EXPLORING THE LIMITS OF SCIENCE AND BEYOND: RESEARCH STRATEGY AND STATUS

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ABSTRACT: This paper offers a perspective or map of parapsychological research that focuses on the shifting boundary between answerable and unanswerable questions. The scientific method is based on accepting the simplest, most testable hypothesis consistent with available data and moving to more complex hypotheses only when compelled by data. J. B. Rhine's decision to defer study of survival of death and focus on psi effects by experimental subjects is consistent with this principle. After four decades of research on subjects' characteristics and responses to test conditions, the data compelled acceptance of the more complex hypothesis of psi mediated experimenter effects. The hypothesis of goal-oriented psi experimenter effects, which views an entire experiment as one complex random event with .05 as the a priori probability of success, appears to be at the outer limit of testable hypotheses at present and will greatly alter parapsychological research if it is verified. The lack of correlation between sample size and significance level in meta-analyses of RNG and ganzfeld studies provides tentative support for this hypothesis, and the results of majority-vote studies provide stronger evidence. Many more complex hypotheses cannot be directly tested at present. Researchers can and should investigate the effects on peoples' lives of anomalous experiences and belief systems even when the underlying reality of the experiences or beliefs cannot be directly tested. Available data indicate that beliefs about possible paranormal experiences or religion that are beyond the limit of scientifically testable hypotheses can have beneficial effects on peoples' well-being and health.

In this paper, I offer a perspective on where the field of parapsychology has been, where it is today, and where it is going. This perspective may be of value to those deciding what lines of research to undertake and particularly to those pondering questions about whether scientific progress has been made and can be made in parapsychological research.

This paper covers a diverse range of topics that together form a framework or map that has guided my thoughts and decisions about parapsychological research. First, the paper discusses the scientific method and the evolution of parapsychology in the context of what hypotheses can and cannot be scientifically investigated. Then, some thoughts on the status of the current outer limits of scientifically testable

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hypotheses are presented. Finally, the paper discusses the role that scientific research can play relative to concepts and beliefs that are currently beyond the domain of direct scientific test.

The Scientific Method and Parapsychology

Many Possible Mechanisms for Psi

Numerous hypotheses have been proposed to explain how psi operates in parapsychological experiments. Figure 1 shows a matrix of possible sources and mechanisms for psi effects in a typical ESP experiment. The matrix in Figure 1 contains a representative range of possibilities for discussion and is not intended to be definitive or exhaustive.

Mechanism of psi	Source of psi					
	Subject	Experimenter/ dominant participant	Combined effect[a]	Future obser.	Spirit guides	Angel(s), God(s) or karma
ESP on individual trials	×					
PK on individual trials	×	×	×	×	×	×
ESP on groups of trials	×					
PK on groups of trials	×	×	×	×	×	×
Goal-oriented psi	×	×	×	×	×	×

Figure 1. Possible sources and mechanisms of psi. Combinations that are theoretically impossible are indicated with ×s. The combined effect is for all persons involved in a study.

The possible sources of psi in typical ESP experiments include:

1. *Subjects.* Historically, researchers have assumed that the subjects were the source of psi in experiments.

2. *Experimenter or dominant participant.* Following the terminology of Nash (1975), the "dominant participant" is the person who appears to control or dominate the experimental results. This person may be the experimenter or the subject, or someone else with a role in the experiment. This category also includes the "observational theory" that

the first person to observe the results is the source of psi (see Millar, 1978).

3. *Combined effect of all involved.* The psi effect could be a combined result of all persons involved in the -research project rather than the result of one dominant person.

4. *Future observers.* Observational theories can include the hypothesis that a psi effect is a combined result of *all* persons who eventually learn about the experimental results, not just the first observer (Millar, 1978).

5. *Spirit guide(s).* The idea that spirits of deceased persons are responsible for at least some psi effects is the underlying premise of spiritualism.

6. *Angel(s), God(s), or karma.* Many religious beliefs hold that paranormal effects are produced by entities such as angels, God, or god(s), or by the less discrete forces of karma. For purposes of this discussion, these various concepts can be put in one category and precise definitions are not necessary.

As shown in Figure 1, possible mechanisms for psi effects in typical ESP experiments include:

1. *ESP on individual trials.* Parapsychologists have traditionally assumed that ESP experimental results were due to the subjects' using ESP on individual trials.

2. *PK on individual trials.*[1] The possibility that the random generation of ESP targets could be influenced by PK to match the subjects' calls was recognized from the onset of laboratory PK experiments (Rhine, 1942; Rhine & Pratt, 1957, p. 62). This category of mechanism includes both PK effects on the generation of targets and PK effects on the subject to influence the subject's calls to match the targets.

3. *ESP on groups of trials.* In an effort to explain displacement effects and other patterns of ESP scoring, Pratt (1974) proposed that experimental subjects may respond to a sequence of targets as a unit rather than to individual trials. For example, the subject may respond to a run of 25 ESP cards as a unit.

4. *PK on groups of trials.* PK effects that influence either the random generation of targets or the subject's calls could also occur on groups of trials as a unit rather than on individual trials. For example, the observational theories propose that psi will operate on a group of trials as a unit if the feedback to the observer is the outcome of the group of trials (Millar, 1978).

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[1]The purposes of the present paper can be achieved without dealing with the controversial question of whether PK effects are produced by a force-like influence on the random process or by a precognitive mechanism of selecting a time with favorable random fluctuations of the random process (May et al., 1985; Rhine & Pratt, 1957, pp. 57-58; Walker, 1987). In the present paper, the term *PK* is used for either case, whether applied to influences of individual trials or to broader experimenter effects.

5. *Goal-oriented psi.* If the dominant goal of the psi source(s) is to get an overall significant result on the experiment, the experiment as a whole may be viewed as one complex random event with the probability of success equal to .05 (or the alpha significance level of the experiment) . Under the goal-oriented psi hypothesis, the case when a person says, "I'm going to carry out an experiment and get a significant result" is not different from "I'm going to roll the die and get a six." In both situations a person wants a certain outcome from a random process. The probability of a successful outcome by chance is 1 in 6 for the die and 1 in 20 for the experiment. The primary difference between these two cases is that the experiment is a more complex random process. However, goal-oriented psi is assumed to achieve the outcome or goal independent of the complexity of the random process. When the goal is the outcome of the experiment, the specific design and details of the experiment may not matter, just as the details of the RNG do not matter when goal-oriented psi is applied to each trial. However, if the psi source(s) focus on each trial separately, then the unit of psi operation will be each individual trial, as traditionally assumed. The idea that psi is not related to task complexity can be traced back at least as far as the early discussions of the "unitary" nature of psi (Foster, 1940; Rhine et al, 1940) and has been reviewed previously (Kennedy, 1978; 1979).

How Can We Interpret Psi Experiments?

How can scientists meaningfully interpret experiments given the many possible explanations for the results? This issue frequently arises in parapsychology today. The answer is well established in principle, although the implementation of the principle is sometimes controversial.

The scientific method is based on accepting or favoring the simplest model or hypothesis consistent with the data and resorting to more complex models only when compelled to do so by additional data. This principle is often called the principle of parsimony or Occam's (or Ock-ham's) Razor. Of course, determining at what point data compel acceptance of a more complex model or hypothesis can sometimes be controversial.

The principle of simplicity is interwoven with the principle of testable hypotheses. Karl Popper (1959), in his classic book on the scientific method, *The Logic of Scientific Discovery*, forcefully pointed out that falsifi-able hypotheses are the foundation of the scientific method and distinguish science from metaphysics and pseudoscience. Simple models are more easily tested. Popper devoted a chapter to the issue of simplicity (Chapter 7) and specifically equated simplicity of hypothesis with degree of falsifiability. Jefferys and Berger (1992) recently provided a more quantitative discussion of the equivalent point that simple models have

the fewest flexible "fudge factor" variables. These simple models make sharper, less adjustable predictions and therefore are more testable and scientifically justified than are more complex models.

The simplest hypothesis is the one that explains the existing data and can most easily be empirically tested. With more complex hypotheses, important variables are more difficult to control, and predictions for the outcome of empirical research are less specific. From this perspective, scientific progress moves along a path that encounters hypotheses that are increasingly difficult to investigate.

For efficient, systematic progress, science must exclude the vast number of untestable (i.e., complex) hypotheses that the human mind can readily imagine. Parapsychologists, for example, do not hypothesize that angels influence their experiments. Such hypotheses are less testable than viable alternative hypotheses and therefore are deferred or ignored.

The Principle of Simplicity in Parapsychology

The principle of simplicity has played a central role in parapsychology since the advent of research at the Duke Laboratory.

J. B. Rhine's early decision to defer investigation of survival of death is a classic example of the principle of simplicity in science. Following an emerging trend in psychical research, Rhine recognized (a) that psi from living persons was a viable alternative for any effects hypothesized as being due to spirits of the deceased, and (b) that hypotheses about living people are more testable (i.e., simple) than hypotheses about spirits. Therefore, he took the position that researchers must establish limits on psi from living persons before they can convincingly investigate survival (Mauskopf & McVaugh, 1980, pp. 96, 102, 103; Rhine, 1933).

The possible sources and mechanisms for psi effects listed in Figure 1 are generally more complex and difficult to test as one moves to the right and downward on the table. For example, the dominant-participant hypothesis is more difficult to test than the subject hypothesis because the dominant person could be any one of several people. Similarly, the goal-oriented psi hypothesis is more difficult to investigate than the assumption that psi focuses on individual trials because, for example, the experimental outcome may be determined by the experimenter's goal of getting a significant result rather than by the aspects of the procedure that are ostensibly under investigation.[2]

[2] The relative degree of complexity and testability for some items in Figure 1 can be questioned. For example, I am not certain that the spirit guide hypothesis is more difficult to test than the future observers hypothesis. Fortunately, the main conclusions of this discussion are based on general principles, not the details of the table, and particularly not the right half of the table.

Rhine narrowed the research program to the simplest hypothesis (ESP by subjects on individual trials) as shown in the upper left corner of Figure 1. This step was necessary to bring psychical research firmly within the scientific method. PK (row 2 of the first column in Figure 1) was established empirically shortly after ESP was established (Rhine, L. E., & Rhine, J. B., 1943). The research program then focused on research on ESP and PK effects by the subjects in experiments. Researchers investigated subjects' reactions to various test procedures and test environments, and how psi performance may be related to subjects' attitudes, personalities, moods, states of consciousness, and so forth.

After about four decades of this research, sufficient data had accumulated to compel researchers to move to column 2 of Figure 1, hypotheses about experimenter effects and dominant participants. This "paradigm shift" to experimenter effects occurred in 1976 when several major review articles brought the issue into the mainstream (Kennedy & Taddonio, 1976; Thouless, 1976; White, 1976a, 1976b). Evidence for psi-mediated experimenter effects had gradually accumulated over the years. In addition to the direct evidence for experimenter effects, the slow progress of the field was probably an important factor underlying the paradigm shift.

Research on experimenter/dominant-participant effects has thus far focused on hypotheses about effects on individual trials and groups of trials. Examples of this research include studies of observer/checker effects (see Schmidt, Morris, & Rudolph, 1986; Weiner & Zingrone, 1989) and unique scoring patterns associated with certain individuals (e.g., Berger, 1988; Radin, 1993). Researchers have also recently started more openly to recognize and discuss their personal psi experiences and abilities, as evidenced by the symposium on "Exceptional Experiences of Psi Investigators: Their Meaning and Implications" at the 1993 Parapsychological Association Convention.

The Outer Limit of Testable Hypotheses: Goal-Oriented Psi

It appears to me that the hypothesis of goal-oriented psi by a dominant participant (usually the experimenter) is presently at the scientific frontier or outer limit of testable hypotheses. The goal-oriented experimenter-effects hypothesis can be tested. However, more complex hypotheses about combined effects, future observers, spirit guides, and so forth appear to be outside the range of available scientific data and methods because simpler hypotheses can explain existing data. These more complex hypotheses must be deferred for the present but may become amenable to direct investigation in the future.

Experimental research will be much more difficult if goal-oriented experimenter effects are valid. Conceivably, an experimenter with psi abilities may obtain support for virtually any hypothesis he or she wants. Research on basic issues such as the relationship between psi and other variables, optimum conditions for psi operation, and how psi works would be dominated by the experimenter's expectations or goals.

The goal-oriented psi hypothesis can be tested by meta-analysis examining the effect of sample size on experimental outcome and by analysis of signal enhancement with majority-vote procedures. Data to date appear to support the hypothesis, but further work is needed. The hypothesis explains findings that are very difficult to explain (i.e., are anomalous) with more simple models.

Sample Size and Goal-Oriented Psi

The statistical significance level of an experiment is directly related to the number of trials if psi operates on individual trials. The nature of this relationship is shown in Figure 2A. The *z* score is directly proportional to the square root of the number of trials, all else being equal. The direct relationship between the *z* score and square root of the number of trials is easily seen from the equation for the *z* score:

$$z = \frac{N_{\text{hits}} - NP}{\sqrt{NPQ}} = \frac{NP_{\text{hits}} - NP}{\sqrt{NPQ}} = N\,\frac{P_{\text{hits}} - P}{\sqrt{N}\,\sqrt{PQ}} = \sqrt{N}\,\frac{P_{\text{hits}} - P}{\sqrt{PQ}}$$

where N is the number of trials, N_{hits} is the number of hits, P_{hits} the a priori probability of a hit, P_{hits} is the scoring rate or proportion of hits, and Q is (1-P). Other statistical tests also follow this principle.

Traditional experimental design and statistical analyses are based on this assumption. As shown in Figure 2A, different psi strengths have lines with different slopes, but they all start at zero and increase directly with the square root of the number of trials.

However, statistical significance level is not related to number of trials under the goal-oriented experimenter-effects hypothesis. Because the overall experiment is viewed as one complex random event with the a priori probability of success equal to .05, the *z* score would be constant, regardless of such details as the number of subjects or trials in the experiment. This relationship is shown in Figure 2B. Different psi strengths have lines that are constant and parallel. The differences between Figures 2A and 2B are clearly testable in principle.

A meta-analysis of electronic RNG experiments supported the goal-oriented psi hypothesis. Using 332 *z* scores from 56 reports, May et al. (1985) tested several models, including both the goal-oriented psi model and the model that assumes that psi operates on individual trials. The

data fit the goal-oriented psi model and were significantly different from the model that assumes that psi operates on individual trials. However, several aspects of the analyses need clarification before these results can be interpreted with confidence regarding goal-oriented psi.[3]

Meta-analyses of ganzfeld experiments also appear to support the goal-oriented experimenter-effects model. In a review of 42 ganzfeld studies, Hyman (1985) found that the significance levels did not follow the relationship with sample size that is normally expected in statistical research. The studies with small sample sizes were more significant than would be expected and the difference between the observed and expected values was statistically significant (Honorton, 1985; Hyman, 1985). Hyman speculated that this "strange" result indicated selective reporting of significant results. However, an investigation of selective reporting failed to support this hypothesis (Blackmore, 1980). Of course, this strange result is expected under the goal-oriented experimenter-effects hypothesis.

A further series of 11 ganzfeld studies gave similar results. Bern and Honorton (1994) reported a significant negative correlation between effect size and sample size. Because effect size is basically the z score divided by the square root of the sample size, this result is consistent with the goal-oriented psi hypothesis and is significantly different from the usual assumptions for statistical research.[4] These studies were free of any selective reporting bias. Also, the negative correlation was not due to decline effects interacting with the varying lengths of the studies because these studies did not have systematic declines in hits across sessions.

A meta-analysis of early ESP experiments was also consistent with goal-oriented experimenter effects but the results were confounded. In a meta-analysis of the ESP studies listed in Rhine et al. (1940), Nash (1989) correlated the sample size and scoring rate for each different a priori

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[3]One factor that particularly needs clarification is how the simulated data were generated. In addition to the 332 published values, 95 simulated nonsignificant *z*- and sample-size values were included in the analysis to correct for the estimated selective reporting of significant results, and 30 of the 332 *z* and sample-size values were simulated for nonsignificant studies that did not report the numbers. Simulated data in particular have the potential to bias the results toward one model or the other. Also, some *z* scores applied to subdivisions of the experiments rather than to the overall score, which reflects the fact that the analysis was not specifically optimized to investigate goal-oriented experimenter effects because May et al. were primarily interested in another hypothesis.

[4]As can be seen from the equation for the *z* score on page 65, under the traditional assumption that psi operates on individual trials, the *z* score is positively correlated with the square root of the sample size, and the effect size (*z* score divided by the square root of sample size) is unrelated to sample size. Under the goal-oriented experimenter-effects hypothesis, the *z* score is unrelated to sample size, and therefore the effect size must be negatively correlated with sample size.

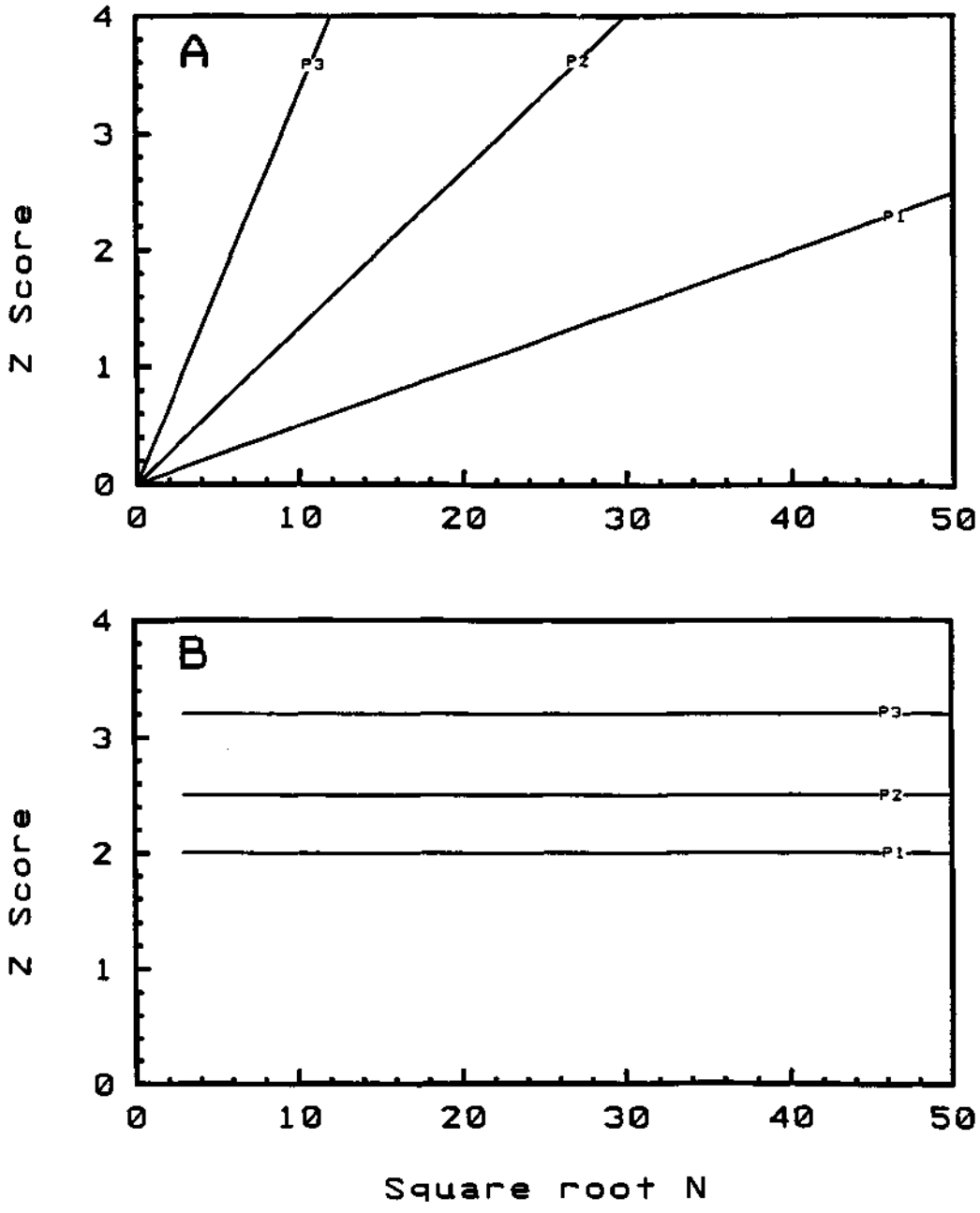

Figure 2. The z score versus the square root of sample size for two models. Panel A (*top*) is the model for psi effects on individual trials and is the normal model underlying statistical research. Panel B (*bottom*) is the goal-oriented psi model, which views the entire experiment as one random event with a probability of success equal to the alpha significance level for the experiment (usually .05). For both models, lines P1, P2, and P3 are different strengths of psi.

probability of a hit. The scoring rate is a measure of effect size for a given a priori probability of a hit. The correlations were negative for each of the 13 different levels of a priori probability *(p* = .0002). Although this result is consistent with the goal-oriented experimenter-effects hypothesis, it is confounded because sample size was also correlated with number of trials per subject and quality of methodology, both of which could affect scoring rate.

Although meta-analysis support for the goal-oriented psi hypothesis seems remarkably consistent, it must be taken with caution until several technical issues are addressed. They include the following: (a) the lines in Figure 2 vary with psi strength, and psi strength appears to vary among experimenters (Kennedy & Taddonio, 1976; White, 1976b); (b) the slopes in Figure 2A may vary with the a priori probability of a hit; (c) selective reporting of significant results could bias and hide the low end of the lines in Figure 2A; (d) both the sample size and the quality of methodology often increase as a line of research evolves, and the scoring rate may decrease as the methodology improves; (e) decline effects combined with differing numbers of trials per subject could give differing scoring rates; and (f) the relevant goal for the psi source may vary with researchers or experimental procedure. These factors could lead to misleading results on meta-analyses evaluating goal-oriented experimenter effects. Methods for addressing these factors include analyzing selected subsets of experiments and/or carrying out sensitivity analysis (probably simulations) to explore how these factors affect the results.

Majority-Vote and Goal-Oriented Psi

Studies of repeated-calling methods also provide support for the goal-oriented psi hypothesis and offer methods for further testing. Majority-vote or repeated-calling techniques will enhance the accuracy of psi effects if psi operates on the individual events comprising the majority vote. On the other hand, if goal-oriented psi operates directly on the experimental outcome or on each majority-vote outcome as one complex event, majority-vote procedures will not truly enhance psi accuracy. Here, too, the differences between models are clear and testable. The rationale and initial findings have been reviewed previously (Kennedy, 1978,1979).

The goal-oriented experimenter-effects hypothesis is supported by evidence that majority-vote results are determined by the experimenter's expectations rather than by the majority-vote process. In a study of goal-oriented psi that directly compared majority-vote and single-event trials, Schmidt (1974) expected and found approximately equal (and very significant) scoring rates in both conditions, not increased accuracy in the

majority-vote condition. However, in other studies, the experimenters expected and found that majority-vote procedures enhanced psi scoring rates (reviewed in Kennedy, 1978, 1979).

The studies showing enhanced scoring rates with majority-vote procedures obtained this result in a way that was more consistent with the goal-oriented psi model than with the traditional majority-vote model (see Kennedy, 1978,1979). In six studies from three research groups, the psi effects were focused on the majority votes with narrower majorities.[5] These results correspond to low scoring rates (minimal psi effects) on the raw trials. For example, in the Brier and Tyminski (1970) study, the entire psi effect was due to majority votes of 3 out of 5, while votes of 4 and 5 out of 5 were not significant and were significantly different from votes of 3 out of 5 (Kennedy, 1979). Under the usual assumptions for majority-vote signal enhancement, votes of 4 and 5 should have produced higher scoring rates. This consistent pattern of results for the six studies is anomalous under the usual assumptions for majority-vote procedures and may be evidence for efficient goal-oriented psi.

Two recent majority-vote studies found a similar pattern that also supports the goal-oriented psi hypothesis. Puthoff, May, and Thompson (1986) and Radin (1990-1991) obtained significant psi results using sequential sampling majority-vote procedures. These procedures result in varying numbers of events or sequence lengths in the majority-votes. Both studies found that the psi scoring rate was significantly higher on the majority votes for longer sequence lengths than for shorter sequence lengths. As noted by Radin, this pattern is not expected under the usual assumptions for sequential sampling which result in approximately equal scoring rates for all sequence lengths. Radin suggested that the higher scoring on longer sequence lengths may result from some type of efficient psi operation. In fact, these data may be consistent with the pattern in the six studies discussed in the previous paragraph because, with sequential sampling, the longer sequence lengths have lower scoring rates on the raw trials (e.g., 14/20 = 70% compared with 4/4 = 100%). However, the interpretation of these data is complicated by the varying sequence lengths as well as by the sequential sampling procedure of discarding many trials.

This internal pattern is evidence that psi is responding to, or operating on, the majority-vote outcomes rather than being distributed throughout the raw trials as expected. The pattern is evidence for some type of goal-oriented psi effect even if it does not actually reflect efficient psi operation. This pattern of psi effects focusing on the majority votes

[5]This internal analysis could not be applied to several other majority-vote studies because of lack of data.

with low scoring rates on the raw trials has been found only in studies that specifically used majority votes to increase psi accuracy, and it has occurred in the great majority, if not all, of those studies. The pattern has been found in cases when the experimenters did not expect it and were at a loss to explain it (e.g., Brier & Tyminski, 1970), as well as in cases when the experimenters predicted it (e.g., Radin, 1990-1991).

It is unlikely that majority-vote and other communication theory methods can be used to increase psi accuracy or reliability if the goal-oriented psi hypothesis is correct. The experimental outcome or majority-vote outcome becomes the goal rather than the individual events comprising the majority vote, as assumed in communications theory. The study by Schmidt (1974) directly demonstrated this point. Suggestions for study designs that might minimize or circumvent this limitation, as well as some ideas on the interesting implications of efficient psi operating in a shifting hierarchy of goals, have been discussed previously (Kennedy, 1978, 1979).

Evaluating Simplicity

The goal-oriented experimenter-effect hypothesis is a good example of why simplicity must be measured by ease of testing rather than just conceptual simplicity. Conceptually the goal-oriented experimenter-effect hypothesis is extremely simple. Many experimental parameters (sample size, subject selection, etc.) that are important under the traditional assumptions for psi research are dropped from the model. However, the goal-oriented experimenter-effect hypothesis makes the interpretation of research much more difficult and is therefore a more complex hypothesis to investigate.

Beyond the Limit of Testable Hypotheses

The preceding discussion of simplicity in science indicates that many important hypotheses are outside the domain of convincing scientific tests. Hypotheses pertaining to life after death and religious beliefs are obvious examples. Although the public widely holds religious beliefs and believes in life after death, these concepts are basically ignored in scientific research, while simpler, testable hypotheses are considered. Of course there is no empirical evidence that these untestable concepts are actually incorrect. Because scientific progress conceivably could lead to direct tests in the future, these concepts are more properly classified as deferred or "on hold" rather than wrong.

What role, if any, does science have for concepts that are widely held but are beyond the present limit of testable hypotheses? Is science a basis for dismissing such concepts as unscientific, irrational, and indicative of maladjustment? Alternatively, is science impotent with regard to these topics? A variety of factors bear on these questions.

Concepts that are outside the domain of science can have value. Popper (1983, pp. 175-177) was dismayed that his work on the scientific method was used to discredit or disregard concepts that are outside the domain of science at a given time. He firmly believed that such concepts may sometimes have meaning and value. Of course the concepts are in the realm of metaphysics, not science. On a more empirical level, a variety of important questions about personal beliefs and experiences can be scientifically investigated even though the underlying reality of the beliefs and experiences is not one of them. Questions such as "Does a particular belief or experience have beneficial or detrimental effects on a person?" and "What leads people to hold these beliefs or have these experiences?" can be scientifically investigated. These investigations are important in order that individuals and society may gain any benefits and avoid any adverse effects from various experiences or belief systems.

In particular, scientific methods can be used to investigate the effects of experiences and belief systems on health and well-being even when the underlying reality of the experiences or beliefs are not testable.[6] One cannot assume that there are no beneficial effects simply because the mechanisms are unknown, particularly for beliefs or experiences that are relatively common and therefore presumably fill some need.

Anomalous or paranormal experiences can result in beneficial effects on people's well-being and health. People with near-death experiences commonly report that the experience enhanced their appreciation of life, understanding of self and others, concern and tolerance for others, and sense of purpose and meaning for their lives (Ring, 1984; Sabom, 1982). Suicidal tendencies are reduced after near-death experiences (Greyson, 1981; Ring & Franklin, 1981-1982). The experiencers usually believe they directly experienced the realm of life after death, but, of course, researchers firmly adhering to the scientific method currently entertain more falsifiable hypotheses. Other types of anomalous or

[6]Health researchers increasingly try to use well-being as a measure of health status and success of treatment. The adverse side effects of various treatments have forced the medical industry to recognize dial die goal of treatment is more dian just keeping the vital organs functioning. Quality-of-life measures are ultimately based on well-being and are becoming widely used in medical research (e.g., Spilker, 1990). Well-being is usually defined as including (a) die cognitive factor, life satisfaction, and (b) positive affect (Diener, 1984). It is noteworthy dial positive affect is also generally recognized as a key component of mystical or transcendent experiences (Noble, 1987; Spilka, Hood, & Gorsuch, 1985, p. 176).

paranormal experiences apparently can sometimes induce similar life transformations, but they have received relatively little research effort (Gabbard & Twemlow, 1984; Hardy, 1979; Milton, 1992; Ring, 1984).

Numerous studies have found positive relationships between religious beliefs or practices and physical or mental health measures (recent reviews include: Chamberlain & Zika, 1992; Gartner, Larson, & Alien, 1991; Koenig, 1990, 1993; Larson, et al., 1992; Levin & Schiller, 1987; Levin & Vanderpool, 1989). For example, Levin and Schiller (1987) reviewed over 200 studies that examined religious beliefs and physical health measures including cardiovascular disease, hypertension, stroke, and general mortality. Likewise, Gartner, Larson, and Alien (1991) reviewed over 200 studies on religious commitment and mental health. The reasons for the generally positive relationships between religious beliefs and health need further research. Levin and Vanderpool (1989) discuss twelve possible explanations for these relationships, ranging from lifestyle and social support factors to paranormal influences. Although the mechanisms for the correlations with health can be investigated, the underlying religious beliefs about God are outside the realm of direct scientific investigation at present.

Scientists and skeptics should be careful not to claim that beliefs are false when actually they are untestable. Efforts to suppress experiences and belief systems that cannot be scientifically tested at present may deprive individuals and society of important benefits. Furthermore, scientists may face ethical dilemmas in the application of science in cases when beliefs have beneficial effects but can be shown to be false. Taylor has summarized a wide range of research indicating that certain "illusions" are valuable in maintaining self-esteem, coping with stress, setting and achieving goals, and general mental health (Taylor, 1989; Taylor & Brown, 1988). These beneficial illusions are sometimes based on de-monstrably incorrect beliefs, as well as on untestable beliefs.

Further Research

The effects that paranormal experiences have on a person's life deserve greater attention within parapsychology. Documenting beneficial effects of possible paranormal experiences is a form of application of parapsychological phenomena that could enhance interest in, and acceptance of, the field. This point has been made by others (e.g., Black-more, 1988; White, 1990). In addition, mind-body health is a growing social movement that is forcing the medical industry to expand its perspectives (Borysenko, 1987; Dossey, 1991; Ornish, 1990, particularly Chapter 9). This movement is very open to parapsychological phenomena, but it focuses on the health effects. At present the parapsychological

literature has surprisingly little information to contribute concerning the effects of anomalous experiences on peoples' lives. If parapsychologists do not provide this type of research, it will be provided by others.

Studies of religion and health suggest that academic research with college students can give a misleading picture of the health effects of belief systems. Koenig (1990, pp. 49-50) noted in his review that "most of the studies that have demonstrated personality maladjustments with increasing religious observance have been among college students and young adults who are at a time in life characterized by instability, disorganization, and immaturity." For older adults, Koenig found that religion had a consistently positive relationship with mental health. Gartner, Larson, and Alien (1991) in their review noted a related factor:

> Most studies linking religious commitment to psychopathology have employed mental health measures that we have called "soft variables," that is, paper-and-pencil personality tests which attempt to measure theoretical constructs. In contrast, most of the research linking religion to positive mental health is on "hard variables," that is, "real life" behavioral events which can be reliably observed and measured and which are unambiguous in their significance, (p. 6)

The lessons from research on religion and health may offer valuable guidelines for researchers investigating relationships between health and other beliefs or experiences. Of course, finding an overall positive relationship between a belief system or experience and health does not preclude the possibility that similar beliefs or experiences may be associated with mental problems for certain individuals. Researchers who overlook this possibility may be providing a serious disservice. Taylor (1989) has noted the importance of distinguishing beneficial from detrimental illusions. Likewise, several investigators have discussed characteristics that distinguish cases of healthy versus unhealthy religious or anomalous experiences (Grof & Grof, 1990; Lukoff, 1985; Margolis & Elifson, 1983), and further research is needed.

Conclusions

The key conclusions of this discussion are that:

1. Numerous hypotheses can explain the results of psi experiments. These range from psi by the subject to divine intervention.
2. The scientific method is based on accepting the simplest (most testable) hypothesis consistent with available data and moving to more complex hypotheses only when the data compel it.

3. The field of parapsychology has generally adhered to this principle of simplicity.

4. The hypothesis of goal-oriented psi experimenter effects, which views an entire experiment as one random event with the a priori probability of success (significant outcome of the experiment) equal to .05, appears to be at the outer limit of testable hypotheses at present. Para-psychological research will change greatly if this hypothesis is verified.

5. In meta-analyses of RNG and ganzfeld studies, the relationship between statistical significance and sample size was consistent with the goal-oriented experimenter-effects hypothesis and was significantly different from the traditional assumptions for experiments. The results of majority-vote studies were also consistent with the goal-oriented psi hypothesis and differed significantly from the normal assumptions for using communication theory methods to enhance psi accuracy. Further research is needed with both meta- analyses and majority-vote studies.

6. Concepts and experiences that are outside the domain of scientifically testable hypotheses can have beneficial effects on peoples' health and well-being.

7. Scientists and skeptics should be careful not to claim that beliefs are false when actually the beliefs are untestable.

8. Researchers can and should investigate the effect on peoples' lives of anomalous experiences and belief systems even when the underlying reality of the experiences or beliefs cannot be scientifically tested.

REFERENCES

BEM, D. J., & HONORTON, C. (1994). Does psi exist? Replicable evidence for an anomalous process of information transfer. *Psychological Bulletin,* **115,** 4-18.

BERGER, R. E. (1988). Search of "psychic signatures" in random data. In D. H. Weiner & R. L. Morris (Eds.), *Research in parapsychology 1987 (pp.* 81-85). Metuchen, NJ: Scarecrow Press.

BLACKMORE, S. (1980). The extent of selective reporting of ESP ganzfeld studies. *European Journal of Parapsychology,* 3, 213-219.

BLACKMORE, S. (1988). Do we need a new psychical research? *Journal of the Society for Psychical Research,* **55,** 49-59.

BORYSENKO, J. (1987). *Minding the body, mending the mind.* New York: Bantam.

BRIER, R. M., & TYMINSKI, W. V. (1970). Psi application: Part II. The majority-vote technique—analysis and *observations. Journal of Parapsychology,* 34, 26-36.

CHAMBERLAIN, K., & ZIKA, S. (1992). Religiosity, meaning in life, and psychological well-being. InJ. F. Schumaker (Ed.), *Religion and mental health* (pp. 138-148). Oxford: Oxford University Press.

DIENER, E. (1984). Subjective well-being. *Psychological Bulletin,* **95,** 542-575.

DOSSEY, L. (1991). *Meaning and medicine.* New York: Bantam.

FOSTER, A. A. (1940). Is ESP diametric? *Journal of Parapsychology, 4,* 325-328.

GABBARD, G. O., & TWEMLOW, S. W. (1984). *With the eyes of the mind: An empirical analysis of out-of-body states.* New York: Praeger.

GARTNER,J., LARSON, D. B., & ALLEN, G. D. (1991). Religious commitment and mental health: A review of the empirical literature. *Journal of Psychology and Theology,* 19, 6-25.

GREYSON, B. (1981). Near-death experiences and attempted suicide. *Suicide and Life-Threatening Behavior,* 11, 10-16.

GROF, C., & GROF, S. (1990). *The stormy search for the self.* Los Angeles: Jeremy P. Tarcher.

HARDY, A. (1979). *The spiritual nature of man.* Oxford: Clarendon Press.

HONORTON, C. (1985). Meta-analysis of psi ganzfeld research: A response to Hyman. *Journal of Parapsychology,* 49, 51-91.

HYMAN, R. (1985). The ganzfeld psi experiment: A critical appraisal. *Journal of Parapsychology,* 49, 3-49.

JEFFERYS, W. H., & BERGER, J. O. (1992). Ockham's Razor and Bayesian analysis. *American Scientist,* 80, 64-72.

KENNEDY, J. E. (1978). The role of task complexity in PK: A review. *Journal of Parapsychology,* **42,** 89-122.

KENNEDY, J. E. (1979). Redundancy in psi information: Implications for the goal-oriented hypothesis and for the application of psi. *Journal of Parapsychology,* **43,** 290-314.

KENNEDY, J. E., & TADDONIO, J. L. (1976). Experimenter effects in parapsychological *research. Journal of Parapsychology,* 40, 89-122.

KOENIG, H. G. (1990). Research on religion and mental health in later life: A review and commentary. *Journal of Geriatric Psychiatry,* **23,** 23-53.

KOENIG, H. G. (1993). Religion and aging. *Reviews in Clinical Gerontology,* 3, 195-203.

LARSON, D. B., KIMBERLY, A. S., LYONS, J. S., CRAIGIE, F. C., THIELMAN, S. B., GREENWALD, M. A., & LARSON, S. S. (1992). Associations between dimensions of religious commitment and mental health reported in the *American Journal of Psychiatry* and *Archives of General Psychiatry:* 1978-1989. *American Journal of Psychiatry,* 149, 557-559.

LEVIN,J. S., & SCHILLER, P. L. (1987). Is there a religious factor in health? *Journal of Religion and Health,* 26, 9-36.

LEVIN, J. S., & VANDERPOOL, H. Y. (1989). Is religion therapeutically significant for hypertension? *Social Science and Medicine,* 29, 69-78.

LUKOFF, D. (1985). The diagnosis of mystical experiences with psychotic features. *Journal of Transpersonal Psychology,* 17, 155-181.

MARGOLIS, R. D., & ELIFSON, K W. (1983). Validation of a topology of religious experience and its relationship to psychotic experience. *Journal of Psychology and Theology,* 11, 135-141.

MAY, E. C., RADIN, D. I., HUBBARD, B. S., & UTTS, J. M. (1985). Psi experiments with random number generators: An informational model. *Proceedings of the 28th AnnualParapsychologicalAssociation Convention,* (pp. 235-266). Tufts University, Medford, MA.

MAUSKOPF, S. H., & MCVAUGH, M. R. (1980). *The elusive science.* Baltimore: Johns Hopkins University Press.

MILLAR, B. (1978). The observational theories: A primer. *European Journal of Parapsychology,* 2, 304-332.

MILTON, J. (1992). Effects of "paranormal" experiences on people's lives: An unusual survey of spontaneous cases. *Journal of the Society for Psychical Research,* 58, 314-323.

NASH, C. B. (1975). Dominant participant effect. *Journal of the Society for Psychical Research,* 48, 56-58. (Letter)

NASH, C. B. (1989). Intra-experiment and intra-subject scoring declines in *Extra-sensory Perception After Sixty Years. Journal of the Society for Psychical Research,* 55, 412-416.

NOBLE, K. D. (1987). Psychological health and the experience of transcendence. *The Counseling Psychologist,* 15,601-614.

ORNISH, D. (1990). *Dr. Dean Ornish's program for reversing heart disease.* New York: Random House.

POPPER, K. R. (1959). *The logic of scientific discovery.* New York: Basic Books.

POPPER, K. R. (1983). *Realism and the aim of science.* Totowa, NJ: Rowman & Littlefield.

PRATT, J. G. (1974). Some notes for the future Einstein for parapsychology. *Journal of the American Society for Psychical Research,* 68, 133-155.

PUTHOFF, H., MAY, E. C., & THOMPSON, M. J. (1986). Calculator-assisted psi amplification: II. Use of the sequential-sampling technique as a variable-length majority-vote code. In D. Weiner & D. Radin (Eds.), *Research in para-psychology 1985* (pp. 73-77). Metuchen, NJ: Scarecrow Press.

RADIN, D. I. (1990-1991). Enhancing effects in psi experiments with sequential analysis: A replication and extension. *European Journal of Parapsychology,* 8,98-111.

RADIN, D. I. (1993). Neural network analyses of consciousness-related patterns in random sequences. *Journal of Scientific Exploration,* 7, 355—373.

RHINE, J. B. (1933). On the possibility of proving survival. *Journal of the Society for Psychical Research,* 28, 125-128. (Letter)

RHINE, J. B. (1942). Evidence of precognition in the covariation of salience ratios. *Journal of Parapsychology,* 6, 111-143.

RHINE, J. B., & PRATT, J. G. (1957). *Parapsychology: Frontier science of the mind.* Springfield, IL: Charles C Thomas.

RHINE, J. B., PRATT, J. G., STUART, C. E., SMITH, B. M., & GREENWOOD, J. A. (1940). *Extrasensory perception after sixty years.* Boston: Bruce Humphries.

RHINE, L. E., & RHINE, J. B. (1943). The psychokinetic effect: I. The first experiment. *Journal of Parapsychology,* 7, 20-43.

RING, K. (1984). *Heading toward omega.* New York: William Morrow.

RING, K., & FRANKLIN, S. (1981-1982). Do suicide survivors report near-death experiences? *Omega,* 12, 191-208.

SABOM, M. B. (1982). *Recollections of death: A medical investigation.* New York: Harper & Row.

SCHMIDT, H. S. (1974). Comparison of PK action on two different random number generators. *Journal of Parapsychology,* 38, 47—55.

SCHMIDT, H. S., MORRIS, R., & RUDOLPH, L. (1986). Channeling evidence for a PK effect to independent observers. *Journal of Parapsychology,* 50, 1-16.

SPILKA, B., HOOD, R. W., & GORSUCH, R. L. (1985). *The psychology of religion: An empirical perspective.* Englewood Cliffs, NJ: Prentice-Hall.

SPILKER, B. (1990). (Ed.). *Quality of life assessments in clinical trials.* New York: Raven Press.

TAYLOR, S. E. (1989). *Positive illusions: Creative self-deception and the healthy mind.* New York: Basic Books.

TAYLOR, S. E., & BROWN, J. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin,* 103, 193-210.

THOULESS, R. H. (1976). The effect of the experimenter's attitude on experimental results in parapsychology. *Journal of the Society for Psychical Research,* 48, 261-266.

WALKER, E. H. (1987). A comparison of the intuitive data sorting and quantum mechanical observer *theories. Journal of Parapsychology,* 51, 217-227.

WEINER, D. H., & ZINGRONE, N. L. (1989). In the eye of the beholder: Further research on the "checker *effect." Journal of Parapsychology,* 53, 203-231.

WHITE, R. A. (1976a). The influence of persons other than the experimenter on the subject's scores in psi experiments. *Journal of the American Society for Psychical Research,* 70, 133-166.

WHITE, R. A. (1976b). The limits of experimenter influence on psi test results: Can any be *set? Journal of the American Society for Psychical Research,* 70, 333-369.

WHITE, R A. (1990). An experience-centered approach to parapsychology. *Exceptional Human Experience,* 8, 7-36.

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