneously and the role of the a priori probability of a hit were also considered, the area of majority vote (MV) provided the most valuable insight. Redundancy methods in general and MV procedures in particular appear to this reviewer to be the most direct means of investigating the hypothesis that psi effects are goal oriented. Examining the effects of redundancy in psi is also important because redundancy is the basis for the methods of increasing the accuracy of signals in normal (i.e., sensory, technical) communications systems, and most techniques proposed to enhance the reliability of psi to a level suitable for practical application follow the same principles. Any limitations or peculiarities that appear when redundancy enters into psi effects will be likely to result in limitations on the reliability and thus on the practical applications we can expect with psi.

In the technical use of the term, redundancy refers to multiple or repeated transmissions of the same information and is a measure of the extent to which no new information is added. If a signal is buried in random noise, repeated transmission and averaging of the signal will tend to make the noise cancel out, leading to a more discernible signal. In principle, with enough repetitions any degree of accuracy can be achieved if one is willing to pay the price of decreased data rates due to redundant transmission. Using a large number of trials or sample size in experiments is a form of redundancy, since the function of all the data is to measure certain effects which presumably are buried in noise. The larger sample sizes are expected to give more reliable results.

While other forms of redundancy can occur in psi experiments and will be covered below, the most frequently discussed method for introducing redundancy has been the majority-vote or multiple-calling procedure (e.g., Foster, 1943; Fisk & West, 1957; Thouless, 1960; Ryzl, 1966; Carpenter, 1968; Brier & Tyminski, 1970a). MV procedures are employed in PK experiments by collecting many

random events and collapsing the data into one MV trial scored according to whatever outcome occurred on the majority (or plurality) of the individual events. For ESP experiments MV typically takes the form of multiple calling of the same targets, sometimes with elaborate randomization procedures so that the subject does not know which calls are to be combined. The "signal-enhancement" hypothesis holds that if a low-level psi effect occurs on the individual RNG events or calls, then MV procedures will be expected to increase the accuracy of psi to a high level.

However, if psi is independent of task complexity, MV procedures may not give increased scoring rates for cases in which the "goal" or primary interest in the experiment is the outcome of the majority votes. The individual RNG events or calls in the MV procedures may simply be by-passed by psi in the same way that any complex mechanism is irrelevant to the psi effect. The hypothesis that psi is goal oriented leads to the prediction that signal enhancement will take place if the primary focus of the psi sources is the individual events or calls that go into the MV but that *when the primary focus is the outcome of the majority votes, actual signal enhancement will not take place and the scoring rate on the MV outcomes will be the same as would occur if only one event or call were being utilized.*

The purpose of the present paper is to review the literature relevant to redundancy in ESP. This general topic will be surveyed with the specific intent of seeing the extent to which the ESP findings are in line with the goal-oriented psi hypothesis and the final discussion will be based on both the ESP and PK literature.

METHODOLOGY AND PREVIOUS FINDINGS

One way to test the goal-oriented hypothesis directly is to compare a condition in which the subjects focus on the outcome of the MV of many events with a condition in which the subjects focus on the outcome of just one event. Schmidt (1974a) carried out such a study with PK, basing the feedback for one condition on one RNG event and for the other condition on the MV of 100 RNG events. The two types of trials were randomly intermixed, with the subjects and experimenter blind as to which type of trial was occurring at any time. The scoring rate on the MV outcomes was not higher than that of the single-event trials, a result clearly in line with the goal-oriented psi hypothesis and in opposition to the signal-enhancement hypothesis. Unfortunately, the interpretation of this finding is

somewhat confounded by the use of different types and speeds of RNG's in the two conditions.

Another means of investigating the effects of MV procedures is to examine the internal characteristics of MV trials. According to the signal-enhancement hypothesis, a definite pattern should appear. The scoring rate on the individual events that comprise the MV should be lower than the scoring rate for the MV outcomes; and for cases in which the binomial distribution can be applied (e.g., most PK experiments with a fixed number of events in the MV), the expected MV scoring rate can be calculated on the basis of the single-event scoring rate. The calculation is easy for binary cases (see, e.g., Schmidt, 1973), but is more difficult if several outcomes are possible on each event (see Scott, 1960). In general, the MV outcomes with larger majorities should have more accurate results than MV trials with narrow majorities. The signal-enhancement hypothesis also predicts that the CR for the MV outcomes will be somewhat less than the CR for all the individual events comprising the MV's (Scott, 1960).

The review of the PK literature showed that, as expected by both the signal-enhancement and goal-oriented hypotheses, in the two experiments (Schmidt, 1973; and the 1962 study summarized in Cox, 1974) in which MV procedures were applied to data collected for other purposes, the internal pattern exactly fitted the signal-enhancement hypothesis. However, in five experiments which were carried out specifically because the experimenters were interested in MV results (four experiments reported in Cox, 1974; and Bierman & Houtkooper, 1975), a very different pattern appeared. The results superficially followed the signal-enhancement hypothesis in that the scoring rates were higher for the MV outcomes than for the individual events comprising the MV's, but in all five cases the CR's for the MV were larger than the overall CR's for the single events. This is not in line with the signal-enhancement hypothesis and apparently occurred because the MV trials with narrow majorities obtained more accurate results than the trials with large majorities. One possible explanation for this unexpected pattern is that PK may have been operating directly upon the outcomes of the majority votes in an efficient manner, thus influencing a minimal number of events while achieving the goal of significant MV scoring rates. While this interpretation supports the goal-oriented psi hypothesis, it must be considered as tentative, since (1) in all five cases the experimenters were expecting something along these lines; and (2) the significance

of the deviations from the signal-enhancement hypothesis could not be calculated because the numbers of events in the majority votes varied across trials in all the experiments that showed this pattern.

Another series of PK experiments using MV procedures (Heseltine, 1977; Heseltine & Mayer-Oakes, 1978) gave significant results on the individual events but not on the MV outcomes. These results are more in line with the signal-enhancement hypothesis although the decrease in CR's from single event to MV results was larger than might be expected. The figures needed for more complete internal analyses were not given. In these experiments the subjects received feedback for the MV outcomes. The MV procedure was apparently used only as a convenient means of reducing the data for feedback, and the experimenters were primarily interested in the interaction of the individual RNG events with EEG activity. The interpretation of the MV results is not clear, and some type of experimenter effect seems likely since the significant results were associated with the experimenter's points of interest rather than the outcomes that the subjects received feedback for and were allegedly trying to influence.

Besides MV procedures, other forms of redundancy are also possible with PK. Rather than collecting a number of RNG events for one MV trial, feedback for one RNG event can be repeated several times. Under the assumption that PK is completely independent of time, redundant presentations of feedback about the outcomes of one trial should lead to increased scoring rates. In fact, Schmidt (1976) found that when each RNG decision was recorded and presented four times, the scoring rate was approximately four times higher than for trials with only one feedback presentation. Other experimenters have failed to find any enhancement effect with multiple presentations (Houtkooper, 1977b; Millar & Broughton, 1977; Schouten, 1977; Davis & Morrison, 1978; Morrison & Davis, 1979); however, these studies showed little consistent evidence for any PK effects.

A slight extension of the multiple-feedback form of redundancy occurs when several observers or psi sources are involved with each RNG event. In a typical case both an experimenter and his/her subject observe the PK results and have strong motivations for a successful outcome, raising the possibility (perhaps likelihood) of a combined or additive PK effect. Logical extensions of this form of redundancy lead to what has become known as the "divergence problem" (Schmidt, 1975; Houtkooper, 1977a; Hartwell, 1977). If PK effects are independent of time and if the magnitude of the effects are

additive, then when a large number of people care about and become aware of an experimental outcome, very strong effects should be manifest. One can speculate that the expected strong effects are very rare because any large and reasonably random sample of the population contains approximately equal numbers of hitters and missers so that their net psi effects tend to cancel to nearly zero. Perhaps a more plausible speculation is that psi effects are not completely independent of time and therefore the redundancy value of retro-effects is very limited. Empirical answers are needed for these speculations. The few existing studies specifically investing multiple psi sources are reviewed in White (1976).

Redundancy can also appear in ESP experiments in several ways besides explicit MV procedures and it seems doubtful that all such forms of redundancy are relevant. For example, each card in an ESP test could have several images of the symbol instead of just one. An early experiment (L. E. Rhine, 1937) found that having multiple copies of the target symbol on the cards did not lead to increased scoring, and most researchers today would probably not expect this to be a relevant form of redundancy. A more plausible form of useful redundancy may occur with complex or multiple-aspect targets. In a simple case, dual-aspect targets consisting of five possible symbols in five different colors could be used. If the two aspects varied independently, no redundancy would be present. However, if the two aspects were related so that a certain symbol always appeared in a certain color, then awareness of either symbol or color would give information about the other aspect and about the target as a whole. In essence, this situation would be a form of multiple calling and could be useful whether or not the subjects were aware of the associations between the two aspects. Complex picture targets in free-response experiments are an extreme example of this redundancy, since each target has numerous features that are not shared with the other targets.

Various empirical findings related to the topic of redundancy in ESP are discussed below.

REDUNDANCY IN ESP

Forced-Choice ESP Experiments

Several researchers have tried to use the signal-enhancing property of MV procedures in attempts to move toward the practical application of psi. The experiment of Brier and Tyminski (1970a,

1970b) is the most relevant to the present discussion. In several series the outcome of various gambling games in a casino were predicted before the experimenter entered the casino. All the games had $P = 1/2$. Three different subjects participated, but only one subject was used in each series. For each series the subject made 10 runs of 25 (or 20) binary calls. Five runs were combined by MV (5 calls in each MV) to apply to the first 25 (or 20) trials in the casino. These trials were used as indexing trials which guided the betting on the MV calls of the other five runs, the experimental trials. The latter were reversed if missing was obtained on the indexing trials; and if a score very close to chance was obtained on the index trials, the experimental trials were predicted to be chance and were not included in the main analysis. The subjects knew the design of the experiment but did not know which runs were the index runs and which were experimental. Given the typical casino environment, the possibility of recording errors would seem to be a potentially severe methodological problem; unfortunately, the authors give no information about precautions that were taken to insure accurate recording.

Pooling all series, 170 MV predictions were made, resulting in 104 hits, a scoring rate of 61.18%, $CR = 2.88$. The individual trials comprising the MV had a scoring rate of only $434/850 = 51.06\%$ with a nonsignificant $CR = .58$. Given this scoring rate on the individual trials and assuming that the binomial distribution applies (the usual assumption in discussions of the use of MV to increase scoring rates), a successful rate of 51.98% would be expected on the MV outcomes. The observed rate is significantly greater than 51.98% $(CR = 2.32; p < .02$, two-tailed), which indicates that *the data do not follow the binomial distribution.* This result could be a manifestation of psi efficiently achieving the MV goal, or it could be an artifact of nonindependence of the calls.

In multiple calling of ESP targets, one cannot assume independence of calls, and thus the binomial distribution may not apply. Although this "stacking effect" problem is well known, the binomial distribution has been used to estimate the expected increase in scoring rate in most discussions of the signal-enhancing capabilities of MV procedures. While the significant scoring rate on the MV outcomes can be attributed to psi, the unexpected enhancement of MV scoring in the Brier and Tyminski data could be an artifact of calling

habits if the subjects tended to call predominately 3/5 majorities.[2] The subjects did not know which five runs were index trials and which were experimental trials, but odd-numbered runs were used for indexing while even-numbered runs were the experimental trials for six of the seven series. Some type of artifactual interaction of order and calling habits would seem possible given this procedure. One way to check for this type of problem is to see if the number of times majorities of 3/5, 4/5, and 5/5 occurred was close to what would be expected if the calls were binomially distributed. Assuming the probability of calling either symbol was 1/2, the observed and expected number of the various majorities in the experimental and indexing trials are as shown in Table 1. The observed values are very close to the expected values, making it unlikely that calling habits were responsible for the enhanced significance of the MV results.

Table 1
NUMBER OF TIMES VARIOUS MAJORITIES OCCURRED IN
THE BRIER-TYMINSKI EXPERIMENT

Size of Majority	Experimental Trials		Index Trials	
	Number Observed	Number Expected	Number Expected	Number Observed
3/5	108	106	87	91
4/5	48	53	47	45
5/5	14	11	11	9

More important evidence that the enhanced significance was a psi effect comes from the fact that the entire significance of the MV/ESP effect was due to majorities of 3/5 (76/108 = 70.37%; *CR* = 4.14) while majorities of 4/5 and 5/5 showed nonsignificant missing tendencies (23/48 = 47.92% and 5/14 = 35.71%, respectively). The scoring rate for majorities of 3/5 is significantly different from that of majorities of 4/5 ($x^2 = 6.29$, *df* = 1; *p* < .02) and from that of

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[2] The range of error can be seen by looking at the case with *P* = 1/2 and 5 trials in a MV. For each MV, the binomial variance is *NPQ* = 1.25. If the subject always calls all 5 trials the same, the number of correct calls will always be 0 or 5 and the variance will be Dev.^{2} = 6.25. If all the majorities are 3/5, the number of correct calls will be either 2 or 3 and the variance will be .25. This small variance would lead to MV scoring rates well above those predicted by the binomial distribution.

majorities of 5/5 (x^2 = 5.21, *df* = 1; *p* < .05). This restriction of the psi effect to the small majorities cannot be an artifact of calling habits.

To check further on this unexpected result, Brier and Tyminski switched the roles of the experimental and indexing runs to see if the effect occurred in the index data. (One run was excluded since the predicted score was chance.) The scoring rate on the individual calls was 379/725 = 52.28%; *CR* = 1.19, which leads to an expected scoring rate on the MV outcome of 54.26% according to the binomial distribution. The observed rate was 86/145 = 59.31%, which is significantly greater than 50.00% *(CR* = 2.16; *p* <.05, two-tailed), indicating the presence of ESP; but it is not significantly greater than the expected 54.26%. The general pattern however, was the same as in the other data; majorities of 3/5 showed significant scoring (54/87 = 62.07%; *CR* = 2.14; *p* <.05, two-tailed) while majorities of 4/5 (28/47 = 59.57%) and 5/5 (4/11 = 36.36%) had lower and nonsignificant scoring rates. The differences between scoring rates were not significant for these data. Louisa Rhine[3] pointed out that if psi is an efficient, goal-oriented process, the indexing trials would be expected to be used efficiently and reversing the role of the indexing and experimental trials should lead to less significant results.

It must, of course, be kept in mind that PK at the casino could have entered into the results. The experimenter in the casino apparently had on his data sheets the magnitudes of the majorities as well as the predictions; however, it is not clear why a PK effect (or recording errors, for that matter) would be focused on trials with majorities of 3/5. The authors apparently did not expect this effect and were at a loss to explain it. Previous work had suggested that large majorities might yield better MV scores and, according to the signal-enhancement view of MV (the hypothesis under investigation), majorities of 3/5, 4/5, and 5/5 should show increasingly higher scoring rates—the opposite of what actually occurred.

Since the subjects and experimenters in this experiment clearly focused their interest on the outcome of the MV at the casino, the concentration of significance in the slimmest majorities appears to be a psi effect in line with the hypothesis that psi achieves goals efficiently. The expectancy and desires of the experimenters do not seem to be a factor in this case because they apparently did not ex-

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[3] Dr. Rhine made this point during a research meeting at the Institute for Parapsychology in 1979.

pect this effect and were at a loss to explain it.

Several other studies involving majority-vote procedures have been reported but the results cannot be directly applied to the present questions. Ryzl (1966) reported that 19,350 binary trials *(P = 1/2)* combined by MV and a coding procedure predicted with 100% accuracy 15 decimal digits. A simple sequential sampling method was used until a strong majority was acquired for each decimal call. The published results cannot be evaluated in terms of efficiency of psi although the 61.90% binary scoring rate *(CR = 33.10,* but about one-third of the 19,350 trials were actually index trials) was increased to 100% for the decimal targets (equivalent *CR = 6.5)* which indicates that scoring enhancement clearly took place. The experiment was designed and carried out specifically to "furnish experimental proof that . . . application of ESP is possible in principle" (p. 22), so the experimenter's interest presumably focused on the outcome of the decimal trials. The subject, Pavel Stepanek, was very familiar with the binary task and had a quite stable performance before participating in this work; but it is not clear from the report how he approached this particular experiment.

Carpenter (1968, 1975; also see Brier & Tyminski, 1970a) has reported a series of exploratory ESP experiments using MV as part of complicated signal-enhancing algorithms involving indexing trials, a mood test, and variance effects. Significant success rates have been obtained on the final predictions but the complicated adjustments for variance effects interacting with the index trials make it very difficult to discern the internal characteristics that are relevant to the discussion here. There was a suggestion in one study that more accurate predictions were produced by large rather than narrow majorities (see Brier & Tyminski, 1970a) although the small numbers of trials did not produce a significant difference.

A MV procedure was also used by Fisk and West (1956) to evaluate a large number of clock-card trials *(P = 1/12 = 8.33%)* collected by mail from about 200 subjects. The 35,716 individual trials yielded a nonsignificant success rate of 8.29%; but when the data were reduced to 657 MV trials, the scoring rate was 11.72%, *CR = 3.07.* While this result is in line with the efficiency hypothesis, any interpretation is ambiguous, since some of the calls were excluded from the MV analysis; and also it is not clear what role, if any, MV had in the motivation for designing and carrying out the experiment.

Several other experimenters (e.g., Foster, 1943; Fisk & West,

1957; Dean, 1968; Haight, Weiner, & Morrison, 1979) have attempted to explore the signal-enhancement property of MV but did not obtain significant results—possibly because of small sample sizes in some cases. These nonsignificant studies are not relevant to the present discussion.

Another situation in which a MV procedure is used occurs with tests of "consistency" which evaluate the number of subjects with results above versus below MCE. In some experiments the consistency test was more significant than the *CR* analysis of trials and, in light of the discussion above, these situations could perhaps be taken as evidence for some kind of efficient, goal-oriented experimenter effect. However, an informal sampling of the literature indicated that, by far, most experiments were not in line with this hypothesis—i.e., the consistency tests were less significant than the analyses of trials—so a more systematic inquiry did not seem warranted. It is reasonable to assume that the experimenters were primarily interested in the overall *CR* analysis rather than the consistency test.

In summary, the experiment by Brier and Tyminski shows the same characteristics as were found previously in the PK/MV experiments, adding further support to the hypotheses that (1) psi is a goal-oriented process, and (2) that the goals are achieved efficiently. The other forced-choice ESP studies cannot be clearly applied to these questions and they neither support nor contradict the above hypotheses.

Free-Response Experiments

The concept of multiple-calling or redundancy can also be applied to less structured ESP responses. That the use of redundancy in the form of repeated responses to the same target may lead to increased accuracy for free-response experiments has been mentioned by Puthoff and Targ (1976), but unfortunately, no well-controlled comparisons have been made yet. Honorton, Krippner, and Ullman (1972) reported a dream study that found more correspondences between dream reports and ESP targets when different targets were used for each dream than when the same target was used repeatedly.[4] Although this study was not evaluated in terms of

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[4] Although it is not clear from the abstract (Honorton, Krippner, & Ullman, 1972), each dream was apparently treated as a separate trial, even when the same target was used repeatedly. The difference between conditions (i.e., repeated use of the same target versus a different target for each dream) was evaluated with a *t* test and the differences were significant for three of the four subjects. It is not clear to this reviewer how a *t* test could be legitimately applied under these circumstances, since the targets were clearly not independent for the trials using the same target. However, the fact that the results for all four subjects were in the same direction can be taken as a suggestive finding.

MV, it did involve multiple calling of the targets and the results clearly are *not* in line with the signal-enhancement hypothesis. In commenting on these results Ullman, Krippner, and Vaughan (1973, p. 199) suggest that ESP was more effective with novel targets than with repetition of the same targets.

The current free-response experimental methods themselves intrinsically involve large amounts of data reduction and thus potential for redundancy. Typically a subject's response consists of describing the images and impressions that occur during a period of the order of 15 to 40 minutes, and later a judge (the subject or an independent judge) ranks or rates several possible targets according to correspondences with the subject's response. The judging process of comparing the individual elements in the response with elements in the targets can be viewed as a majority-vote procedure with the ranking or rating reflecting the number of correct votes.[5] Not only is this form of redundancy present, but the judging process also allows an opportunity for the judges to use ESP aside from any information that may be contained in the subjects' responses, thus adding another form of multiple calling. If redundancy can lead to increased scoring rates, free-response experiments should give high scoring rates.

In order to evaluate the occurrence and effect of redundancy in free-response experiments, we need to understand what, exactly, judges base their decisions on; unfortunately, very little effort has been made to investigate this area. A few findings may be relevant, although other explanations for these results are also quite plausible. Honorton (1976) compared the duration of Ganzfeld isolation in successful versus nonsignificant ganzfeld studies and found that the successful studies had used a significantly longer isolation period. One of the reasons for success with the longer imagery periods may be that the longer period allowed more information or "trials" for the majority-vote aspect of the judging process—in effect, increasing the amount of redundancy.[6] In the same vein, experiments in which

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[5] The situation is somewhat analogous to scoring forced-choice ESP experiments by having a subject make a large number of calls and then analyzing the data by scoring the calls against several sets of potential target sequences, one of which is the true target sequence. Each target sequence could be ranked according to the number of hits and the probability that the largest number of hits occurred for the true target sequence would be \IN, where N is the number of potential target sequences. An experiment consisting of several such "trials" should yield high scoring through the data reduction process.

[6] Robert Morris suggested this idea in personal communication in August 1978.

associations are collected along with the primary responses by the subjects could also allow additional opportunities for the entrance of redundant ESP information. In a telepathic dream study (the second study in Ullman, Krippner, & Feldstein, 1966), the results were more significant when the judges used the dreams plus associations to the dreams than when the dreams alone were examined; however, both cases gave significant results and the difference between them would not be significant. Likewise, in a ganzfeld study, Sondow (1979) found that when the judges utilized the subjects' associations to each of the potential targets in the pool along with the response transcripts the results were more successful than when the responses were used alone. Here, too, the difference in scoring between the two cases was not significant. On the other hand, the finding in a recent ganzfeld experiment (Stanford, 1979) that (nonsignificantly) better results were obtained with partial response transcripts than with full transcripts may indicate that factors other than redundancy are important and perhaps dominant. While most of these findings are in line with the idea that redundancy plays a role in free-response experiments, direct experimental investigation will be needed before an interpretation can be made with any confidence.

If psi is an efficient, goal-oriented process and if we can assume that the primary motivation in most free-response experiments is to have the responses judged correctly for statistical analysis, then we would expect that the ESP information contained in the responses would be the minimal needed to distinguish the correct target from the others in the target pool. Thus, we might expect that the subject would respond to those specific features of the target not contained in the other targets in the pool and that redundancy in the form of a large number of impressions might not increase the scoring rate since only the minimal effect would occur. This would be analogous to the finding in the forced-choice MV experiments that the strongest results occur on the small majorities. On the other hand, if the primary motivation is to obtain an accurate and dramatic description of the target, then each piece of information about the target would be desired and the MV type of redundancy would be beneficial. The redundancy resulting from the fact that the judging process allows an additional opportunity for psi to enter would seem to be beneficial in either case, assuming the judges to be positively motivated.

Spontaneous Cases

The amount and nature of ESP information redundancy in spontaneous cases is difficult to investigate. The number of opportunities for psi to operate is completely unknown and only a few hints of possible redundancy are available. In some cases a person has experienced a recurrent dream or impression, a clear form of redundancy that has enhanced the attention given to the ostensible psi experiences. However, Louisa Rhine[7] has commented that such recurrent spontaneous experiences are rare in her large collection.

For intuitive, or impression, cases (i.e., cases involving a feeling, compulsion, or just knowing without imagery), it is difficult to ascertain the duration of the actual psi impression. The sense of concern that often persists in these cases could be a response to a brief ESP message or it could be a result of recurring ESP information, a prolonged and therefore redundant psi experience.

The feeling of conviction that an impression or image is psi-mediated seems to be separable from the actual information that is received and may therefore provide a somewhat redundant opportunity for psi to operate. Evidence that conviction or confidence represents a separate ESP experience has been discussed, not only for spontaneous cases (L. E. Rhine, 1962a, 1962b) but also for nonstatis-tical free-response experiments (White, 1964) and forced-choice experiments (see, e.g., Rao, 1966, p. 113). Further support from forced-choice data comes from the prominent role of psi-missing on confidence calls in a recent series of experiments (see Jackson, Franzoi, & Schmeidler, 1977). L. E. Rhine (1962a, 1962b) has suggested that spontaneous experiences involving imagery or hal-lucinations may have three separable components: (1) the appearance of the imagery or hallucination; (2) the interpretation of the imagery or hallucination, and (3) the conviction that the information is psi-mediated. Some redundancy is implied in such conceptualizations, since psi may to a certain extent compensate at one stage for inadequacies at another stage.

DISCUSSION

Evidence for the Goal-Oriented Psi Concept

As a whole, the MV experiments provide quite consistent support for the goal-oriented psi hypothesis. Besides the direct test of the

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[7] Personal communication, August 1979.

hypothesis in the PK experiment by Schmidt (1974a), the Brier and Tyminski ESP experiment (1970a, 1970b) confirms and extends the findings from the PK literature that in situations in which the primary point of interest in the experiment is the MV outcomes, the internal pattern of the MV results does not conform to the signal-enhancement model. In these cases the fact that the strongest (and usually the only significant) psi effects occurred on MV trials with narrow majorities is in line with the hypotheses that (1) psi can operate directly on MV outcomes and thus is goal oriented, and (2) psi operates efficiently in achieving the goal. The other MV studies, the free-response experiments, and the spontaneous case reports do not provide clear evidence either for or against these hypotheses.

As was pointed out in the review of task complexity in PK (Kennedy, 1978), the idea that psi operates in both a goal-oriented and efficient manner has particularly interesting implications for situations in which a hierarchy of goals is involved. The MV studies are an example of such a hierarchy, since individual trials combine to form the MV outcomes and the MV outcomes combine to form the final experimental result.

The fact that the significant psi effects observed on certain MV outcomes would not be expected, given the nonsignificant effects for the trials comprising the MVs, suggests the general principle that psi effects can occur directly on the higher levels of a hierarchy without being built from or even manifest in the lower levels. Such a principle is clearly in line with the view that psi can, at least sometimes, operate directly on an overall experimental outcome as a unit.[8] While it is not surprising in the context of the goal-oriented concept that there are psi effects which can be identified only with respect to the specific outcomes of interest to the psi sources, the generalization of this principle may have important implications that go beyond the level of individual experiments. As noted in a previous paper (Kennedy, 1978):

> Most experimenters have a hierarchy of goals; the experimenter wants (1) the individual trials to be successful, (2) the individual subjects to be successful, (3) the experiment to be successful, (4) the line of research to be successful, and (5) his/her personal career to be successful.

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[8] The fact that the probability of obtaining a successful outcome on an experiment is usually 1/20 or 1/100 while the P's for individual trials in experiments are typically in the range of 1/2 to 1/10 is a noteworthy and potentially important factor. As was noted previously (Kennedy, 1978) the probability of a hit factor is a fundamental aspect of psi with many profound implications; yet virtually no experiments have been carried out to investigate this area.

This situation may be analogous to the majority-vote studies; if the experimenter focuses on a successful experiment, this outcome could be achieved efficiently with a minimal effect on the trial level. Likewise, the goal of a successful line of research would be accomplished with less significant results on the level of experimental outcomes, not to mention the lower levels of individual subjects or individual trials. One could speculate that the decline in significance often found when replicating experiments (Taves & Dale, 1943; Kennedy & Taddonio, 1976) is due to the experimenters' shifting their goals to a higher level in the hierarchy (e.g., focusing more on the outcome of the line of research than on individual subjects). . . . *These speculations raise the intriguing possibility that psi may not be as capricious as has been thought; perhaps we just have not been correctly identifying the goals that have been accomplished in a very efficient manner,* (p. 117)

The hypothesis that psi operates efficiently is important, not only because it plays a key role in the interpretation of the evidence for the concept of goal-oriented psi, but also because efficiency could be a fundamental property of psi, with many theoretical and practical ramifications. If efficiency is a general characteristic of psi, then evidence for it and the goal-oriented principle should appear in many situations besides MV procedures. Two areas in which future investigations may provide direct evidence for or against these hypotheses are, briefly, the following.

First, as noted above, for efficiency the ESP impressions received in free-response experiments should primarily involve those features of the target that most distinguish it from the other targets in the judging pool—thus implying that the subjects respond to the entire target pool, not just the actual target in isolation. This tendency should be more pronounced when the focus (goal) of the experiment is for statistical results as compared to experiments in which the emphasis is on dramatic qualitative correspondences between the targets and responses.

Second, the fact that errors such as psi-missing, consistent missing, near hits, and displacement effects occur is very relevant. Taken alone, the efficient, goal-oriented view of psi does not provide an opening for the occurrence of such errors and their existence would seem to be a blow to the hypotheses that psi is either efficient or goal oriented. An approach that may resolve the apparent contradiction between the existence of psi errors and the findings from MV studies is to acknowledge that psi, even if it is efficient and goal oriented, must function within certain boundaries or limitations. The errors mentioned above could arise as a result of the limitations

on the operation of psi in particular situations. More specifically, it appears that psi operates most easily, if not exclusively, in situations in which elements of indeterminacy or randomness (presumably "pure" randomness as derived from quantum uncertainties) are involved (see Stanford, 1977, 1978; Kennedy, 1978; Palmer, 1978, is also very relevant). The occurrence of psi may then be limited by the extent to which the goals or motivations of the psi sources can be fulfilled by influencing or utilizing indeterminate processes.[9] Goals that would require psi effects on completely deterministic processes may be futile. Likewise, errors may arise because the range of possible psi effects in a particular situation may be limited by the nature and role of the randomness that is present.

Some recent theories (e.g., Walker, 1974, 1975; Stanford, 1978) have proposed that ESP occurs by means of psi influences upon indeterminate processes within the brain. According to these theories, cognitive experiences are generated that correspond to external information. While the extent and role of indeterminacy (i.e., quantum uncertainties) in neural activity is at present a controversial topic, these theories do have many appealing features. In particular, the indeterminate elements in brain functioning and thus the potential for and nature of ESP impressions would be expected to be constrained by psychological variables such as personality, state of consciousness, and response habits. Goal-oriented psi would have to operate within the limitations imposed by the amount and nature of indeterminacy in neural activity at any given time. Errors could occur when the susceptible cognitive mechanisms do not match the ESP information to be generated into the subject's mentation or response. *Furthermore, motivated and unmotivated errors could occur as the ESP information is subsequently processed and interpreted.*

While most studies relating psychological variables to ESP performance can be interpreted within this framework, Stanford (1979) has reported work specifically investigating and in general supporting the view that ESP is derived from random phenomena within the brain. Further investigations of this theoretical framework should help clarify the extent to which psi is a goal-oriented process operating within limitations set by the nature of the available indeterminacy.

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[9] As was discussed in the PK review (Kennedy, 1978), the presence and role of randomness in a process is related to the a priori probability of the occurrence of the desired outcome and can be investigated within that context.

Implications for the Practical Application of Psi

The goal-oriented principle indicates that attempts to use MV or other redundant procedures to enhance the reliability of psi to practical levels may be defeated since psi may by-pass the methods for redundancy and operate at a weak level directly on the final outcome. For the same reason, redundancy in the form of large sample sizes in experiments may not lead to more reliable results—a speculation that has occurred to many workers in the field of parapsychology.

These somewhat frustrating limitations may apply, however, only for situations in which the dominant psi sources are focused primarily on the final outcome of the redundancy. If the psi sources focus on, or have as a goal, the outcome of the individual events (RNG events for PK or calls for ESP) that comprise the redundancy, then increased reliability should take place. A dilemma may arise here, however, since it may be difficult or impossible for the psi sources to truly focus on individual redundant bits of information when clearly the important outcome is the final result. Increased reliability may be more likely for situations in which the final outcome is unimportant, thus deterring any valuable application of psi. Obtaining useful signal enhancement will require that careful control be maintained over the "goals" of the dominant psi sources. The psi sources must focus on the redundant individual bits of information while at the same time, the information must be applied toward a larger purpose.

An understanding of what actually constitutes the goal for the operation of psi is needed. Recent observational theories (Schmidt, 1975; Walker, 1975) and certainly the PK experiment by Schmidt (1974a) suggest that feedback of the outcome may be a prerequisite for delimiting the goal for psi, but as yet all the specifics of this hypothesis have not been fully developed and tested. The existing MV studies have employed various degrees of feedback and, in general, the results seem to be more related to the experimenters' wishes than to the type of feedback. If feedback is necessary for psi, there will be limitations on the practical application of ESP. For example, it would not be possible to use ESP to read documents in foreign capitals unless verification of the ESP information by sensory means occurred. However, many useful applications such as predicting the stock market, obtaining advance notice of announcements, locating people and minerals, and solving math problems would be feasible, since feedback about the correctness of the ESP predictions would

normally be available.

Independent of whether feedback is or is not crucial, it is generally assumed that some form of motivation or need must be associated with the outcome in order that an event may be a goal for the operation of psi. The role of motivation in psi is one of the most difficult areas in parapsychology. Not only is it a difficult construct to quantify and control, even on a superficial level, but there is also some evidence suggesting that deep-lying motivational factors are important in psi phenomena. The possibility that underlying resistance to, and fear of, psi may inhibit or distort psi effects has been discussed by numerous authors (e.g., Eisenbud, 1963; Van de Castle, 1971; Tart, 1975). Assuming that such inhibiting factors can be dealt with, both spontaneous cases and laboratory experiments in nonin-tentional psi (Stanford, 1974a, 1974b) suggest that psi can operate without conscious intent or direction, a situation that makes it difficult to identify, let alone control, what the actual motivations and goals are in a particular instance. For redundancy methods to increase the reliability of psi, procedures must be developed to maximize the involvement of the psi sources with the outcome of each redundant event. Most of the experiments utilizing MV procedures have not incorporated this feature.

The general design that, to this reviewer's knowledge, most optimizes the subjects' involvement with each event was proposed by Helmut Schmidt several years ago in a meeting at the Institute for Parapsychology. Basically, it calls for a random generator to be used to generate numbers that would be coded onto a tape. The random numbers and code would be of the same format as the ticker tape for the stock market. At a future time the RNG tape would be compared line by line with an actual stock market ticker tape and a subject would receive a reward for each time the RNG tape matched the ticker tape. A MV procedure could be employed by generating many RNG tapes for the same and/or different subjects. The original proposal suggested animals as subjects, but obviously humans could be used as well. Likewise, any practical information could be coded on a tape for use with this design, and technical features such as correcting for psi-missing and employing more efficient sequential sampling procedures (Taetzsch, 1962; Puthoff & Targ, 1976) could also be incorporated. The important point is that the subjects (hopefully the psi sources) would have motivation for the outcome of each event and, at the same time, the information would be applied to a larger purpose.

The same general strategy could also be applied in a less technical manner by collecting from many subjects free-response ESP protocols about a common target. Data reduction would occur by utilizing only those characteristics common to several responses. Again, it would be important for each subject to be more interested in the accuracy of his/her own response than in the overall success of the project.

Various reservations can, of course, be raised about this strategy whether it is applied in the technical forced-choice mode or in a less structured free-response procedure. Besides uncertainties related to the focusing of motivation, the strategy requires certain questionable assumptions about psi being independent of time. Specifically, the information flow consists of (a) collecting the data, (b) reducing the redundant data to accurate ESP predictions, and (c) individual feedback of the data. In a practical application of psi, awareness of the outcome of the project will be established with the success or failure of the prediction at Step b, which will necessarily occur before the individual feedback is given in Step c. The design assumes that the psi effects resulting from Step c will be independent of what has previously happened at Step b, a very questionable assumption. Furthermore, it seems likely that if this form of time independence of psi is valid, then the divergence problem mentioned above (i.e., psi effects from later observers) will in fact be a very serious problem. A somewhat related topic that may lead to difficulties in applying psi has to do with the question of how the net psi effect results from the interaction of several psi sources with different goals— particularly with goals on different levels of a hierarchy. One can only speculate on these topics at present. Without being either unduly optimistic or unduly pessimistic, this reviewer considers the general strategy outlined above to be one of the best hopes for the practical application of psi.

Another form of redundancy also merits investigation. Rather than employing redundancy in the form of multiple RNG events or calls, multiple or redundant motivation for one event or call could be used. Several subjects could be involved with the outcome of each trial or one subject could receive multiple feedback (rewards) from each trial. Assuming psi effects are related to motivation or needs in some kind of additive way, such redundancy should lead to enhanced effects. However, a common-sense view of history strikes this reviewer as indicating that the actual outcomes of situations with the potential for psi influence are not in any practical sense an additive

function of motivation or need. Of course, final judgments in this matter should be based on scientific work which remains to be done. Whatever the outcome of that work, it is clear that the extent of validity and the implications of the goal-oriented psi principle provide intriguing areas for research.

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