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THE WILL-TO-BELIEVE; AN INVESTIGATION OF COGNITIVE AND
MOTIVATIONAL DETERMINANTS OF ESP BELIEF-PERSEVERANCE

by

Hans P. de Groot

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of

Doctor of Philosophy

Department of Psychology

Carleton University

Ottawa, Ontario

September, 1991

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ISBN 0-315-75955-0

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The undersigned hereby recommend to
the Faculty of Graduate Studies and Research
acceptance of the thesis,

The Will-to-Believe:
An Investigation of Cognitive and Motivational
Determinants of ESP Belief-Perseverance

submitted by

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in partial fulfilment of the requirements
for the degree of Doctor of Philosophy

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Abstract

A number of hypotheses have been invoked to explain the resistance to disconfirmation of belief in ESP. One hypothesis attributes ESP belief perseverance to dogmatism on the part of believers. According to the reasoning error hypotheses, ESP belief perseveres, because believers characteristically underestimate the frequency of chance occurrences, and/or make errors in judging the validity of hypotheses based on evidential statements. In addition, several mainstream social psychological hypotheses have been invoked to explain ESP belief-perseverance; including, cognitive dissonance, discounting of evidence, and selective learning. Three studies tested these hypotheses. A pilot study tested the relationship between ESP belief and deductive and inductive reasoning performance. Contrary to the reasoning error hypotheses, there were no significant relationships between belief and reasoning performance. The relationship between ESP belief and dogmatism was tested in the second and third studies, but was not significant in either of these studies. In the second study, believers and nonbelievers were given several inductive reasoning problems. Following these problems, subjects underwent a card-guessing task, and received feedback indicative of either highly accurate or only chance-level guessing. As in the first study, there were no significant relationships between ESP belief and inductive reasoning performance. Contrary to the reasoning error

hypothesis, believers and nonbelievers did not differ in their estimates of mean chance expectation for the card-guessing task. The third study tested a cognitive-motivational model of ESP belief-perseverance. This model argues that individuals engage in evidence-discounting and selective learning in order to reduce the negative arousal evoked by exposure to belief-discrepant evidence. Subjects in this study completed several deductive reasoning problems. Following these problems, subjects read abstracts which either confirmed or disconfirmed their prior belief in the deterrent value of capital punishment or in the existence of ESP. After subjects completed a measure of mood state, they received a recall trial, and evaluated the study presented in the abstract. Finally, subjects listed arguments both for and against the hypothesis presented in the abstract. Contrary to the reasoning error hypothesis, ESP belief was not significantly related to deductive reasoning performance. Although we found a selective learning effect for subjects who read ESP-confirming evidence, no such effect emerged in the other three treatment conditions. A discounting of evidence effect only emerged for subjects who read deterrence-disconfirming evidence. The results are discussed in terms of subjects' emotional reactions to evidence, and their prior knowledge of the belief domain.

Acknowledgements

I would like to thank the following people for their contributions to this project: Dr. Nick Spanos, my supervisor, for his invaluable advice and patience; Joe Johnston and Max Gwynn for their encouragement and friendship; and Ana Rojo-Diez for her encouragement, love, and patience.

I dedicate this dissertation to the memory of my father who awakened my interest in 'book learning,' and to my mother for her unwavering support.

single recall item asking, "What did the author conclude?", indicated that only the believers showed lower recall of the conclusion when their beliefs were disconfirmed. Indeed, Russell and Jones reported that four of the eight believers in the ESP disproven condition who incorrectly recalled the conclusion actually reversed the conclusion to ESP having been proven.

Although the findings of Russell and Jones (1980) were consistent with the selective learning hypothesis, a recent study by Grant (1987) failed to replicate their findings. Like Russell and Jones, Grant exposed believers and nonbelievers in ESP to a summary of a hypothetical ESP study which either confirmed or disconfirmed the ESP hypothesis. Following the abstract, subjects were asked several factual questions about the abstract, including a question about the authors' conclusions. Although believers made more recall errors than nonbelievers, this difference was not statistically significant. Moreover, Grant found that the recall performance of his subjects was superior to that of Russell and Jones' subjects. Whereas only 39% of believers in the Russell and Jones study correctly recalled the authors' conclusion in the ESP disproven condition, Grant reported that 84% of believers in the corresponding condition of his study correctly answered this question.

The replication failure of Grant can be attributed to several important methodological differences between his study and that of Russell and Jones. First, Grant's design did not

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Introduction

Extrasensory perception or ESP refers to acts of perception or cognition which are independent of activity in the sense organs (Hansel, 1980). Although ESP has not been scientifically validated (e.g., Alcock, 1987; Hansel, 1980), reports (e.g., Alcock, 1981; Davies, 1988; Gallup & Newport, 1991) suggest that belief in this and related phenomena is common and widespread. For instance, a recent Gallup poll of 1236 American adults (Gallup & Newport, 1991) indicated that 49% believed in ESP, 46% believed in psychic healing, and 17% believed in psychokinesis. Moreover, one-quarter of those surveyed claimed to have experienced psychic healing or telepathy. These levels of belief are especially interesting when it is considered that similar or higher levels of belief have been reported in university-educated samples (e.g., Gallup poll, 1978), and that the Gallup poll format may underestimate actual levels of belief in the population (Gray, 1990).

One reason for the prevalence of ESP belief may be that it often remains uncontradicted in everyday experience (Scheibe & Sarbin, 1965). In particular, the current levels of belief may reflect widespread ignorance of alternative, naturalistic explanations of ESP and other paranormal phenomena (e.g., Gray, 1986; McGowan, 1984; Singer & Benassi, 1981). This ignorance may be based, in part, on the failure of most secondary and post secondary science curriculae to critically address paranormal

claims (Singer & Benassi, 1981; Stevens, 1988). These failures in science education may be exacerbated by features of the media coverage of the paranormal (Singer, 1979; Zusne & Jones, 1982). Instead of presenting a balanced or critical appraisal of paranormal claims, this coverage has often catered to a perceived public demand for mystery and excitement (Singer, 1979). Moreover, this coverage may have contributed to the prevalent idea that many ESP phenomena have been validated by the scientific community at large (Zusne & Jones, 1982).

A number of 'teaching' studies (e.g., Banziger, 1983; Gray, 1986; Jones & Zusne, 1981) have tested the ignorance hypothesis. Students in these studies received instructional packages containing alternative, naturalistic interpretations of ESP and other paranormal phenomena. Although these studies reported significant decreases in ESP belief, they also found that about half of the students persevered in their belief. In addition, Jones and Zusne (1981) reported that the magnitude of belief change in their teaching study was negatively related to students' initial belief scores. Moreover, changes in ESP belief may not persist over time. Gray (1986) reported that a one-year follow-up of his students indicated that, "the drift toward precourse levels was substantial in the case of ESP."

A number of hypotheses have been invoked to explain the perseverance of ESP beliefs (e.g., Blackmore & Troscianko, 1985; Grant, 1987; Russell & Jones, 1980; Wierzbicki, 1985). For

instance, several investigators have proffered explanations of ESP belief perseverance in terms of such mainstream social psychological hypotheses as biased assimilation of evidence (Grant, 1987), cognitive dissonance (e.g., Festinger, Riecken, & Schachter, 1956), or selective learning (Russell & Jones, 1980). Although these explanations may differ with respect to the specific mechanisms of belief perseverance, they share in common the idea that existing belief influences the processing of related information. Moreover, these explanations either implicitly or explicitly assume that ESP belief is continuous with other forms of strong belief, and that an explanation of paranormal belief perseverance may contribute toward an understanding of the dynamics of strong belief in general (Jones & Zusne, 1981).

Alternatively, several investigators (e.g., Blackmore & Troscianko, 1985; Wierzbicki, 1985) have attributed both the acquisition and the perseverance of ESP belief to individual differences in logical reasoning ability. These investigators argue that ESP belief may persevere because believers characteristically underestimate the likelihood of chance outcomes (Blackmore & Troscianko, 1985), and/or because they make errors in judging the validity of their beliefs on the basis of evidential statements (Wierzbicki, 1985). Unlike mainstream social psychological hypotheses, these reasoning error hypotheses minimize the influence of existing ESP belief on the processing

of related information. In addition, the focus of convenience of these hypotheses may only be ESP belief.

Although there is certainly no lack of hypotheses to explain ESP belief perseverance, only a handful of studies have actually tested these different hypotheses. Moreover, these studies have often reported inconsistent or negative findings. One purpose of the present paper will be to critically examine these studies, in order to delineate methodological factors which may have contributed to these inconsistent or negative findings. In addition, the perseverance mechanisms implied by these hypotheses will be integrated within a cognitive-motivational model of ESP belief-perseverance. This model is an extension of one developed earlier by Jones and his co-workers (e.g., Jones & Russell, 1980; Russell & Jones, 1980; Zusne & Jones, 1982). According to this model, people engage in evidence-discounting and selective learning in order to reduce the negative arousal evoked by exposure to belief-discrepant evidence.

Literature Review

Accounts of Belief-Perseverance

The idea that people's beliefs often persevere despite exposure to disconfirming evidence has received considerable support in social psychology (Higgins & Bargh, 1987). Indeed, in contrast to the rational assumption that mixed or negative evidence should lead to reduced belief, studies (e.g., Festinger et al., 1956; Lord et al., 1979) have indicated that such

evidence may actually lead to polarization of subjects' initial attitudes or beliefs. At least three accounts have been proposed for the perseverance of people's beliefs; namely, cognitive dissonance (e.g., Aronson, 1969), selective learning (e.g., Levine & Murphy, 1943), and biased assimilation of evidence (Lord et al., 1979).

Cognitive Dissonance

One of the most influential formulations in social psychology is Festinger's cognitive dissonance theory (e.g., Aronson, 1969; Festinger et al., 1956). According to cognitive dissonance theory, the perceived inconsistency between two cognitions (e.g., a belief and evidence which contradicts that belief) induces a state of psychological discomfort which subjects are motivated to alleviate. More specifically, cognitive dissonance can be conceptualized as a drive state characterized by negative arousal (e.g., Aronson, 1969; Elkin & Leippe, 1986). Festinger (e.g., Festinger et al., 1956) delineated three ways in which dissonance could be reduced:

The person may try to change one or more of the beliefs, opinions, or behaviors involved in the dissonance; to acquire new information or beliefs that will increase the existing consonance and thus cause the total dissonance to be reduced; or to forget or reduce the importance of those cognitions that are in a dissonant relationship (p. 56).

One of the original tests of cognitive dissonance theory (Festinger et al., 1956) involved paranormal beliefs related to ESP. Festinger et al. studied members of a group which subscribed to a paranormal ideology containing a mixture of ideas; including, the lost continents of Atlantis and Mu, Christianity, Spiritualism, Theosophy, and UFOlogy. Through automatic writing, the spiritual leader of the group (Mrs. Keech) had prophesized that part of North America would soon be submerged by a cleansing deluge. However, the members of the group would be saved from the flood by the timely intervention of extraterrestrial 'Guardians,' who would transport the faithful to safety in flying saucers. Unlike most prophecies of this nature, Mrs. Keech had actually specified dates for the occurrence of the flood, and the arrival of the Guardians.

Festinger et al. reported that the failure of the prophecy produced visible consternation among members of the group. However, most of the members did not change their paranormal beliefs, or their belief in the prophecy. Instead, they re-interpreted the failure of the prophecy as a test of their faith by the Guardians. According to the members, the strength of their faith had actually saved the world from imminent disaster.

Festinger et al. (1956) interpreted their findings in terms of cognitive dissonance theory. According to these investigators, the consternation expressed by the group

membership was symptomatic of cognitive dissonance evoked by the failure of the prophecy. However, when faced with the alternatives of reducing dissonance by changing their beliefs about the prophecy or by changing their beliefs about the evidence, the membership chose the latter alternative. They re-interpreted the failure of both the flood and the Guardians to materialize as confirmation of the prophetic skills of Mrs. Keech, and of the validity of their belief-system.

More recently, Russell and Jones (1980) reported findings consistent with the cognitive dissonance explanation of ESP belief perseverance within an experimental context. Russell and Jones exposed subjects who had previously completed a paranormal belief questionnaire to a bogus journal abstract which either confirmed or disconfirmed the ESP hypothesis. Following the abstract, subjects completed a questionnaire measure of negative arousal. The findings for the negative arousal measure were consistent with the predictions of cognitive dissonance theory: Although the correlation between paranormal belief and negative arousal was positive when ESP was disproven ($r = .37$), it was negative when ESP was proven ($r = -.31$). Thus, both believers and nonbelievers exhibited negative arousal when they were exposed to information which was inconsistent with their opinion concerning ESP.

Festinger et al. (1956) reported that believers in their study attempted to reduce cognitive dissonance by distorting the

meaning of the failed prophecy. Russell and Jones (1980) argued that a similar type of distortion occurred in their study. Specifically, they argued that believers in their study attempted to reduce the negative arousal evoked by exposure to ESP-disconfirming evidence through selective learning.

Selective Learning

The selective learning hypothesis (e.g., Levine & Murphy, 1943) suggests that people learn and remember information which supports their attitudes and beliefs more easily than information which contradicts these cognitions. Although this hypothesis has considerable intuitive appeal, the available studies have indicated inconsistent effects of attitudes and beliefs on memory, prompting some investigators to reject the idea entirely (e.g., Greenwald & Sakamura, 1967; Waly & Cook, 1966). Nonetheless, a recent meta-analysis of the selective learning literature by Roberts (1985) indicated a significant, albeit small effect of attitudes and beliefs on memory. Moreover, several studies (e.g., Roberts, 1985; Weldon & Malpass, 1981) have investigated a number of factors which may affect selective learning; including, the instructional set, the type of recall measure, and subjects' learning skill and prior familiarity with the stimulus material.

Instructional set. Tests of the selective learning hypothesis have typically employed a similar paradigm; subjects who scored either high or low on an attitude or belief dimension

were tested for their recall of supportive and/or non-supportive information. Despite this similarity, these studies exhibited a number of important methodological differences. One obvious difference between selective learning studies concerns the instructions subjects received prior to reading the stimulus material. Subjects in these studies were asked either to read the learning material (Levine & Murphy, 1943; Roberts, 1984), to be prepared to judge the material (Weldon & Malpass, 1981), to learn the material (Jones & Aneshansel, 1956), or to learn the material in order to perform a subsequent part of the experiment (e.g., Jones & Aneshansel, 1956; Weldon & Malpass, 1981).

The results of two studies (Jones & Aneshansel, 1956; Weldon & Malpass, 1981) suggest that differences in instructional set may affect the extent of selective learning by subjects. Jones and Aneshansel (1956) reported that subjects who favored racial segregation were more likely to remember anti-segregation statements when they were told that these statements would form the basis of counter-arguments later on during the experiment, than when they were simply asked to learn the statements. Similarly, Weldon and Malpass (1981) reported that subjects with negative attitudes toward student activism exhibited lower recall of essay material advocating student activism when they were instructed to judge the essay, than when they were asked to learn and be prepared to recall the essay material at a later time. Together, these findings suggest that selective learning may be a

function of the perceived strategic utility of the stimulus material (Roberts, 1985).

Immediate vs. delayed recall. Another important difference between selective learning studies concerns the type of recall measure used to test learning of the stimulus material. Although some studies (e.g., Greenwald & Sakamura, 1967; Waly & Cook, 1966) used immediate memory tests, others (e.g., Levine & Murphy, 1943; Roberts, 1984) used delayed memory tests, often preceded by an interpolated task. Roberts (1985) reported that selective learning effects were significantly larger when a delayed then when an immediate recall test was used. He also found a significant positive correlation between the length of the retention interval and the magnitude of the selective learning effect.

Learning skill and prior knowledge. There is some evidence that characteristics of the subject and of the stimulus materials may also affect selective learning (Roberts, 1985; Weldon & Malpass, 1981). For instance, Weldon and Malpass (1981) suggested that learning and recall performance may be related to subjects' intellectual skills, and their prior familiarity with the belief-relevant evidence. In line with these ideas, Weldon and Malpass found that recall of an essay advocating or criticizing student activism was significantly associated with measures of intellectual skills and prior familiarity with the essay material. They also found that the interaction of

attitudes toward student activism with essay bias on recall performance was significant only after the intellectual skills and prior familiarity measures were partialled out of the analyses.

Two studies by Jones and Russell (1980; Russell & Jones, 1980) have implicated selective learning in the perseverance of ESP belief. Jones and Russell (1980) assigned subjects to either a 'believer' or a 'skeptic' grouping based on a median-split of their responses to a paranormal belief questionnaire. Subjects were then exposed to either a successful or an unsuccessful ESP card-guessing demonstration performed by two confederates of the experimenter. The subjects in the success condition witnessed the 'receiver' guessing the cards at the rate of 60 percent accuracy; the unsuccessful 'receiver' guessed the cards at the rate of 20 percent accuracy. Following this demonstration, subjects went through a similar card-guessing task, but with themselves acting as the percipients.

The results indicated that the skeptics' judgments of whether or not ESP had occurred were consistent with the information they had received: Skeptics indicated that ESP had occurred when the confederate guessed cards correctly at above chance levels, and that ESP had not occurred when the confederate performed at chance levels. Similarly, the skeptics' ratings of their own ESP ability were significantly related to their own performance on the card-guessing task. In contrast, believers

concluded that ESP had occurred regardless of the outcome of the initial demonstration. Moreover, the believers' ratings of their ESP ability were unrelated to their own card-guessing performance; they indicated having ESP, despite correctly guessing the cards at only chance levels.

Although the findings of Jones and Russell were consistent with the selective learning hypothesis, their design did not rule out alternative interpretations of their results. For instance, their measure of whether or not ESP had occurred during the demonstration confounded subjects' recall with their belief in that phenomenon (Roberts, 1985). However, a study by Russell and Jones (1980) compared the recall of believers and nonbelievers for ESP-related evidence. Recall that Russell and Jones exposed believers and nonbelievers in the paranormal to a bogus abstract which either confirmed or disconfirmed the ESP hypothesis. Following the abstract, subjects completed an interpolated task which consisted of filling out the questionnaire measure of negative arousal. The subjects then completed a 15-item recall test of the content of the abstract.

Consistent with the selective learning hypothesis, the results indicated a significant negative correlation ($r = -.38$, $p < .05$) between ESP belief and number of items correctly recalled in the ESP disproven condition. However, the correlation between ESP belief and recall performance was non-significant ($r = .07$, n.s.) for subjects in the ESP proven condition. Analyses of a

single recall item asking, "What did the author conclude?", indicated that only the believers showed lower recall of the conclusion when their beliefs were disconfirmed. Indeed, Russell and Jones reported that four of the eight believers in the ESP disproven condition who incorrectly recalled the conclusion actually reversed the conclusion to ESP having been proven.

Although the findings of Russell and Jones (1980) were consistent with the selective learning hypothesis, a recent study by Grant (1987) failed to replicate their findings. Like Russell and Jones, Grant exposed believers and nonbelievers in ESP to a summary of a hypothetical ESP study which either confirmed or disconfirmed the ESP hypothesis. Following the abstract, subjects were asked several factual questions about the abstract, including a question about the authors' conclusions. Although believers made more recall errors than nonbelievers, this difference was not statistically significant. Moreover, Grant found that the recall performance of his subjects was superior to that of Russell and Jones' subjects. Whereas only 39% of believers in the Russell and Jones study correctly recalled the authors' conclusion in the ESP disproven condition, Grant reported that 84% of believers in the corresponding condition of his study correctly answered this question.

The replication failure of Grant can be attributed to several important methodological differences between his study and that of Russell and Jones. First, Grant's design did not

include a delay between the learning and recall trials. In addition, Grant used a forced-choice question to assess subjects' recall of the authors' conclusion. Thus, the only errors that his subjects could make on that question involved reversals of the abstract's conclusion. In contrast, Russell and Jones employed an open-ended questionnaire, and reversals were only one type of recall error which subjects could make. Perhaps most importantly, Grant's subjects could review the abstract while answering questions about it's contents.

Discounting of Evidence

The selective learning hypothesis suggests that learning and recall of information is guided by its perceived consistency with prior belief(s). Along similar lines, Lord, Ross, and Lepper (1979) suggested that information relevant to a particular belief is not processed impartially. Instead, subjects' evaluations of evidence are biased by the perceived consistency of this evidence with their beliefs. One mechanism of biased assimilation may be a tendency to discount belief-disconfirming evidence. For instance, an individual who believes that the existence of capital punishment serves as a deterrent to homicide might resist disconfirming evidence by pointing out that deterrence studies typically involve correlational designs, fail to control for residual deterrence effects, and the like (e.g., Archer, Gartner, & Beittel, 1983).

Lord et al. (1979) tested the discounting hypothesis by exposing subjects who either favored or opposed capital punishment as a deterrent to homicide to the conclusions of a study which were either consistent or inconsistent with the deterrence hypothesis. Following this exposure, subjects were again asked to rate their opinion of the deterrence hypothesis. After making their ratings, subjects were provided with additional information on the study. This information included the methodology of the study, as well as criticisms of that methodology. Subjects were again asked to rate how well done they thought the study had been. This procedure was then repeated for each subject, but using a study which reported the opposite conclusions. Finally, subjects were again asked about their opinion of the deterrence hypothesis.

In line with the discounting hypothesis, Lord et al. (1979) reported that subjects rated the studies which supported their initial opinion about capital punishment as being more convincing and more well done than studies which did not support that opinion. Lord et al. also reported that exposure to both pro- and anti-deterrent information led to attitude polarization. Thus, subjects who initially favored capital punishment became more pro-capital punishment, while subjects who initially opposed capital punishment became more anti-capital punishment following mixed evidence. Moreover, the changes in subjects' attitudes were significantly related to their ratings of how convincing and

how well done the studies were.

Recall that Grant exposed subjects to either positive or negative evidence concerning the ESP hypothesis. In addition to testing subjects for selective learning, Grant also asked them to evaluate the abstracts along the dimensions of replicability, the adequacy of the controls used, the appropriateness of the conclusions, and overall design. Grant summed subjects' ratings on these dimensions, and correlated them with their ESP belief ratings within each evidence condition. Contrary to the discounting hypothesis, Grant found that subjects who received belief-discrepant information were not more likely to discount this evidence than subjects who received belief-confirming information. In fact, Grant found that subjects evaluated the abstracts they read quite favorably; the mean rating for the combined evidence questions was 19.21 out of 28.

The replication failure of Grant (1987) can be attributed to important methodological differences between his study and that of Lord et al. (1979). Grant attributed his negative findings to his failure to expose subjects to both positive and negative evidence. Although this factor may have contributed to his replication failure, it is also possible that subjects did not discount evidence due to the absence of a methodological critique of the abstract. This possibility is consistent with findings reported by Lord et al. (1979). Lord et al. examined subjects' attitudes immediately following their exposure to the first

abstract, but prior to their exposure to a methodological critique. They found that subjects' evaluations were more favorable immediately after reading the study than after reading the critique.

A Cognitive-Motivational Model of Belief-Perseverance

An important distinction in social psychology concerns the difference between so-called cognitive and motivational accounts of belief change (e.g., Kunda, 1990; Tetlock & Levi, 1982). Motivational accounts, such as cognitive dissonance theory, assume that human cognition reflects directional goals or motives. For example, cognitive dissonance theory argues that processes such as attitude or belief change are motivated by a desire to reduce cognitive dissonance. In contrast to motivational accounts, cognitive accounts (e.g., Lord, 1989; Nisbett & Ross, 1980) suggest that it is unnecessary to invoke directional goals or motives to explain human social cognition. Instead, cognitive accounts assume that social cognition can be parsimoniously explained in terms of a non-directional need for accurate understanding of the social environment (Kunda, 1990; Tetlock & Levi, 1982).

Although cognitive accounts initially presented a serious challenge to motivational formulations, there has recently been a revival of interest in motivational factors affecting social cognition (e.g., Aronson, 1989; Berkowitz & Devine, 1989; Kunda, 1990). Recent interest in motivational factors reflects a

variety of considerations: For one, there has been growing recognition that, despite the claims of cognitive theorists, cognitive accounts are often no more parsimonious than corresponding motivational accounts (Kunda, 1990). In addition, a number of investigators (e.g., Abelson, 1979; Pyszczynski & Greenberg, 1987) have argued that a complete understanding of human behavior and experience necessarily entails a consideration of affective, cognitive, and motivational processes. These considerations have led several investigators (e.g., Kruglanski & Klar, 1987; Kunda, 1990; Pyszczynski & Greenberg, 1987) to propose that human social cognition involves both directional (motives) and non-directional (accuracy) goals.

Although the discounting and selective learning hypotheses are compatible with both cognitive and motivational accounts (Aronson, 1989; Lord et al., 1979; Roberts, 1985), the above considerations suggest integrating these mechanisms within a cognitive-motivational model of ESP belief-perseverance. Specifically, we developed a model of ESP belief-perseverance which suggests that subjects engage in evidence-discounting and selective learning in order to reduce the negative arousal associated with exposure to belief-discrepant evidence. This model is based to a large extent on previous work by Jones and his associates (e.g., Jones & Russell, 1980; Russell & Jones, 1980; Zusne & Jones, 1982) and Aronson (1965; 1989).

Jones and Zusne (1982) argued that exposure to

belief-discrepant evidence is associated with negative emotional reactions, and distortion of that evidence. Russell and Jones (1980) hypothesized that exposure to belief-discrepant evidence evokes negative arousal in subjects, which, if sufficiently high, may interfere with learning; causing subjects to distort or not learn this evidence. They reported that believers who reversed the conclusion of the ESP-disconfirming abstract showed lower levels of negative arousal than those who did not reverse that conclusion; indicating successful dissonance reduction. When believers who reversed the conclusion of the ESP-disconfirming abstract were eliminated from the analyses, the correlation between belief and negative arousal rose from $r = .37$ to $r = .44$ in that condition.

Although evidence-discounting is typically associated with cognitive accounts (e.g., Lord et al., 1979), Aronson (1969) described a similar perseverance mechanism in the context of dissonance theory. Aronson presented an example a smoker who might cope with the dissonance associated with exposure to evidence that smoking is harmful by "belittling" that evidence. The idea of motivated evidence-discounting has also been addressed in several recent cognitive-motivational accounts (e.g., Kunda, 1990; Pyszczynski & Greenberg, 1987). An important idea in these accounts is that even when directional goals become salient, subjects do not process information in an unconstrained manner. Instead, subjects' responses are typically constrained

by their perceived plausibility (Kunda, 1990). In fact, it appears that even when subjects are processing information in a biased manner, they are still concerned with conveying an "illusion of objectivity" (Pyszczynski & Greenberg, 1987). According to Pyszczynski and Greenberg (1987), one important way in which individuals can create such an "illusion of objectivity" is through evidence-discounting.

The idea that subjects' responses are constrained by plausibility considerations may shed additional light on Grant's (1987) failure to obtain a discounting effect for his ESP believers and nonbelievers. Without critiques of ESP studies, his subjects were, perhaps, constrained by plausibility considerations from making biased evaluations of those studies. However, the presence of these types of critiques could remove those constraints, and facilitate evidence-discounting.

Belief and perceived control. Jones and his co-workers (e.g., Jones & Russell, 1980; Zusne & Jones, 1982) hypothesized that the magnitude of subjects' negative emotional reaction to belief-discrepant evidence is a function of the personal importance of their belief. They further argued that the personal importance of ESP and other paranormal beliefs derives from their ability to satisfy important human psychological needs. One need which may be satisfied by these beliefs is the need to experience events in one's life as being controllable and predictable (e.g., Singer, 1977; Zusne & Jones, 1982).

Specifically, beliefs that one's desires, feelings, and thoughts can influence external events, or that one can acquire information about events in the physical or social environment by paranormal means may foster an illusion of mastery over the physical and/or social environments. These feelings of mastery could then either complement or compensate for perceptions of control in more mundane matters (cf. Davies & Kirkby, 1985; McGarry & Newberry, 1981).

One prediction which derives from this functionality hypothesis is that believers should have an internal locus of perceived control. According to Rotter (1966),

When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an individual, we have labeled this a belief in external control. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, we have termed this a belief in internal control (p. 1).

A number of studies (e.g., Haraldsson, 1981; Jones, 1980; Jones et al., 1977; McGarry & Newberry, 1981; Scheidt, 1973;

Tobacyk & Milford, 1983) have investigated the relationship between paranormal belief and perceived locus of control. However, these studies typically reported either negative findings, or that believers were more external than nonbelievers. Davies and Kirkby (1985) recently criticized these studies for failing to take into consideration the multidimensionality of both paranormal belief and perceived control. For instance, factor analytic studies of paranormal belief (e.g., de Groot & Johnston, 1990; Tobacyk & Milford, 1983) have indicated that this construct is composed of several related but separate dimensions. Although these dimensions may load on an underlying higher order factor, they, nonetheless, display different patterns of intercorrelation with measures of other psychological attributes (e.g., de Groot & Johnston, 1990; Tobacyk & Milford, 1983).

A growing number of studies (for brief reviews see Davies & Kirkby, 1985; Paulhus, 1983) have similarly indicated that perceived control can be usefully conceptualized as a multidimensional construct. For instance, Paulhus (1983) recently validated a model of perceived control which suggests that people can have varying perceptions of control within three primary behavioral spheres. According to Paulhus, people develop perceptions of locus of control through interactions with the nonsocial environment (personal efficacy), the social environment (interpersonal control), and the socio-political environment (socio-political control). Based on this model, Paulhus (1983)

developed a 30-item questionnaire which measures perceived control in each of these three behavioral spheres; the Sphere of Control (SOC) scale. Initial validation of the SOC (Paulhus, 1983) indicated that these three dimensions typically showed only small intercorrelations with each other, and that scores on the Rotter I-E scale were most highly correlated with scores on the Sociopolitical Control scale.

Davies and Kirkby (1985) recently investigated the relationship between paranormal belief and perceived control using the SOC of Paulhus (1983) and the Belief in Paranormal Phenomena questionnaire (BPP) of Tobacyk and Milford (1983). The BPP yields both a full scale score indicative of overall paranormal belief, and subscale scores indicative of belief in more specific paranormal phenomena, such as Psi belief. Davies and Kirkby found that, although belief in Psi was associated with an internal locus of control in the interpersonal sphere of behavior, this belief was associated with an external locus of control in the sociopolitical sphere of behavior. In addition, although scores on the Psi belief subscale were not significantly correlated with Personal Efficacy scores, these belief scores loaded moderately (.62) on a canonical variate characterized by high-moderate loadings on Personal Efficacy (.71), and Interpersonal Control (.72). Although the findings of Davies and Kirkby are consistent with the functionality hypothesis that belief in ESP serves as adjunct or alternative means of attaining

feelings of mastery over one's immediate social and nonsocial environments, no replication attempts of these findings have as of yet been reported.

Knowledge Structure and Belief-Perseverance

The above model suggests that believers discount and distort belief-disconfirming information in order to reduce the negative arousal evoked by exposure to that information. In contrast, Pratkanis (1989) recently argued that subjects' reactions to attitude-related evidence are moderated by the type of knowledge structure which supports their attitudes. According to Pratkanis, some attitudes exhibit a bipolar knowledge structure which "contains not only arguments, beliefs, and expectations supporting one position, but also opposing information (and perhaps counterarguments refuting this material)" (1989, p. 85). A bipolar knowledge structure would be expected for important social issues such as, abortion, nuclear power, capital punishment, and the like. Other attitudes exhibit a unipolar knowledge structure, with knowledge increasing as a linear function of positive attitude. For instance, a positive attitude toward sports is associated with increased knowledge concerning the rules of different sports, the best players in those sports, and the like.

Pratkanis (1989) argued that memory for attitude-relevant terms and information is a function of the degree of development of the knowledge structure associated with subject's attitude.

More specifically, Pratkanis argued that recall performance will be a positive function of subjects' knowledge of the attitude domain. According to him, selective learning effects will only occur for attitudes exhibiting a unipolar knowledge structure, because only subjects possessing a positive attitude are expected to possess the knowledge structures necessary for encoding and/or retrieving attitude-relevant terms and information. In contrast, subjects are likely to counterargue attitude-discrepant information when their attitudes are associated with a bipolar knowledge structure. Several unpublished studies by Pratkanis (reported in Pratkanis, 1989) have indicated support for the knowledge structure hypothesis. Those studies indicated that selective learning only occurred for attitudes exhibiting a unipolar, but not a bipolar knowledge structure.

Although no study has as of yet investigated the role of knowledge structures in ESP belief-perseverance, this hypothesis could be easily tested by asking subjects to list arguments both for and against the ESP hypothesis (cf. Pratkanis, 1989). Interestingly, the predictions of the knowledge structure hypothesis might be different from those of the cognitive-motivational model. Specifically, the available evidence (e.g., Jones & Zusne, 1981; Zusne & Jones, 1982) suggests that belief in ESP among college students may be positively related to knowledge of the paranormal. For instance, Jones and Zusne (1981) found that believers in the paranormal who

had attempted a paranormal phenomenon scored higher on a questionnaire measure of objective knowledge about the paranormal than other believers and nonbelievers. These considerations would imply that any selective learning effect obtained for ESP belief would take the form of superior recall of ESP-confirming evidence by believers. In addition, if evidence-discounting represents a form of counterarguing (Kunda, 1990), then the knowledge structure hypothesis would predict that only believers exposed to ESP-disconfirming evidence would engage in discounting.

Pratkanis (1989) explicitly argued that the focus of convenience of his knowledge structure hypothesis was attitudes, but not beliefs. However, although these constructs are conceptually distinct (e.g., Lingle & Ostrom, 1981), they are often related in practice (e.g., Ajzen & Fishbein, 1980; Tourangeau, Rasinski, & D'Andrade, 1991). For instance, it is likely that people who believe in ESP will also hold positive attitudes toward this phenomenon. Consequently, ESP beliefs could reflect an underlying unipolar knowledge structure.

Reasoning Errors and Paranormal Belief

The studies of Festinger et al. (1956), Grant (1987), and Russell and Jones (1980) were based on the assumption that similar dynamics underly the perseverance of ESP and other common social beliefs. In addition, these investigators assumed that the only important difference between believers and nonbelievers

in ESP is their opinion regarding the existence of that phenomenon. In contrast to these ideas, a number of investigators (e.g., Blackmore & Troscianko, 1985; Wierzbicki, 1985) have suggested that there are cognitive/intellectual differences between believers and nonbelievers which affect the processing of belief-relevant information. According to the 'reasoning error' hypotheses of Blackmore and Troscianko (1985) and Wierzbicki (1985), differences between believers and nonbelievers in deductive and inductive reasoning ability underly both the acquisition and the perseverance of ESP belief.

Inductive Reasoning

A number of investigators (e.g., Alcock, 1981; Marks & Kammann, 1979; Zusne & Jones, 1982) have noted that believers in ESP phenomena frequently attribute their belief to personal experiences. In addition, studies (e.g., Alcock, 1981; McClenon, 1984; Polzella, Popp, & Hinsman, 1975) have reported significant associations between measures of ESP belief and subjects' self-reports of having experienced one or more ESP phenomena. Based on these reports, Blackmore and Troscianko (1985) proposed an account of how belief in ESP could be acquired from and supported by personal experience. They suggested that most commonly reported ESP experiences, such as precognitive dreams, can be usefully conceptualized as simple coincidences between external events and subjective states (dreams, feelings, thoughts). Although such co-occurrences would be expected to

occur occasionally by chance alone, misjudgments of the probabilities involved might predispose some people to underestimate the likelihood of such chance occurrences. As a result, these individuals might reject a naturalistic explanation in terms of chance co-occurrence in favor of the alternative hypothesis of ESP causation.

One prediction which derives from this account is that belief in ESP is associated with errors in probabilistic reasoning. Blackmore and Troscianko (1985) tested this hypothesis by comparing the performance of subjects who scored either above or below the mean on a measure of belief in ESP on several tasks involving probabilistic reasoning. Subjects were asked to 1) generate a string of 20 random numbers using only the digits from 1 to 5; 2) determine the biasedness or unbiasedness of 12 random mixtures of boys and girls invited to a hypothetical party; 3) determine the biasedness or unbiasedness of a hypothetical coin as a function of varying probabilities of obtaining 'heads' ($p = .50$ or $p = .75$) and varying numbers of tosses ($n = 4, 12, 20,$ or 60); and 4) to answer questions about sampling with or without replacement.

Blackmore and Troscianko (1985) performed two separate studies using these reasoning problems, and concluded that belief in ESP was related to probabilistic reasoning errors. However, even a cursory examination of their results suggests only equivocal support for this relationship. For one, significant

differences in performance were only obtained on one type of reasoning problem in each study. Moreover, the two problems which discriminated between believers and nonbelievers differed between the two studies. In the first study, the nonbelievers were significantly better than believers at estimating the biasedness of hypothetical coins as a function of the probability of obtaining 'heads,' and the number of coin-tosses. However, this problem did not significantly discriminate between believers and nonbelievers in the second, larger study. Instead, the results of the second study indicated that believers made significantly more errors than nonbelievers on the sampling questions. Thus, in contrast to the conclusion of Blackmore and Troscianko, these findings provide only equivocal support for the existence of reliable differences in probabilistic reasoning between believers and skeptics.

Another problem with this reasoning error account involves the levels of performance shown by both believers and nonbelievers on the probabilistic reasoning tests. Although Blackmore and Troscianko found that nonbelievers performed significantly better than believers on some probability tests, both believers and nonbelievers typically performed poorly on these tests. According to the reasoning error hypothesis, nonbelievers would, therefore, also be susceptible to making the types of inductive reasoning errors which lead to psi belief. The fact that, by definition, nonbelievers do not believe in ESP

could present a problem for this version of the reasoning error hypothesis. Of course, one possibility is that reasoning performance must fall below a particular level before ESP belief can be acquired and subjectively validated. However, the reasoning error hypothesis does not address this issue.

Blackmore and Troscianko (1985) also claimed support for probabilistic reasoning differences between believers and disbelievers based on the results of an illusion of control study. According to Langer (1975), the introduction of skill-related cues in situations where outcomes are determined by chance leads subjects to believe that skill is being exercised. Earlier, Benassi, Sweeney, and Drevno (1979) had reported significant relationships between subjects' responses to a paranormal belief questionnaire and their ratings of perceived control and perceived success during a psychokinesis experiment. Although Benassi et al. (1979) obtained these associations in the context of a psychokinesis experiment, Blackmore and Troscianko (1985) hypothesized that believers in ESP would be more susceptible than skeptics to an illusion of control, regardless of whether or not the task was presented as a parapsychology experiment.

Blackmore and Troscianko (1985) tested this hypothesis using a computerized coin-tossing game. One hundred medical students were instructed to make a coin on a computer screen fall as either a head or a tail using a push-button. Unknown to

subjects, only half the trials made actual control possible; on the remaining trials the outcome of the simulated coin-tossing procedure was randomly determined. Following the computer game, subjects completed a belief in ESP questionnaire and were assigned to either a belief or nonbelief grouping based on a mean-split of their questionnaire scores.

One of the hypotheses which Blackmore and Troscianko (1985) tested in this experiment was that believers would overestimate their own performance, and remember more 'hits' than nonbelievers. However, in contrast to that prediction, Blackmore and Troscianko found that believers actually recalled significantly fewer 'hits' than nonbelievers. Blackmore and Troscianko hypothesized that the latter finding may have reflected believers' underestimation of chance-level scoring during the game. To test this hypothesis, they asked a sub-sample of their subjects to estimate the number of 'hits' they would have obtained out of 20 tosses if their eyes were closed. In line with their prediction, Blackmore and Troscianko reported that nonbelievers gave significantly more accurate estimates of chance-level scoring than believers. In fact, whereas the average estimate of chance-level scoring for nonbelievers was 9.6/20, the average estimate was 7.9/20 for believers.

Blackmore and Troscianko (1985) labeled the lower estimates of chance-level scoring by believers the 'chance-baseline shift.'

According to them, the chance-baseline shift could represent an important mechanism whereby ESP beliefs could be subjectively validated despite objectively disconfirming information:

[The chance-baseline shift] provides a possible mechanism by which both the illusion of control and belief in psi could be continuously reinforced. If a person consistently underestimates the size of any pure chance effect, then when chance outcomes occur he will seek an additional explanation. This may be in terms of his own control and so produce an illusion of control, or may be interpreted as psi, so confirming his belief in the ESP. In this way errors in judgements of probability might underly both the illusion of control and belief in psi (Blackmore & Troscianko, 1985, p. 466).

Blackmore and Troscianko (1985) did not make a connection between their findings and the report by Jones and Russell (1980). However, it is clear that the chance-baseline shift hypothesis presents an alternative interpretation of the Jones and Russell's findings. Recall that Jones and Russell (1980) found that believers persevered in their belief despite exposure to disconfirming feedback during an ESP card-guessing task. Although Jones and Russell provided their subjects with an explanation of chance-level scoring, it is possible that believers, nonetheless, underestimated the probability of chance

matches during the guessing tasks. As a result, they may have subjectively interpreted objectively disconfirming evidence as validating their ESP belief.

Recently, de Groot, Hordy, Johnston, & Spanos (1991) tested this hypothesis using an ESP card-guessing task. Believers and nonbelievers in ESP rated themselves for perceived ESP ability. After making their ratings, subjects underwent 60 trials of an ESP card-guessing task. On each trial, subject were asked to guess which one of five symbols was on the front of an ESP Zener card held by the experimenter. Subjects received one of four different types of feedback concerning their guessing performance: Subjects in the no feedback condition only received feedback at the end of the experiment. Subjects in the accurate feedback condition received feedback following each guessing trial. Subjects in the negative feedback condition received bogus feedback after each trial suggestive of a very poor guessing performance (3 'hits'/60 trials). Subjects in the positive feedback condition received bogus feedback after each trial suggestive of highly accurate guessing (24 'hits'/60 trials). Following the guessing task, subjects were asked to estimate the number of 'hits' they made and mean chance expectation for the task, and were again asked about their perceived ESP ability.

Contrary to the chance-baseline shift hypothesis, de Groot et al. did not find a relationship between belief in ESP and

subjects' estimates of mean chance expectation for the guessing task. Instead, subjects' estimates of mean chance expectation were related to the type of feedback they received during this task; with subjects in the positive feedback condition giving significantly higher estimates than subjects in the negative feedback condition. However, subjects' estimates of mean chance expectation did not differ significantly from those of subjects' who received either accurate or no feedback. The fact that the majority of subjects reported not having ESP ability suggested a cognitive-motivational explanation for our findings: Although subjects' estimates of mean chance expectation reflected their performance expectations for the guessing task, this directional tendency was constrained by their awareness of the actual mean chance expectation for the guessing task.

Although subjects who received accurate feedback did not change their belief concerning their own ESP ability, the small number of subjects per cell ($n = 15$) precluded a correlational test of the selective learning hypothesis. However, contrary to that hypothesis, we did not find that subjects' increased their ESP ability estimates following exposure to bogus positive feedback. The finding that subjects in the latter condition did not change their ESP ability estimates may reflect differences between our own feedback manipulation and that of Jones and Russell (1980). Unlike our manipulation, which involved subjects obtaining twice the number of 'hits' than would be expected by

chance alone, the confederate in the Jones and Russell study guessed correctly on more than half of the guessing trials. Alternatively, our findings may indicate that although subjects are willing to accept the idea that someone else has ESP, they are resistant to the idea that they themselves possess this extraordinary ability.

Deductive Reasoning

At least two studies (Polzella et al., 1975; Wierzbicki, 1985) have compared the deductive reasoning performance of believers and nonbelievers in ESP. Polzella et al. (1975) asked believers and nonbelievers in ESP to evaluate the validity of 28 categorical syllogisms. Although Polzella et al. reported that nonbelievers made fewer reasoning errors than believers, that difference was only marginally significant ($p < .10$). More recently, Wierzbicki (1985) compared the reasoning performance of believers and nonbelievers on 16 syllogisms categorical and conditional syllogisms. In line with the reasoning errors hypothesis, he reported a small, but significant correlation ($r = .28$) between subjects' scores on a paranormal belief questionnaire and the number of errors they made on the syllogisms.

Wierzbicki (1985) also proffered an alternative account of the asymmetry in selective learning reported by Jones and Russell (1980; Russell & Jones, 1980). Recall that Jones and Russell reported that believers, but not nonbelievers, persisted in

concluding that ESP had occurred despite exposure to disconfirming information. Although Jones and Russell attributed these findings to selective learning, Wierzbicki attributed them to reasoning errors. According to him,

It is possible that believers attend to attitude-discrepant evidence as well as skeptics do but differ from skeptics in their ability to draw valid conclusions from the evidence. For example, believers may conclude that ESP had occurred even in the face of evidence to the contrary. Thus, they would make errors when asked to interpret this evidence. Once errors in interpretation have occurred, subjects would then err when recalling the outcome of the event (Wierzbicki, 1985, p. 490).

Wierzbicki (1985) tested this hypothesis by varying the logical form of the 16 syllogisms he administered to subjects. Specifically, his syllogisms involved two overall logical forms: Half of the syllogisms asked subjects to evaluate the validity of hypotheses given evidential statements (hereafter called 'Form A' syllogisms). An example of a Form A syllogism is:

If A is true, then B will be observed.

B is observed.

Therefore: A is true.

The remaining syllogisms asked subjects to evaluate the validity of empirical predictions generated from given hypotheses

(hereafter called 'Form B' syllogisms). An example of a Form B syllogism is:

If A is true, then B will be observed.

A is true.

Therefore: B will be observed.

In line with the reasoning error hypothesis, Wierzbicki found that belief and reasoning errors were significantly correlated when participants evaluated Form A syllogisms ($r = .28$), but not when they evaluated Form B syllogisms ($r = -.06$).

Although Wierzbicki initially presented this hypothesis as an alternative to selective learning, he later asserted that these hypotheses were not "mutually exclusive" (1985, p. 493). However, several considerations suggest that these hypotheses may, in fact, be incompatible with each other. For one, the reasoning error hypothesis attributes individual differences in ESP belief to individual differences in logical reasoning ability. In contrast, the selective learning account of Jones and his associates attributes the differential processing of belief-relevant information to individual differences in ESP belief. The selective learning hypothesis also predicts no differences in logical reasoning ability between believers and nonbelievers. This hypothesis argues that negative arousal is evoked by challenges to important beliefs. But, these challenges essentially involve people's awareness or realization of a logical incompatibility between their belief and the available

evidence (cf. Kruglanski & Klar, 1987). Therefore, the negative arousal evoked by belief-discrepant evidence is contingent upon people's ability to perceive a logical inconsistency between these cognitions.

There is, however, one sense in which the mechanisms posited by Wierzbicki's account could be compatible with the selective learning hypothesis and the model we are developing. This compatibility is based on the idea of belief-biases in deductive reasoning. According to Evans (1989), "belief bias is exhibited when subjects reject a logically valid conclusion which is unbelievable or when they accept an invalid conclusion which is believable" (p. 71). In line with this hypothesis, several recent studies (Evans, Barston, & Pollard, 1983; Oakhill & Johnson-Laird, 1985; Revlin & Leirer, 1978) found significant effects of the believability of the conclusions on deductive reasoning performance. Interestingly, Wierzbicki (1985) also tested for a belief-bias effect in his study by crossing each level of logical form with two levels of logical content; half of the syllogisms involved ESP content, the remainder involved a neutral, letter content. In line with the belief-bias hypothesis, he reported that belief and reasoning errors were correlated when the syllogisms had an ESP contents ($r = .39$), but not when the contents were neutral ($r = .14$).

A number of explanations have been proposed for the belief-bias effect. Henle (1962) suggested that belief-biases

reflect the failure of subjects to accept the logical task. According to her, subjects simply focus on the believability of the conclusion without attempting to reason logically from the premises to this conclusion. Similarly, Revlin and his associates (e.g., Revlin & Lierer, 1978) have argued that belief-bias effects reflect the rational, but personalized representations of the syllogism's premises. Evans et al. (1983) investigated these issues by asking subjects to verbally explain why they had judged a series of syllogisms to be either valid or invalid. Evans et al. found that subjects' verbal explanations reflected a competition between logical and nonlogical tendencies. According to them,

The picture that finally emerges is that logic and belief conflict throughout, but they do so at different levels. When subjects focus primarily on the conclusion, belief biases are maximal and logical effects are minimal....On about 25% of occasions, though, a genuine premise-to-conclusion inference is attempted, with much higher logical success. It is most important to note, however, that even in cases in which the logical task is accepted, substantial (although lesser) effects of belief bias are still observed (p. 305).

The findings of Evans et al. suggest that belief-biases in reasoning may operate much like evidence-discounting (Evans,

1989). In both cases, subjects evaluate evidence (its logical validity, reliability, etc.) on the basis of its perceived compatibility with their prior belief.

These considerations may mitigate Wierzbicki's (1985) interpretation of the asymmetric selective learning effect reported by Russell and Jones (1980). Recall that Wierzbicki tested this hypothesis by summing over all syllogisms involving a similar logical form. His overall scores for different logical forms, therefore, reflected subjects' performance collapsed across levels of content. As a result, differences in the number of reasoning errors made by believers and skeptics could indicate either consistent differences on most problems, or on only a few specific problems; namely, those involving ESP contents. Unfortunately, Wierzbicki did not test for a possible three-way interaction of prior belief, logical form, and problem content on reasoning performance.

It is worth noting that both Polzella et al. (1975) and Wierzbicki (1985) used conclusion-evaluation tasks to test for a relationship between belief and reasoning errors. The subjects in these studies were given syllogisms containing both the conclusion and the premises, and asked to judge whether or not the conclusion was valid. Conclusion-evaluation tasks may be contrasted with conclusion-production tasks in which subjects are only given the premises of the syllogisms, and are then asked to generate or produce the appropriate conclusions. Although

conclusion-evaluation tasks have been used frequently in research on deductive reasoning, Evans (1989) and Bara and Johnson-Laird (1985) have recently criticized the use of these types of measures. According to these investigators, conclusion evaluation tasks confound actual premise-to-conclusion reasoning with unrelated factors.

One factor which may confound the measurement of reasoning ability on conclusion evaluation tasks is the believability of the conclusions (Evans, 1989). This consideration suggests that belief-biases could be reduced when the reasoning task involves a conclusion production task rather than a conclusion evaluation task. Barston (1986; reported in Evans, 1989) tested this hypothesis using the same premises as those used earlier by Evans et al. (1983). However, unlike Evans et al. who used a conclusion-evaluation task, Barston used a conclusion-production task. In line with the speculations of Evans (1989), Barston found no evidence of a belief-bias effect when subjects had to generate their own conclusions to the syllogisms.

Taken together, the issues considered above suggest only equivocal support for the reasoning error hypotheses of Blackmore and Troscianko (1985) and Wierzbicki (1985). Although Blackmore and Troscianko reported differences in inductive reasoning between believers and nonbelievers, these differences were not consistent across their two studies. In addition, de Groot et al. (1991) failed to replicate their findings of a

chance-baseline shift for believers. Our review also suggests that Wierzbicki's finding of a difference in inductive reasoning performance between believers and nonbelievers may be an artifact of his reasoning measures.

Dogmatism

Another individual difference variable which has been implicated in the perseverance of ESP and other paranormal beliefs is dogmatism. Dogmatism refers to the extent to which an individual's belief system is closed to new information (Rokeach, 1967). Individuals who score high on dogmatism should be relatively more resistant to belief-discrepant information than individuals who score low on this dimension. Although several studies (e.g., Alcock & Otis, 1980; Jones, 1980; Tobacyk & Milford, 1983) have tested for a relationship between ESP and related beliefs and dogmatism, those studies reported inconsistent findings. Alcock and Otis (1980) found a positive correlation between belief in psychic phenomena and dogmatism. Tobacyk and Milford (1983) reported a positive, but non-significant relationship between questionnaire measures of psi belief and dogmatism. In contrast, Jones (1980) found a marginally significant negative correlation between belief in parapsychological phenomena and dogmatism. Thus, further study is needed to evaluate the extent to which belief in ESP may persevere as a function of closed-mindedness on the part of believers.

Summary

A number of hypotheses have been invoked to explain the perseverance of ESP and other paranormal beliefs. One hypothesis suggests that these beliefs persist, because believers are simply more dogmatic than nonbelievers. The reasoning error hypotheses of Blackmore and Troscianko (1985) and Wierzbicki (1985) argue that the dynamics of ESP belief, including acquisition and perseverance, reflect individual differences in reasoning ability between believers and nonbelievers. These hypotheses suggest that belief in ESP perseveres, because believers characteristically underestimate the likelihood of chance occurrences, and/or because they make logical errors in interpreting belief-relevant evidence. Although the dogmatism and reasoning error hypotheses suggest that differences between believers and nonbelievers contribute to ESP belief perseverance, it is also possible that this phenomenon reflects mechanisms which are common to a variety of social beliefs. For instance, belief in ESP may persist, because believers discount, distort, or ignore belief-discrepant evidence as a means of coping with the negative arousal associated with exposure to this evidence.

The remainder of this paper presents three studies which tested these hypotheses. The first study was a pilot study which investigated the reasoning errors hypothesis using materials similar to those used by Blackmore and Troscianko (1985), Polzella et al. (1975), and Wierzbicki (1985). The second study

investigated the roles of inductive reasoning errors and the chance-baseline shift in the perseverance of ESP belief during an ESP card-guessing experiment. The third study investigated the relationship between deductive reasoning performance and ESP belief using a conclusion production task. This study also tested the cognitive-motivational model of ESP belief-perseverance, and the knowledge structure hypothesis of Pratkanis (1989).

The third study involved two belief domains. Subjects rated the extent to which they believed in the deterrent effects of capital punishment and the ESP hypothesis. The deterrence hypothesis was chosen for several reasons: First, this attitude/belief domain was also used by Lord et al. (1979) in their test of the discounting hypothesis. In addition, Roberts (1984) reported a selective learning effect for capital punishment material. Roberts found that subjects with a favorable attitude toward the use of capital punishment showed better recall of pro-capital punishment material than subjects who opposed this punishment. In both of the principal studies, we tested the relationship between ESP belief and dogmatism.

Pilot Study

A pilot study was conducted to test the relationship between ESP belief and deductive and inductive reasoning. The subjects in this study received four probability tests similar to those used by Blackmore and Troscianko (1985). However, unlike Blackmore and Troscianko (1985) who asked subjects to evaluate the randomness of 12 strings of 12 digits each, we asked subjects to evaluate the randomness of 15 strings of 20 digits each. Moreover, whereas Blackmore and Troscianko used only random strings, five of our strings involved non-random series of digits. The subjects were also tested on a conclusion evaluation task. The syllogisms for this task were taken from Polzella et al. (1975), and Wierzbicki (1985). Unlike previous studies, we also tested deductive reasoning in believers and nonbelievers using the Wason selection task (e.g., Evans, 1989).

Method

Subjects

Subjects were 38 (21 males, 16 females; gender information missing on 1 subject) introductory psychology students who received course credit for their participation.

Materials and Procedure

All of the subjects were tested during the same group session. Upon their arrival at the testing room, subjects were greeted by the experimenter who administered the questionnaire package. The first questionnaire in this package was a 10-item

belief in ESP scale which is currently being validated in our laboratory (e.g., de Groot & Johnston, 1990). Appendix ? presents this questionnaire. Subjects were asked to rate the extent of their agreement or disagreement with each statement on this questionnaire using a five-point likert-type scale, ranging from **strongly disagree** (scored 1), to **strongly agree** (scored 5).

The next questionnaire was a conclusion-evaluation task. The subjects were asked to evaluate the logical validity of 37 syllogisms. Twenty-one of these syllogisms were taken from Polzella et al. (1975); the remaining 16 were taken from Wierzbicki (1985). The latter syllogisms involved two logical forms; determining the validity of hypotheses given evidential statements (Form A), and judging the validity of empirical predictions from given hypotheses (Form B), crossed with two contents; ESP and letter. The syllogisms were administered in the same random order to all of subjects.

Following the syllogisms, subjects received four probability tests similar to those used by Blackmore and Troscianko (1985). These tests were administered in the same order as those of Blackmore and Troscianko. The first test was a randomness generation task. The subjects were told that, "A hat contains a large number of pieces of paper with the digits 1, 2, 3, 4, and 5 on them in equal proportion. Please write a list of 20 numbers in the order that you think they might be drawn from this hat." The dependent measure for this task was the number of 'doubles'

(i.e., the same number repeated twice in succession) generated by subjects. The mean chance expectation (MCE) for this task was four doubles (Blackmore & Troscianko, 1985).

The next test was a randomness evaluation task similar to that employed by Blackmore and Troscianko. The subjects were asked to judge the randomness of 15 strings of 20 numbers each. Each string contained only the digits from zero through five, inclusive. All of the non-random strings involved systematic series such that subsequent numbers in that series could be logically inferred from previous ones. None of the non-random strings contained any 'doubles.' The random number strings were all taken from a table of random numbers, and each string contained at least one set of doubles. Subjects were asked to make their judgments on a dichotomous scale, with Y indicating randomness and N indicating nonrandomness. Correct ratings were scored '1'; incorrect ratings were scored '0.'

The subjects were also asked to judge the biasedness or unbiasedness of coins based on the outcomes of hypothetical coin-tossing experiments. The outcomes presented to subjects were a function of the probability of obtaining 'heads' ($p = .50$, or $.75$), and the number of times the coin was tossed ($n = 4, 12, 20$, or 60). Subjects were asked to judge the biasedness of the hypothetical coins using a dichotomous scale, with Y indicating biasedness and N indicating unbiasedness.

The last probability test asked subjects to predict the

likely outcomes of experiments involving sampling with or without replacement. For each problem, subjects were instructed to check one of three alternatives; one outcome is more likely than the other, the other outcome is more likely, or both outcomes are equally likely. (The soccer question in this problem was modified so that the two teams involved were from Canadian rather than British cities.) Correct responses were scored '1'; incorrect responses were scored '0.'

The last reasoning problem was the Wason selection task (e.g., Evans, 1989). Subjects were presented with four hypothetical cards. The first two cards contained the letters 'A' and 'K,' respectively; the next two cards contained the numbers '5' and '4,' respectively. Subjects were told that each card had a letter on one side, and a number on the other side. Subjects were asked which cards they would need to turn over to test the rule that, "if a card has a vowel on its letter side, then it has an even number on its number side." The subjects received 1 point for indicating that the rule could be tested by turning over the card marked 'A,' and the card marked '5.' All other responses were scored zero.

Results

Descriptive Statistics

Subjects' judgements of the validity of the syllogisms were summed to yield the following measures: the total number correct on the Polzella et al. (1975) syllogisms, the total number

correct on syllogisms involving ESP content, the total number correct on syllogisms involving letter contents, total number correct on syllogisms involving judgements of the validity of hypotheses given evidential statements (Form A), and the total number correct on syllogisms involving judgements of the validity of empirical predictions (Form B). The subjects' evaluations of the randomness of the 15 number strings were summed to yield scores reflecting the total number correct on the random and on the non-random number strings. A similar procedure was used for the sampling questions. The subjects' ratings for the coin-tossing task were scored and summed following the procedure outlined by Blackmore and Troscianko (1985). Table 1 presents the means and standard deviations for the ESP belief measure, and the deductive and inductive reasoning tasks.

Correlational Analyses

Table 2 presents the intercorrelations between subjects' scores on the belief in ESP questionnaire, the syllogistic reasoning indices, the probabilistic reasoning indices, and the card selection task. As this table indicates, the only correlation between ESP belief and reasoning performance which even approached conventional levels of statistical significance was in the direction opposite to that predicted by the reasoning error hypothesis. ESP belief was positively correlated with performance on syllogisms involving a letter contents, $r(36) = .27$, $p < .05$ (one-tailed). The significant intercorrelations

between the syllogistic reasoning measures can mainly be attributed to linear dependency among these measures. Interestingly, performance on syllogisms involving judging the validity of empirical predictions from given hypotheses was uncorrelated with performance on syllogisms involving judging the validity of hypotheses given evidential statements. In addition, performance on syllogisms involving letter contents was uncorrelated with syllogisms involving ESP contents. The only significant intercorrelation between the probabilistic reasoning items involved the two randomness evaluation tasks; $r(36) = -.33, p < .05$.

Table 1

Mean-ESP-belief-and-Inductive-and-Deductive-Reasoning-Scores

Variable	M	SD
ESP-belief	30.37	6.59
Doubles	1.14	0.82
Random number strings	7.66	2.40
Non-random number strings	3.84	1.18
Coin-tossing	0.24	0.54
Sampling problems	2.03	0.72
Wason selection task	0.11	0.31
ESP content	6.11	0.95
Letter content	6.29	0.87
Form A	5.87	1.10
Form B	6.53	0.60
Polzella	13.24	2.91

Note. n = 38

Table 2

Intercorrelations between the ESP Belief and Inductive and
Deductive Reasoning Measures

Measure	1	2	3	4	5	6	7	8	9	10	11	12	
1 ESP---		.07	-.08	.09	-.10	.19	-.02	.07	.27	.16	.21	-.07	
2 Doubles---			.01	.05	-.07	-.06	.05	.08	.25	.30	-.04	-.04	
3 Random				---	-.33*	-.16	-.10	-.17	-.03	-.12	-.04	-.15	-.10
4 Non-random					---	-.24	.23	-.03	.06	-.01	.13	-.15	.10
5 Coin-toss						---	.12	.01	-.42*	.02	-.26	-.14	-.24
6 Sampling							---	-.26	-.00	-.19	-.06	-.16	-.09
7 Wason								---	-.04	.28	.12	.13	.30
8 ESP content									---	.09	.64*	.56*	.45*
9 Letter										---	.64*	.32*	.44*
10 Form A											---	.19	.62*
11 Form B												---	.22
12 Polzella													---

Note. n = 33

ESP = ESP-belief; Doubles = the number of 'doubles' generated by subjects; Random = randomness evaluation task (random number strings); Non-random = randomness evaluation task (non-random number strings); Coin-toss = coin biasedness evaluation task; Sampling = sampling questions; Wason = Wason selection task; ESP content = syllogisms involving ESP content; Letter = syllogisms involving letter content; Form A = syllogisms which involve judging the validity of hypotheses from evidential statements; Form B = syllogisms which involve judging the validity of empirical predictions from given hypotheses; Polzella = the syllogisms used by Polzella et al.

Discussion

The present findings failed to support the reasoning error hypothesis of Blackmore and Troscianko (1985) and Wierzbicki (1985). In contrast to the predictions of Blackmore and Troscianko (1985), we found no significant relationships between subjects' responses to the ESP belief questionnaire and their performance on the inductive reasoning tasks. Although our failure to replicate a relationship between the belief measure and the randomness evaluation task could be attributed to differences in the format of the latter measure, the same criticism cannot explain the lack of relationship between subjects' belief and their performance on the sampling problems. The only difference between the sampling problems in these two studies concerned the cities mentioned in the soccer question.

Contrary to Wierzbicki, we did not find that believers made more errors than nonbelievers on measures of deductive reasoning. Instead, the only correlation between ESP belief and deductive reasoning which even approached conventional levels of statistical significance was in the direction opposite to that predicted by the reasoning error hypothesis.

Although the present findings were inconsistent with the reasoning error hypothesis, these findings were based on a relatively small sample. The hypotheses that believers have lower deductive and inductive reasoning ability than nonbelievers were, therefore, tested again in the two main studies.

Study One

General Outline and Hypotheses

This study involved an ESP card-guessing task similar to that employed by de Groot et al. (1991) and Jones and Russell (1980). Prior to the guessing task, subjects completed the probabilistic reasoning tasks from the pilot study, and filled out questionnaire measures of ESP belief, belief in ESP ability, perceived control, and dogmatism. Subjects also completed a new task which consisted of estimating mean chance expectation for hypothetical card-guessing, coin-tossing, and die-tossing experiments. During the card-guessing task, subjects were asked to guess the symbols on 30 ESP (Zener) cards in succession. One group of subjects received accurate feedback on their performance after each guess. Another group of subjects received feedback indicative of highly accurate guessing performance. Following the card-guessing task, subjects completed questionnaires asking them to estimate their own performance during the task, and the mean chance expectation and critical value for this task. Subjects then completed a second set of ESP belief and ESP ability questionnaires.

This study tested the following hypotheses:

- 1) We tested the hypotheses of Blackmore and Troscianko (1985) that belief in ESP is inversely related to inductive reasoning performance, and that believers characteristically underestimate the frequency of chance occurrences.

2) We also tested the hypothesis of Jones and Russell (1980) that, whereas nonbelievers' judgments of their own ESP ability would be related to their performance on the card-guessing task, believers would indicate having ESP, regardless of their performance on the guessing task.

3) Based on the findings of Davies and Kirkby (1985), we predicted that subjects' ESP belief scores would be related to their scores on the Interpersonal Control, but not the Personal Efficacy and Sociopolitical Control subscales of the Paulhus (1983) Sphere of Control scale.

Method

Subjects

Subjects were introductory psychology students who volunteered for an 'ESP study.' Although 110 subjects originally volunteered, two became suspicious of the bogus feedback manipulation (see below) and were dropped from the analyses. The final sample contained 108 subjects (58 males, 50 females) who received course credit for their participation.

Materials and Procedure

All subjects were tested in individual sessions. Upon their arrival in the testing room, participants were met by the investigator, who asked them to complete a questionnaire booklet. The first page of this booklet asked subjects to estimate mean-chance expectation (MCE) for a coin-tossing, a die-tossing, and a card-drawing experiment, respectively. Appendix 2 presents

these problems. Correct responses received a score of '1;' incorrect responses received a score of '0.'

The remaining four probability tests were similar to those used in the pilot study, with the exception that subjects evaluated the randomness of the number strings and the biasedness of the coins on seven-point scales. The scale alternative for the randomness evaluation task ranged from highly likely that this series was not randomly generated (scored 1), to highly likely that this series was randomly generated (scored 7). The scale alternatives for the biasedness evaluation task ranged from highly likely that the coin was unbiased (scored 1), to highly likely that the coin was biased (scored 7).

The next part of the questionnaire booklet contained the dogmatism, ESP belief, and perceived control measures (see Appendix 9). The ESP belief questionnaire was identical to that used in the pilot study. The dogmatism questionnaire was a 20-item short-form of Rokeach's dogmatism scale developed by Troldahl and Powell (1965). This questionnaire has a split-half reliability of .79, and responses to it correlate highly ($r = .94$) with those to the 40-item full-scale (Troldahl & Powell, 1965). The Sphere of Control scale of Paulhus (1983) contains 30 items, measuring the extent of subjects' perceptions of control within the personal, interpersonal, and sociopolitical spheres of action. Paulhus (1983) reported test-retest reliabilities over a 4-week period of above .90 for this questionnaire. The order of

the three questionnaires was randomly determined for each booklet.

Following the questionnaires, subjects were asked to rate the extent to which they agreed with the statement, "I have ESP ability," on a seven-point scale. The scale alternatives ranged from strongly disagree (scored 1) to strongly agree (scored 7). In addition, subjects were also asked to rate their confidence in their ESP ability rating on an 11-point rating scale, with '0' indicating no confidence, and '10' indicating complete confidence. Appendix C presents the ESP ability and confidence rating scales.

After completing the questionnaire booklet, the experimenter explained the card-guessing task to the subject. The subjects were told that they would receive 30 trials of an ESP card-guessing task. Standard ESP cards were used for the card-guessing task. Standard ESP card decks contain five cards of each of the following five symbols; three wavy lines, a circle, a square, a cross, and a star. The subjects were told that the cards were in equal proportion, but that they would be presented in random order. The order of presentation of the cards was randomized using a random number table before each testing session.

The experimenter and the participant were seated at opposite ends of a 1.5 m table. At approximately 1 m distance from the participant, a partition had been placed on the table, so that

his/her view of the experimenter and his activities was completely obstructed. A small 15 x 15 cm window was cut at approximately eye-level in the middle of this partition. This window was covered on the experimenter's side with a black curtain. On each card-guessing trial, the experimenter presented the back of the card to be guessed to the participant through this window. Following each guess, the experimenter called out either 'hit' or 'miss,' depending on the accuracy of the participant's guess and his/her feedback condition (see below). A photocopy of these five symbols with their labels was placed below the window in the partition.

Feedback conditions. Subjects were randomly assigned to one of two feedback conditions, with an equal number ($n = 54$) of subjects in each condition. Subjects in the Accurate Feedback condition were accurately told whether they had scored a 'hit' or a 'miss' following each card-guessing trial. The mean chance expectation for the Accurate Feedback condition was 6 correct guesses on 30 trials (probability of a 'hit' = .20). Subjects in the Positive Feedback condition received false feedback indicating that they had scored 18 'hits' in 30 trials (probability of a 'hit' = .60). The trials on which the experimenter called 'hit' were randomly determined beforehand for each subject in the Positive Feedback condition.

Following the card-guessing task, subjects completed three short questionnaires asking them 1) the number of 'hits' they

made (perceived performance), 2) the number of 'hits' they would expect by chance alone (chance-level scoring), and 3) the number of 'hits' which would lead them to conclude that ESP had occurred in the experiment (critical value). Appendix four presents these questionnaires. Each of these questions was presented on a separate page, and the order of presentation of the questions was randomized for each subject. After completing these questionnaires, subjects were again administered the ESP ability and confidence rating scales, as well as the 10-item ESP belief questionnaire.

Finally, subjects were debriefed about the purposes of the experiment, their questions addressed by the experimenter, and remunerated for their participation.

Results

ESP Hypothesis

The ESP hypothesis predicts that subjects will guess ESP cards at above chance-levels. A between-groups t -test comparing the guessing performance of subjects in the accurate and positive feedback conditions was non-significant, $t(105) = 0.00$, n.s. The guessing scores of subjects in the accurate and positive feedback conditions were, therefore, combined into an overall test of the ESP hypothesis. The mean number of correct guesses for the entire sample was 5.85, with a standard deviation of 2.06. A one-sample t -test comparing the mean number of correct guesses (5.85) to the average number expected by chance alone

(i.e., 6) was not significant, $t(106) = .17$, n.s.

The 'sheep-goat' hypothesis is a variation of the ESP hypothesis. According to the sheep-goat hypothesis, 'sheep' (believers) will obtain higher ESP scores than 'goats' (nonbelievers) (Palmer, 1977; Rao & Palmer, 1987). This hypothesis was tested using a hierarchical multiple regression analysis (MR). Subjects' responses to the ESP-belief questionnaire were summed to provide a total ESP-belief score. The number of correct guesses made by subjects during the card-guessing task was regressed on the total ESP-belief score, and coded vectors representing treatment condition membership (dummy-coded) and the total ESP-belief score $\times$ treatment condition interaction. Table 3 presents the results of this analysis. As indicated by this table, the overall model did not account for either a meaningful or a significant proportion of the variance in subjects' card-guesses, $R\text{-square} = .03$, $F(3, 103) = 1.11$, n.s. However, an a priori test of the sheep-goat hypothesis indicated a small but significant correlation between ESP-belief and guessing performance, $t(105) = .17$, $p < .05$ (one-tailed).

The 'sheep-goat' hypothesis was also tested using subjects' ratings of their perceived ESP ability. Subjects' performance on the card-guessing task was regressed on vectors representing their perceived ESP ability ratings, treatment condition, and perceived ESP ability $\times$ treatment condition interaction,

respectively. Table 4 presents the results of this analysis. As indicated by this table, the complete model did not account for a meaningful or a significant amount of variance in subjects' guessing performance, $R\text{-square} = .01$, $F(3, 98) < 1$. Nor was there a significant relationship between perceived ESP ability and guessing performance, $r(100) = -.10$, n.s.

Table 3

Summary Table for the Hierarchical Regression of
 ESP-Card-Guessing-Performance-on-ESP-Belief-and-Feedback
 Condition-Membership

Source	Rsq Chg	df	SS	MS	E
Regression		3	14.12	4.71	1.11 n.s.
Belief	.021	1	9.41	9.41	2.23 n.s.
Condition	.001	1	0.58	0.58	< 1
Belief x Condition	.002	1	0.69	0.69	< 1
Residual		103	435.49	4.23	

Table 4

Summary Table for the Hierarchical Regression of
 ESP Card-Guessing Performance on Perceived ESP
 Ability and Feedback Condition Membership

Source	Rsq Chg	df	SS	MS	F
Regression		3	4.82	1.61	< 1
Belief	.003	1	1.46	1.46	< 1
Condition	.000	1	0.11	0.11	< 1
Belief x Condition	.000	1	0.13	0.13	< 1
Residual		98	423.58	4.32	

Between-and-Within-Groups-Analyses

A 2 (accurate feedback/positive feedback) x 2 (first administration/second administration) doubly multivariate analysis of variance (MANOVA) was conducted on subjects' responses to the ESP belief, perceived ESP ability, and confidence questionnaires. The main effect for feedback condition was non-significant, $F(3, 94) = 1.02$, n.s. However, there was a significant effect of administrations, $F(3, 94) = 6.19$, $p < .01$, and a significant feedback condition x administrations interaction, $F(3, 94) = 5.50$, $p < .01$. Table 5 presents the means for the feedback condition x administrations interaction. An examination of the univariate F-tests generated for the feedback conditions x administrations interaction indicated that this interaction was located at the perceived ESP ability measure. The interaction did not approach significance for the ESP belief and confidence measures, $F's < 1$.

The significant interaction for perceived ESP ability was followed-up using simple effects analyses. The feedback conditions did not differ significantly on the first administration of the perceived ESP ability questionnaire, $F < 1$. In addition, the mean perceived ESP ability ratings of subjects in the positive feedback condition did not change significantly over the two administrations of the questionnaire, $F < 1$. However, among subjects in the accurate feedback condition, the perceived ESP ability ratings decreased significantly over the

two administrations of this questionnaire, $F(1, 101) = 37.05$, $p < .05$.

An examination of the univariate F-tests generated as a follow-up to the multivariate main effect of administrations indicated a marginally significant effect on the confidence measure, $F(1, 96) = 3.10$, $p < .10$. However, the addition of cases deleted from the MANOVA procedure also indicated a significant administrations effect on the confidence measure, $F(1, 101) = 5.00$, $p < .05$. Table 5 indicates that subjects had higher confidence in their perceived ESP ability ratings following the card-guessing task than before it.

A 2 (feedback conditions) x 3 (estimates of performance/mean chance expectation/critical value) mixed ANOVA indicated a significant main effect of feedback condition; $F(1, 95) = 56.91$, $p < .001$, a main effect of estimates; $F(2, 190) = 160.31$, $p < .001$, and a significant feedback condition x estimates interaction; $F(2, 190) = 11.52$, $p < .001$. Table 6 presents the ANOVA summary table for this analysis. Table 7 presents the means for the feedback condition x estimates interaction. Simple effects analyses conducted at each level of the estimates factor indicated that subjects who received positive feedback gave significantly higher estimates of their own performance; $F(1, 150) = 70.95$, $p < .001$, mean chance expectation; $F(1, 150) = 5.73$, $p < .05$, and the critical value; $F(1, 150) = 15.73$, $p < .01$ than subjects in the accurate feedback condition. In

addition, the simple effect of estimates was significant at each level of feedback condition; $F(2, 190) = 91.05, p < .001$, and $F(2, 190) = 80.67, p < .001$, for the accurate and positive feedback conditions, respectively. Multiple comparisons among the means for subjects in the accurate feedback condition using the LSD test indicated that subjects' estimates of the critical value were significantly higher than their estimates of both their own performance and mean chance expectation. However, their estimates of their own performance and mean chance expectation did not differ significantly. Multiple comparisons for the subjects in the positive feedback condition indicated that subjects' estimates of the critical value differed significantly from those of their own performance and mean chance expectation. In addition, subjects' estimates of their own performance were significantly higher than those of the mean chance expectation for the guessing task.

Table 5

Mean ESP Beliefs, Perceived ESP Ability, and Confidence Scores
by Feedback Condition and Questionnaire Administration

		Administration		
Feedback condition	Measure	-----		
		1	2	

Accurate	ESP belief	M	31.63	31.65
		(SD)	(5.98)	(6.07)
	ESP ability		3.58	2.73
			(1.25)	(1.50)
	Confidence		5.50	5.71
			(2.90)	(3.46)

Positive	ESP belief		32.46	32.38
			(6.43)	(6.91)
	ESP ability		3.52	3.52
			(1.30)	(1.40)
	Confidence		4.82	5.28
			(3.32)	(2.93)

Table 6

ANOVA Summary Table for the Performance Mean Change
Expectations and Critical Value Estimates by Feedback
Condition

Source	SS	DF	MS	F
Feedback Condition	1872.77	1	1872.77	56.91***
Error	3126.12	95	32.91	
Estimates	7217.27	2	3608.64	160.31***
Feedback x estimates	518.55	2	259.28	11.52***
Error	4276.99	190	22.51	

*** $p < .001$

Table 7

Mean Performance, Mean Chance Expectation, and Critical Value
Estimates by Feedback Condition

Variable	Feedback condition	
	Accurate	Positive
Perceived performance	M 5.77	14.49
	(SD) (2.16)	(3.46)
Chance-level scoring	7.50	9.90
	(2.95)	(4.16)
Critical value	17.85	21.96
	(7.25)	(7.77)

Note. n's = 48 and 49 for the accurate and positive feedback conditions, respectively, for this analysis.

Correlation and Regression Analyses

The subjects' responses to the MCE tests were summed to yield a total chance-level estimation score. The subjects' ratings on the randomness evaluation task were summed to yield a total score for the random and non-random strings, respectively. Subjects' ratings of the biasedness of the coins in the coin-tossing problem were scored and summed following the procedure outlined by Blackmore and Troscianko (1985). Responses to the sampling problem were summed to provide a total sampling score. Table 8 presents the means for the probability questions, and the dogmatism and perceived control questionnaires.

The subjects' responses to the probability questions, the dogmatism and perceived control questionnaires, and the ESP-belief, ESP-ability, and confidence questionnaires were intercorrelated. Table 9 presents the results of this analysis. As indicated by this table, subjects' responses to the perceived ESP ability and ESP belief questionnaires did not correlate significantly with their performance on any of the probabilistic reasoning problems. However, ESP belief scores were significantly correlated with the perceived ESP ability ratings, $r(101) = .36$, $p < .001$, and with scores on the Interpersonal Control scale, $r(105) = .34$, $p < .001$.

Pooled within cell correlations were computed between subjects' estimates of their own performance, chance-level scoring, and the critical value on the card-guessing task.

Subjects' estimates of their performance correlated significantly with their estimates of mean chance expectation, $r(104) = .78$, $p < .001$, and with their estimates of the critical value, $r(97) = .31$, $p < .01$. In addition, there was a small, but significant correlation between their estimates of mean chance expectation and their estimates of the critical value, $r(95) = .24$, $p < .05$.

The subjects' estimates of their own performance, chance-level scoring, and the critical value were entered into hierarchical MR's. The subjects' performance and critical value estimates were regressed on the following blocks of predictors: ESP belief, personal efficacy, interpersonal control, and performance on the mean chance expectation tasks, an effect-coded vector representing feedback condition membership, and product vectors representing the interaction of the ESP belief, personal efficacy, interpersonal control, and performance on the mean chance expectation tasks with feedback condition.

Table 10 presents the results of the hierarchical MR's. As can be seen from this table, the full model significantly predicted subjects' performance, mean chance expectation, and critical value estimates; all F 's (9, 85) ≥ 2.26 , all p 's $< .05$. Table 10 also indicates that only the vector representing feedback condition membership significantly predicted subjects' performance and critical value estimates. Two blocks of predictors contributed significantly to the prediction of subjects' estimates of mean chance expectation for the

card-guessing task; the continuous measures, and feedback condition membership. Examination of the beta-weights for the continuous measures indicated that only subjects' performance on the mean chance expectation tasks was significantly related to their chance-level estimates; $t(94) = -3.29$, $p < .01$ (semi-partial $r = -.33$).

Recall that Jones and Russell (1980) reported that skeptics' (nonbelievers) estimates of their own ESP ability were significantly related to their performance on the card-guessing task. However, believers' estimates were unrelated to their own card-guessing performance. This hypothesis was tested using hierarchical MR. Subjects' ratings of their perceived ESP ability following the card-guessing task were regressed on the following variables; subjects' estimates of their own performance and their ESP belief scores; a product vector representing the interaction of subjects' ESP belief scores and their estimates of their own performance; an effect-coded vector representing feedback condition membership; two product vectors representing the interaction of feedback condition membership with subjects' ESP belief scores and with their estimates of their own performance; and a product vector representing the three-way interaction of subjects' ESP belief scores, estimates of their own performance, and feedback condition membership. Table 11 presents the results of this analysis.

As indicated by table 11, the overall model significantly

predicted subjects' perceptions of their own ESP ability following the guessing task; $F(7, 98) = 4.05, p < .001$. However, only the initial entry of subjects' performance estimates and ESP belief scores was associated with a significant R-square change; $F(2, 103) = 12.50, p < .001$. The beta-weights associated with subjects' ESP belief scores and their estimates of their own performance were both significant; $t(104) = 3.04, p < .01$ (semi-partial $r = .27$), and $t(104) = 3.78, p < .001$ (semi-partial $r = .33$), respectively.

Table 8

Year_Dogmatism_Perceived_Control_and_Inductive_Reasoning
Scores

Variable	M	SD
Dogmatism	68.11	14.69
Personal efficacy	41.09	6.92
Interpersonal control	34.08	5.30
Socio-political control	30.32	7.56
Mean chance estimation	2.22	0.78
Doubles	1.72	1.41
Random number strings	43.66	10.41
Non-random number strings	14.46	7.39
Coin-tossing	0.32	1.36
Sampling problems	2.01	0.83

Note. $.95 \leq r \leq .108$

Table 9

Intercorrelations between the ESP Beliefs, Perceived ESP Ability, Confidence, Perceived Control, Dogmatism, and Inductive Reasoning Measures

1	2	3	4	5	6	7	8	9	10	11	12	13
1---	.36*	-.09	-.09	.34*	.13	-.07	-.09	.16	-.07	.13	-.07	-.02
2	---	.13	.04	.19	.09	.01	.02	-.04	-.03	.03	-.09	.00
3		---	.24*	.06	.00	-.01	.00	.00	-.04	.03	-.07	.14
4			---	.13	.16	.01	.03	.00	.02	-.11	.04	.12
5				---	.03	-.20*	-.04	.00	-.05	-.09	.02	-.08
6					---	-.17	.14	.20*	.13	-.07	.05	-.03
7						---	.04	-.16	-.12	-.07	-.21*	.18
8							---	.08	.02	-.31*	.12	.14
9								---	.05	.33*	.03	-.04
10									---	-.11	-.08	.07
11										---	-.11	-.14
12											---	.13
13												---

Note. $95 \leq n \leq 108$

* $p < .05$

1 = belief in ESP; 2 = perceived ESP ability; 3 = confidence rating; 4 = Personal Efficacy; 5 = Interpersonal Control; 6 = Sociopolitical control; 7 = Dogmatism; 8 = mean chance expectation task; 9 = number of 'doubles'; 10 = randomness evaluation task; 11 = non-randomness evaluation task; 12 = biasedness evaluation task; 13 = sampling questions.

Table 10

~~R-Square Change Scores for the Hierarchical Regression of
Performance, Mean Chance Expectation, and Critical Value
Estimates on ESP Belief and Feedback Condition Membership~~

Independent variables	Dependent variables		
	Guess	Chance	Critical
Block 1:			
ESP belief			
Personal efficacy			
Interpersonal control			
Mean chance expectation	.03	.12*	.07
Block 2:			
Feedback condition	.68***	.13***	.08**
Block 3:			
Block 1 X Block 2	.01	.00	.05
R-Square total	.71***	.25**	.19*

* $p < .05$ ** $p < .01$ *** $p < .001$

Note. Guess = estimates of guessing performance; Chance = estimate of mean chance expectation; Critical = estimates of critical value.

Table 11

**R-Square Change Scores for the Hierarchical Regression of
Perceived ESP Ability on ESP Belief and Estimated
Performance**

Predictor	ESP ability

Block 1:	
Performance	
ESP belief	.20***
Block 2:	
Performance x ESP belief	.01
Block 3:	
Feedback condition	.00
Block 4:	
Performance x Feedback condition	
ESP belief x Feedback condition	.01
Block 5:	
Performance x ESP belief x Feedback condition	.00
R-square total	.22***

*** $p < .001$

Note. $N = 106$.

Discussion

A number of studies (e.g., de Groot et al., 1991; Jones & Russell, 1980; Jones & Zusner, 1981) have found that subjects' belief in ESP is resistant to disconfirmation. In line with those findings, our results indicated that subjects who received accurate feedback concerning their guessing performance did not change their belief in ESP. However, contrary to the findings of de Groot et al. (1991), we found that subjects in the accurate feedback condition revised their estimates of their own ESP ability following the card-guessing task. We also failed to replicate the finding of Jones and Russell (1980) that believers, but not nonbelievers, ignored their own card-guessing performance when making their second set of ESP ability estimates. Instead, we found that both believers' and nonbelievers' second set of ESP ability ratings were significantly related to estimates of their own guessing performance.

These replication failures may be attributed to methodological differences between these studies. Specifically, neither de Groot et al. (1991) nor Jones and Russell (1980) asked their subjects to estimate the critical value for their card-guessing task. An interesting finding concerning that measure was that subjects' critical value estimates typically exceeded their estimates of their own guessing performance. In effect, subjects were admitting both to themselves and to the investigator that they were guessing at only chance levels.

Under these circumstances, it would, therefore, have proven difficult for them to maintain even a pretense of objectivity without revising their ability downwards to some extent.

Like de Groot et al. (1991), we found that subjects who received bogus positive feedback did not revise their beliefs in their own ESP ability upwards. The fact that de Groot et al. failed to obtain an increase in subjects' ESP ability ratings could have reflected the relatively weak positive feedback manipulation in that study. However, the present manipulation involved a 'hit'-rate identical to that of the bogus demonstration arranged by Jones and Russell (1980). Together, these findings suggest that although subjects may be willing to accept the idea that someone else has ESP, they are resistant to the idea that they themselves possess this ability.

The present findings failed to support the chance-baseline shift hypothesis of Blackmore and Troscianko (1985). Contrary to that hypothesis, we found no relationship between subjects' belief in ESP and either their performance on the mean chance expectation problems or their estimates of mean chance expectation following the card-guessing task. Instead, like de Groot et al., we found that subjects' estimates of mean chance expectation for the guessing task were related to their feedback condition membership. Not surprisingly, subjects' estimates were also related to their performance on the mean chance expectation problems. In addition, our findings indicated that subjects'

critical value estimates were also related to their feedback condition. The fact that subjects in this study, like that of de Groot et al., typically rated themselves as being at or below the midpoint on the ESP ability questionnaire suggests further support for the idea that subjects revise their estimates of mean chance expectation or the critical value to conform with their expectations concerning their own ESP ability.

The present findings also failed to support the reasoning error hypothesis of Blackmore and Troscianko (1985). Contrary to that hypothesis, we found no significant negative relationships between either the ESP belief or belief in ESP ability measures, and any of the probabilistic reasoning measures. Together with the results of the pilot study presented earlier, these findings question the idea that believers in ESP differ from nonbelievers in inductive reasoning ability.

Interestingly, although subjects' changed their beliefs in their ESP ability following exposure to disconfirming feedback, they did not also revise their belief in ESP. This finding may reflect the nature of the relationship between subjects' belief in ESP and their belief that they possess ESP ability. The small magnitude of this relationship suggests that although belief in ESP may be a necessary condition for believing one also has ESP ability, not everyone who believes in ESP also believes that they possess this ability. Thus, evidence that they are scoring at only chance-levels may have little impact on subjects' overall

belief in ESP.

The present findings were consistent with those of Davies and Kirkby (1985) concerning the relationship between psi belief and perceived control. Davies and Kirkby (1985) reported a significant relationship between psi belief and internal control expectancies in the interpersonal sphere of activity. In line with their findings, we found that subjects' responses to the ESP belief questionnaire correlated positively and significantly with perceived control in the interpersonal sphere of activity. In addition, we found that subjects with internal control expectancies on this dimension were more likely to increase their belief in their ESP ability in the positive feedback condition. These findings are consistent with the observation by Davies and Kirkby that ESP belief may supplement more mundane perceptions of control, as long as subjects' belief in ESP does not conflict with their perceptions of the nature of reality. More generally, these findings are consistent with the idea that people acquire and internalize ESP and other paranormal beliefs, because these beliefs fulfill important psychological needs (e.g., Arandon, 1984; Kurtz, 1986; Singer, 1977; Zurne & Jones, 1982).

The findings of the present study indicated little support for the ESP hypothesis. This hypothesis predicts that subjects will guess ESP cards at above chance levels. However, we found no evidence of extra chance guessing in our sample. In addition, although we found a relationship between ESP belief and guessing

performance, this relationship was only significant when we used a one-tail test. In addition, a previous test of the sheep/goat hypothesis by de Groot et al. (1991) found no significant correlation between belief in ESP and performance on a similar card-guessing task. More generally, these findings are consistent with a large body of evidence (cf. Alcock, 1987; Brandon, 1984; Hansel, 1980) which indicates that psi phenomena do not occur under well-controlled conditions. The parapsychological interpretation of these findings (e.g., Rao & Palmer, 1987) is that controlled conditions are 'psi-inhibiting.' However, a more parsimonious interpretation is that controlled conditions simply inhibit experimenter and/or subject cheating (Hansel, 1980).

Study Two

General Outline and Hypotheses

This study was primarily designed to test the cognitive-motivational model of belief-perseverance. To this end, subjects were exposed to a short abstract summarizing research on either the deterrence or ESP hypotheses. Within each content domain, the subjects were presented with evidence which either confirmed or disconfirmed the relevant hypothesis.

Following the abstract, subjects were tested for their recall of the stimulus material, their evaluations of this material, and the number of arguments both for and against capital punishment or ESP. Subjects were also tested for deductive reasoning using a conclusion-production task. Subjects were asked to produce conclusions to both valid and invalid syllogisms involving three types of content (deterrence, ESP, or neutral), and at least two logical forms (Form A: deducing the validity of hypotheses given evidential statements; Form B: deducing empirical predictions from hypotheses).

The principal hypotheses tested in this study were as follows:

- 1) Wierzbicki (1985) reported that nonbelievers performed significantly better than believers on problems which involved determining the validity of hypotheses given evidential statements, and on problems with ESP content. This study tested those predictions using a conclusion-production rather than a

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conclusion-evaluation task.

2) If the reasoning error hypothesis is true, then subjects who perform poorly on problems involving ESP content would also perform poorly on problems involving capital punishment content. However, if differences in reasoning ability between believers and skeptics reflect a belief-bias effect (and if beliefs about deterrence and ESP are unrelated), then nonbelievers and believers would not differ in reasoning performance on syllogisms involving capital punishment or neutral content. In addition, if the reasoning errors hypothesis is tenable, then performance on problems which involved determining the validity of hypotheses given evidential statements (collapsed across content) would be negatively correlated with performance on the recall task for subjects receiving abstracts with an ESP content. However, if our model is correct, then subjects' reasoning performance and learning of the belief-disconfirming information would only be related if they showed a belief-bias on the syllogisms.

3) A main focus of this study was the test of the cognitive-motivational model of ESP belief-perseverance. This model predicts that exposure to belief-disconfirming evidence will be associated with negative arousal, evidence-discounting, and selective learning.

5) We also tested several predictions of the knowledge structure hypothesis of Pratkanis (1989). Specifically, we tested the hypotheses that evidence-discounting would occur for

beliefs exhibiting a bipolar knowledge structure, but that selective learning would occur for beliefs exhibiting a unipolar knowledge structure.

Method

Subjects

Subjects were 207 (105 males, 100 females, gender information missing on two subjects) introductory psychology students who volunteered for a 'questionnaire study.' The sample sizes for each cell formed by the crossing of the abstract content and evidence type factors (see below) were as follows: deterrence/confirming evidence, $n = 52$, deterrence/disconfirming evidence, $n = 53$, ESP/confirming evidence, $n = 53$, and ESP/disconfirming evidence, $n = 49$. All subjects received course credit for their participation.

Materials and Procedure

Subjects were tested in group sessions involving up to 20 students. At the beginning of each session, subjects received a questionnaire package containing the experimental materials. The first part of this package contained the dogmatism questionnaire, and a 'Social Beliefs Questionnaire.' The Social Beliefs Questionnaire is a bogus questionnaire created for this study. This questionnaire contains ten items asking subjects' opinions about a variety of social topics; including, abortion, the environment, free trade, and the like. Subjects made their ratings on a seven-point scale ranging from *disagree strongly*

(scored 1) to agree strongly (scored 7). Item four was identical to the question Grant (1987) asked his subjects about ESP, "I doubt very much if extrasensory perception (ESP) exists." Item eight was similarly worded, but with the exception that it asked subjects' opinion about the deterrent value of deterrence, "I doubt very much if deterrence (the death penalty) acts as a deterrent to homicide (murder)." Scoring of these two items was subsequently reversed so that a score of seven was indicative of strong belief. Appendix E presents the social beliefs questionnaire. The order of the dogmatism and social beliefs questionnaires was counterbalanced.

These questionnaires were followed by the conclusion-production task (see Appendix F). Subjects received 24 syllogisms involving three different contents; deterrence, ESP, and neutral (i.e., non-deterrence, non-ESP content). In addition, the syllogisms with deterrence and ESP content involved two overall logical forms; determining the validity of hypotheses given evidential statements (Form A), and deducing empirical predictions from given hypotheses (Form B). The 24 syllogisms were grouped into four sets of six syllogisms each. Each set contained two syllogisms from each content category. Within each set, the syllogisms were arranged so that no two syllogisms involving similar contents or similar logical form would follow each other. Moreover, this arrangement also precluded that two syllogisms involving similar logical content or similar logical

form would follow each other in adjacent sets. The order of the four sets was randomly determined for each participant.

The principal experimenter scored subjects' responses to the syllogisms as either correct (1 point) or incorrect (0 points). To check the reliability of his scoring, a random subsample of 20 reasoning protocols was drawn, and rated by a co-worker who was blind to both subject's condition and the hypotheses under investigation. The average interrater agreement was 98%.

The next part of the questionnaire booklet contained the abstracts used to test the evidence-discounting and selective learning hypotheses. Subjects read abstracts of roughly similar lengths (260-270 words each) which involved either deterrence or ESP content. The deterrence abstract was based on a cross-national test of the deterrence hypothesis by Archer, Gartner, and Beittel (1983). The ESP abstract was based on a test of the ESP hypothesis by Polzella et al. (1975). These abstracts contained a similar introductory passage which mentioned the hypothesis of interest. The abstract then went on to describe that the relevant hypothesis had recently been tested by researchers at Queen's University in Kingston, Ontario, the methodology which had been used to test the hypothesis, a general description of the statistical procedure used, the relevant p-value ($p < .05$ or $p > .10$), and the conclusions of the researchers. Within each content, the abstract concluded that the hypothesis was either supported (confirming evidence) or not

supported (disconfirming evidence) by the results of the study. Thus, the abstract manipulation involved a factorial design with two types of abstract content (deterrence/ESP) crossed with two types of evidence (confirming/disconfirming). Appendix ? presents the four abstracts.

Following the abstract, subjects completed a semantic differential measure of mood state developed by Mehrabian and Russell (1974). This semantic differential measured three theoretically independent dimensions of emotional state; arousal, pleasure, and dominance (Mehrabian & Russell, 1974; Russell, 1989). Each dimension of emotional state was measured with six adjective pairs. Following the recommendations of Mehrabian and Russell, the 18 pairs were presented in a randomized order, and half of the items were reversed. A numerical scale of 0 to 8 was used for each adjective pair, and (after reversing the scoring of the relevant items) subjects' ratings were summed over the six pairs within each dimension of emotional state. Appendix I presents the measure of emotional state.

Following the mood questionnaire, subjects engaged in a filler task which consisted of counting the number of adjectives appearing in an unrelated passage taken from a recent issue of 'National Geographic.' Appendix J presents this passage. The mood ratings and counting tasks served as distractor tasks between the exposure to the target information and the recall task.

The recall task consisted of seven questions. The first question asked subjects to write down everything they could remember from the (deterrence/ESP) abstract they read. Subjects were provided with a blank page upon which to write down their answer. The next page contained more specific questions about the abstract. For instance, question two asked subjects, "What did the author conclude?" Appendices 11 and 12 present the recall questions for the deterrence and ESP abstracts, respectively.

The scoring of the first question was accomplished by dividing the abstract into several 'idea units.' Idea units contained one or two sentences related to identifiable ideas expressed in the relevant abstracts. For each idea unit subjects received a score of '2' for accurately reproducing the gist of the idea, a score of '1' for inaccurately reproducing the gist of the idea, and a score of '0' for failing to mention the idea entirely. The scoring of the more specific questions was similar, with the exception that a score of '0' indicated that the answer space was left blank by the participant. The recall protocols were scored by the principal experimenter, and an assistant who was blind to the hypotheses under investigation. The average interrater agreement for the capital punishment material was 87% for the first question, and 94% for the remaining questions. The average interrater agreement for the ESP material was 81% for the first question, and 97% for the

remaining questions. Discrepancies between the two raters were resolved through discussion.

Following the recall items, subjects read a critique of the study presented in the abstract. Critiques of the deterrence abstracts were taken verbatim from a discussion of methodological problems in deterrence research by Archer et al. (1983). Subjects in the deterrence confirming evidence condition received a critique suggesting that single-variable evaluations of the deterrence hypothesis may understate the complexity of the factors which drive homicide rates. Subjects in the deterrence disconfirming evidence condition received a critique suggesting that homicide rates may remain relatively constant following abolition due to residual deterrence effects. Subjects in the ESP confirming evidence condition condition received a critique suggesting that apparently well-controlled ESP experiments are often susceptible to either experimenter or subject cheating. Subjects in the ESP disconfirming evidence condition condition received information suggesting that ESP effects may be faint and difficult to detect in laboratory settings. Appendices 13 and 14 present the critiques for the ESP and deterrence articles, respectively.

Following these critiques, subjects were asked to complete a series of Likert-type questions. The first five questions were taken from Grant (1987). Subjects rated the extent to which they thought the study they read was replicable, the adequacy of the

controls, the appropriateness of the conclusions drawn by the authors, and the extent to which the study was well-designed. Subjects were also asked to rate the extent to which the study has caused them to change their mind about either the deterrent effects of capital punishment, or the existence of ESP. The next item was the belief question from the Social Beliefs Questionnaire which corresponded to the level of abstract content (deterrence/ESP) that subjects received. Thus, subjects who read either the ESP-confirming or disconfirming abstract were again asked to rate the extent of their agreement with the statement, "I doubt very much if extrasensory perception (ESP) exists." Subjects who read one of the deterrence abstracts were again asked to rate their agreement with the deterrence item.

The subjects also received two Likert-type questions which asked them to rate on a seven-point scale the extent to which they were familiar with arguments or evidence which (1) supported, and (2) contradicted the hypothesis tested in the abstract they read. The last task asked subjects to list as many arguments for and against the use of capital punishment or the existence of ESP. Subjects were provided with half of an 8' x 11' sheet of paper to list their arguments. The page was divided into two columns headed 'For,' and 'Against,' respectively. The principal experimenter, who was blind to subjects' beliefs, counted the number of non-redundant arguments listed by subjects, regardless of their plausibility. Appendices 15 and 16 present

the questionnaires for the ESP and capital punishment abstracts, respectively.

After completing the questionnaire booklet, subjects were thoroughly debriefed about the purposes of the experiment, and remunerated for their participation.

Results

Dependent Measures

Recall measures. Initially, we developed three measures of free recall performance. The first was the number of idea units mentioned by subjects, regardless of accuracy. This score was incremented by one point for every idea unit rated as '2' or '1' by the principal experimenter and his assistant. The second measure was an accuracy score. This measure was scored as follows: Ratings of '2' (idea unit correctly recalled) were recoded as +1, while ratings of '1' (idea unit incorrectly recalled) were recoded as -1. The recoded ratings were summed to yield an accuracy score for each subject. The third measure reflected the percentage of idea units correctly recalled by subjects. This measure was scored as follows: The subjects' score was incremented by one point for every idea unit rated '2' by the experimenter and his assistant. The total score was divided by the number of idea units in the essay and multiplied by 100 to yield a percentage free recall score. A similar procedure was used for the cued recall questions, and yielded a percentage cued recall score for each subject.

The three free recall measures were intercorrelated within each level of abstract content. Within the capital punishment content condition, the percentage free recall measure correlated highly with the number of idea units mentioned by subjects, $r(99) = .84$, $p < .001$, and with their recall accuracy, $r(99) = .39$, $p < .001$. The accuracy and number measures were only moderately correlated, $r(99) = .49$, $p < .001$. A similar pattern of correlations emerged for the ESP content condition. Although percentage free recall correlated highly with the number of idea units mentioned by subjects, $r(94) = .86$, $p < .001$, and their recall accuracy, $r(94) = .90$, $p < .001$, the latter two measures were only moderately correlated, $r(94) = .57$, $p < .001$. It was, therefore, decided to use only the percentage free recall and the percentage cued recall scores in the subsequent analyses.

Evaluation of evidence measures. The pooled within cells correlations between the four evaluation of evidence questions were all positive and significant. Following Grant (1987), we, therefore, summed subjects' responses to each of these items to obtain an overall evaluation of evidence score for each subject.

Familiarity with evidence measures. The pooled within cells correlation between the two familiarity with evidence measures was positive and significant, $r(204) = .68$, $p < .001$. These ratings were, therefore, summed to yield an overall familiarity score for each subject.

Between and Within Groups Analyses

A 2 (abstract content) x 2 (evidence type) MANOVA was performed on subjects' responses to arousal and pleasure scales, percentage free recall, percentage cued recall, overall evaluation of evidence scores, self-reported belief-change, and familiarity scores. This analysis yielded significant main effects for both the abstract content and evidence type factors; $F(7, 177) = 5.02, p < .001$, and $F(7, 177) = 3.24, p < .01$, respectively. The abstract content x evidence type interaction was not significant; $F(7, 177) < 1$. Tables 12 and 13 present the means and standard deviations for the main effects of content and evidence type, respectively. The multivariate main effect of content was followed-up by a step-wise discriminant function analysis (DA). The step-wise DA indicated that five variables contributed significantly toward the discrimination between the two content groupings: Subjects who read the ESP abstracts had significantly higher percentage free recall (structure coefficient $r = -.44$) and pleasure ($r = -.23$) scores than those who read the capital punishment abstracts. However, subjects who read the ESP abstracts obtained lower scores than their capital punishment counterparts on the familiarity measure ($r = .39$), percentage cued recall ($r = .36$), and arousal ($r = .34$) measures.

Examination of the univariate F -tests generated as a follow-up to the main effect of evidence type indicated that this effect was located at the evaluation of evidence measure, $F(1,$

193) = 15.28, $p < .001$. None of the remaining F-tests were significant. As indicated by table 13, subjects evaluated disconfirming evidence more favorably than confirming evidence.

A 2 (abstract content) x 2 (evidence type) x 2 (for/against) mixed ANOVA was performed on the number of arguments subjects generated both for and against the relevant hypothesis. Table 14 presents the results of this analysis. As indicated by this table, there was a significant main effect for abstract content; $F(1, 193) = 13.28, p < .001$. However, this main effect was qualified by a significant content X for/against interaction; $F(1, 193) = 8.10, p < .01$. No other main effects or interactions were significant. Table 15 presents the means for the content X for/against interaction. The interaction was followed up with simple effects analyses. This analysis indicated that although there was no difference in the number of arguments subjects listed 'for' and 'against' the existence of ESP, subjects listed significantly more arguments 'against' than 'for' the use of capital punishment; $F(1, 193) = 5.17, p < .05$. In addition, although there was no significant difference in the number of arguments subjects listed 'for' the use of capital punishment and the existence of ESP, subjects listed more arguments 'against' the use of capital punishment than 'against' the existence of ESP; $F(1, 193) = 20.99, p < .001$.

Table 12

**Mean-Mood-State, Recall, Evaluation of Evidence,
Self-Rated Belief Change, and Familiarity with Evidence
Scores by Abstract Content**

Measure		Abstract content	
		Deterrence	ESP
Arousal	M	22.22*	20.20*
	(SD)	(6.37)	(7.10)
Pleasure		28.60*	30.19*
		(8.56)	(6.80)
Percentage free recall		31.84*	39.44*
		(19.29)	(20.52)
Percentage cued recall		42.78*	36.48*
		(20.54)	(19.81)
Evaluation of evidence		16.74	16.67
		(4.33)	(4.53)
Relief change		2.57	2.29
		(1.62)	(1.36)
Familiarity		6.97*	6.03*
		(2.44)	(3.07)

Note. Deterrence $n = 97$, ESP $n = 90$, for this analysis.
* means differ significantly at $\alpha = .05$

Table 13

Mean Mood States, Recall, Evaluation of Evidence,
Self-Rated Belief Change, and Familiarity with
Evidence Scores by Evidence Type

Measure		Evidence type	
		Confirming	Disconfirming
Arousal	M	21.93	20.56
	(SD)	(6.19)	(7.31)
Pleasure		29.72	29.00
		(7.97)	(7.61)
Percentage free recall		34.02	37.00
		(19.28)	(21.09)
Percentage cued recall		38.47	41.04
		(19.56)	(21.22)
Evaluation of evidence		15.50*	17.92*
		(4.60)	(3.87)
Belief change		2.47	2.40
		(1.49)	(1.53)
Familiarity		6.33	6.71
		(2.78)	(2.81)

Note. Confirming evidence $n = 94$, Disconfirming evidence $n = 93$ for this analysis.

* means differ significantly at $\alpha = .05$

Table 14

ANOVA Summary Table for the Number of Arguments Listed as a
Function of Abstract Content and Evidence Type

Source	SS	DF	MS	F
Content	39.17	1	39.17	13.29**
Evidence type	0.24	1	0.24	< 1
Content x evidence type	5.52	1	5.52	1.87
Error	569.04	193	2.95	
For/against	0.13	1	0.13	0.13
Content x for/against	8.26	1	8.26	8.10**
Evidence type x for/against	2.43	1	2.43	2.38
Content x evidence type x for/against	2.83	1	2.83	2.78
Error	196.89	193	1.02	

** p < .01

*** p < .001

Table 15

Mean Number of Arguments Listed by Abstract Content

		Abstract content	
Argument		Deterrence	ESP
For	M	1.65	1.33
	(SD)	(1.41)	(1.43)
Against		2.00	1.08
		(1.53)	(1.25)

Correlation and Regression Analyses

Belief, dogmatism, and deductive reasoning. The subjects' responses to the syllogisms were summed to yield the following measures: Total correct on syllogisms which involved determining the validity of hypotheses given evidential statements (Form A), total correct on syllogisms which involved deducing empirical predictions from given hypotheses (Form B), total correct on syllogisms involving capital punishment contents, total correct on syllogisms involving ESP contents, and total correct on the neutral syllogisms. Table 16 presents the means and standard deviations for the belief, deductive reasoning, and dogmatism measures.

The subjects' responses to the belief, deductive reasoning, and dogmatism measures were intercorrelated. Table 17 presents the results of this analysis. As indicated by this table, belief in the deterrence and ESP hypotheses were uncorrelated. In addition, belief in these hypotheses was uncorrelated with the deductive reasoning and dogmatism measures. Although dogmatism was significantly correlated with performance on Form A syllogisms, and on syllogisms involving deterrence and ESP content, the magnitude of these correlations was small, and accounted for less than five percent of the variance in the reasoning scores. Performance on Form A syllogisms correlated significantly with performance on Form B syllogisms, $r(177) = .45$, $p < .001$. Performance on syllogisms involving ESP content

correlated significantly with performance on syllogisms involving deterrence content, $r(197) = .38$, $p < .001$, and marginally significantly with performance on syllogisms involving neutral content, $r(193) = .14$, $p < .06$. Performance on syllogisms involving deterrence content correlated significantly with performance on syllogisms with a neutral content, $r(194) = .32$, $p < .001$.

Table 16

Mean Belief, Deductive Reasoning, and Dogmatism Scores

Measure	M	SD
ESP belief	4.11	1.58
Deterrence belief	4.19	1.92
Dogmatism	71.72	14.19
Form A syllogisms	3.31	1.35
Form B syllogisms	3.86	0.98
ESP syllogisms	3.31	1.38
Deterrence syllogisms	3.86	1.01
Neutral syllogisms	4.07	1.42

Note. $199 \leq n \leq 208$.

Table 17

Intercorrelations between the Beliefs, Dogmatism, and Deductive Reasoning Measures

Measure	1	2	3	4	5	6	7	8
1. ESP belief ---	---	-.08	-.12	.07	.06	.10	.01	-.01
2. Deterrence belief---		---	.01	-.01	.00	-.03	.03	-.04
3. Dogmatism			---	-.17*	-.13	-.16*	-.14*	-.13
4. Form A syllogisms				---	.45**	.80**	.68**	.18*
5. Form B syllogisms					---	.69**	.64**	.28**
6. ESP content						---	.38**	.13
7. Deterrence content							---	.32**
8. Neutral content								---

Note. $196 \leq n \leq 208$

* $p < .05$

** $p < .001$

Argument, Belief Change, and Mood Scores. The relationships of subjects' initial belief ratings with their arousal and pleasures scores, the number of arguments they listed 'for' and 'against' capital punishment or ESP, and the difference between their initial and final belief ratings were tested using hierarchical MR. Within each level of abstract content (capital punishment/ESP), these dependent variables were regressed on their initial belief ratings, a coded vector for evidence type (1 = confirming evidence, -1 = disconfirming evidence), and a product vector representing the belief x evidence type interaction. Table 18 presents the results of these analyses for both abstract content conditions.

As indicated by this table, the complete model did not account for a significant proportion of the variance in subjects' arousal scores in either content condition, F 's < 1 . The complete model did, however, account for a significant proportion of the variance in subjects' pleasure scores in both content conditions; $F(3, 99) = 3.38, p < .05$, and $F(3, 95) = 2.82, p < .05$, for the capital punishment and ESP conditions, respectively. In addition, the initial belief x evidence type interaction was significant for both content conditions; $F(3, 99) = 7.23, p < .01$, and $F(3, 95) = 6.51, p < .05$, for the capital punishment and ESP conditions, respectively. Within each level of abstract content, the correlation between subjects' belief ratings and pleasure scores was significant for confirming evidence, $r(50) =$

.34, $p < .05$, and $r(46) = .37$, $p < .01$, for the capital punishment and ESP conditions, respectively, but not for disconfirming evidence; $r(49) = -.07$, n.s., and $r(49) = -.06$, n.s., for the capital punishment and ESP conditions, respectively.

Table 18 also indicates that the overall model did not significantly predict the number of arguments subjects listed either 'for' or 'against' capital punishment; $F(3, 93) < 1$, and $F(3, 93) = 2.42$, n.s., respectively. Although the overall model also failed to predict the number of arguments subjects listed 'against' ESP; $F(3, 94) = 1.13$, n.s., it significantly predicted the number of arguments subjects listed 'for' that hypothesis; $F(3, 94) = 5.15$, $p < .01$. As indicated by table 18, only the initial entry of subjects' belief in ESP ratings was associated with a significant change in R-square; $F(1, 96) = 14.69$, $p < .001$.

The overall model also significantly predicted changes in subjects' beliefs in both the deterrence and the ESP hypotheses; $F(3, 100) = 13.27$, $p < .001$, and $F(3, 96) = 3.57$, $p < .05$, respectively. Only the initial entry of subjects' initial belief ratings produced a significant R-square change in the case of the deterrence material; $F(1, 102) = 38.77$, $p < .001$, $r = -.52$. Although the entry of subjects' belief ratings also produced a significant R-square change in the case of the ESP material; $F(1, 98) = 6.42$, $p < .05$, there was also a significant belief x

evidence type interaction; $F(1, 96) = 3.36, p < .10$. Examination of the correlations between subjects' belief and change scores between evidence conditions indicated a significant correlations between these measures in the confirming evidence condition, $r(46) = -.39, p < .01$, but not in the disconfirming evidence condition, $r(50) = -.16, n.s.$

Recall and evaluation of evidence scores. The relationships between subjects' initial belief, arousal, and pleasure scores and their evaluations and recall of the abstract material were also assessed using hierarchical MR. Subjects' overall evaluation of evidence scores, and their percentage free and cued recall scores were regressed on the following predictors: The first two blocks entered measures of prior familiarity and learning skill as covariates. The measure of prior familiarity was subjects' summed familiarity ratings; the measure of learning skill was the total number of correct responses subjects made during the syllogistic reasoning task. The next block contained subjects' belief, arousal, and pleasure scores. The fourth block was an effect-coded vector representing evidence type. The fifth block contained product vectors representing the interaction of each of the continuous variables (belief, arousal, pleasure) with evidence type. Table 19 presents the results of these analyses.

As indicated by table 19, the overall model significantly predicted subjects' percentage cued recall of the deterrence material; $F(9, 78) = 3.01, p < .01$, and their percentage free

recall of the ESP material; $F(9, 76) = 3.27, p < .01$. The overall model did not significantly predict subjects' percentage free recall of the deterrence material; $F(9, 78) = 1.24, n.s.$, or their percentage cued recall of the ESP material; $F(9, 76) = 1.63, n.s.$ In the case of subjects' cued recall of the deterrence abstract, only the entry of the block containing the syllogistic reasoning measure was associated with a significant change in R-square; $F(1, 85) = 12.26, p = .001$. However, in the case of subjects' free recall of the ESP abstract, both the entry of the blocks containing the reasoning measure and the interaction vectors were associated with significant changes in R-square; $F(1, 83) = 14.63, p < .001$, and $F(3, 80) = 2.79, p < .05$, respectively. Although the regression of the percentage free recall scores was not significant in the ESP/disconfirming evidence condition; $F(3, 43) < 1$, it was significant in the ESP/confirming evidence condition; $F(3, 39) = 8.11, p < .001$. Although the correlation between subjects' belief in ESP ratings and percentage free recall was $r = .30$, only the beta-weights for the arousal and pleasure scores were significant; $t(41) = -2.05, p < .05$ (semi-partial $r = -.26$), and $t(44) = 4.09, p < .001$ (semi-partial $r = .51$), for the arousal and pleasure scores, respectively.

Table 19 also indicates that the overall model predicted subjects' evaluation of the deterrence material; $F(9, 78) = 2.46, p < .05$, but not their evaluation of the ESP material; F

(9, 76) = 1.61, n.s. In the case of the deterrence material, the entry of the blocks representing evidence type, and the interaction vectors were both associated with significant changes in R-square; $F(1, 81) = 7.26, p < .01$, and $F(3, 78) = 2.56, p < .07$, respectively. The significant interaction was followed up with separate regression analyses at each level of evidence type. The analysis for subjects' who read deterrence-confirming information was not significant; R-square = .11, $F(3, 48) = 2.01$, n.s. However, the correlation between belief and evaluation of evidence approached significance; $r(50) = .20, p < .10$. The analysis for subjects' who read deterrence-disconfirming information was significant; R-square = .16, $F(3, 46) = 2.83, p < .05$. Only the beta-weight for subjects' belief ratings was significant; $\beta(48) = -2.30, p < .05$ (semi-partial $r = .31$).

Table 19 also indicates that entry of the subjects' syllogistic reasoning scores was associated with significant changes in R-square in the case of subjects' free and cued recall of the ESP abstract, and their cued recall of the capital punishment abstract; $F(1, 83) = 14.63, p < .001$, $F(1, 83) = 8.88, p < .01$, and $F(1, 85) = 12.26, p = .001$, respectively. In addition, the entry of subjects' reasoning scores was associated with a marginally significant change in R-square in the case of subjects' free recall of the capital punishment abstract; $F(1, 85) = 3.24, p < .08$.

Recall of abstract conclusion. Subjects' belief, arousal, and pleasure scores were intercorrelated with their free and cued recall of the abstracts' conclusion. Table 20 presents the resultant point-biserial correlation coefficients. As indicated by this table, subjects' initial beliefs in deterrence or ESP did not significantly predict their recall of the authors' conclusion. However, there were significant correlations between the recall and pleasure measures for subjects who read the ESP/confirming evidence abstract.

Internal analysis of recall errors. An internal analysis of subjects' recall errors indicated that three subjects reversed the abstracts' conclusion; one in each of the capital punishment confirming evidence, capital punishment disconfirming evidence, and ESP disconfirming evidence conditions, respectively. However, the elimination of these subjects from the above analyses did not substantively alter the results.

Table 18

**B-Square-Change-Scores-for-the-Hierarchical-Regression-of-the
Mood-State, Argument-List, and Belief-Change-Measures-on-Initial
Belief-and-Evidence-Type-by-Abstract-Content**

Abstract Content	Predictor	Dependent Variable				
		Arousal	Pleasure	For	Against	Change
Deterrence	A	.00	.02	.03	.02	.28****
	B	.00	.00	.00	.05**	.01
	C	.00	.07***	.01	.01	.00
	R-square	.00	.09**	.03	.07	.28****
ESP	A	.00	.02	.13****	.00	.06**
	B	.00	.00	.01	.01	.01
	C	.01	.06**	.00	.03*	.03*
	R-square	.01	.08**	.14***	.03	.10**

* $p < .10$

** $p < .05$

*** $p < .01$

**** $p < .001$

Note. A = belief, B = evidence type, C = belief X evidence type,
Column values may not add up to R-square total due to rounding
errors.

Table 19

B-Square Change Scores for the Hierarchical Regression of Recall and Evaluation of Evidence on the Covariate-Augmented Cognitive-Motivational Model

		Dependent Variable		
Content	Predictor	Free recall	Cued recall	Evaluation
Capital punishment	Familiarity	.01	.01	.00
	Syllogisms	.04	.13****	.02
	A	.06	.07	.04
	B	.00	.00	.08***
	C	.01	.06	.08*
	B-square total	.13	.26***	.22**
ESP	Familiarity	.00	.00	.01
	Syllogisms	.15****	.10***	.02
	A	.03	.04	.05
	B	.02	.02	.06**
	C	.08**	.01	.03
	B-square total	.28***	.16	.16

* $p < .10$, ** $p < .05$, *** $p < .01$, **** $p < .001$

Note. A = belief, arousal, and pleasure scores; B = evidence type; C = A X B. Column values may not add up to B-square total due to rounding errors.

Table 20

Point-Biserial Correlations of Belief and Mood State
Measures with Recall of the Abstract Conclusion by
Abstract Content

Abstract Content	Evidence Condition	Predictor	Free Recall	Cued Recall
Capital punishment	Positive	Belief	-.17	-.20
		Arousal	-.07	-.11
		Pleasure	.11	.11
	Negative	Belief	-.06	.10
		Arousal	-.10	.10
		Pleasure	-.00	.05
ESP	Positive	Belief	.09	.23
		Arousal	-.09	-.02
		Pleasure	.34*	.39**
	Negative	Belief	-.15	.04
		Arousal	-.07	-.03
		Pleasure	-.12	-.08

* $p < .05$, ** $p < .01$

Discussion

The findings for the ESP belief measure were consistent with those of previous studies of ESP and other paranormal beliefs (e.g., Glick & Snyder, 1986; Jones & Russell, 1980; Jones & Zusner, 1981). Like those studies, we also found that believers in ESP were more resistant to belief-discrepant evidence than nonbelievers. Although nonbelievers exhibited a slight increase in their belief ratings following exposure to ESP-confirming evidence ($M = 1.00/6$, $SD = 1.41$), believers showed no corresponding decrease in their belief ratings following exposure to ESP-disconfirming evidence ($M = -.25/6$, $SD = 1.22$). However, contrary to the predictions of our cognitive-motivational model, exposure to ESP-disconfirming evidence was not associated with strong negative emotions among believers. Not only did the predicted interaction between belief and evidence type fail to emerge, but the average arousal score in each treatment combination was below the theoretical midpoint on that measure. There was also no evidence of believers distorting or discounting ESP-disconfirming evidence.

One interpretation of these findings is that believers in ESP were not threatened by the disconfirming evidence presented in the abstract. For instance, believers may have dismissed the disconfirming findings of a single study as coincidence (cf. Glick & Snyder, 1986). In contrast, the evidence manipulation of Russell and Jones (1980) may have evoked stronger negative

emotional reactions, because their abstract presented subjects with a summary of a series of negative findings. Nor did our subjects have to endure the type of public embarrassment and ridicule which was experienced by subjects in the Festinger et al. (1956) study. It is also likely that few, if any, of our subjects showed the same levels of conviction in and commitment to their belief as those shown by the followers of Mrs. Keech in that study.

Although we found no selective learning effect for subjects who were exposed to ESP-disconfirming evidence, we did find a positive relationship between belief and free recall performance in the ESP-confirming evidence condition. Moreover, this selective learning effect was consistent with subjects' emotional reactions to the ESP-confirming evidence. However, the effect of subjects' emotional reactions on their recall performance was different from that posited by Russell and Jones. Those investigators argued that subjects' emotional reactions to evidence interfered with their learning and/or recall of that material. In contrast, our findings suggested that subjects' emotional reactions to evidence facilitated free recall performance. Specifically, we found that the most important predictor of subjects' free recall of the ESP-confirming abstract was their pleasure scores. In addition, we obtained significant correlations between subjects' pleasure scores and both their free and cued recall of this abstract's conclusion. These

findings are consistent with the general motivational hypothesis that individuals are more likely to learn and/or remember pleasing than displeasing information (Roberts, 1985).

The present findings did not replicate the selective learning effect of Roberts (1984). Roberts found that believers in the deterrence hypothesis exhibited superior recall of deterrence-confirming evidence than nonbelievers. However, we found no differences in recall between believers and nonbelievers in the deterrence hypothesis in either of our evidence conditions. Our replication failure may reflect subjects' emotional reactions to the deterrence evidence. Although we found a positive association between belief and pleasure scores in the deterrence-confirming condition, the mean pleasure score for believers in this condition was well below that for ESP believers who received belief-confirming evidence. These findings are consistent with the hypothesis of Russell and Jones (1980) that subjects' emotional reactions to evidence must reach a certain strength before they affect learning and/or recall performance.

The findings for the evaluation of evidence measure were consistent with those of Lord et al. (1979) and Grant (1987). In line with Lord et al., we found that believers in the deterrence hypothesis gave lower evaluations of deterrence-disconfirming evidence than nonbelievers. Although the relationship between belief and evaluation of evidence was not significant for

subjects who read deterrence-confirming evidence, it was in the direction predicted by that hypothesis. However, like Grant (1987), we found no relationships between belief in ESP and evaluations of either ESP-confirming or disconfirming evidence.

Grant (1987) suggested that his subjects did not evaluate evidence in a biased manner, because he failed to expose them to both positive and negative evidence. However, we found that subjects evaluated the deterrence-related information in a biased manner despite being exposed to only one type of evidence and a short methodological critique. Although these findings do not rule out the possibility that believers in ESP require both types of evidence before making biased evaluations, they do suggest that other factors may have contributed to our failure to obtain a biased evaluation effect for ESP material.

One factor which may have influenced subjects' evaluations of the evidence is the content of the critique they read prior to making their ratings. The critiques of the deterrence abstracts suggested that these studies may have confounded tests of the deterrence hypothesis with factors such as post-war increases in homicide rates, or residual deterrence effects. In contrast, the critique of the ESP-confirming abstract suggested that any ESP effect may have been due to either experimenter or subject cheating. The suggestion that any purported ESP effect could be due to cheating may have mitigated against subjects' ability to maintain an illusion of objectivity while giving high ratings to

the ESP-confirming study. The critique of the ESP-disconfirming evidence abstract suggested that tests for extrachance scoring were typically underpowered. Interestingly, an examination of the intercorrelations between subjects' belief ratings and their ratings of the individual evaluation of evidence items in that condition indicated a significant negative relationship between ESP belief and evaluations of the overall design of this bogus study. These issues could be explored in a future study.

The findings for the evaluation of evidence measure were inconsistent with the discounting account of Aronson (1969). According to Aronson, people discount belief-discrepant evidence in order to reduce cognitive dissonance associated with exposure to that evidence. Although we found that believers in the deterrence hypothesis discounted deterrence-disconfirming evidence, their evaluations did not correlate significantly with their emotional reactions to that evidence. Of course, these findings do not rule out the possibility that dissonance reduction may be a motive for evidence-discounting. Instead, these findings suggest that other directional motives may be sufficient to induce discounting by subjects.

Interestingly, the findings for the evaluation of evidence and recall measures were consistent with the knowledge structure hypothesis of Pratkanis (1989). That hypothesis suggests that selective learning is more likely to occur for attitudes exhibiting a unipolar than an bipolar knowledge structure.

However, selective learning effects are unlikely for bipolar attitudes, because subjects can use discrepant evidence in order to develop counter-arguments to that evidence. In line with that hypothesis, we found that belief in the deterrence hypothesis was associated with an underlying bipolar knowledge structure, and that subjects evaluated deterrence-relevant evidence in a biased manner. In contrast, belief in ESP was positively associated with the number of arguments subjects generated 'for' the existence of that phenomenon. Although believers showed greater free recall of ESP-confirming information than nonbelievers, there were no differences in subjects' recall of ESP-disconfirming evidence. Nor did subjects evaluate belief-relevant evidence in a biased manner.

In terms of the knowledge structure hypothesis, our failure to replicate the selective learning findings of Roberts (1984) for capital punishment material may reflect differences in the samples used in the Roberts study and in our own studies. Specifically, Roberts' sample contained members of the general public, whereas our sample was selected from a university population. One possibility is that these populations differ in their distributions of domain-related knowledge. For instance, it may be that attitudes toward capital punishment in the general public are associated with a unipolar knowledge structure, while those in university samples are associated with a bipolar knowledge structure. These ideas could be easily tested in

future studies.

The present findings did not support the reasoning error hypothesis of Wierzbicki (1985). The reasoning error hypothesis predicts that believers in ESP will make more errors than nonbelievers on problems which involve determining the validity of hypotheses given evidential statements. Contrary to that hypothesis, we found that the correlation between ESP belief and reasoning errors failed to even approach conventional levels of statistical significance, regardless of logical content or form. However, we did find that subjects' reasoning performance was related to their recall performance. One interpretation of these findings is that intellectual skills are related to recall performance (Weldon & Malpass, 1981).

Although our findings for the 'intellectual skill' measure were consistent with those of Weldon and Malpass (1981), we found no relationship between our recall and prior familiarity measures. Earlier, Weldon and Malpass (1981) found that prior familiarity predicted recall of an attitude-related communication. One account for our failure to replicate this finding concerns difference between these studies in the familiarity measure. Our measure asked subjects to rate their familiarity with arguments or evidence which supported or refuted the relevant hypothesis. In contrast, Weldon and Malpass measured subjects' prior familiarity with the specific ideas presented in the belief-relevant communication. Their measure

was also more complex; involving an assessment of the associational network corresponding to each idea. Nonetheless, our findings indicated that statistical control of subjects' prior familiarity with belief-relevant evidence is not necessary for obtaining a significant selective learning effect.

General Discussion

A number of studies (e.g., Alcock, 1981; Davies, 1989, Tobacyk & Milford, 1983) have indicated that belief in ESP is common among undergraduate students. The present findings were consistent with those reports. In both principal studies, the average belief score was above the theoretical midpoint of the questionnaire used to measure subjects' belief. Studies (e.g., Glick & Snyder, 1986; Jones & Russell, 1980) have also found that believers show more resistance to belief-discrepant evidence than nonbelievers. These types of findings have led some investigators (e.g., Glick & Snyder, 1986) to suggest that whereas nonbelievers in paranormal phenomena are "data-driven," believers can be characterized as "theory-driven." Consistent with that characterization, we found that believers exposed to disconfirming evidence either in the form of their own chance-level performance on a card-guessing task, or a bogus scientific abstract indicating no support for the ESP hypothesis persevered in their initial belief in ESP.

The finding that believers did not change their overall belief in ESP despite performing at only chance levels during a card-guessing task is, perhaps, understandable. The idea that subjects did not perform at above chance levels is not logically incompatible with the ideas that they might show ESP under different circumstances, or that ESP ability is confined to other individuals. However, the abstracts presented in the second

principal study clearly indicated that subjects in those ESP studies had been selected on the basis of their perceived ESP ability. One reason why believers may have resisted ESP-disconfirming evidence is because their belief was personally important to them. In line with the functionality hypothesis, we found that belief in ESP was significantly related to perceptions of control in the interpersonal sphere of activity. Earlier, Davies and Kirkby (1985) found that beliefs in psi phenomena and witchcraft were also related to perceptions of control in the interpersonal sphere of activity. Together, these findings indicate support for an observation by Zusne and Jones (1982) that, "paranormal beliefs appear to operate so as to reassure the believers that there is order, meaning, and control in what may otherwise appear to be a chaotic and capricious world" (p. 210).

Although our findings were consistent with the functionality hypothesis, we did not find that exposure to belief-disconfirming evidence was associated with strong negative emotions, and evidence-discounting or distortion. These findings suggest that several other factors may contribute toward the types of emotional reactions and evidence distortion reported by Festinger et al. (1956) and Russell and Jones (1980). One factor which may moderate the extent to which believers become negatively aroused by, and, hence, discount or distort disconfirming evidence may be the degree of threat posed by that evidence. In turn, the extent to which individuals perceive belief-discrepant evidence as a

threat may depend on such factors as the amount and credibility of that evidence, and the degree to which the belief is central to their belief-system. These issues could be fruitfully addressed in future studies.

The selective learning effect we obtained was different from that reported by Russell and Jones (1980). However, it was consistent with other selective learning findings reported in the literature (e.g., Roberts, 1985). Reports of selective learning have typically indicated a positive association between belief and recall of belief-confirming evidence. At least two explanations (e.g., Pratkanis, 1989; Roberts, 1985) have been proffered for these findings. For one, these findings may reflect the underlying knowledge structure associated with the particular belief domain. Alternatively, these findings could reflect subjects' emotional reactions to the evidence; with believers exhibiting better learning and/or recall of pleasing (i.e., belief-confirming) material. Unfortunately, the present study did not provide a crucial tests of these hypotheses. Greater recall of the ESP-confirming abstract was associated with both higher pleasure scores and more developed knowledge structure as measured by the argument listing task.

Even if future studies indicate support for the cognitive-motivational model, the present findings suggest modifications to this model. For one, Russell and Jones (1980) hypothesized that strong negative emotions interfered with the

processing of belief-disconfirming evidence. However, our findings indicated that positive emotional reactions can also affect the processing of belief-relevant evidence; namely, by facilitating the processing of supportive information. Russell and Jones also suggested that emotional reaction interfered with initial encoding of belief-disconfirming evidence. That suggestion is incompatible with evidence presented by Roberts (1985) that selective learning is moderated by the length of the delay between the learning and recall trials. Roberts' findings suggest that selective learning is not a function of the initial encoding of belief-relevant material, but of its subsequent elaboration and/or retrieval. Unfortunately, the issue of the cognitive mechanisms which underly selective learning has not been thoroughly addressed in the literature (Johnson, 1991).

The findings of our three studies indicated no support for the reasoning error hypotheses of Blackmore and Troscianko (1985) and Wierzbicki (1985). Although those hypotheses suggest that believers differ from nonbelievers in logical reasoning ability, we found no significant differences in performance between believers and nonbelievers on the probability problems and the syllogisms. We also found no support for the chance-baseline shift hypothesis of Blackmore and Troscianko (1985). Although that hypothesis suggests that believers characteristically underestimate the frequency of chance occurrences, we found no differences between believers' and nonbelievers' estimates of

mean chance expectation for either the ESP card-guessing task, or the chance-level estimation problems.

Although our findings represent a failure to reject the null hypothesis of no difference in reasoning performance, several considerations support this inference. For one, despite large sample sizes, the correlations between the belief and reasoning measures in the two main studies failed to even approach conventional levels of statistical significance. In addition, the findings for the ESP card-guessing task replicated those of de Groot et al. (1991). Those investigators found no relationship between subjects' belief in ESP and their estimates of mean chance expectation for a card-guessing task under a variety of feedback conditions. They did, however, find that subjects' estimates of mean chance expectation were a function of their feedback condition membership. Our findings are also consistent with those reported by Jones et al. (1977). Contrary to the idea that believers suffer from cognitive/intellectual deficits, Jones et al. (1977) actually found a small, but significant positive correlation between paranormal belief and IQ scores.

The present findings also question the idea that the perseverance of ESP belief is due to the closed-mindedness of believers. In fact, the obtained correlations between belief and dogmatism were in the direction opposite to that predicted by that hypothesis. Although our findings are inconsistent with the

idea that believers are more dogmatic than nonbelievers, these findings are consistent with those reported earlier by Jones (1980). Jones reported a marginally significant ($p < .10$) negative correlation between belief in parapsychological phenomena and dogmatism. Similarly, we found a marginally significant negative correlation between belief in ESP and dogmatism in our second main study. Together, the findings for the dogmatism and reasoning measures suggest that the perseverance of people's beliefs in ESP and other paranormal phenomena cannot simply be attributed to closed-mindedness or intellectual deficits.

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Appendix A

1. A hat contains a very large number of equal-sized pieces of paper, and each piece of paper has a single digit written on it. The pieces of paper are folded such that it is impossible to see the digit written on them. The digits are either 1, 2, 3, 4, or 5, and they are in equal proportion. Assume that a person picks out 20 pieces of paper, one at a time, and records the digit on each piece of paper. Please write a list of 20 numbers in the order that you think they might be drawn from this hat.

A coin-tossing experiment is carried out a very large number of times. Each time, the experimenter tosses a fair (unbiased) coin 100 times, and records the number of times that the outcome 'head' occurred. On average, about how many times out of 100 would the outcome 'head' be expected to occur?

--- / 100

A die-tossing experiment is carried out a very large number of times. Each time, a die is cast 120 times, and the number of times the outcome '3' occurred is recorded. On average, about how many times out of 120 tosses would the outcome '3' be expected to occur?

--- / 120

An ordinary deck of playing cards contains 52 cards, divided into 4 suits: clubs, diamonds, hearts, and spades. A card-drawing experiment is carried out a very large number of times. Each time, the experimenter 'cuts' the deck 26 times, and the number of times the outcome "a 'face' card" (Jack, Queen, or King) occurred is recorded. Assuming that the experimenter replaces the card, and shuffles the deck thoroughly after each 'cut,' on average, about how many times out of 26 'cuts' would the outcome "a 'face' card" be expected to occur?

--- / 26

2. Presented below are several series of 20 digits (the digits are 0, 1, 2, 3, 4, and 5). Some of these series were randomly generated, others were not randomly generated. Your task is to judge which of these series were randomly generated, and which were not randomly generated. Place a 1, 2, 3, 4, 5, 6, or 7 beside each series, depending on whether you think it was randomly generated or not randomly generated.

- 1- It is highly likely that this series was not randomly generated.
- 2- It is moderately likely that this series was not randomly generated.
- 3- It is somewhat likely that this series was not randomly generated.
- 4- I cannot decide.
- 5- It is somewhat likely that this series was randomly generated.
- 6- It is moderately likely that this series was randomly generated.
- 7- It is highly likely that this series was randomly generated.

4 5 1 2 3 2 5 2 0 1 4 5 0 3 1 5 1 2 3 2	---
0 2 5 3 4 2 3 1 1 2 1 0 3 3 4 5 3 0 2 3	---
4 1 5 1 2 4 4 4 4 5 2 0 3 4 3 4 0 4 3 2	---
4 1 3 0 1 0 3 4 0 0 1 0 2 1 2 3 4 5 1 4	---
0 1 2 3 4 5 0 1 2 3 4 5 0 1 2 3 4 5 0 1	---
5 3 4 2 2 4 5 3 2 4 5 4 4 4 1 4 4 2 5 3	---
4 2 5 2 5 0 2 4 1 5 0 3 1 1 3 5 3 5 3 3	---
5 3 1 2 5 5 2 0 2 5 4 5 2 5 4 0 0 0 4 2	---
5 4 1 0 5 4 2 3 3 2 1 0 4 1 2 3 2 0 1 5	---
0 1 2 1 0 1 2 3 2 1 2 3 4 3 2 3 4 5 4 3	---
3 2 5 5 1 0 1 0 3 2 5 4 2 5 2 5 0 2 3 4	---
2 5 5 4 2 1 4 4 2 5 2 1 4 0 0 2 5 0 0 1	---
5 4 3 2 1 0 1 2 3 4 5 4 3 2 1 0 1 2 3 4	---
0 1 2 3 4 5 4 3 2 1 0 1 2 3 4 5 4 3 2 1	---
3 4 5 5 1 5 2 3 3 5 4 5 4 3 2 3 4 4 4 1	---

Below are listed the outcomes of several coin tossing experiments. Your task is to judge whether or not the different coins which were used in each one of these experiments was either biased or unbiased. An unbiased coin is one which has a 50/50 chance (probability = .50) of turning up either heads or tails. A biased coin will favor either heads or tails. Place either a 1, 2, 3, 4, 5, 6, or 7 beside the outcome depending on whether you think the coin was biased or unbiased.

- 1- It is highly likely the coin was unbiased.
- 2- It is moderately likely the coin was unbiased.
- 3- It is somewhat likely that the coin was unbiased.
- 4- I cannot decide.
- 5- It is somewhat likely that the coin was biased.
- 6- It is moderately likely that the coin was biased.
- 7- It is highly likely that the coin was biased.

I toss a coin 20 times and get heads 10 times ---
I toss a coin 12 times and get heads 9 times ---
I toss a coin 4 times and get heads 3 times ---
I toss a coin 4 times and get heads 2 times ---
I toss a coin 60 times and get heads 45 times ---
I toss a coin 60 times and get heads 30 times ---
I toss a coin 20 times and get heads 15 times ---
I toss a coin 12 times and get heads 6 times ---

Presented below are four sampling questions. Your task is to determine which of the possible outcomes is most likely to occur. Please check the outcome that is most likely to occur.

- (a) A hat contains 10 red and 10 blue smarties. I pull out 10 smarties one at a time, and set them aside. Eight of the smarties are red. Am I more likely to get a red or a blue smarty the next time I pull one out?

red	blue	either equally likely
-----	------	-----------------------------

- (b) A box contains buttons that are either green or yellow in unknown proportion. Out of 10 buttons taken out, 8 were yellow. Which is more likely to be pulled out next?

green	yellow	either equally likely
-------	--------	-----------------------------

- (c) A coin is tossed to decide which soccer team kicks off first. In the last four games between Ottawa and Toronto, Ottawa have kicked off first every time. Assuming that the coins are always fair (unbiased), which team is more likely to kick off first at their next encounter?

Ottawa	Toronto	either equally likely
--------	---------	-----------------------------

- (d) How many people would you need to have at a party to have a 50/50 chance that two of those people will have the same birthday (not counting year)?

22	43	98
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Appendix B

This questionnaire contains some statements people have made as their opinion on several topics. You may find yourself agreeing strongly with some of the statements...disagreeing just as strongly with others...and perhaps uncertain about others. Whether you agree or disagree with any statement, you can be sure many other people feel the same as you do. We want your personal opinion on each statement. For each statement, circle the number that best represents your opinion.

- 1 : Disagree very much
- 2 : Disagree on the whole
- 3 : Disagree a little
- 4 : Don't know
- 5 : Agree a little
- 6 : Agree on the whole
- 7 : Agree very much

1. In this complicated world of ours the only way we can know what's going on is to rely on leaders or experts who can be trusted.

1 2 3 4 5 6 7

2. My blood boils whenever a person stubbornly refuses to admit he's wrong.

1 2 3 4 5 6 7

3. There are two kinds of people in this world: those who are for the truth and those who are against the truth.

1 2 3 4 5 6 7

4. Most people just don't know what's good for them.

1 2 3 4 5 6 7

5. Of all the different philosophies which exist in the world there is probably only one which is correct.

1 2 3 4 5 6 7

6. The highest form of government is a democracy and the highest form of democracy is a government run by those who are most intelligent.

1 2 3 4 5 6 7

7. The main thing in life is for a person to want to do something important.

1 2 3 4 5 6 7

8. I'd like it if I could find someone who would tell me how to solve my personal problems.

1 2 3 4 5 6 7

9. Most of the ideas which get printed nowadays aren't worth the paper they are printed on.

1 2 3 4 5 6 7

10. Man/woman on his/her own is a helpless and miserable creature.

1 2 3 4 5 6 7

11. It is only when a person devotes himself to an ideal or cause that life becomes meaningful.

1 2 3 4 5 6 7

12. Most people just don't give a "damn" for others.

1 2 3 4 5 6 7

13. To compromise with our political opponents is dangerous because it usually leads to the betrayal of our own side.

1 2 3 4 5 6 7

14. It is often desirable to reserve judgment about what's going on until one has had a chance to hear the opinions of those one respects.

1 2 3 4 5 6 7

15. The present is all too often full of unhappiness. It is only the future that counts.

1 2 3 4 5 6 7

16. The United States and Russia have just about nothing in common.

1 2 3 4 5 6 7

17. In a discussion I often find it necessary to repeat myself several times to make sure I am being understood.

1 2 3 4 5 6 7

18. While I don't like to admit this even to myself, my secret ambition is to become a great person, like Einstein, or Beethoven, or Shakespeare.

1 2 3 4 5 6 7

19. Even though freedom of speech for all groups is a worthwhile goal, it is unfortunately necessary to restrict the freedom of certain political groups.

1 2 3 4 5 6 7

20. It is better to be a dead hero than to be a live coward.

1 2 3 4 5 6 7

This questionnaire is designed to assess some of your personal beliefs. For each item, please circle the number from "0" to "6" that best describes your agreement with the statement. Alternative "0" means that you disagree with the statement as it applies to you. Alternative "6" means that you agree with the statement as it applies to you. The other numbers refer to degrees of agreement which are equally spaced between these two extremes.

1. When I make plans I am almost certain to make them work.

disagree 0 1 2 3 4 5 6 agree

2. On any sort of exam or competition, I like to know how well I do relative to everyone else.

disagree 0 1 2 3 4 5 6 agree

3. I prefer games involving some luck over games requiring pure skill.

disagree 0 1 2 3 4 5 6 agree

4. My major accomplishments are entirely due to my hard work and ability.

disagree 0 1 2 3 4 5 6 agree

5. When I get what I want, it's usually because I worked hard for it.

disagree 0 1 2 3 4 5 6 agree

6. I can usually establish a close personal relationship with someone I find attractive.

disagree 0 1 2 3 4 5 6 agree

7. Often people get ahead just by being lucky.

disagree 0 1 2 3 4 5 6 agree

8. Competition discourages excellence.

disagree 0 1 2 3 4 5 6 agree

9. In the long run, we, the voters, are responsible for bad government on a national as well as a local level.

disagree 0 1 2 3 4 5 6 agree

10. I prefer to concentrate my energy on other things rather than on solving the world's problems.

disagree 0 1 2 3 4 5 6 agree

11. In attempting to smooth over a disagreement, I usually make it worse.

disagree 0 1 2 3 4 5 6 agree

12. I usually don't set goals because I have a hard time following through on them.

disagree 0 1 2 3 4 5 6 agree

13. When being interviewed, I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.

disagree 0 1 2 3 4 5 6 agree

14. I can learn almost anything if I set my mind to it.

disagree 0 1 2 3 4 5 6 agree

15. It's pointless to keep working on something that's too difficult for me.

disagree 0 1 2 3 4 5 6 agree

16. The average citizen can have an influence on government decisions.

disagree 0 1 2 3 4 5 6 agree

17. One of the major reasons we have wars is because people don't take enough interest in politics.

disagree 0 1 2 3 4 5 6 agree

18. With enough effort, we can wipe out political corruption.

disagree 0 1 2 3 4 5 6 agree

19. I often find it hard to get my point of view across to others.

disagree 0 1 2 3 4 5 6 agree

20. Bad economic conditions are caused by world events that are beyond our control.

disagree 0 1 2 3 4 5 6 agree

21. When I look at it carefully, I realize it is impossible to have any really important influence over what big business does.

disagree 0 1 2 3 4 5 6 agree

22. There is nothing we, as consumers, can do to keep the cost of living from going higher.

disagree 0 1 2 3 4 5 6 agree

23. It is difficult for people to have much control over the things politicians do in office.

disagree 0 1 2 3 4 5 6 agree

24. If there's someone I want to meet, I can usually arrange it.

disagree 0 1 2 3 4 5 6 agree

25. I find it easy to play an important part in most group situations.

disagree 0 1 2 3 4 5 6 agree

26. I'm not good at guiding the course of a conversation with several others.

disagree 0 1 2 3 4 5 6 agree

27. If I need help in carrying off a plan of mine, it's usually difficult to get others to help.

disagree 0 1 2 3 4 5 6 agree

28. I have no trouble making and keeping friends.

disagree 0 1 2 3 4 5 6 agree

29. By taking an active part in political and social affairs we, the people, can control world events.

disagree 0 1 2 3 4 5 6 agree

30. Even when I'm feeling self-confident about most things,
I still seem to lack the ability to control social
situations.

disagree 0 1 2 3 4 5 6 agree

Appendix C

On the scale provided below, please rate the extent to which you agree with the following statement:

"I have ESP ability."

----	----	----	----	----	----	----
strongly	disagree	slightly	I don't	slightly	agree	strongly
disagree		disagree	know	agree		agree

On a scale of 0 to 10 (where 0 is no confidence and 10 is complete confidence), please rate how confident you are about your rating of your own ESP ability.

Appendix D

Please estimate the number of correct guesses (out of 30) a person would make by chance alone:

Please estimate the number of correct guesses (out of 30)
that you made during this experiment:

At least how many correct guesses (out of 30) would a person have to make for you to conclude that ESP had occurred in this experiment?

Appendix E

Using the scales below, please indicate the extent to which you agree with each of the following statements by circling the digit which most corresponds to your opinion.

1. The use of drugs such as cocaine, heroine, and marijuana should be legalized in Canada.

disagree strongly 1 2 3 4 5 6 7 agree strongly

2. In the final analysis, the decision over whether or not to abort a pregnancy lies with the woman.

disagree strongly 1 2 3 4 5 6 7 agree strongly

3. First world countries such as Canada should cancel the debts of the developing nations.

disagree strongly 1 2 3 4 5 6 7 agree strongly

4. I doubt very much if extrasensory perception (ESP) exists.

disagree strongly 1 2 3 4 5 6 7 agree strongly

5. Feminism is a positive force for change in Canadian society.

disagree strongly 1 2 3 4 5 6 7 agree strongly

6. There is a God.

disagree strongly 1 2 3 4 5 6 7 agree strongly

7. Environmental destruction is the price we have to pay for economic prosperity.

disagree strongly 1 2 3 4 5 6 7 agree strongly

8. I doubt very much if capital punishment (the death penalty) acts as a deterrent to homicide (murder).

disagree strongly 1 2 3 4 5 6 7 agree strongly

9. In the long run, free trade between countries will improve the quality of life for most people on earth.

disagree strongly 1 2 3 4 5 6 7 agree strongly

10. Democracy is the highest form of human government.

disagree strongly 1 2 3 4 5 6 7 agree strongly

Appendix F

In this part of the study, you will be given several reasoning problems. All problems have the same format. Each problem has two statements. Your task is to read these two statements, and then write a logical conclusion that can be inferred from them.

For example, statement 1: All A are B.

 statement 2: All B are C.

 Therefore: All A are C.

Some problems may contain material that is unfamiliar to you. In all cases, logical reasoning will enable you to determine the correct conclusion. In some of the problems, you may disagree with the correctness of the first two statements. Do not allow this to affect your answer. For each separate problem, assume that the first two statements are correct.

Please keep in mind that not all of these problems lead to a definite conclusion. If you think that no definite conclusion can be derived from the first two statements, simply write, "NDC" (no definite conclusion) beside the "Therefore" prompt.

Do you have any questions? Please turn the page and begin.

All effective homicide deterrents reduce the homicide rate.
Capital punishment does not reduce the homicide rate.

Therefore:

If mental telepathy exists, then one person can accurately
predict what another person is about to say.
One person cannot accurately predict what another person
is about to say.

Therefore:

All elephants which are natives of Australia are elephants.
All elephants which are natives of Australia are natives of
Australia.

Therefore:

If a person is civilized, he has questioned his
first principles.
This person is civilized.

Therefore:

All effective homicide deterrents reduce the homicide rate.
Capital punishment reduces the homicide rate.

Therefore:

If mental telepathy exists, then one person can accurately
predict what another person is about to say.
Mental telepathy does not exist.

Therefore:

No psychotics are rational.
All dictators are psychotic.

Therefore:

All clairvoyants are successful at identifying face-down
ESP cards.
This person is not a clairvoyant.

Therefore:

If capital punishment is an effective homicide deterrent,
then the homicide rate will go down when it is introduced.
Following the introduction of capital punishment, the homicide
rate does not go down.

Therefore:

If a person has not questioned her first principles,
she is not civilized.
This person is civilized.

Therefore:

All clairvoyants are successful at identifying face-down ESP
cards.
This person is not successful at identifying face-down ESP
cards.

Therefore:

If capital punishment is an effective homicide deterrent,
then the homicide rate will go down.
Capital punishment is not an effective homicide deterrent.

Therefore:

All clairvoyants are successful at identifying face-down
ESP cards.

This person is successful at identifying face-down ESP
cards.

Therefore:

If capital punishment is an effective homicide deterrent,
then the homicide rate will go down when it is introduced.
Following the introduction of capital punishment, the
homicide rate goes down.

Therefore:

No androids are human.

Data is not human.

Therefore:

If mental telepathy exists, then one person can accurately
predict what another person is about to say.

Mental telepathy does not exist.

Therefore:

All effective homicide deterrents reduce the homicide rate.

Capital punishment is not an effective homicide deterrent.

Therefore:

No men are infallible.

Some communists are men.

Therefore:

If capital punishment is an effective homicide deterrent,
then the homicide rate will go down when it is introduced.
Capital punishment is an effective homicide deterrent.

Therefore:

Some professional wrestlers are not very highly skilled
performers.
But all good actors are very highly skilled performers.

Therefore:

All clairvoyants are successful at identifying face-down ESP
cards.
This person is a clairvoyant.

Therefore:

All effective homicide deterrents reduce the homicide rate.
Capital punishment is an effective homicide deterrent.

Therefore:

If mental telepathy exists, then one person can accurately
predict what another person is about to say.
One person can accurately predict what another person is
about to say.

Therefore:

All attics are places which are hot in summer and cold
in winter.
No comfortable lodgings are places which are cold in
winter and hot in summer.

Therefore:

Appendix G

For well over a century, scientists have been investigating the so-called deterrence theory of capital punishment. Briefly stated, the deterrence hypothesis suggests that the existence of capital punishment (the death penalty) acts as a deterrent to homicide (murder).

Recently, a group of researchers at Queen's University in Kingston, Ontario, tested the deterrence hypothesis using census data for 15 first world countries which had abolished the death penalty this century. A number of earlier studies had indicated that socio-economic factors may have an impact on homicide rates. To control for socio-economic differences between countries which could affect interpretation of the results, change scores were computed for each country by subtracting the homicide rate before abolition from that following abolition. Evaluation of the deterrence hypothesis is often complicated by the failure to distinguish between countries which have a capital punishment law but fail to use it, and those which actually execute convicted murderers. This factor was controlled by comparing homicide rates only for those countries which had actually executed convicted murderers before abolition of capital punishment.

The results were analyzed as follows: The average of the 15 change scores was compared to the average change score which would be expected if chance alone was operating (i.e., zero). The results indicated that the average change in homicide rates

did not differ significantly from zero ($p > .10$). Thus, the researchers concluded that there was no evidence from this study to suggest that homicide rates had increased in these countries following the abolition of capital punishment, and that there is no reason to think that capital punishment acts as a deterrent to homicide.

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The results were analyzed as follows: The average of the 15 change scores was compared to the average change score which would be expected if chance alone was operating (i.e., zero). The results indicated that the average change in homicide rates was significantly higher than zero ($p < .05$). Thus, the

researchers concluded that there was evidence from this study to suggest that homicide rates had increased in these countries following the abolition of capital punishment, and that there is reason to think that capital punishment acts as a deterrent to homicide.

Appendix H

For well over a century, scientists have been investigating the so-called ESP hypothesis. Briefly stated, the ESP hypothesis suggests that individuals are able to acquire information about their environment through means other than the five senses.

Recently, a group of researchers at Queen's University in Kingston, Ontario, performed an experiment to test the ESP hypothesis. Fifteen subjects were recruited based on their willingness to participate and their belief in their own ESP talents. Each subject underwent 30 trials of an ESP-card guessing task. On each trial, the subject was asked to guess which one of five symbols (a circle, a cross, a square, a star, or three wavy lines) was on the front of an ESP card whose back appeared in a small window in front of them. The symbol for each trial was randomly selected using a table of random numbers generated beforehand by a computer. The subject received feedback about his/her performance after each trial. The experimenter registered the subject's guess following each trial.

The results were analyzed as follows: The number of correct guesses made by the 15 subjects was compared against the number that they would have been expected to make by chance alone (i.e., 6). The results indicated that the number of correct guesses made by subjects did not differ significantly from 6 ($p > .10$). Thus, the researchers concluded that there was no evidence from this study to suggest that ESP is a real phenomenon, and that

there is no reason to think that subjects can guess ESP cards at above chance levels.

For well over a century, scientists have been investigating the so-called ESP hypothesis. Briefly stated, the ESP hypothesis suggests that individuals are able to acquire information about their environment through means other than the five senses.

Recently, a group of researchers at Queen's University in Kingston, Ontario, performed an experiment to test the ESP hypothesis. Fifteen subjects were recruited based on their willingness to participate and their belief in their own ESP talents. Each subject underwent 30 trials of an ESP-card guessing task. On each trial, the subject was asked to guess which one of five symbols (a circle, a cross, a square, a star, or three wavy lines) was on the front of an ESP card whose back appeared in a small window in front of them. The symbol for each trial was randomly selected using a table of random numbers generated beforehand by a computer. The subject received feedback about his/her performance after each trial. The experimenter registered the subject's guess following each trial.

The results were analyzed as follows: The number of correct guesses made by the 15 subjects was compared against the number that they would have been expected to make by chance alone (i.e., 6). The results indicated that the number of correct guesses made by subjects was significantly higher than 6 ($p < .05$). Thus, the researchers concluded that there was evidence from this study to suggest that ESP is a real phenomenon, and that there is reason to think that subjects can guess ESP cards at above chance

levels.

Appendix I

Take about two minutes to really get into how you are feeling right now; then rate your feelings using the adjective pairs below. Some of the pairs might seem unusual, but you'll probably feel more one way than the other. So, for each pair, put a check mark (Example: ---:---:---:---) close to the adjective which you believe to describe your feelings better. The more appropriate that adjective seems, the closer you put your check mark to it.

Autonomous	---:---:---:---:---:---:---:---:---	Guided
Happy	---:---:---:---:---:---:---:---:---	Unhappy
Annoyed	---:---:---:---:---:---:---:---:---	Pleased
Despairing	---:---:---:---:---:---:---:---:---	Hopeful
Submissive	---:---:---:---:---:---:---:---:---	Dominant
Relaxed	---:---:---:---:---:---:---:---:---	Bored
Important	---:---:---:---:---:---:---:---:---	Awed
Calm	---:---:---:---:---:---:---:---:---	Excited
Satisfied	---:---:---:---:---:---:---:---:---	Unsatisfied
Stimulated	---:---:---:---:---:---:---:---:---	Relaxed
Cared for	---:---:---:---:---:---:---:---:---	In control
Frenzied	---:---:---:---:---:---:---:---:---	Sluggish
Aroused	---:---:---:---:---:---:---:---:---	Unaroused
Influenced	---:---:---:---:---:---:---:---:---	Influential
Melancholic	---:---:---:---:---:---:---:---:---	Contented
Dull	---:---:---:---:---:---:---:---:---	Jittery
Controlling	---:---:---:---:---:---:---:---:---	Controlled
Sleepy	---:---:---:---:---:---:---:---:---	Wide-awake

Appendix J

Below is presented a short article from a magazine. Your task involves counting the number of adjectives which are presented in this article. Once you have completed this task, turn the page for further instructions.

The tide recedes, and in multitudes that defy counting, white birds stab their beaks into mud that glistens brown and sleek, like a peeled, bruised peach. Virtually all the greater snow geese in the world are here, for fifty miles or more along the St. Lawrence River, gabbling in resonant discord as they feed upon aquatic plants. It is fall, and they are down from the north, but soon they will leave even this place to the snow that makes battlemented castles of the barns and to the ice that locks the deep, broad river in its grip.

Like a portent of that unfailing snow, the geese blanket the foreshore flats around Cap-Tourmente, just northeast of Quebec City, starting in early October. When the last one has journeyed from the eastern Arctic, they number two hundred thousand.

This has been a hurried fall, with colors flashing through the foliage and chilling winds raking the river before Halloween. Now, in late November, I watch the geese trail off to the south in the slated sky.

And I think:

This could be the year when the cycle of the seasons finally fails, allowing the freeze to carry into August and beyond. But of course that will not happen. Just as certainly as cod spawn on the Grand Banks, there will come a day when the run of first melt splashes on the pale face of the land. Then too, the river ice will start to break up into brash remnants of the thick cover.

This passage contains ___ adjectives.

Appendix K

The following questions refer to the ESP article you read previously.

1. Please write down everything you can remember from the ESP article.

2. What did the authors conclude?
3. What hypothesis was tested in this study?
4. What does this hypothesis state?
5. How many subjects were tested?
6. How many guessing trials did each subject undergo?
7. Which symbols appeared on the cards subjects were asked to guess?

Appendix L

The following questions refer to the capital punishment article you read previously.

1. Please write down everything you can remember from the capital punishment article.

2. What did the authors conclude?
3. What hypothesis was tested in this study?
4. What does this hypothesis state?
5. How many countries were examined in this study?
6. why did the authors use change scores in this study?
7. Which factor often complicates evaluation of the deterrence hypothesis?

Appendix M

Recently, a number of investigators have criticized the methodology of ESP experiments similar to the one you have just read. Specifically, these investigators have criticized the small number of subjects who are typically used to test the ESP hypothesis. According to these investigators, any potential ESP effects may be faint and difficult to detect in laboratory settings. Because the sensitivity of statistical tests increases as larger number of subjects and/or trials are used, these investigators have advocated increasing the size of the samples which are used in ESP experiments. In effect, they have suggested that most ESP experiments to date have not provided sensitive enough tests of this important and intriguing hypothesis.

Recently, a number of investigators have criticized the methodology of ESP experiments similar to the one you have just read. Specifically, these investigators have argued that most of these experiments are open to the possibility of cheating on the part of either the experimenter or the subject. According to them, the fact that cheating has occurred several times in the past, suggests that precautions be taken against both experimenter and subject fraud. One way in which subject cheating can be controlled is by having professional magicians run through the experiment, and determine the opportunities for motivated subjects to see the cards. Experimenter cheating can be eliminated by having both the card presentation and the subject's guesses recorded electronically.

Appendix N

Recently, several investigators have criticized the methodology of deterrence studies similar to the one you have read. According to them, a constant homicide rate, despite abolition, may occur because of unawareness and not because of lack of deterrence: people remain deterred for a lengthy interval by the severity of the penalty in the past, or by the severity of penalties used in similar circumstances nearby. Thus, the effects of deterrence could be present though masked by public ignorance of abolition, particularly in the first year following this change. One way in which this issue can be addressed is by comparing homicide rates before abolition with those five to ten years following abolition of capital punishment.

Recently, several investigators have criticized the methodology of deterrence studies similar to the one you have read. According to them, homicide rates are driven by many factors, and single variable evaluations understate this complexity by pretending that these forces do not exist. For example, a number of abolitions in the study you just read occurred around war time, and recent research indicates that wars frequently elevate post-war rates of violent crime. Thus, increases in homicide rates in this sample may, in part, have reflected a general trend for increases in these rates following a major war. Although it is not known what factors underly increases in post-war homicide rates, these studies suggest that these factors must be accounted for in tests of the deterrence hypothesis.

Appendix 0

Please answer the following additional questions about the ESP study you read.

8. If this study were to be repeated with every detail the same, do you think the same results would be obtained?

(circle a digit)

no, very unlikely 1 2 3 4 5 6 7 yes, very likely

9. Considering the nature of this investigation, the controls which the authors used were (circle a digit)

very inadequate 1 2 3 4 5 6 7 very thorough

10. In view of the results these investigators obtained, I believe the conclusions they drew were (circle a digit)

very inappropriate 1 2 3 4 5 6 7 very appropriate

11. I believe this study was (circle a digit)

poorly designed 1 2 3 4 5 6 7 well designed.

12. Reading the results of this study has caused me to change my mind about ESP. (circle a digit)

not at all 1 2 3 4 5 6 7 very much

13. I doubt very much if extrasensory perception (ESP) exists.

(circle a digit)

disagree strongly 1 2 3 4 5 6 7 agree strongly

14. How familiar are you with arguments or evidence which suggest the existence of ESP?

very unfamiliar 1 2 3 4 5 6 7 very familiar

15. How familiar are you with arguments or evidence which suggest that ESP does not exist?

very unfamiliar 1 2 3 4 5 6 7 very familiar

16. Please list as many arguments for and against the existence of ESP as you can.

For:

Against:

of/de

3

Resolution test chart showing patterns of vertical and horizontal lines with numerical labels:

- 1.0
- 1.1
- 1.25
- 1.4
- 1.6
- 1.8
- 2.0
- 2.2
- 2.5
- 2.8
- 3.2
- 3.6
- 4.0
- 4.5
- 5.0
- 5.6
- 6.3
- 7.1
- 8.0
- 9.0
- 10
- 11
- 12.5
- 14
- 16
- 18
- 20
- 22.5
- 25
- 28
- 32
- 36
- 40
- 45
- 50
- 56
- 63
- 71
- 80
- 90
- 100
- 112
- 125
- 140
- 160
- 180
- 200
- 224
- 250
- 280
- 315
- 360
- 400
- 450
- 500
- 560
- 630
- 710
- 800
- 900
- 1000
- 1120
- 1250
- 1400
- 1600
- 1800
- 2000
- 2240
- 2500
- 2800
- 3150
- 3600
- 4000
- 4500
- 5000
- 5600
- 6300
- 7100
- 8000
- 9000
- 10000

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Appendix P

Please answer the following additional questions about the capital punishment study you read.

8. If this study were to be repeated with every detail the same, do you think the same results would be obtained?

(circle a digit)

no, very unlikely 1 2 3 4 5 6 7 yes, very likely

9. Considering the nature of this investigation, the controls which the authors used were (circle a digit)

very inadequate 1 2 3 4 5 6 7 very thorough

10. In view of the results these investigators obtained, I believe the conclusions they drew were (circle a digit)

very inappropriate 1 2 3 4 5 6 7 very appropriate

11. I believe this study was (circle a digit)

poorly designed 1 2 3 4 5 6 7 well designed.

12. Reading the results of this study has caused me to change my mind about the deterrent effects of capital punishment. (circle a digit)

not at all 1 2 3 4 5 6 7 very much

13. I doubt very much if capital punishment acts as a deterrent to homicide. (circle a digit)

disagree strongly 1 2 3 4 5 6 7 agree strongly

14. How familiar are you with arguments or evidence which suggest that capital punishment has a deterrent effect on homicide?

very unfamiliar 1 2 3 4 5 6 7 very familiar

15. How familiar are you with arguments or evidence which suggest that capital punishment does not deter homicide?

very unfamiliar 1 2 3 4 5 6 7 very familiar

16. Please list as many arguments for and against the deterrent effects of capital punishment as you can.

For:

Against:

Appendix Q

Mean Arousal, Pleasure, Recall, Evaluation of Evidence,
Self-Rated Belief Change, and Familiarity Scores by
Abstract Content and Evidence Type

Measure	Deterrence		ESP	
	Pro	Con	Pro	Con
Arousal	22.65	21.74	21.07	19.40
	(5.76)	(7.03)	(6.64)	(7.48)
Pleasure	29.02	28.13	30.56	29.85
	(9.04)	(8.06)	(6.48)	(7.13)
Percentage free recall	30.94	32.85	37.67	41.06
	(17.95)	(20.81)	(20.36)	(20.77)
Percentage cued recall	41.50	44.20	34.88	37.94
	(20.10)	(21.15)	(18.48)	(21.05)
Evaluation of evidence	15.77	17.83	15.19	18.02
	(4.89)	(3.33)	(4.28)	(4.38)
Belief change	2.51	2.63	2.42	2.17
	(1.61)	(1.65)	(1.35)	(1.37)
Familiarity	7.18	6.74	5.33	6.68
	(2.16)	(2.73)	(3.10)	(2.92)

Note. N = 187

Pro = Confirming evidence; Con = Disconfirming evidence.

END

2/3/12/92

FIN