PSYCHOKINETIC ATTEMPTS ON A RANDOM EVENT BASED MICROCOMPUTER TEST USING IMAGERY STRATEGIES

by

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ABSTRACT

This dissertation reports three pilot psychokinesis (PK) experiments and two imagery-based "training" PK experiments. The two imagery experiments attempted to increase PK scores (as measured by a computer test called "Synthia") of Ss through the practice of three visual-imagery strategies. In Synthia a trial is initiated by pressing the space-bar upon which the computer selects randomly one number. If this number corresponds to a target number randomly generated by the computer the trial is counted as a hit. A blue star appears on the computer screen and a beep sounds each time a hit is made in a feedback version of Synthia. In a nonfeedback version no such feedback is provided. The three strategies were process-oriented imagery (PO), goal-oriented imagery (GO), and end-oriented imagery (EO). In PO, Ss visualized energy building up inside their bodies and then sent it into the computer screen. In GO, Ss imagined the feedback (the beep and the star) provided for hits on the computer test. In EO, Ss visualized the final number of hits they wanted to achieve in each run on Synthia, and as shown on a display at the end of a 40-trial run. The three pilot studies were by and large conducted to test and refine the experimentation environment and the computer test. In the first imagery training study 24 selected Ss participated. Ss were divided into three groups of 8 Ss each. Each group practised one of the three imagery strategies on Synthia on six sessions. In the second imagery training study 52 selected Ss participated. Ss were divided into four groups of 13 Ss each. Three groups each practised one of the three imagery strategies on Synthia on four sessions. The fourth group was a control group which also did four sessions. Altogether 76 Ss participated in the two imagery experiments contributing to 352 "training" sessions. In both experiments the three imagery strategies resulted in neither significant PK scoring nor in an increase in PK scores over a period of time as had been predicted. The conclusion is drawn that PO, GO and EO do not work as a "training" method in a multi-session experimental set-up with a computer test such as the one employed. As predicted, Ss using PO spent significantly longer time on the PK task when they obtained feedback on their performance than in the absence of such feedback. Also as predicted, Ss using GO spent significantly longer time on the PK task in the presence of feedback than in the absence of feedback. This time effect was interpreted in terms of different degree of concentration. Three post-hoc findings were of interest: (1) In the latter imagery study, the control group increased marginally significantly ($p=.051$, 2-T) in total PK scores across sessions whereas the three imagery groups decreased nonsignificantly. Whilst acknowledging that this observation could be due to chance given the number of analyses conducted, a possible psi-based explanation discussed is that the experimenter psi-missed precognitively in deciding when to initiate the computer test. (2) In the second imagery experiment, the 27 "sheep" (those who believe in the existence of psi) showed a nonsignificant incline in PK scores between first and second half of the experiment, whereas the 12 "goats" (those who do not believe in the existence of psi) declined significantly ($p=.009$, 2-T). The difference between incline with sheep and decline with goats was significant ($p=.007$, 2-T). (3) Finally, an examination of 170 pilot / screening sessions indicated that the more Ss reported having had a PK experience the higher their PK scores tended to be on the computer test (an outcome of meta-analysis yielded $z = 3.03$, $p=.001$, 1-T). Three possible lines of research are suggested as a direct continuation of present experimentation.

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DECLARATION

This dissertation has been composed by myself and the work is my own.

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CONTENTS

Tables and figures are presented at the end of the chapter in which they are referred to.

CHAPTER ONE

INTRODUCTION

1.1 THE OBJECTIVE OF THE DISSERTATION

The title of this dissertation, "Psychokinetic attempts on a random event based microcomputer test using imagery strategies", consists of two main components:

A. "Psychokinetic attempts using imagery strategies". This refers to the main objective, the empirical goal, of the thesis which is to try to see if psychokinesis is trainable with human subjects through the practice of three visual-imagery strategies. Typically, psychokinesis (abbreviated as PK) has been referred to as the "influence of mind on external objects or processes without the mediation of known physical energies or forces" (Dale & White, 1977, p.931).

B. "A random event based microcomputer test". This refers to the method of measuring PK. Considerable time and effort was spent on developing and testing a microcomputer test / game called "Synthia" that could serve as a measure of psychokinesis.

Other secondary theoretical and empirical issues interacted with the main purpose. These include investigations into for example, models of psychokinesis that can apply to the data and into the possibility of predicting psychokinesis performance through scalar instruments.

1.2 GENERAL ISSUES IN PARAPSYCHOLOGY

The term "psychical research" was used in Britain as equivalent to what the Germans called "Parapsychologie" and the French "la metapsychique" in the nineteenth century. In 1927 William McDougall came to Duke University as Chairman of a newly formed psychology department. Shortly thereafter J.B. Rhine arrived to study psychical research under the guidance of McDougall. Rhine adopted the term "parapsychology" from the German to represent the experimental and quantitative subdivision of psychical research (Mauskopf & McVaugh, 1980, p.117). Today it has come to replace the older expression, embracing the scientific study of all aspects of psi phenomena (see below) in the U.S. and on the continent, although the British still seem to use the two words interchangeably.

Definitions of Concepts. The term "psi" is a theoretically neutral term to identify an organism's alleged extrasensorimotor interaction with the environment (Thouless, 1942, p.5). Parapsychologists tend to talk about psi ability and psi phenomena, and so on. Thus, psi includes both "extrasensory perception" (abbreviated as "ESP") and "psychokinesis" (abbreviated as "PK"). The Parapsychological Association (1988, pp.353-354, see also Morris, 1982; Palmer, 1982) defines ESP and PK in the following way:

> When an event is classified as a psi phenomenon, it is claimed that all known channels for the apparent interaction have been eliminated. Thus it is clear that labeling an event as a psi phenomenon does not constitute an explanation for that event, but only indicates an event for which a scientific explanation needs to be sought. Phenomena occurring under these conditions are said to have occurred under psi-task conditions. [The Parapsychological Association's emphasis.] Labels such as "extrasensory perception" (ESP) and "psychokinesis" (PK) refer to the apparent direction of information or influence. ESP refers to situations in which, under psi-task conditions, an organism behaves as if it has information about the physical environment (as in "clairvoyance"), another organism's mental processes (as in "telepathy"), or a future event (as in "precognition"). PK refers to situations in which, under psi-task conditions, an organism's physical environment changes in a way that appears to be related to the organism's mental or physiological processes.

There are however alternatives to the above conceptualization which I shall not pursue here that attempt to place the psi phenomenon into meaningful frameworks. Morris has elaborated the psi terminology into a conceptual scheme as presented in a basic communication model (Morris, 1975; 1979). Stanford, questioning the relevance of communication models, has reinterpreted psi events as "dispositional" in character rather than being analogous to known sensori-motor skills (Stanford, 1978; see also philosophical justification for this model in Edge, 1978).

Defining the Field. The content of parapsychology can be considered to be the study of interactions between organisms and their external environment (including other organisms), which occur under conditions when it is claimed that participation of the known sensorimotor systems has been ruled out. This hypothetical type of interaction between organisms and environment has been referred to as being "extrasensorimotor", i.e. it is not dependent on the senses and muscles, or other physical means (see e.g. Dale & White, 1977). Parapsychology is a branch of psychology, as it studies the behavior of organisms, although it interacts with other fields such as social anthropology, biology, physics, and so on.

The methodology that is practised in parapsychology is scientific; i.e. its practitioners put forward hypotheses from which predictions are deduced that can be objectively tested and replicated under identical conditions (e.g. Pratt, 1978, p.85). Although answers are sought through controlled and quantified observation in this thesis, I am aware of an alternative methodological approach towards the understanding of the behavior and experience of human subjects which has been referred to as phenomenology (Koch, 1964, p.34 ff; MacLeod, 1964). See Wann (1964) for discussion of these two approaches in psychology.

A Few Notes on Criticism. Psi phenomena have been the subject of scientific examination for over 100 years. The so-called "psi hypothesis", which states that the existing evidence is sufficient for us to take seriously the idea that a hitherto unrecognized means of interaction / communication with the environment is available to us and that it is amenable to scientific investigation, is still doubted in the scientific community. Criticism on the broad spectrum of research in parapsychology can be found in Crumbaugh (1976) and Ransom (1976). A bibliography of the skeptical literature has been provided by Hovelmann, Truzzi and Hoebens (1985). Methodological criticism of parapsychology has been given by Akers (1984). Summary of the critical writings of the major critics can be found in Child (1987). (See also on the most recent debate, for parapsychology Rao & Palmer, 1987; against parapsychology Alcock, 1987; and open peer commentary on these two papers in Behavioral & Brain Sciences, 1987.)

Inside the field itself, no set of explanations put forth is adequate to explain the range of reported experiences and controlled laboratory studies that have gone on record. However, there is no need to abandon certain areas of research because the questions asked are "out of the ordinary" and do not at present yield any definite answers. On comparing the state of affairs in parapsychology to that of physics past and present, Arthur Koestler (1972) wrote:

> When, in the seventeenth century, experimenting with electricity became fashionable, previously undreamt-of phenomena were discovered, and scientists vied in proposing hypotheses to account for them - postulating effluvia, liquid fires, currents, fields, without turning a hair. Magnetism and gravity had a similar history: when Kepler suggested that the tides are due to attractive forces emanating from the moon, Galileo shrugged the idea off as an "occult fancy" because it involved action-at-a-distance and thus contradicted the "laws of nature"... (p. 79)
>
> ... parapsychological research has become more rigorous, statistical and computerized, while theoretical physics has become more and more "occult", cheerfully breaking practically every previously sacrosanct "law of nature". Thus to some extent the accusation could even be reversed: parapsychology

> has laid itself open to the charge of scientific pedantry, quantum physics to the charge of leaning towards such "supernatural" concepts as negative mass and time flowing backwards. (p.11)

1.3 A BRIEF HISTORY OF PK LABORATORY RESEARCH

In this thesis I chose to focus on PK research because I was more interested in questions related to PK than ESP. A brief history of PK laboratory research is given below.

The first attempt to institutionalize the scientific study of psychic phenomena dates from the establishment of the Society for Psychical Research (SPR) in London in 1882. It was about 50 years later that statistically evaluated studies of PK started (for recent overviews on history of, and findings in, PK research see, Isaacs, 1982; Palmer & Rush, 1986; Randall, 1982; Rush, 1977; 1982; 1986; Schmeidler, 1977; 1982; 1984; 1987; Stanford, 1977b). The early investigations into psychokinesis consisted of research on physical mediums such as D.D. Home (Crookes, 1972; Dunraven, 1924; Zorab, 1970), Eusapia Palladino (Feilding, Baggally & Carrington, 1909), and Indridi Indridason (Gissurarson & Haraldsson, 1989; Hannesson, 1924). A levitation of a table in the presence of a medium was considered to be a possible PK event when/if the hypothesis of deception could be ruled out with reasonable confidence.

Investigating the claims of a gambler, J.B. Rhine at Duke University initiated in 1934 formal research into the hypothesis that movement of objects (such as dice) can be influenced by volition without any physical mediation. The results were not published until 9 years later when Rhine felt that the cumulative results from the numerous repetitions of the PK experiments offered a "moderately strong case" for the existence of PK (Rhine & Rhine, 1943, p.21). The use of dice-throwing as a test for PK was devised independently by Carroll Nash in 1940 (Nash, 1944).

In typical dice-throwing experiments that were to follow a well made die (or two or more dice) was repeatedly thrown and after bouncing many times came to rest. Over a long series of throws it should land (given the appropriate controls for bias via "normal" means) with an approximately equal number of each of its six faces in the uppermost position. The subject in a PK experiment of this sort was usually asked to "will", "wish" or "cause" a specific preassigned face of the die to turn up. This enabled a statistical estimate to be made as to how likely the result achieved was, supposing that the probability for a given fall was one in six. The dice-throwing experimental design was gradually made more rigorous as the PK experiments continued.

A retrospective analysis of the early PK results showed that PK scoring tended over time to follow a typical decline pattern. In the first experiment among those subjects who did three runs in a sequence (each run consisting of twelve throws of pairs of dice) - the average score for the first, second and last runs showed a steady decline (Rhine & Rhine, 1943). If the record sheet for a particular session was divided into two equal chronological halves, the distribution of hits from dice-throws within each run was also found to decline (Reeves & Rhine, 1943). The term "decline effect" nowadays indicates the tendency for positive scoring in psi tests to decrease within either a run or specific unit of experimentation longer than run or decline in time.

During the 50s and 60s, the so-called placement method took over by and large from the die-face method as a major experimental design. Two researchers, W.E. Cox (1951; 1954) and Haakon Forwald (1952a; 1952b; Rhine, 1951) introduced the placement design. (It is unclear whether

Forwald introduced it independently or was replicating Cox's work.) This particular method consisted of, for instance, letting one or more dice (or other objects) roll down a sloped panel after being initiated mechanically. At the end of their roll, the dice would land on a table on either the left or the right hand side of the sloped panel. The subject's task was to try to influence the dice to move and come to rest on either the left or the right side of the table, whichever was the designated target side. The target sides of the placement table were alternated, so that any bias inherent in the apparatus would cancel out. Statistical methods could then be used to evaluate the results.

After examining more than 200 publications dealing with PK, Girden (1962) offered a detailed criticism on the statistical PK research on dice and placement. He criticized the earlier PK tests for being poorly designed and badly executed. He pointed out for example that (ibid., pp.358-360,382); adequate control tests were lacking, equal numbers of trials were not obtained with the several target faces of the dice, the use of a hand shaken container in a majority of the reports was not completely fool proof, motor driven dice machines possibly turned out repetitions that were not properly random, and that little or no effort was made to insure accuracy in recording the obtained scores.

Beloff and Evans (1961) were the first researchers in parapsychology to utilize the decay of a radioactive atom (the most random process known to physics to the best of my knowledge) as a PK target. They set up a radiation counter adjacent to a piece of uranium compound and asked their subjects to try to alter the count rate. They did not find any evidence of PK. One year after his publication of precognition results with a similar machine, Helmut Schmidt in 1970 published the results of some PK experiments he conducted with an electronic apparatus made up of a binary random number generator (abbreviated as "RNG") connected to a display panel which he designed and built (Schmidt, 1970a; 1970b). (RNGs are discussed in more detail in section 3.3.) Schmidt's original RNG equipment made use of electrons emitted by the decay of the radioactive nuclei from strontium-90 to trigger a Geiger counter. "The momentary position of a binary high frequency counter at the time of the electron registration" determined whether a "+1" or a "-1" was generated (Schmidt, 1970a, p.177). The essential aspect of the display panel was a circle of nine lamps which lit one step at a time for each trial in the clockwise (+1) direction or the counterclockwise (-1) direction, depending on which of the two numbers the RNG produced for that trial. The subject's task was to choose either the clockwise or counterclockwise motion and try by using PK to make the light proceed in that direction. Schmidt acknowledged that, although he discussed his experimentation in terms of PK, in principle, the results could also be ascribed to precognition on the part of the experimenter or the subject.

In order to improve efficiency, Schmidt designed a high-speed RNG that could produce faster sequences of random numbers (Schmidt, 1973). Instead of radioactive decay the random element in the new RNG was electronic noise, which was used to select a target whenever the generated noise exceeded a certain threshold amplitude. Nowadays RNGs most often make use of electronic noise instead of Strontium-90 and much of the contemporary PK research is conducted with numbers produced by RNGs as targets. (The project reported in this thesis makes use of a RNG computer test.) Since the publication of Schmidt's RNG work, he has continued to run successful RNG PK experiments. More importantly, a number of other researchers have successfully used the same devices or similar ones to replicate psi results (e.g. Nelson et al., 1986; Radin et al., 1986; and summary of results in Jahn & Dunne, 1987, pp.144-148).

Today many parapsychologists make a distinction between macro- and micro-psychokinesis (e.g. Palmer & Rush, 1986). According to this classification, which may sometimes be ambiguous, macro-PK describes phenomena such as purported metal-bending and such large scale phenomena as alleged gross movements of objects typical of claimed poltergeist manifestations (also referred to as Recurrent Spontaneous Psychokinesis, "RSPK"). Macro-PK phenomena can be observed directly. Micro-PK describes the small scale phenomena, such as a specific face of a die turning up more often than one would expect by chance. Measurement of some sort is needed to know whether a micro-PK phenomenon has taken place. This thesis concentrates on micro-PK research. One can argue that the experimental approach to the micro-PK category can be divided into two crude categories according to how the results are arrived at: a) The method of detecting psychokinesis by statistically significant deviation from mean chance expectation (MCE). b) The method of detecting psychokinesis by other quantitative measurements such as changes in intensity or pulse frequency of a light source, or temperature, or growth of enzymes.

As with ESP, the physical processes responsible for PK remain obscure. The distinction between the subcategories of psi is often arbitrary (Nash, 1975; Rhine, 1974). For instance, it is difficult to distinguish between precognition and PK when it comes to anomalous bias in RNGs. It is unclear whether PK makes a contribution of energy to the systems apparently affected, and most modern theories do not hypothesize PK as being a form of energy. Some researchers have constructed theories that reduce all statistical psi results to PK, called the observational theories (Schmidt, 1975a; 1975b; 1978; Walker, 1975; overviews in Houtkooper, 1983; Millar, 1978). Others have reinterpreted the available experimental RNG data pool in terms of an informational model called Intuitive Data Sorting (May et al., 1985). These two ideas, which are amongst the most prominent ones today, are discussed in more details in chapter 3.

1.4 THE RATIONALE BEHIND THE DISSERTATION

The Choice of a Training Study

The problem of obtaining on demand, and maintaining satisfactory control over psi has not yet been solved in parapsychology. The solution of many basic research problems in parapsychology (such as building and testing theories) depends on the researchers having reliable high-scoring individuals to act as experimental subjects. Not enough of these turn up in experiments and those who do are liable to lose their ability to score highly after a period of time (Thouless, 1963, p.71). As stated by John Beloff (1967, p.120), "Progress is possible in science only when the relevant phenomena are available for research".

Since the amount of psi shown in experiments is usually very small (despite often being statistically significant), many parapsychologists think it is of major importance to find means to enhance PK scoring in experiments. Gardner Murphy (1969, p.3) wrote for instance that the problem of cultivating "good psychic subjects" was really the beginning and the center of all psychical research. For him the cultivation of the "paranormal gift" seemed not unlike the cultivation of almost any other kind of gift whether playing the piano or learning to wiggle one's ears (ibid., p. 10).

The state of affairs in parapsychology seems to call for a reliable procedure to produce statistically measurable psi. This is important in order to bring psi phenomena to such a level that they become available to scrutiny. However, we may be facing a vicious circle here. In order to be able to establish a psi training procedure, one can argue, we need to know more about how psi can be controlled. This view is reflected in the following quotation from R. H. Thouless (1963, p.71):

> It has seemed to me for many years that one of the most urgent unsolved problems of parapsychology is the question of how we may obtain such control of its phenomena that we can train subjects to succeed in paranormal tasks.

One way around this dilemma is to think of the two views as going hand in hand. When there is a suggestion that research on a topic has reached a promising level - we try to take the research one step further and use the available data in some form of a training procedure. For the sake of argument, let us suppose that a certain mental procedure such as visualizing successful outcome on a psi task results in extrachance scores. This encourages the hope that we may look into this direction for one solution of the problem of psi control, and thus replicability. Whether this is, or is not the case must be discovered by research. We may want to investigate whether use of this mental procedure results in higher and higher psi scores with continuous practice. Whether subjects were successful because they practised the mental procedure, or whether this technique merely served to trigger off some latent natural abilities, or simply boosted their motivation, confidence, etc., are other questions which would have to be answered by yet further research.

The Choice of Visual-Imagery Strategies

The topic of imagery has started to play a larger research role in various academic disciplines. In sport psychology reviews of mental practice (such as visualization) suggest that mental practice may have positive influence in the acquisition or the performance of a skill

(Feltz & Landers, 1983; Suinn, 1983; 1984). In an albeit unorthodox line of research within medical science, there seems to be growing interest in relating "attitude" variables and imagery to the outcome of cancer (e.g. Achterberg & Lawlis, 1979; Achterberg et al., 1977; Simonton, 1972; for a general discussion on clinical uses of mental imagery see Sheikh & Jordan, 1983). For example, in an imagery of disease test known as Image-CA (Achterberg & Lawlis, 1984), cancer patients are given an interview in which they are asked to imagine, draw and discuss pictures of their tumors, their white blood cells, and their current medical treatment. The interview protocol is scored on 14 dimensions, e.g. frequency of positive images, symbolism, vividness. The total score on the Image-CA has been found to predict the status/outcome of cancer with 93% accuracy for those in total remission, and with 100% accuracy for those who had died or had rapid deterioration (Achterberg & Lawlis, 1979).

Looking to parapsychology, experiential reports of purportedly gifted ESP subjects (see especially, Kelly et al., 1975; White, 1964), as well as material from spontaneous case collections (e.g. Rhine, 1953; 1954) suggest the importance of the role of visual imagery in the manifestation of ESP. On such material George and Krippner (1984, p.80) commented:

> Qualitative material gathered by parapsychologists suggests that the enhancement of mental imagery is an obvious candidate for a relevant commonality among allegedly psi-conducive practices.

Experimental work also suggests the possibility (although not unambiguously) that ESP performance can be enhanced through the practice of visual-imagery strategies (see reviews in George, 1981; George & Krippner, 1984).

Many popular books on "positive thinking" and "psychic development" have claimed that visualization and imagery is important in bringing about desired outcomes (e.g. Koran, 1972; Peale, 1952, Sherman, 1972; 1978). Morris (1980a) did a review on "psychic self-development" methods as presented in the popular literature. He noted that these methods frequently stressed the importance of visualization and imagery in developing psychic ability. He wrote (ibid., p.10):

> ... members of the research community would do well to consider the techniques offered and to explore them more systematically under controlled conditions.

There are reasons to think that imagery may play a role in the generation of psychokinesis. On reviewing the literature (see following chapter) on what can in a broad sense be called research into "mental training" and psychokinesis - those strategies involving visual-imagery of some sort seem to be promising. The reason for choosing psychokinesis training via visual-imagery strategies was not only based on reviewing the literature, but the author had also the opportunity to do such research under the supervision of Robert Morris, who has been actively involved in the area of psychokinesis conducive visual-imagery practice. Finally I want to quote Evan Harris Walker on the study of imagery in parapsychology (Walker, 1984b, p.11):

> The detailed study of imagery is possibly the most important experimental tack being taken to solve the problem of repeatability in parapsychology.

1.5 ISSUES EXPLORED IN THE THESIS

The research reported in this thesis could probably be called process-oriented as distinguished from proof-oriented. The emphasis is not on trying to prove PK to be true or false. The aim of process-oriented research is to learn more about the processes that may be involved when/if numbers produced by a RNG show an anomalous bias from the expected distribution and when this bias is associated with mentation of volitional activity. John Palmer wrote on process-oriented research (Palmer, 1986, p.185):

> However, even though there may be process psi researchers who personally consider psi to be an established fact, such a belief is by no means a prerequisite for doing process research. It is only necessary that the existence of psi be accepted as a working hypothesis. Indeed, looking at the matter from a broader perspective, one can easily conceive of process research designed to demonstrate that the process underlying 'psi' is a normal physical one.

The issues that are explored in the thesis, and the methods used in the following experiments, tie into research in other fields of psychology such as sport psychology, the study of imagery in cognitive psychology and psychological testing.

The main body of chapter 2 presents a review of the literature on what can in a broad sense be called "mental training" and PK. Specific emphasis is put on describing studies that have explored visual-imagery of some sort in an attempt to enhance PK scoring. The last part of chapter 2 includes a discussion of imagery research as it is practised in cognitive psychology. The first part of chapter 3 gives a summary on the so-called RNG microcomputer games that are presently in use. This is followed by a description of the author's construction of a computer test/game called "Synthia" that was used throughout the research project to measure possible PK effects. Finally two models are outlined that have been developed by Schmidt (1982) and May et al. (1985) to account for anomaly in RNGs, and are current in the field. Chapter 4 presents the exploratory phase of the thesis. It consists of three pilot studies that were conducted to scout for ideas, develop hypotheses, and to examine the experimental environment and the equipment (mainly the RNG computer test and questionnaires). Chapter 5 describes the first of two large experiments reported in the thesis. It was a preliminary study into the training of PK through three visual-imagery strategies. Chapter 6 reports the second large experiment that was conducted to attempt to improve PK performance with human subjects via the visual-imagery strategies. Finally, chapter 7 sums up the main findings and contains a discussion of the overall results.

The working assumption behind this Ph.D. project is the "psi-hypothesis" (which states that psi exists) and that RNGs have apparently been biased via psi, whether that in turn is due to precognition or PK. To make life easier, in the rest of this dissertation I shall use the term PK to denote whatever psi effect may be involved because the subjects were asked to engage in volitional activity to try to influence the RNG. I am aware however that the alternative explanation (i.e. precognition) may be applied.

CHAPTER TWO

REVIEW ON "TRAINING" PK

2.1 INTRODUCTION

This chapter starts by providing general definitions of training and learning. Then it reports a summary of research exploring possible ESP facilitating conditions. This is followed by an extensive survey of the existing experimental work on potential PK facilitating conditions, of which I was aware when starting my research. Experiments that explored visual-imagery strategies are described in detail. Reports that came to my attention after the start of the experimentation, and which are relevant to the purpose of my project, are reported in the discussion sections following each experiment. The final part of this chapter deals with miscellaneous issues concerning feedback and imagery.

2.2 DEFINING TRAINING AND LEARNING

For present purposes, psi ability can be construed as the ability to interact (or exchange information) with one's environment without apparent access to presently understood channels (or means of information transfer) (e.g. Morris, 1980a, p.9). This thesis explores whether the psi ability can be trained. The importance of training psi is to attempt to bring this ability to such a level that it becomes available for research.

Training. The term "training" in this thesis denotes, generally, the process of bringing an organism's performance, such as making some specific response(s) or engaging in some complex skilled activity, to an agreed end state of proficiency by a specific instructional program or structured manner of practice. The above definition is adopted from Reber (1987, p.782) with some revision (e.g. from Schneiders, 1956, pp.420-421) in order to make it more specific. The psychology of training has been referred to by Wolfle (1951, p.1267) as "the applied psychology of learning." By virtue of it being an applied field, the purpose of training can be said to be to attain consistent levels of high performance.

Learning. According to Reber (1987, p.396) the definition and manner of use of the term learning has caused relatively little controversy amongst psychologists. "Learning" is used with relatively few encumbrances by developmental, educational and cognitive psychologists, and so on. The tendency seems to be to allow the socially accepted meaning to prevail.

In learning theory in psychology the process of the initial conditioning of operant behavior has been called learning (Ferster et al., 1975, p.315). Since this definition is quite narrow, for present purpose I will adopt a working definition of learning from Hovland (1951, p.613), who stated:

> Learning will be defined as the change in performance associated with practice and not explicable on the basis of fatigue, of artifacts of measurement, or of receptor and effector changes.

To the best of my knowledge, this view still holds by and large although the reference is fairly old.

Many psychologists make a distinction between performance and learning (Spence, 1951). Performance has reference to the observable and measurable response, which is an empirical concept. Learning refers to a hypothetical factor which is assumed (i) to be the product of the past interactions of the individual with his environment and (ii) to be one of the conditions that determines his performance at any moment.

2.3 PSI TRAINING - A GENERAL BACKGROUND

Popular Training Systems

Folk traditions. Historically, the thread of psi training runs through hundreds of traditions, such as priesthood, mystical fraternities and spiritual lineages, each with its own cults, variations and interpretations. In various religions psychic abilities have been thought to be within the capacities of shamans (e.g. Giesler, 1984; 1985), and other possession trance mediums (e.g. Dobbin, 1986; Gissurarson, 1989). Training as a shaman, for instance, in the Afro-Brazilian ecstatic religion or "cult", Umbanda, involves many years of an intensified study of doctrine and ritual, mediumistic training and sacerdotal instruction.

Popular literature. In the popular literature as well as in the scientific literature training of psi has mostly dealt with ESP. Many popular training systems are in use that claim to facilitate or train ESP (for an overview see e.g. Mishlove, 1983). That ESP training can take many forms is suggested by numerous autobiographical and popular accounts published by various authors (e.g. Scott, 1938; Yogananda, 1949). In his evaluation of the different popular psi training systems, Mishlove (1983, p.136; 1988, p.179) stated that there had not been any unequivocal scientific demonstrations of the efficacy of any such popular programs, although circumstantial evidence supporting some claims did exist.

Morris (1977; 1980a; 1980b) conducted a survey in 1975 and 1976, collecting 74 "popular" books, representing 57 authors, which claimed to instruct how to develop psychic ability. This survey was referred to as the "Airport Project" as the data was derived from the type of books commonly found for sale in bus stops or airport news-stands. The data, collected by students from two of his introductory parapsychology classes, revealed certain consistencies in the type of advice given. This advice generally stressed the need to be mentally and physically healthy at the start, confident, mature, with an initially positive, receptive attitude towards psi and an acceptance of the consequences of acquiring psychic ability.

General suggestions for PK. The popular literature on training PK often emphasizes that in order to, for instance, obtain an object which the heart desires, one has to strengthen one's belief or faith in obtaining the object, exercise imagery and visualization of the object, and feel confident and relaxed about getting it (e.g. Clark, 1978; Koran, 1964; Rampa, 1965). Several of the books in Morris' (1977) survey suggested that the target (or any other goal) for PK should be meaningful in one way or another and that it should be visualized repeatedly, while going through some kind of mental and physical relaxation procedure to clear out irrelevant thoughts. In general, the practitioners were urged to maintain confidence despite any failure, and to practise routinely. Skills in relaxation, concentration and visualization were supposed to be necessary and had to be acquired if one did not already possess them. The books rarely gave any specific guidelines on how to evaluate one's psychic development objectively.

Summary of Training of ESP

The experiments cited below were not necessarily aimed at contributing to the "training" literature of ESP. Many of them explored methods that might potentially facilitate the operation of PK on a single occasion. Strictly speaking, a training study would involve repeated sessions and emphasize a process with actual training goals in mind. But since the cited studies examine what can be seen as methods that may prove themselves to be possible training tools in the future, they should receive our attention. It is important to note that this is true of most of the PK studies as well reported in section 2.4.

A large body of controlled studies is available on possibly ESP-conducive methods in the experimental environment. The methods reported in these studies can be put under six main headings: 1) hypnosis, 2) yoga and meditation, 3) relaxation, 4) sensory deprivation, 5) feedback and 6) imagery. I selected these particular methods, because I thought that if they could be shown experimentally to be ESP-conducive they could be used without too much difficulty in or as a specific instructional program aimed at bringing subjects' PK performance to a high and consistent scoring level. (The selection of PK categories in section 2.4 is based on the same rationale.) Following is a short historical description of each category with a brief statement of evaluation as reported by an authority on the subject.

Hypnosis. Claims relating hypnotic suggestion to unusual psychic abilities have been recorded ever since the early days of Mesmer in the 18th century. The early issues of the Proceedings and Journal of the Society for Psychical Research contain a number of reports of successful clairvoyant and telepathic experiments with subjects who had been hypnotically prepared (e.g. Gurney, 1888; Richet, 1889). An extensive survey of these early studies has been provided by Dingwall (1967; 1968).

One of the most comprehensive procedures for the training of ESP ability under hypnosis reported in the experimental literature has been carried out by Milan Ryzl (1962; 1966; Ryzl & Ryzlova, 1962; see also summary of studies on the best known graduate of Ryzl's program, Pavel Stepanek, in Pratt, 1973). The Ryzl technique appeared to involve two essential stages (Beloff & Mandleberg, 1966, p.230): (i) Repeated hypnotic sessions during which the subject became practised at experiencing vivid visual hallucinations to order. (ii) Further hypnotic sessions during which the subject was encouraged to try to ascertain by means of ESP selected target objects which should then give rise to "veridical" hallucinations. Several investigators have attempted to replicate the Ryzl technique but without success (Beloff & Mandleberg, 1966; Fourie, 1977; Haddox, 1967; also on ESP hypnosis training see Stephenson, 1965). Honorton and Krippner (1969) pointed out that in some ways the methods used in these studies differed from Ryzl's original technique.

Honorton and Krippner (1969) surveyed the contemporary experimental studies published in the English language that attempted to facilitate ESP performance through hypnotic suggestion (see also Van de Castle, 1969). Their conclusion was as follows (Honorton & Krippner, 1969, p.244):

> ...it seems clear that hypnosis does affect psi performance. Nine of the twelve studies involving direct comparison of ESP performance in hypnosis and the waking state yielded significant treatment differences.

Yoga and meditation. As with hypnosis which has a history in Western culture, yoga, originating from Hinduism in India, and meditation have often been regarded as techniques for facilitating ESP. The idea that psychic abilities manifest as a by-product of meditation can be traced back to the early writings on yoga (Eliade, 1954/1971). It is possible to differentiate between the term "meditation" and yoga. The term "meditation" seems to be a broad label covering different mental relaxation and concentration exercises for quieting the flow of thoughts by contemplating a given sound, image, thought or even nothing at all. Yoga refers more to a certain "lifestyle" (with its special philosophy, relationship with a guru, special diets, moral discipline, postures and breathing techniques, etc.), and it includes various meditation exercises. It has been regarded by many practitioners as a method leading to the mystical union of the self with the Supreme Being.

Research attempts to validate psi claims made for yoga have been minimal but apparently successful so far (e.g. Dukhan & Rao, 1973; Motoyama, 1969; Schmeidler, 1970). Reviews on the possible link between yoga / meditation and ESP performance have been provided by Honorton (1977b) and Mishlove (1988). In his review Honorton put both meditation and yoga in ESP and PK studies under the heading of "meditation". The combined results for all of the studies involving psi tasks during or following "meditation" were highly significantly above chance (Honorton, 1977b, p.442).

Sensory deprivation. In surveying the relevant research conducted up to that time, Honorton (1974a; 1974b) proposed that ESP may be facilitated by the reduction of external and internal stimulation, or "noise", and a concomitant redistribution of attention inwardly on internally mediated mental processes. To test this hypothesis Honorton and Harper (1974) utilized a method of sensory habituation called the "ganzfeld". (The ganzfeld method was first introduced by Witkin, see e.g., Bertini, Lewis & Witkin, 1964).

This method has become one of the most prominent purportedly psi-conducive situations to be studied in parapsychology and many ganzfeld studies have yielded statistically significant results (Sargent, 1980; Schouten, 1981; Stanford, 1984). The procedure involves attempting to produce a relatively homogeneous sensory input to a percipient, who (in a typical procedure used in psi testing) is fitted with headphones through which white noise is played. The percipient's eyes are covered by goggles (usually made from halved ping-pong balls) onto which red light is directed to provide an unstructured visual field. Typically there is an agent who attempts to "send" the content of a target picture, and a percipient who generates imagery which is to provide details of the target picture in a free-response format (e.g., Delanoy, 1986; Haraldsson & Gissurarson, 1985; Houtkooper, Gissurarson & Haraldsson, 1989).

Results of an extensive systematic evaluation of ESP results in the ganzfeld have been much debated (e.g. Honorton, 1985; Hyman, 1985). However, a mutual agreement between Hyman (a critic) and Honorton (a proponent) of the technique's success was that "there is an overall significant effect in this data base that cannot reasonably be explained by selective reporting or multiple analysis" (Hyman & Honorton, 1986, p.351).

<u>Relaxation.</u> The first experimental suggestion of the possible role of relaxation in extrachance ESP performance came from Schmeidler (1952). Taking up the thread about twenty years later, Braud and Braud (1973) reported a series of exploratory experiments in which they attempted to assess the effects of a modified Jacobson's progressive relaxation technique on ESP. Since then a growing body of evidence is available suggesting that relaxation techniques may indeed facilitate positive ESP scoring (for overviews see Honorton, 1977b; Mishlove 1988).

The strength of contemporary relaxation studies are the underlying models which apparently have been developing hand in hand with the relevant research area. According to Braud (1978c, p.5; see also Braud & Braud, 1977, p.10) these models are by and large an elaboration and extension of Honorton's original "noise reduction" model. Braud and Braud (1974) suggested a so-called "relaxation syndrome", a cluster of characteristics or "symptoms" of what can be referred to as the "relaxation state" (such as lowered frequency and increased amplitude of EEG activity). The presence of the relaxation syndrome was hypothesized to be psi-conducive since the findings of their research showed that subjects without any prior history of "psychic" experiences in everyday life demonstrated reliable psi abilities while in a state of physical and mental relaxation (Braud & Braud, 1974). Braud (1975) formally proposed a "psi-conducive syndrome" consisting of seven major characteristics, such as physical relaxation and reduced physiological arousal or activation. Subsequently, Braud and Braud (1977; see also Braud, 1978c) have introduced a so-called "noise reduction model of psi-optimization," which includes suggestions for specifying, measuring and reducing various "noise" sources.

Feedback. Feedback was first introduced as an ESP training method by Tart in 1966 (Tart, 1966; 1975a; 1975b; 1977). Tart thought that the failure of contemporary card guessing tests to show consistent ESP might be due to not providing trial by trial feedback. Subjects were never able to distinguish between correct and incorrect responses, as the reward could not be clearly associated with the correct responses by the subjects. The desired behavior was not learned or, if already present, was extinguished. Tart suggested that the manner in which feedback was given in ESP card-guessing tests in fact led to extinction rather than learning. He pointed out that learning could only be accomplished by subjects who had a fairly high level of ESP scoring to begin with, otherwise, there would not be any psi-mediated responses to reinforce and no possibility of learning.

The feedback training method used by Tart was based upon operant conditioning and involves a different approach to the training of ESP as opposed to the other categories so far discussed (as pointed out by Delanoy, 1986). Instead of utilizing psi-conducive states of consciousness to develop skills which may be related to psi ability, it utilizes immediate feedback (that is provided after each trial) to recognize cues or states associated with correct ESP information about the target. Reviews of studies that have been conducted to test the efficacy of Tart's training model have for example been provided by Palmer (1978; 1982) and Tart et al. (1979). Given the reported tendency for psi scoring to decline, Palmer (1978, p.187) concluded that feedback did indeed have a tendency to stabilize ESP scoring and perhaps to enhance it in some cases.

Imagery. One area of methods that are aimed at enhancing ESP scoring is that of visual imagery. Although this is reported here as a separate category of potential ESP training procedures, visualization and imagery tie into the other groups as well. Fourie (1977, p.60) for example noted that Ryzl's hypnosis technique actually consisted of two separate procedures, one of which he called "practice in vivid mental imagery," wherein the hypnotized subject tried to form an image of the target object. Furthermore, the importance of visual imagery in the manifestation of ESP has been, more or less, hinted at throughout the history of parapsychology (e.g. Kelly et al, 1975; Sinclair, 1930/1962; White, 1964).

Typically studies exploring the role of what we can broadly put under the heading of the "imagery method" for the facilitation of ESP involve imagery practices (e.g. George, 1982; Morris & Bailey, 1979; Morris, 1980b) and/or the manipulation of the imagery instructions to subjects (e.g. Honorton et al., 1974; Kreiman, 1980). An overview on imagery studies has been provided by George (1981) and George and Krippner (1984). George and Krippner (1984, p.80) commented on the imagery research:

> ...to determine what type of imagery training will be most suitable for magnifying psi effects, research data need to be less ambiguous than they are at present. For example, the experiential reports of purportedly gifted ESP subjects as well as the material from spontaneous cases suggest the importance of imagery vividness to the manifestation of psi. Yet, the parapsychological experiments attempting to measure individual differences in imagery or to manipulate imagery through instructions have yielded inconsistent results. Again, one would assume that practice in evoking imagery would improve ESP scoring, yet the experimental work in this area is quite inconsistent.

Comments. There are, of course, other methods on record that do not easily fit into one or the other of above groups. One such is the "waiting technique" that emphasizes the role of visual imagery and involves training in relaxation and concentration (Beloff & Mandleberg, 1967; White, 1964). The waiting technique could also relate to meditation. It should be noted that each method does not necessarily demand only one faculty, relaxation procedure or hypnosis, and so forth. In fact, one could argue that the faculties called upon in each method are not arbitrary, and/or that most methods explicitly or implicitly call for one or more of the others, for instance the ganzfeld procedure and meditation involve relaxation to some degree.

2.4 "TRAINING" METHODS IN PSYCHOKINESIS RESEARCH

I have put the following studies of potential PK facilitating conditions into six main categories, five of which are described in this section: 1) hypnosis, 2) yoga, 3) meditation, 4) relaxation and, 5) operant conditioning. Visual imagery, which is the last group of methods for the enhancement of PK, is reported in a following section.

Hypnosis

Rhine reported an exploratory study carried out in 1936 examining the effects of hypnosis on PK performance in a dice-throwing situation (Rhine, 1946). Five subjects participated, aiming to influence the fall of 96 dice at a time. The session began with a pre-hypnotic control series, during which each subject completed 20 throws of the 96 dice (contributing overall to 480 runs). The subjects were then hypnotized. While being in that state they were given instructions that they would be able to influence the dice by their concentrated effort, and that they would have great confidence in their ability to make the dice behave as they willed. Following administration of these suggestions, the subjects were dehypnotized. Then they carried out the same PK task as before posthypnotically (finishing 492 trials in all).

Although their PK scores were well above chance (the report does not say whether this deviation was significant) before the hypnosis treatment (mean PK scores = 4.19, MCE=4), the scores dropped below chance following the hypnotic suggestions for improved performance (mean PK scores = 3.99, MCE=4). This drop was contrary to the effect intended by the hypnotic suggestion. Rhine noticed, however, that an incidental break in the hypnotic state with two of the subjects (interruption for one subject and a cigarette break for the other) brought about a reversion to high scoring. After the break their subsequent performance (mean PK scores of 4.35 and 4.36) proved to be higher than in the pre-hypnosis baseline session (mean PK scores = 4.19 and 3.92, respectively). (It is not clear in the report whether the difference was significant.) Two subjects (not the ones who had the incidental break) were rehypnotized and given suggestions that they would take part in further tests but this time they would feel free and easy about the tests, be relaxed and would throw the dice in the spirit of a game which they would enjoy. Both scored above chance and significantly higher than on the first posthypnotic occasion (both obtaining mean PK scores of 4.29).

Honorton and Krippner (1969) commented on this study: Firstly, the decline in scoring following the hypnosis session could have been an order effect, rather than treatment effect. Secondly, since no formal assessment was made of the depth of the hypnosis it is not possible to assess the effectiveness of this study as a test of the effect of hypnosis on PK performance.

Breederveld and Jacobs (1979) carried out a study to test the hypothesis that hypnosis combined with suggestions of high scoring would lead to better results in PK experimentation compared to no hypnotic induction. The "PK test" was a public German lottogame, in which six winning numbers were chosen on a weekly basis from numbers between 1 to 49. The selection of winning numbers was broadcast by TV. Five experimental series were carried out (each apparently with about 10 sessions). Prior to the first experiment six numbers were chosen as the target. (It is unclear from the report whether those numbers remained the same throughout all experiments). One subject observed the results of the lottogame usually on TV, either under hypnotic induction or in a normal waking state. When hypnotized the subject was told that he would observe the selection of the winning lotto numbers and that these numbers would be the preselected target numbers. After observation of the lotto numbers (on TV) the subject was dehypnotized back to his normal state of awareness. Whether the subject was assigned to the hypnosis or the waking condition could not be planned beforehand. It depended upon circumstances, hypnosis usually being carried out when the subject was at home with not too many people around.

The overall results showed an impressive difference between the number of hits for the hypnosis condition and that of the nonhypnotic condition (p=.002) in favor of the hypnotic condition. However, post-hoc examination of the data showed that the psi-missing that occurred in waking condition contributed more to the success of the experiment than the psi-hitting in the hypnosis condition. Thus, we can conclude, psi-hitting in the hypnosis condition appears not to have been produced by the hypnosis condition.

Comments. It is premature to judge the effectiveness of hypnosis in the production of PK from only two studies on record, one of which was a pilot study and the other had only a single subject. It would seem that further research is needed in this area.

Yoga Training

Winnett and Honorton (1977) reported a PK experiment with ten recent initiates of Ajapa yoga. They describe Ajapa as follows (ibid., p.97):

> Ajapa is a yoga breathing technique, practiced throughout the day without imposed conditions of time and place. It is based on the belief that natural breathing is an expression of universal forces of attraction and repulsion which are balanced by a slight alteration of the breath. Ajapa meditation combines this alteration in breathing with concentration on a mantra.

The testing apparatus, called PSIFI, was a feedback device with a noise-driven binary RNG, in which the PK task is a standard "coin-flipping" type of test (p=1/2). The PSIFI can present both physiological biofeedback (EEG and EMG) and psi feedback (see details in May, 1976). The psi feedback can be a "signal" (various types of auditory sounds) for each hit. Alternatively an average can be computed for each trial and the nine previous ones and a "signal" created if the average number of these hits is "outside the preset range" (ibid., p.21). It is unclear in the report what "outside the preset range" refers to. Besides a manual choice the PSIFI has an optional auto-alternating mode of operation which automatically reverses the target definition between heads (high-aim) and tails (low-aim) every other trial. Thus any bias in the generator will cancel out.

The session was divided into three phases. The ten subjects were each tested before, during and after periods of meditation. In each phase a subject was given ten experimental runs (100 trials per run). During the pre- and postmeditation tests, subjects were given the auditory feedback. However, unknown to the subjects, the feedback contingency was reversed between the fifth and sixth runs, such that the feedback was associated with hits (high-aim) for half of the runs and misses (low-aim) for half of the runs. During the meditation phase, only nonfeedback PK data were collected.

The pre-meditation runs were significant for the low-aim condition ($p=.005$, 2-T), but scores were at chance level during the high-aim condition period. The difference in PK scores between the high- and low-aim conditions was significant ($p<.005$, 2-T). Both the meditation and post-meditation runs resulted in nonsignificant scoring. Actually, the subjects did obtain more "hits" following meditation but this higher scoring was obtained when they were aiming for low scores or "misses". Thus Winnett and Honorton concluded that the Ajapa practitioners showed a significant decrement in PK performance following meditation for the low-aim contingency ($p=.0053$, 2-T). It is probably arguable whether the change from high-aim to low-aim goal (or vice versa) of the PK task changes the nature of the PK task (the report does not say why this arrangement was done). It looks to me as if the reversed conditions are essentially two conflicting tasks.

Green and Green (1977) reported a session with an Indian adept named Swami Rama who claimed to be able to produce movement of an object from one place to another. The Greens set up an experiment in their laboratory. Swami Rama prepared himself by meditation, practising breathing exercises and repeating a mantra. The target object was two knitting needles glued together forming a "X". A small hole was drilled through the place where the needles intersected. The assembly was set on a vertical axle, a steel pin that extended from a plastic box. The plastic box was glued to a 360^{O} protractor so that "before" and "after" readings could be taken of the position of the needle assembly. On the appointed day in the presence of scientists Swami Rama sat in lotus position five feet from the knitting needle. Prior to the session a special face mask had been made which Swami Rama put on. The face mask was to make sure that Swami Rama did not blow air on the needle. Two times Swami Rama gave "the word of command" upon which on both occasions the needle reportedly rotated toward him through about ten degrees of arc.

Comments. As with the hypnosis PK experiments, it is premature to judge the effectiveness of yoga training in the production of PK from only two studies. It would seem that the area is still open for exploration.

Meditation

Matas and Pantas (1972) hypothesized that the increased ability to concentrate acquired through the practice of meditation might be related to the production of PK phenomena. They compared PK performance in two groups of 25 subjects each, one of which consisted of individuals who had pursued some form of meditation for at least six months. The other group consisted of subjects, all of whom reported that they had not pursued any form of meditation (the control group). The testing device was a Schmidt electronic RNG machine that generated binary random numbers, either "+1" or "-1". The meditation group was given 15 minutes of meditation prior to the beginning of the PK test but otherwise the testing procedure was identical for both groups. Whenever a +1 was generated a globe lamp turned on (a hit), and whenever a -1 was generated it turned off (a miss). The results supported their hypothesis. The meditation group was successful in the PK task and deviated significantly from chance ($p<.02$, 2-T). The control group showed psi-missing that deviated insignificantly from chance expectation. The meditators scored significantly higher than the control subjects ($p=.003$).

Schmidt and Pantas (1972a) reported two series of experiments using an electronic RNG machine. The machine had a panel with four lamps, four corresponding pushbuttons, and two display counters. Whenever a button was pressed the RNG provided the random lighting of one of the four lamps. If the button press corresponded to the lamp to be lit the trial was a hit, otherwise a miss.

Only the second experimental series (see also Schmidt & Pantas 1972b) is of concern here because it involved Zen meditation. It was done with a single subject, Pantas, who had found in self-tests that he scored exceptionally high when he was in a very relaxed but alert state, and that he could induce such a state with the help of Zen meditation. Before each test session in the second series, Pantas practiced Zen meditation for about 20 minutes in front of the test machine. Then, while attempting to remain in a relaxed, alert state, he made 25 trials on the machine (at an average rate of one trial per minute). He completed a total of 20 sessions and finished 500 PK trials on the whole in the PK oriented condition of the machine. The PK results proved to be positively significant ($p<.005$, 1-T) with 25 hits above chance. Commenting on this study Stanford (1977b, p.343) however writes that Panta's results cannot unambiguously be attributed to the meditation as there was no control group or series conducted at the same rate.

Schmeidler (1973a; 1973b) tested three subjects, one of whom had "had considerable experience with meditation" (1973b, p.64). The target apparatus was a thermistor that was placed at some distance from the subject. Instructions were to make this target hotter or colder in a predetermined counterbalanced sequence. The meditator showed a significant difference in accordance with instructions (psi-hitting) in his first half-session ($p<.001$) and a significant difference counter to instruction (psi-missing) in his second half-session ($p<.001$).

In this study the "psychic" Ingo Swann was involved as one of the three subjects. Although Swann was not the meditator his results are worth mentioning briefly since he used a novel way to influence the target. Swann was repeatedly successful at the PK task. Out of ten half-sessions seven showed significant differences in accordance with instructions. (The overall results are not provided in the report.) Swann had previously been involved in an unconventional form of mind training associated with Scientology. He felt he was able at will to dissociate his consciousness from his body (Stanford, 1977b, p.344; Swann, 1975). Swann reported that he used PK by "exteriorizing" (or going "out of the body") to mentally inspect or "probe" the target (Schmeidler, 1973a, pp.331,335).

Braud and Hartgrove (1976) reported a study in which ten long term practitioners of transcendental meditation (TM) were matched with ten nonmeditators (control group) who were selected from individuals attending introductory lectures on TM. They assumed that the control subjects had personality and interest characteristics similar to those of the meditators. Each group was given free-response clairvoyance tests and a PK test which involved influencing a Schmidt RNG without feedback. For the PK task the RNG produced sequences of binary random numbers, +1 or -1, at a rate of 50 numbers per second for twenty 20-second run periods, separated by 40-second rest periods. Half of the subjects attempted to influence the RNG so that more +1s were generated. Half attempted to increase the frequency of -1s. Subjects were instructed that they could influence the RNG by intending for the desired outcome to occur and by confidently imagining a successful outcome.

The PK trials occurred during a twenty minute period of meditation (or a 20 minute rest period for nonmeditators). A 5 minute period followed during which the subject "gradually terminated" his meditation or rest. The meditators scored significantly better than nonmeditators on the clairvoyance task ($p = .024$, 1-T), although neither group attained ESP scores differing significantly from MCE. The two groups did not differ in PK scores. Combining the two groups yielded significant PK missing overall ($p = .034$, 2-T). When assessed independently, neither the PK scores of the meditators nor that of the nonmeditators differed significantly from chance.

Honorton and May (1976, see also Honorton, 1977b, p.442) performed a study with ten subjects designed to assess volitional control on the PSIFI. All runs were performed in the automatic mode such that the target ("heads" or "tails") was alternated every other trial. Subjects received both auditory and visual feedback. All subjects were experienced at some form of internal state exploration. Altogether there were six meditators. Each subject completed five high-aim runs, trying to achieve scores above the chance level of 50% and five low-aim runs, trying to achieve scores below 50%.

The mean run score for subjects in the high-aim condition was 51.92% (p=.009, 1-T). The mean run score for subjects in the low-aim condition was 49.22%, which was a nonsignificant deviation from chance. The difference between the high- and low-aim conditions was significant (p=.035, 1-T). Five of the ten subjects obtained individually significant (p<.05) differences in the expected direction (p=.00006). Four of the five individually successful subjects were meditators (Honorton, 1977b, p.442). The probability that four of the six meditators would obtain independently significant results at the .05 level was itself highly significant (p=.00009). Honorton and May noted a significant decline effect even though subjects received both auditory and visual feedback. They concluded that the results demonstrated that subjects can exert volitional control of dynamic PK effects.

Honorton (1977a) reported a PK pilot study with a single practitioner of TM. The PK task was the PSIFI binary RNG previously described in the auto-alternating mode of operation which automatically reversed the target definition every other trial. Trial-by-trial feedback (an auditory tone) was provided through headphones. In the first half of the experimental runs of a pre-meditation phase a feedback signal was associated with hits (high-aim) and with misses for the second half of the runs (low-aim). The subject was blind as to the feedback contingencies all the time. (The report does not describe what the assigned task was for the subject.)

In the pre-meditation phase, neither the five high-aim nor the five low-aim runs differed significantly from MCE. PK trials during a 25-minute meditation period without PK feedback were also nonsignificant. Post-meditation PK score were significantly above MCE during the high-aim feedback contingency period (p=.024, 2-T). During the low-aim contingency period, the subject's scores were nonsignificantly below chance expectation. The difference in PK scoring between high- and low-aim was significant (p=.0054, 2-T). Honorton concluded that PK can be guided by directional feedback, and that a nearly significant PK effect obtained during meditation without feedback suggested that feedback may not be a necessary condition for PK.

Comments. Four studies out of six produced a significant PK effect related to meditation. However, two of those four studies were conducted with a single subject and no control condition (Honorton, 1977a; Schmidt & Pantas, 1972b), and the PK effect of meditators was observed post-hoc in one study (Honorton & May, 1976). That leaves us with only one study predicting and producing a significant PK effect related to meditation compared to a control condition (Matas & Pantas, 1972). In conclusion, while acknowledging the trend suggested by the four studies that yielded positive significant scoring apparently related to meditation, the finding of the Matas and Pantas (1972) study will have to be replicated before any judgement is passed on the effectiveness of meditation in the production of PK.

Relaxation

Honorton and Barksdale (1972, see also Honorton, 1972) published results from three exploratory PK experiments. In the first one they tested six subjects who attempted to exert a group PK influence on the frequency of red vs. green light flashes produced by a Schmidt binary RNG. The first experiment consisted of eighty 16-trial runs under waking suggestions in two conditions; muscle tension and muscle relaxation.

Each of the two lamps served as target for an equal number of runs in each condition. Within the two conditions half of the runs were carried out under instructions for active concentration ("willing", exerting conscious effort toward the target light) and the other half of the runs for passive concentration (no conscious effort directed toward controlling the target light). Overall results (1280 trials) were statistically significant (p<.04, 2-T), as was the difference between muscle tension and relaxation conditions (p<.02, 2-T). Runs following muscle tension suggestions were independently significantly above chance (p<.005, 2-T). Subjects obtained stronger effects following passive concentration instructions than following active concentration instructions (Honorton and Barksdale do not say whether the difference was significant). The only interaction effects that were significant were passive concentration-muscle tension runs, yielding a positive deviation from MCE (p<.002).

In the second experiment a replication was attempted with ten subjects working individually but no significant results were obtained. The muscle tension runs were slightly but nonsignificantly higher than the relaxation runs.

In the third study active and passive concentration instructions were omitted. It was predicted that the muscle tension condition would yield significantly higher PK scores than the relaxation condition. Honorton served as the only subject. He not only scored highly significantly above chance on the muscle tension runs (p<.00005), but the relaxation runs were significantly below chance (p<.0005). The difference between the two conditions was significant (p<<.0005). They suggested that further explorations of the effects of muscle tension vs. relaxation on PK performance should include electromyographic (EMG) monitoring (Honorton & Barksdale, 1972, p.213). To the best of my knowledge, this has not yet been done.

Braud, Smith, Andrew and Willis (1976) reported three studies involving a PK task on an electromechanical RNG. The device had a series of eight lights that started by flashing rapidly but came to halt randomly resulting in one of the eight lights remaining on. The task was to try to make the one remaining light to stop on either the right or left side of the display panel, whichever was the target side.

In the first experiment (see also Andrew, 1975), ten subjects listened through a tape recording to nonanalytical, "noninterpretive" sounds including music, natural environmental sounds and electronically synthesized sounds suggesting depth and imagery ("Mode 1") while simultaneously attempting to influence the RNG. Ten other subjects ("Mode 2") engaged in analytical, verbal, logical and mathematical tasks. Both groups began the experiment by listening to a 10 minute version of a progressive muscular relaxation tape. Mode 1 was intended to stimulate right hemisphere brain functioning and Mode 2 intended to stimulate left hemisphere functioning. As expected, subjects in Mode 1 showed significant psi-hitting ($p=.02$), whereas the other subjects demonstrated significant psi-missing results while engaging in Mode 2 tasks ($p=.011$). The difference between groups was significant ($p<.002$, 2-T).

In the second experiment, twenty subjects were assigned to each group. In Mode 1 subjects listened to a tape recording of music and natural sounds. In Mode 2 subjects were engaged by means of a tape recording in counting the letters in words, solving maths problems and so on. Before listening to the 23 minute long Mode 1 or Mode 2 tapes, during which they attempted to influence the RNG, the subjects listened to a brief tape of recorded instructions for progressive muscular relaxation. There was significant PK hitting in Mode 1 (p=.025, 1-T), chance performance in Mode 2 and a significant difference between the two conditions (p<.05, 1-T).

In a third experiment, both groups scored at chance levels, although subjects engaged in Mode 1 activity did slightly better (and showed nonsignificant PK hitting) than subjects engaged in Mode 2 activity. The overall difference between the two groups was significant (p<.01).

Braud and Braud (1978; see also Braud & Braud, 1979) conducted two experiments to explore PK effects under conditions of limited feedback. In the first experiment they had ten subjects doing the task of influencing a Schmidt binary RNG both when obtaining and when not obtaining immediate feedback of the results. The RNG was attached to a display consisting of 12 small lamps in a circular "clock-face" array where one of the lights would randomly turn on either clockwise or counterclockwise next to the previous light being lit. During feedback trials, subjects were instructed to intend and "wish" for the lights to "move" always in a clockwise direction and to imagine them moving appropriately, attend strongly to them when they did, and to ignore incorrect moves. During nonfeedback trials (the display darkened), subjects were instructed to imagine the light moving from bulb to bulb always in a clockwise direction. Subjects scored significantly above chance in the nonfeedback trials (p<.05, 2-T) but at chance in the feedback trials.

In the second experiment, entirely in the absence of immediate feedback, twenty subjects attempted to maintain an attitude of "passive volition" toward the PK task. An instructional tape was played for a total of 57 minutes to the subjects which included; musical introduction, progressive muscular relaxation exercises (with alternate tension omitted), autogenic phrases, suggestions for mental stillness and quietude, "effortless intention" instructions etc. Significant above chance scoring was again obtained ($p<.05$, 1-T). Braud and Braud reasoned that under certain conditions immediate trial-by-trial feedback does not appear essential to the occurrence of experimental PK (ibid., p.141). The absence of feedback may for example prevent subjects from becoming discouraged upon seeing unsuccessful results.

Palmer and Kramer (1984) did a complicated experiment where 48 subjects were assigned to one of three conditions, with 16 subjects in each. Each subject completed one session with three 2,500-trial sets. The PK task was an electronic noise RNG which on each trial sent eight binary digits to an Apple II computer. The "least significant digit" constituted the PK target (ibid., p.7). (The "least significant digit" probably refers to the last digit on the far right here in a string of 1's and 0's.) By chance, this digit should be 0 and 1 approximately equal percentage of the time. There was no immediate feedback. Palmer and Kramer made use of three induction tapes, one of which had 8 minutes of 4-Hz drum beats that was intended to promote effortless focusing of attention on the target, another of which contained suggestions for progressive relaxation (this tape was in two parts, A and B, that lasted approximately 15 and 10 minutes respectively), and a third tape which included the playing of lively music.

In condition 1 subjects started by listening to drums (set 1), followed by more drums (set 2), and finally to the relaxation A tape (set 3). According to the report, sets 1 and 2 in this condition did not differ from each other. In condition 2 subjects started by listening to relaxation tape A (set 1), followed by music (set 2), and then to the drum tape (set 3). In condition 3 subjects listened to relaxation A (set

1), followed by relaxation B (set 2), and then to the drum tape (set 3). Onset of the drumming was sudden for the 16 subjects in condition 3 to test for a startle effect, but gradual for conditions 1 and 2. The subjects were instructed to attempt to effortlessly merge their consciousness with the computer while focusing their attention on the target number. All subjects attempted to influence the RNG during the silence following the relaxation tape and also during the drumming. In addition, to test for a release-of-effort effect (see below), PK data was collected immediately after set 1 without the subjects' knowledge and following a signal to stop concentrating on the RNG.

The results showed that the "absolute CR scores" of the sets were significantly higher in the experimental series than in baseline tests made by one of the experimenters (that were significantly below chance) (ibid., p.1). The PK scores that were collected during set 2 (without the subjects' knowledge) were significantly above chance in the experimental series, thus confirming their release-of-effort hypothesis. The predicted startle effect was not found and the drum beat did not seem to facilitate PK scoring.

In addition to the studies that have investigated the effect of relaxation on PK performance, some studies have examined the relationship between the alleged PK phenomenon and anxiety, disruption of attention and a striving attitude (Broughton & Perlstrom, 1985a; 1985b; Debes & Morris, 1982; Stanford & Kottoor, 1986). Although they are not described here, they may be regarded as indirect research into the role of relaxation, since anxiety implies tension, low anxiety implies relaxation and disruption of attention and striving implies the opposite state to that of relaxation. The three cited studies suggest that high anxiety, disruption of attention, and striving may lead to lower PK scoring than states that imply relaxation. Furthermore, some research has suggested that PK scoring might be enhanced immediately after subjects cease attempting to consciously exert PK influence - as contrasted with any PK effect shown during the period of intention or effort. This effect has been termed release-of-effort mentioned above (e.g. Stanford & Fox, 1975). A related effect is the so-called linger effect, i.e. the possibility that a target area may become "sensitized," or retain some sort of effect which may have been previously imposed on it (e.g. Watkins, Watkins & Wells, 1973; Wells & Watkins, 1975, p.143).

Comments. The studies reported here prove difficult to interpret because they involved/covered so many other variables than relaxation. The experiments reviewed with the exception of the Honorton and Barksdale (1972) study, seem to suggest that some sort of a "relaxed" approach towards a PK task is more likely to yield extrachance PK score, than an approach that can be regarded as the opposite state to that of relaxation.

Operant Conditioning

So far the relationship between PK and mental training described in this review has been concerned with altered states of consciousness. The studies described below have attempted to "reinforce" (in the learning theory sense) the generation of PK such that it would tend to occur more often.

Camstra (1973) in two main experiments tried to condition the PK faculty by having subjects rewarded every time a certain number was generated by a RNG. During one session the subject had to listen to pop music, disturbed by loud white noise. A RNG was placed in front of the subject. Each time the number 99 was generated from the range 1 to 99, which occurred by chance approximately once in 20 seconds, the subject was "rewarded" by removing the noise for 10 seconds. Conditioning was presumed to take place if there was an increase in frequency of the generation of the number 99. In the first experiment the subject did 60 trials in three phases with 20 trials in each. Conditioning was measured as the difference between success rates on the first and last phase periods. As predicted, subjects who were asked to concentrate on their task were "not conditionable", whereas subjects who were not asked to concentrate produced a significant increase in the generation of the target number (ibid., p.26). (It is not stated in the report why this was predicted or what "not conditionable" refers to.) Subjects who were told that the test was a telepathy task were significantly "better conditioned" than subjects who were told the true identity of the task, it being a PK test. (It is unclear whether this was predicted.)

In a second study, a disturbing video program was introduced as an additional aversive stimulus that could be removed if the target number was generated. A control group was included in this study. The results from the second study did not show any significant influences of any of the factors studied. One can point out that maybe the state induced by the aversive stimulus was not psi-conducive, if such a state exists.

Broughton, Millar and Johnson (1981) applied aversive conditioning procedures from behavior modification techniques in two studies to try to condition PK scoring. The experiment employed an ABA design common in behavior modification research. Each subject performed 8 sessions of 24 runs per session (each with 50 binary trials) per condition. The device was a binary RNG computerized test, called "The Head of Jut". It mimics the test of strength found in carnivals and amusement parks and consists of a number of lights in a column (topped with a bell), which are illuminated successively from the bottom for PK hits (see details in Broughton, 1979). There was a predefined point (lamp no. 22) on The Head of Jut scale below which any run score was considered an unacceptable response. According to Broughton (1979) lamp no. 25 represented MCE. In both A conditions scores falling below the criterion had no aversive consequences but in the B condition every below criterion run score was punished by a strong (as strong as the subject could stand), unpleasant electric shock administered automatically by a computer to the back of the wrist through wrist-band electrodes. In other words, psi-missing was being punished.

Four subjects participated in the pilot study, but no evidence of significant above chance scoring was found in the data of the three conditions. Three subjects participated in the confirmatory study, in which no evidence of any PK conditioning was found. They considered the study as failing to alter scoring patterns in a PK task through punishment.

Tart (1966) in discussing his feedback training method suggested that immediate trial-by-trial feedback of psi-hitting can be seen as a reward (reinforcer). Thus, he argues, providing such feedback can increase correct psi responses as long as the subject has psi ability to begin with that can be reinforced. Most of the work on PK has involved essentially immediate feedback regarding success. However, little attention has explicitly been directed at training PK through immediate feedback. A few studies previously reported, were to some degree designed to examine the effect of feedback. The Honorton (1977a) study suggested that feedback was not a necessary condition for PK; Winnett and Honorton (1977), and Honorton and May (1976) reported a significant decline in PK score involving immediate feedback; The Braud and Braud (1978) study suggested that immediate trial-by-trial feedback did not appear essential to the occurrence of PK, and that under certain conditions, the absence of feedback may actually facilitate PK performance.

Stanford (1977b, p.360) points to one study done by Thouless that utilized immediate feedback as a "training method" for PK. Instead of using the tossing of dice which was popular at Duke University at the time, Thouless' (1945) method was to spin ten coins on their axes and to observe whether they fell heads or tails uppermost. Thouless was the only subject and he did 10 sessions over a period of two months, giving 4000 spins in all. The results he obtained were overall nonsignificant but in the expected direction (above chance). He noticed that a considerable positive deviation from chance expectation occurred in the first four sets of results (over 300 to 1 against chance), and also that his score showed a decline across sessions (dropping down to value 4 to 1 at the end).

Kelly and Kanthamani (1972) carried out three kinds of preliminary tests with a gifted subject, Bill Delmore. One of these tests was a Schmidt four-button RNG machine, where the subject's task is to predict which of four lights the RNG will select next by pushing a corresponding button. An alternative explanation is that by means of PK the subject forces the machine to select that light. The light serves as immediate feedback and indicates to the subject whether each trial was successful or not. When the trials were not being recorded automatically on paper tape, Delmore's performance was above chance; 900 trials yielding a CR of over 10 ($p<<10^{-10}$). Connecting the tape produced a drastic, immediate decline in Delmore's scoring rate and caused him great irritation. Thereafter, he resolved to defeat the machine, and over a period of eight days he progressively raised his scoring to almost his regular rate. This well documented recovery in score seems to suggest a "learning" effect. Although not mentioned in the report, this learning effect could have been due to Delmore learning to ignore the tape. It is not clear in the report how connecting the tape changed the usual conditions.

Braud (1978b) reported a PK design involving "allobiofeedback." The agent's task was to attempt to either increase or decrease the amount of GSR (Galvanic Skin Response) being monitored in ten target subjects (one at a time). Allobiofeedback provided instantaneous and continuous feedback to the agent as he watched an analog recording (polygraph tracing) of the target subject's GSR activity. In a pilot study, Braud acted as the agent himself. The target subjects were participating in another clairvoyance task and were not informed of the attempted PK influence upon their GSR. The agent at various randomly assigned times, attempted through PK either to activate (increase) or relax (decrease) the amplitude of the target subject's GSR. In the pilot study, the results indicated that the mean GSR amplitude was higher during the "increase" periods of the experiment than during the "decrease" periods ($p<.02$, 2-T).

In a confirmatory experiment a new set of ten target subjects participated. They were informed that a PK influence of their GSR activity would be attempted but no details were provided about when or exactly how this attempt would be made. Again Braud acted as the only agent. The results showed greater GSR activity during the activating (increase) periods than during the relaxing (decrease) periods, the difference between these periods being significant ($p<.01$, 1-T). Of the total GSR activity 57.50% occurred during increase periods. Braud concluded that the most direct interpretation of this finding was that the agent exerted a systematic PK influence upon the ongoing physiological activity of the target subjects, as indexed by GSR (ibid., p.131).

Braud (1978a) categorized his earlier PK experiments in terms of the feedback they provided. Some gave immediate, trial-by-trial feedback to both subject and experimenter, some only to the experimenter but not to the subjects, and others only gross, average results to the experimenter. All three types yielded significant PK data. His conclusion was that immediate trial-by-trial feedback was not a necessary condition for the occurrence of PK.

There are, of course, other studies on record. For example, Davis and Bierman (1979), and Weiner and Bierman (1979) compared feedback to different observers. Neither experiment gave clear evidence of psi for any condition. Varvoglis and McCarthy (1982) compared the influence on a RNG or an EEG when subjects were provided with feedback and false feedback from the other instrument. The favorable conditions for PK were either the receiving of PK feedback or "orientation" toward PK (ibid., p.55). It is not clear in the report what "orientation" toward PK refers to. Morris and Garcia-Noriega (1982) studied PK performance with variations in feedback characteristics. A display providing simple feedback proved to be more PK conducive than a complex one. More will be said about the Morris and Garcia-Noriega study in chapter 3.

Tart (1983a) suggested that although his original presentation of the feedback training method focused on ESP, almost all aspects of it could apply directly to the possibility of improving PK ability through immediate feedback training. If initially PK talented subjects who were motivated to learn were given immediate, trial-by-trial feedback on their efforts, decline should be eliminated and improved performance should occur. Tart reviewed the PK literature (33 studies on mechanical systems such as dice and 35 studies on electronic RNGs) to see if his learning theory had been adequately tested. His conclusion was as follows (ibid., p.99):

> In conclusion, the provision of immediate feedback of results to motivated percipients or agents in ESP or PK tasks may lead to improved levels of performance on theoretical grounds. The rarity of talented agents in PK experimentation to date has not allowed adequate test of this possibility.

Comments. (1) "Negative reinforcement" studies: One of the two studies that used negative reinforcement failed to find any evidence of PK (Broughton, 1981). Although Camstra (1973) claimed some support for "conditioning" PK in his first series of two, the lack of details in the report makes it difficult to establish what the preplanned hypotheses were and their rationale. This in turn makes it difficult to evaluate how, if at all, his findings relate to negative reinforcement. Camstra's second series failed to find any evidence of PK. Hence not much evidence, if any, support the notion that PK performance may be enhanced via "negative reinforcement." (2) Research involving immediate feedback: For Ss not preselected on the basis of their initial high scoring, feedback does not appear to be a necessary condition for above chance PK scoring to occur (Braud, 1978a; Braud & Braud, 1978; Honorton, 1977a). Declines in PK scores involving immediate feedback have also been common (e.g. Honorton & May, 1976; Thouless, 1945; Winnett & Honorton, 1977). Having said this, it would seem that further research is needed to investigate whether PK performance of preselected "PK talented" people can be enhanced or stabilized by immediate feedback as Tart (1983a) has suggested (and as seems to have been the case with Delmore, reported by Kelly & Kanthamani, 1972).

Various Approaches

Batcheldor reported possible success in eliciting physical phenomena in a so-called sitter group (Batcheldor, 1966; 1979; 1984a; 1984b; see also Brookes-Smith, 1973; Brookes-Smith & Hunt, 1970; Isaacs, 1983b; 1984; McClenon, 1983; Palmer, 1983; also relevant is Richards, 1982). Batcheldor hypothesized that PK ability was not a rare gift of certain individuals, but an unusual human behavior that could be elicited in ordinary people under favorable conditions. Those conditions were by and large a relaxed and trusting group atmosphere; expectancy of success; excitement without fear; and especially the absence of "ownership resistance" (the fear of being personally the source of a PK event) and "witness inhibition" (the initial reaction of shock or fear if one directly witnesses a PK event). A few months before his unexpected death, Batcheldor (personal communication, 1987) explained the psychological resistance toward PK to me as follows:

> Really, the two main factors which in ordinary circumstances block PK are resistance and doubt [Batcheldor's emphasis], the former being based on fear (and divisible into witness and ownership types) and the latter on sheer inability to believe. Sometimes I refer to the former as 'emotional resistance' and to the latter as 'cognitive/perceptual resistance'.

Batcheldor relied upon a seance type of experiment. He reasoned that darkness minimizes witness resistance, and participation in a group allows each sitter to attribute any disturbing phenomena to the others. Confidence and plausibility were enhanced by approaching the alleged physical phenomena gradually. In the early sittings with a group, simple rocking and tilting of the table were called for, which could be attributed by members of the group to automatisms. Then greater tilting, sliding or hopping of the table were expected. If these went well, levitations of the table often followed as the group's acceptance and belief mounted. Notwithstanding the question of the validity of his observations, Batcheldor's interpretation that almost anyone can develop

PK abilities can be questioned. One can argue that the procedure is simply a traditional device for discovering "psychically" gifted subjects instead of being a training method.

Isaacs has devoted several years to programs designed to train measurable PK abilities (Isaacs, 1983a; see also on subjective aspects of his training program, Isaacs, 1986a; 1986b, 1986c). Isaacs (1983a) reported some apparent success in "training" psychokinetic metal-bending (PKMB) as measured by a special PKMB instrument or sensor that recorded piezoelectric effects. The instrument consisted of three "channels", two of which were used to detect possible sources of artifact (such as "airborne sound" or mechanically transmitted vibration), while the third was designed to detect PKMB effects. The sensor's output was amplified such that it provided a continuous auditory tone as immediate feedback, which increased in pitch with increases in the voltage output of the PKMB channel. (It is not clear in the report how the third "channel", the one designed to detect PKMB, differed from the other two channels.)

In a pilot study, twelve sessions were held of 45 minutes duration at the home of each subject. A session consisted of six trials with the subject near the instrument, a rest period, then six trials with the subject two meters away from the apparatus. One of the five subjects who participated showed a striking incline in performance and three of the other four showed an increase in output, although inconsistently maintained. All subjects were encouraged to develop their own PK facilitating strategies. Although it is not clear in the report, it appears that the subject's task was to produce marked twists of activity in the sensor that met certain preset criteria.

After seeing a film of a PK demonstration by the Soviet "gifted" PK subject, Nina Kulagina, Felicia Parise in the U.S. started to practise in order to do likewise (Honorton, 1974c; Keil et al., 1976). After two to three months of persistent practice, she reportedly was able to produce her first unmistakable movement of an object (a plastic bottle). Gradually thereafter she was able to produce sliding movements of small objects more and more frequently and with a variety of objects, even while being filmed. According to Parise, earlier attempts to create favorable conditions by practising progressive relaxation and other meditative techniques did not succeed. She reported that for her, only concentrated effort when she was really working hard at the task, finally met with success. Later she apparently managed to deflect a magnetic compass needle, a phenomenon observed under carefully controlled conditions (Watkins & Watkins, 1974). This case ended when Parise decided that the demands on her time and energy were becoming excessive.

Morris (personal communication, 1989) knew Parise personally. He reported on Parise's first occurrence of a movement to me as follows: Before the first movement occurred, Parise had estimated that continuous unsuccessful attempts to influence small objects had occupied about 10-12 hours of effort on the whole. Towards the end of an unsuccessful session one evening, Parise got a telephone call from a hospital with a message to return to the hospital where a relative of hers was seriously ill. She put on a coat and as she went past the table where a small plastic bottle stood that she had been attempting to move she said in frustration "abracadabra", upon which the bottle made a sudden movement. This first instance is interesting as it looks like a classic example of a release-of-effort effect. Parise's prolonged tension when attempting to move the plastic bottle was suddenly replaced with total redirection of effort.

Nelson et al. (1986; see also Jahn & Dunne, 1987) published results from their Princeton Engineering Anomalies Research (PEAR) program. Amongst other issues, the report summarized six years of experimental data acquired on three forms of random physical systems. The subjects were instructed to attempt to influence a random distribution either above chance (high-aim) or below chance (low-aim) or generate a baseline (control series). To guide them in that task, each experiment provided some form of feedback, usually a visual display that tracked the degree of shift from the theoretical expected distribution.

The random sources were of three kinds: a) An electronic noise source RNG that was operated by 33 subjects. A grand total of 522,450 trials were reported with this device. b) A deterministic pseudo-random number generator that was operated by 10 subjects. A grand total of 145,000 trials were reported with this device. c) Finally, a "Random Mechanical Cascade" (RMC) operated by 22 subjects. In the RMC, thousands of small polystyrene balls tumbled through spaced arrays of nylon pegs so as to distribute themselves in the chutes at the bottom in an approximately binomial distribution across the chutes. Here the subject's task was to try and skew the distribution either to the right or to the left. A total of 1024 trials were conducted with this device.

The overall results showed above chance scores when subjects aimed for a high score (RNG $p=.004$; pseudo-RNG $p=.078$; RMC $p=.164$), below chance scores when subjects aimed for a low score (RNG $p=.007$; pseudo-RNG $p=.005$; RMC $p=3x10^{-4}$), and, when subjects were instructed to get a baseline score (the control series), the scores were almost precisely identical with the theoretical mean. Total deviation from chance was thus highly significant for all three devices (RNG $p=2x10^{-4}$; pseudo-RNG $p=.003$; RMC $p=3x10^{-6}$). The compound data base for all formal trials showed a highly significant deviation from chance of $p=2x10^{-11}$.

What is important about these data is the consistent anomalous bias in the output of the three random systems. Subjects were allowed to use whatever strategy suited them in attempting to influence these random systems. The strategies employed varied a great deal and involved self-imposed preliminary meditation exercises, visualization techniques, competitive strategies, and many of the subjects frequently engaged in various forms of exhortation, coaxing, pleading or threats (Jahn & Dunne, 1987, pp.141-142). Jahn and Dunne noted that there was little pattern of correlation of such strategies with achievement. However, in the diversity of strategies, it appeared that the most effective subjects seemed to associate successful performance with the attainment of some sense of "resonance" with the device. On this "resonance" Jahn and Dunne (1987, p.142) commented:

> This ["resonance"] has been variously described in such terms as "...a state of immersion in the process which leads to a loss of awareness of myself and the immediate surroundings, similar to the experience of being absorbed in a game, book, theatrical performance, or some creative occupation.
>
> I don't feel any direct control over the device, more like a marginal influence when I'm in resonance with the machine. It's like being in a canoe; when it goes where I want, I flow with it. When it doesn't, I try to break the flow and give it a chance to get back in resonance with me.

Comments. Some of the various approaches reported in this subsection seem to stress the importance of psychological variables in the generation of PK. That high "interest" in combination with continuous "practice" may be important in enhancing the PK function is suggested by the case of Parise (and also by the case of Delmore, reported in Kelly & Kanthamani, 1972). Jahn and Dunne's (1987) most successful Ss reported some sense of "resonance" with the PK apparatus. As I see it, the strength of the Batcheldor approach is the underlying hypothesis on the psychology involved in a PK event, vis., that PK may be blocked by resistance and doubt.

2.5 VISUAL-IMAGERY STRATEGIES IN TRAINING PK

Let us now turn to yet another approach towards the possible training of PK, which is visualization. This section deals with the main focus of the experiments that are reported in chapters 5 and 6. First I report research in which dissimilar strategies are compared. This is followed by studies that have looked at visual imagery strategies only.

The possible importance of the role of imagery in the generation of statistical PK has been noticed by some researchers in parapsychology. Forwald's (1969) experience, for instance, showed him that a person with the ability to produce strong mental images of physical events might well succeed in obtaining PK results without relying on the mental capacities of "will" and "desire". On these images he wrote (ibid., p.71):

> This would mean that the mental image is projected to the physical world outside the subject and produces there a real, meaningful effect. A mental picture which the author has successfully used on many occasions in the actual placement experiments is an imagined wall at the foot of the incline where the cubes roll out on the horizontal plane. The wall is imagined as forming an angle with the moving direction of the cubes so that, when hitting the imagined wall, the cubes would be deflected to the target side in their movement.
>
> Equally effective is the forming of a mental picture of the cubes moving in the target direction. The images must be formed in the mind in advance of the release, which must then be made immediately, when the mental picture is clear and distinct.

Forwald also described how in dice-throwing, with attempts to get a specified one of the six sides uppermost, the mental procedure had generally been to form an image of the cubes resting with the target side uppermost.

Comparison of Dissimilar Strategies

Stanford (1969) gave each of twenty subjects a total of 36 trials in a PK test using a single die. The apparatus used was an enclosed vertical shaft which the die was allowed to fall down. At the top of the shaft, the die was mechanically released on each trial. Each subject alternated between two methods for influencing the die. Six trials were done with one method, then six trials with the other, and so on. Eighteen trials were conducted under visualization instructions. The subjects were told to visualize the die as it fell down the shaft and to see it in their "mind's eye" as coming to a stop with the appropriate die face turning up. The other 18 trials were done under instructions for an "associative activation of the unconscious". Prior to the throw of the die the subject gave free associations for a period of two minutes to the target die face. The subject then attended to other matters than the PK task during the actual throw of the die, such as reading a book. (It could perhaps be argued that this method was some sort of a release-of-effort strategy).

Both strategies yielded results at chance, each producing 61 hits, where 60 in each condition was expected by chance. A free association test, intended to measure subject's "predication tendency" (ibid., p.345), was administered immediately after all the PK trials had been completed. (It is not clear in the report what "predication tendency" stands for.) The measure of this tendency was, as hypothesized, positively and significantly correlated with the difference score for the two experimental conditions ($p<.02$, 2-T). Predication scores correlated positively with the "visualization" scores (+.33). In other words, the more a subject tended to give predication associations, the more his PK results were apt "to favor the visualization method" (ibid., p.338). The correlation of predication with "associative activation" was negative (-.43), and the difference between these two correlations was statistically significant using a t-test ($p<.03$, 2-T).

Stanford argued that predication scores can be regarded as a measure of the subject's tendency to use concrete sensory imagery in thought or to organize his thinking around sensory imagery. He concluded that the results suggested that knowing a subject's predication score allowed to some extent prediction of both the direction and degree of his scoring preference for these two experimental conditions (ibid., p.348).

Steilberg (1975) investigated the effect of two different techniques of attempting to influence four falling dice. He used a dice-casting device that consisted of a chute, into the upper end of which was inserted a funnel with a hole at the bottom. When the dice were thrown into the funnel they started their way down the chute at almost the same point. (It is not clear to me if this was an adequate randomizer.) Each subject was tested under two psychologically different conditions. In the first condition ("conscious concentration"), the subject sat straight in front of the apparatus watching the dice. He was to attempt to influence the dice by consciously focusing his willpower and by inducing a tension in the muscles of his whole body, as if to force the dice to come to a stop with the chosen die-faces on top. In the second technique (visualization), the subject sat relaxed in his chair with his back to the apparatus. He was to visualize vividly in his "mind's eye", in a state of relaxation and while staring at a featureless brown wall, the dice with the desired target die-face upward. The subject could either have his eyes open or closed in the visualization condition. After the image was stabilized, he gave a signal to the experimenter and the test was started.

Ten subjects participated and every subject carried out three series for conscious concentration and three for visualization. The ten subjects made a total of 34,560 trials. Significant evidence of psi missing was obtained in the conscious concentration condition (p<.04, 2-T), using the CR test. The visualization technique produced nonsignificantly positive results. The difference in scoring rate between the two conditions was significant at the .05 level using the Wilcoxon test. Steilberg (1975, p.17) concluded that the negative deviation obtained in the conscious concentration condition and the differential scoring between the conditions indicated that the various effects were unlikely to be due to chance alone. In this experiment the conscious concentration resulted in PK scores below chance. A similar effect has been observed for example by Debes and Morris (1982), who found negative PK scoring being related to a "striving for success" strategy.

Stanford (1981) did a replication of his earlier research with 32 subjects on "associative activation of the unconscious" and visualization. A number was displayed on an illuminated digital counter (the number being randomly chosen by a RNG), which the subject was instructed to influence. All subjects were to attempt to obtain through their PK a digit 0 through 9 as produced by the RNG. Each subject used both methods, association and visualization, the order being counterbalanced. The visualization method involved visualizing the desired goal event clearly and with confidence as occurring at the end of the test run, that is, seeing the target digit as the outcome. The visualization was to be done while the RNG was running (approximately 1 minute for each trial). The free-association method involved subjects associating to a given target, and then picking up a magazine and reading aloud while the RNG was running to distract their conscious minds from the PK task. All subjects checked the outcome of the RNG and thus got feedback at the end of the trial. After the PK task the subjects did a word-association test measuring imagery-based thinking.

The results demonstrated significant psi-missing for the association condition (p=.041, 2-T), but slightly above chance results for the visualization condition (nonsignificant). The difference between the two conditions was significant (p=.035, 2-T). The word-association measure of visual imagery failed to correlate significantly with the difference in the number of hits for the association and the visualization methods.

In Stanford's (1969) visualization strategy, the subjects were to see in their "mind's eye" both the falling-down and the turning-up of the dice in accordance with the target for that particular trial. In Steilberg's and Stanford's (1981) visualization strategy the subjects were only to "see" the desired end result. It looks to me as if the visualization strategy employed by Stanford (1969) was some sort of process-oriented imagery in which subjects visualized a process (the rolling of the dice) leading to the desired outcome. The imagery strategy used by Steilberg (1975) and Stanford (1981), in contrast, could be viewed as goal-oriented imagery, where only the final outcome was visualized.

Debes and Morris (1982) tested 32 subjects on a RNG computer game called "Horizon". Horizon is essentially a computer screen version of the Rhinean PK technique of dice throwing for positions (the placement method). Pyramid-shaped lines from the top center of the computer screen simulated a sort of reclining panel with a solid center line dividing the screen pyramid panel into right and left portions. A trail of randomly behaving dots (representing 192 left vs. right binary RNG decisions) descended down the screen instead of rolling dice. The subject's task was to attempt to deflect the trail as far as possible to either the left or the right side of the pyramid panel, depending on which side was the assigned target. Half of the subjects had described themselves in a pre-session questionnaire as high in competitiveness, half as low. Half of each group were encouraged to use PK by adopting relaxed and noncompetitive strategies (nonstriving instructions). The other half of the group were asked to adopt active, and competitive strategies (striving instructions). The latter group was also asked to engage in active imagery, such as imagining themselves at the top of the screen, bowling a ball toward the target side or having put a wall in the center that prevented the target line of dots from crossing to the nontarget side. An ANOVA showed that scores were significantly higher for subjects instructed to relax than for those instructed to strive and engage in an active imagery. Scores after instructions to relax were significantly above chance ($p<.002$), whereas scores after instructions to strive for success and imagine success were significantly below chance ($p<.01$).

Debes and Morris were essentially comparing volitional strategies, including imagery. Their study is reported in length in this section instead of with the relaxation studies. The reason for doing so, is that its finding (vis., that visualizing a process that leads to success accompanied with striving seems to result in scoring below chance) suggests possible unfavorable or limiting conditions for visualization as a PK conducive method.

Comparison of Imagery Strategies

Morris, Nanko and Phillips (1979; 1982) published two studies in which they explored the effectiveness of two PK visual imagery strategies that were derived from the survey of popular writings on how to develop psychic skills (Morris, 1977, see section 2.3). The apparatus used consisted of a visual display controlled by a RNG (see details in Placer et al., 1977). The display consisted of a ring of 16 red lights. The RNG was employed to advance the illuminated light one step clockwise or counterclockwise, thus producing a "random walk" back and forth around the circle. A binary decision by the RNG decided the direction of the illumination. The subject's task was to try to influence the illuminated light such that it "moved" or "walked" either clockwise or counterclockwise, depending which direction was the target. One of the two strategies was termed "process oriented" imagery (or "PK 98") and involved visualizing a process that gradually led up to the desired final outcome. The subject was asked to visualize "energy" building up inside his body, then flowing out to the testing instrument and assisting in the PK task. The other type of strategy was termed "goal oriented" imagery (or "PK 99") and involved visualizing only the final outcome or the desired goal. The subject was asked to point a finger at the light he wished to become illuminated in the PK task and to visualize vividly the light being lit.

In the pilot study 16 subjects were asked to bias the behavior of the red lights using each imagery strategy half the time (8 runs of 16 trials each were listed for each strategy). Half of the subjects used PK 98 first and the other half used PK 99 first. The order of target directions (clockwise and counterclockwise) for each of the 16 runs was counterbalanced. Two or three minutes' time was given between experimental runs in order for the subjects to build up the mental imagery. After eight runs the subject was allowed 5 minutes to relax and prepare mentally for the next imagery strategy. In the pilot study there was significant positive overall evidence for PK (p<.02, 2-T). Almost all of the positive scoring occurred with the goal-oriented imagery, which produced 52.9% hits (where the chance expectation was 50%) and was independently significant (p<.01, 2-T). Goal-oriented scores did not differ significantly from process-oriented scores.

In the confirmatory study with two sessions 20 new subjects participated. Ten of the subjects indicated that they had previously been involved in one or more mental development courses, such as TM, est, or yoga (the MD group) but the other ten subjects had experienced no such previous involvement (the NMD group). The procedure for the first session was the same as for the pilot study, the subjects using each imagery strategy half the time. For the first session an analysis of variance revealed that imagery strategy was a significant factor (p<.05); the goal-oriented imagery produced scoring of 51.8% above chance, while the process-oriented method obtained below chance scoring of 48.4%. Prior training proved not to be a significant factor. However, there was a significant interaction between imagery strategy and prior training (p<.02). MD subjects showed little difference in imagery scores. NMD subjects showed a strong difference in favor of the goal-oriented imagery with psi missing for process-oriented imagery.

Subjects were allowed to select their preferred imagery strategy to use exclusively for all 16 runs in the second session that took place two weeks later. The subjects were also given instructions for two simple concentration exercises which were to be practised daily until the second session. Eleven subjects chose the process-oriented imagery. Their hit rate was 49.3%, the results being at chance. Eight chose goal-oriented imagery and their hit rate was 52.6%, which is significantly above chance (p<.01, 2-T). One subject used a mixture of both strategies and was excluded from the analysis. The difference between these two groups was statistically significant on a t-test ($p<.02$, 2-T) and appeared to be independent of prior training.

In summary, higher scoring for the goal-oriented strategy was found, regardless of whether the observer was assigned to that strategy or had chosen it (as evidenced in the follow-up session). The total hit rate throughout both studies showed that the goal-oriented imagery had got a hit rate of 52.4%, which deviated significantly from MCE ($p<.0001$, 2-T), using a z-test. Morris et al. concluded that the goal-oriented imagery strategy appeared to be more effective than the process-oriented strategy, at least for those with no prior exposure to mental development training. They wrote:

> ...the results of Session 1 [in the confirmatory study] confirmed the mild success of the goal-oriented imagery procedure and indicated that the lack of success with process-oriented imagery may have been in part due to a negative response toward it by those who had not received prior exposure to mental development procedures. (Morris et al., 1982, p.11)
>
> By examining the popular literature directly, we have been led toward at least one imagery strategy that appears conducive to positive results, and possibly to a second. (Morris, et al., 1979, p.150)
>
> The present study should serve primarily to indicate a promising line of research that hopefully will become useful in working with participants in PK training procedures. (Morris et al., 1982, p.13)

Levi (1979), apparently unaware of the Morris et al. study at the time (ibid., p.277), did an experiment that explored how the presence and absence of visual feedback interacted with three conditions: process-oriented imagery, goal-oriented imagery and a control group. Fifty-one unselected undergraduates participated, 17 in each of the three conditions. Each subject completed 24 trials on a Schmidt RNG employing radioactive decay as the random source. The chance mean of the final Geiger counter outcome was 16. A hit was defined as any number greater than 16. The subjects were given a simple description and schematic diagram of how the RNG worked. The subject's task was to try to get a number higher than 16. The feedback factor was manipulated by turning the RNG either toward (12 trials) or away (12 trials) from the subject. To control for a possible order effect, about half of the subjects in each imagery group received the feedback condition first and half the nonfeedback condition first.

The control group listened to a tape containing information about chance and chance events while conducting their trials to prevent them from spontaneously imagining the desired outcomes. The goal-oriented imagery was a visualization of the desired outcomes. Subjects could do this in any such mental way that they thought might help them to form a clear mental image of a number higher than 16. They could for instance imagine a basketball scoreboard with high scores on it. In the process-oriented imagery subjects were allowed to use any mental device to picture the machine's inner workings leading to a number higher than 16.

Factorial analysis of variance yielded a highly significant interaction between imagery strategy and feedback ($p<.001$). In the presence of visual feedback the goal-oriented imagery strategy lead to higher PK scoring than without feedback (the mean scores being 18.79 vs. 13.90, respectively, the difference being significant at $p=.0008$). Subjects in the process-oriented group showed the reverse pattern. The outcome of the process-oriented strategy was higher in the absence of visual feedback than in the presence of feedback (the mean scores being 17.43 vs. 14.75 respectively, the difference being nearly significant at $p=.056$). In other words, when the subjects could not see the display, process-oriented imagery did better than goal-oriented, and vice versa.

Subjects in the control group were not affected by the feedback. Further post-hoc comparison showed that within both the feedback and nonfeedback conditions, the goal-oriented group differed significantly from the process-oriented group (both p values apparently being <.03). The goal-oriented group was the only group that deviated significantly from chance in both feedback (psi-hitting) and nonfeedback versions (psi-missing).

Morris and Reilly (1980) reported a replication attempt of the goal-oriented imagery strategy with 24 college age students. The apparatus was the same one employed in the Morris et al. (1979) study, except that the display was a single light-emitting diode (LED) that blinked on and off during the course of a run in accordance with the decisions of the noise diode-based RNG. Each time the subject pressed a button, the LED would turn off and on with decisions made at the rate of approximately 50 times a second for a total of 4,096 trials in the run. A run would last about eight seconds, during which time the LED would appear to glow with fluctuating brightness. There were eight runs per session.

For half of the runs, the subjects were asked to visualize the light glowing brightly (glow), but for the other half the subjects were asked to put their thumb (in reality) over the light and experience darkness (dim). The order of target conditions, "dim" vs. "glow" was counterbalanced. The probability of a hit was also varied. The experimenter who alone dealt with the subjects was unaware of whether the target was to make the light "dim" or "glow". The results of the study were nonsignificantly above chance. The report does not give any PK score means or p values. They concluded that the new procedure for enhancing the results using the goal-oriented imagery strategy failed to meet their expectations and did not generate any new information.

Nanko (1981) reported a study in which ten of the subjects from the Morris et al. (1979) study participated. The criterion for selection was based on whether the individual had "above" chance scoring on a prior PK task, felt comfortable in generating goal-oriented imagery, and had the time and willingness to participate in another experiment. Nanko employed the same PK apparatus as was used in the Morris et al. (1979) study. In the experimental session each subject was seated in front of the PK apparatus with the circle display of 16 lights. As was the case with their prior participation, the task was to bias the lights for each run of 256 trials in either the clockwise (CW) or counterclockwise (CCW) direction depending upon the instructions given to them in a concealed envelope. Each subject did 10 experimental runs. Within the 10 runs each subject was required to influence the lights in the CW direction for half of the runs and CCW for half of the runs. This order was counterbalanced.

The subject was asked to relax through deep-breathing exercises and to practise his goal-oriented imagery until he felt comfortable with it and was able to generate a vivid image at will. The subject was reminded to take a few minutes to build up imagery between runs. Again, the number of reported hits was significantly higher than chance expectation ($p<.002$, 1-T). There was a total of 10,488 hits out of 20,480 possible trials. The RNG produced decisions in accordance with the subject's target instructions (hits) 51% of the time. This further suggests that the goal-oriented imagery strategy does not just produce first-session effects.

Comments

Eight studies were reviewed in this section. With the exception of two studies (Debes & Morris, 1982; Stanford, 1969), six explored the role of goal-oriented imagery in the production of PK. All six studies yielded PK scores in the expected direction for goal-oriented imagery. The PK scores were significantly above chance in three of the six studies when immediate feedback of performance was provided (Levi, 1979; Morris et al., 1979; Nanko, 1981). It appears that goal-oriented imagery may be important in the generation of extrachance PK scoring.

The pattern suggested so far in studies exploring the possible role of visual-imagery strategies in the generation of PK can be summarized as follows: (1) Goal-oriented imagery may provide above chance results. (2) Striving associated with visualization does not seem to result in PK scores above chance (Debes & Morris, 1982). (3) Goal-oriented imagery may be associated with higher positive PK scoring than process-oriented imagery under feedback conditions (Levi, 1979; indirect suggestion from Morris et al., 1979, who only employed immediate feedback condition). (4) In the absence of feedback, process-oriented imagery may do better than goal-oriented (Levi, 1979). (5) Goal-oriented imagery does not seem to produce first-session effects (Morris et al., 1979; Nanko, 1981).

Stanford (1969; 1981) employed a free-association test to measure the subject's tendency to organize his thinking around sensory imagery. Steilberg (1975, p.15) also used this test, but it did not yield significant differences between scoring patterns of the subjects. Beside the results of those experiments, I have not come across any study that has attempted to correlate PK score with psychometric imagery scale scores, such as the Vividness of Visual Imagery Questionnaire (VVIQ), the Betts QMI Vividness of Imagery Scale, or the Gordon Test of Visual Imagery Control.

2.6 MISCELLANEOUS ISSUES CONCERNING IMAGERY AND FEEDBACK

Comments on Feedback in the Literature of Psi Training

The feedback training experiments reviewed in section 2.3 have suggested that immediate trial-by-trial feedback of correct guessing may act in the same way as a reinforcer postulated in operant conditioning. Beloff (1967) has pointed out that the decline effects observed in a typical case of a high-scoring subject are rather different from extinction in operant conditioning; the former is long-term and usually irreversible, while the latter is short-term and readily reversible. O'Brien (1976) on reviewing Tart's monograph on feedback training pointed out that learning is a concept that does not avail itself to direct observation; the subjects' high scoring in Tart's experiments could be due to many factors, learning being among the least parsimonious. Stanford (1977a) in reviewing the same monograph wondered what sort of response it was, exactly, that was being reinforced in immediate feedback procedure. However, no one has raised the additional issue that there is probably a distinction between feedback and a reinforcer (Gissurarson, 1988).

Operant conditioning. Although the historical credit for opening up the experimental study of reward and punishment belongs to Thorndike (1911), modern behavioral psychology (operant conditioning is a technique used within behavioral psychology) owes much of its current status to B.F. Skinner (e.g., 1938; 1953). The conceptual system of operant conditioning developed as an explanation of behavior of organisms within natural science.

"Reward" is the general commonsense concept for the technical term "reinforcer" or "reinforcing stimulus". When an organism exhibits behavior that is followed by food (for other examples, a drop of water, a change in temperature, a sexual partner, or an escape from harm, and so on) the behavior is said to be reinforced by that consequence if the behavior tends to recur on similar appropriate occasions, and the food is called a reinforcer. When a reinforcing stimulus (e.g. a stimulus known to be a reinforcer) follows a performance, reinforcement is said to have occurred. The process in which reinforcement of a previously reinforced operant performance (referring to all those performances which can be increased in frequency by reinforcement) is discontinued is called extinction. The usual and most prominent effect of extinction is to decrease the frequency of a performance. Broadly speaking, contingencies of reinforcement came to replace expressions referring to motivation as an explanation of behavior in operant conditioning since such internal attributes arguably produce explanations that are by their nature untestable.

Reinforcer. A reinforcer, or a reinforcing stimulus, is usually considered to be the event which increases the frequency of the performance it follows. Whether stimuli are effective as reinforcers, however, is an empirical question. One way of testing the effectiveness of a stimulus as a reinforcer is to see whether the frequency of the performance it follows decreases in extinction. Another way is to change its frequency to see if that brings about changes in the frequency of the operant response it follows. Traditionally, operant responses are emitted when an organism must adapt to environmental conditions. If behavior produces food and the behavior therefore tends to recur on similar occasions, some features of the external environment then control the behavior as a result of the organism's experience in the environment. Food reinforcement can be spoken of as a cause of the behavior (Ferster et al., 1975, p.19). It is a cause in the sense that it is a critical, necessary condition for maintaining the frequency of the conditioned performance. Roughly speaking, yesterday's reinforcement causes today's response. Past information stored in the organism's repertoire contributes to the likelihood that a similar response will be repeated.

Feedback. Feedback refers to information as to the consequences of a particular action. Although it is easier to learn to wiggle one's ears by looking in a mirror for visual feedback, it does not necessarily mean that one is reinforcing the wiggling with the feedback. One is only making behavior, which is not normally followed by a reinforcing stimulus more conspicuous. Reinforcing stimuli may, however, have feedback properties (and perhaps they always do). Feedback is, by and large, "information", as Skinner (1976, p.62) notes:

> A missile reaches its target when its course is appropriately controlled, in part by information coming from the target during its flight. Such a device is sometimes said to "have purpose built into it," but the feedback used in guidance (the heart of cybernetics) is not reinforcement, and the missile has no purpose in the present sense.

Tart seems to use the two terms, feedback and a reinforcer, interchangeably. My point is that they are often not truly interchangeable. He writes, for instance (Tart, 1975b, p.109):

> When you are right by chance alone a certain proportion of the time [in the card guessing experiments], the situation is more complicated, for you are rewarded for irrelevant guessing rather than for using ESP. If a subject has no ESP ability to begin with, giving immediate feedback should have no effect. If he has a little ESP, immediate feedback should stabilize performance and slow extinction, but the confusion / noise generated by chance reinforcement may eventually bring about extinction.

Conceptual difference between a reinforcer and feedback. It does not follow that if a person receives feedback on wiggling his ears by looking into a mirror that he is more likely to wiggle his ears more frequently. According to operant conditioning as I understand it, he may continue to practise his ear wiggling and try to use the feedback to make it better, but only if there is something in the environment that reinforces him to continue to do so and reinforces him to utilize the feedback to direct him (and also if the nerves and muscles connected to his ear are functioning properly). Assuming that such is the case, more correct ear wiggling may (or may not) result as feedback makes the ear wiggling more conspicuous.

It does not follow that if a subject only receives immediate feedback on his performance on an ESP test that he will necessarily more frequently give correct responses. It may be that he is directed, to some extent, via feedback to internal psi-mediated cues that seemed to precede a hit (as Tart is saying), but only if there is something in the environment that reinforces him to continue to try to do so and reinforces him to utilize the feedback to direct himself. Assuming that such is the case, more correct ESP guesses may perhaps result if feedback makes it easier to recognize internal cues that precede a hit. Also, if and only if, there exist such internal cues.

Further arguments for the distinction. "What little reward there is (feeling gratified at scoring above chance) tends to be associated with the entire run rather than with the individual responses," writes Tart (1966, p.49). He contrasts this situation with the learning situation of the pigeon, where a grain of corn is produced immediately after each correct response: "As the pigeon is hungry, food is rewarding" (Tart, 1966, p.47). But, what would we expect if feedback of correct ESP hits was a reinforcer? Firstly, as is known in many animal experiments with food reinforcement, it is important to stop giving the animal food for a period of time so that the experimenter may use food as an effective stimulus. If immediate feedback of a correct guess in card guessing experiments was, in fact, a reinforcer, then the experimenter could actually stop giving the "feedback" for some period of time in order to increase its effectiveness - in this case stop giving information about correct or incorrect guesses.

Secondly, in operant conditioning, one would often expect a pigeon or a human subject to continue a particular operant performance, even though the reinforcer was provided at the rate of 1:25 (that is, one effective stimulus for twenty five responses) as was the rate in the card guessing experiments. This situation is known as a fixed-ratio (FR) schedule of reinforcement (see for instance, Ferster, Culbertson & Boren, 1975). In the FR type of reinforcement a fixed number of performances (counted from the preceding reinforcement) are required for reinforcement.

Feedback as an independent variable. Causal connection is implied in reinforcement. But what are the effects of feedback? We may possibly get an increase in correct ear wiggling over time with practise in front of a mirror to provide feedback. It does not, however, indicate that continuous trial-by-trial information of successful wiggling is causing or making the person wiggle his ears correctly. When initial conditioning of operant behavior (i.e., "pairing" between a response and its consequence) has occurred, the connection between a response and a reinforcing stimulus can be described as follows (e.g. Hilgard, 1951): A pigeon presses a lever as if in order to obtain food. But it is not easy to see that a human emits a correct ESP guess in order to get information about it being correct.

Operant behavior is considered as a dependent variable because it is influenced by the schedule of reinforcement. The schedule is an independent variable because it may be altered to produce a change in rate of performance. It is possible to argue that a relevant test to examine if feedback of hits in ESP training experimentation was a reinforcer could thus involve changes in frequency of providing feedback to see if that brings about changes in frequency of correct ESP guesses. Subjects could for example be put on a variable-ratio schedule, where a certain number of performances are required on the average for the occurrence of a reinforcer. Variable-ratio schedules generally generate very high rates of pecking with pigeons.

When can feedback be a reinforcer? Let us look at a simple example where ear wiggling could possibly have consequences that make it more likely to recur: When Ed wiggles his ears, we laugh. In this case, the attention (feedback and a reinforcer) that we give Ed when he wiggles his ears makes it more likely that he will wiggle his ears more frequently under similar circumstances.

Let us suppose that a subject tries out a particular "mental" strategy while doing an ESP test, gets a hit and is told about it (or does not get a hit but is told that he did). It may well be the case that the subject uses this strategy again on the next trial. If the frequency of the production of this strategy varies (and we could measure it somehow) as an independent variable with how often we tell the subject that he got a hit, I think we can say that the information, that a guess is a hit, is a reinforcer.

Comments. In conclusion, concepts borrowed from learning theory have been used widely in psychology, but not always accurately. In this subsection I have tried to point out that it is possible to distinguish between feedback and a reinforcer. Providing subjects with feedback about their performance is not necessarily the same as reinforcing them. One of the conclusions that may be drawn from Tart's reasoning and experimentation is that he tested the effect of immediate feedback on

ESP performance, but he may never have tested the effect of reinforcement. Trying to find an answer to why some people volunteer to participate in parapsychology experiments, try to do their best and keep on attending on many occasions, would perhaps, bring us closer to identifying a reinforcer that might affect their behavior.

The confusion of feedback with a reinforcer can also be found in other fields. We can point to B.F. Skinner's model of programmed learning as a clear-cut instance in the history of education of the translation of learning principles for use in the classroom. Programmed learning refers to a system of self-instruction based on operant conditioning where tasks to be mastered are broken down into small steps. The subject is given feedback about his mastery of each step as he goes along. Here, immediate feedback was considered to be a reinforcer in the same way that Tart and others (e.g. Neuringer, 1986) often use the concept. However, Skinner seems to have made the same mistake as Tart in attempting to apply the principles of animal learning to human learning. One can argue that the followers of programmed learning made a false analogy; a word may not have the semantic specificity of reference and effect on persons that a food pellet has on laboratory animals (Fitzgerald, 1970; Rothkopf, 1970).

Imagery Research in Psychology

In this subsection "imagery" is discussed as dealt with in cognitive psychology. Two studies are described from the field of imagery on mental rotation and mental scanning, respectively. There are three reasons for doing so: firstly, to show how imagery is explored in other fields than parapsychology, secondly, to give a background for discussion concerning the definition of imagery, and thirdly, to provide a rationale for the method of using time taken to perform a particular task to make inference about cognitive processes.

One essential feature of imagery is that images are events in consciousness (Marks, 1983, p.96). The general tendency is to think of images as being literally faint pictures in the head. Most researchers in cognitive psychology agree that this "picture in the head" interpretation is inadequate.

Brief account on mental rotation research. Generally, rotating a two dimensional object "mentally" or in the "mind's eye" has been termed mental rotation. Research on mental rotation has been considered to have played a large role in stirring renewed interest in mental imagery after the behaviorists started to loosen their grip on psychology (Anderson, 1980, p.65).

People are often able to determine that two different two-dimensional pictures portray objects of the same three-dimensional shape even though the objects are depicted in very different orientations. Shepard and Metzler (1971) designed an experiment to measure the time that subjects require to determine such identity of shape as a function of the angular difference in the portrayed orientations of the two three-dimensional objects.

They presented eight subjects with 1600 pairs of two-dimensional representations (drawings) of three-dimensional objects. The angular difference was produced either by a "rigid" rotation of one of two identical drawings in its own picture plane or by a more complex, "nonrigid" transformation, of one of the pictures, that corresponded to a (rigid) rotation of the three-dimensional object in depth (ibid., p.701). In a randomly determined order, in half of the pairs the objects could be rotated into congruence with each other, and in the other half, the two objects differed by a reflection as well as a rotation, and could not be rotated into congruence. The subjects' task was to determine if the objects were identical except for orientation. For each pair the subject was asked to pull a right-hand lever as soon as he determined that the two drawings portrayed objects that were congruent with respect to three-dimensional shape and to pull a left-hand lever as soon as he determined that the two drawings depicted objects of different three-dimensional shapes. Each trial began with a warning tone which was followed half a second later by the presentation of a stimulus pair and the simultaneous onset of a timer. The lever-pulling response stopped the timer.

The results showed the reaction time required to recognize that two perspective drawings portrayed the same three-dimensional shape: (i) to increase linearly with the angular difference in portrayed orientation and (ii) to be no longer for a rotation in depth than for a rotation merely in the picture plane. The data seemed to support the notion reported by all the subjects (ibid., pp.701-702): (a) That, to make the required comparison they first had to imagine one object as rotated into the same orientation as the other and that they could carry out this "mental rotation" at a certain limiting rate. (b) Since subjects perceived the two-dimensional pictures as objects in three-dimensional space, they could imagine the rotation around whichever axis was required with equal ease.

Kosslyn, Ball and Reiser (1978) asked eleven subjects to engage in "mental travel," in which they memorized the map of a fictitious island. The island had seven landmarks: sand, a rock, a well, a hut, a lake, a tree, and a thatch of grass. The distance between any two of the seven locations was different. Their question was whether images preserve "metric information". Subjects overlearned the map until they could draw it with great accuracy. They were presented aurally with a landmark and were told to imagine the entire map and then focus on the named location. After five seconds a second landmark was named, and the subjects were told to mentally scan the map until the second landmark had been brought into view. The scanning was to be accomplished by imagining a little black speck zipping in the shortest straight line from the first landmark to the second. When the subjects had mentally focused on the second object they signaled by pressing a button. A clock was stopped when the button was pushed and response times were recorded.

Kosslyn et al. looked at the mean reaction time needed to scan between two points as a function of the distance between the points. The results showed that when subjects engaged in a mental scan from one point on the map to another the reaction time increased linearly as the distance between the points increased. The line of best fit indicated that this sort of image scanning was accomplished at a rate of about 20 centimeters per second. They interpreted this finding as supporting the claim that images are quasi-pictorial entities that can be processed (ibid., p.53). The present data seemed to suggest that one of the defining properties of such visual mental images was that metric distances are "embodied" in the same way as in a percept of a picture.

Results from the above studies and others alike have indicated that when subjects transform a mental object spatially, processing time increases continuously with the amount of the spatial transformation (Anderson, 1980, p.76). Processing time, for instance, increases continuously with angular disparity in the rotation studies or with distance in scanning studies. (See also on mental rotation e.g., Cooper & Shepard, 1973; Shepard & Feng, 1972; on comparison and size of mental objects such as animals e.g., Kosslyn, 1975; 1978; on mental travel or image scanning e.g., Kosslyn, 1973.) Although nobody questions the authenticity of the imagery findings, their interpretation has created considerable disagreement within the various camps of cognitive psychology. The meaning of results on image scanning (that subjects are moving the focus of their mind's eye across an image that is assumed to have spatial properties) has been doubted, for example, because a high linear correlation has been found between scanning distance and predicted scanning times (e.g. Mitchell & Richman, 1980). This suggests that before most subjects begin to scan an image, they apparently already have a good idea of how long it should take to travel particular distances. This implies that the time difference in the Kosslyn et al. (1978) study may have been a demand characteristic of the experiment, i.e. subjects could have deduced the experimental hypothesis and followed suit by responding appropriately (Mitchell & Richman, 1980, p.59).

Broadly speaking, the point made in the mental imagery experiments which is relevant for our purposes (see section 3.4) is that whatever the actual mental processes were, they appeared to be an analog of corresponding physical processes when/as measured by processing (reaction) time. (One process is said to be an analog of another when it mimics or simulates the structure of the other process.)

<u>Towards a working definition of imagery.</u> Richardson (1983) argues that there are two different approaches towards defining imagery. On the one hand is the "behavioral" approach, which uses imagery as an explanatory construct, that is, an independent variable. Performance data on visual spatial tasks have apparently been presented as if the act of mentally rotating an object or of mentally scanning an object involved, required or implied the presence of visual images in awareness (Kosslyn et al., 1979; Shepard, 1978, pp.125,135). On the other hand is

the "experiential" approach that deals with imagery as events to be explained, that is, a dependent variable. Reports of experienced images imply that the awareness of quasi-perceptual events is involved in some way or at some time. Furthermore, Richardson (1979, p.563) argues that visual imagery of a quasi-perceptual nature is not necessary to (or required for) the performance of the spatial tasks discussed above. Therefore, when using the term "mental imagery" we have to distinguish between two fundamentally different conceptual usages; mental imagery as referring to a class of inferred cognitive constructs and processes (such as spatial ability); or as referring to a class of more or less perceptlike experiences (as reported by subjects). According to Richardson (1983, p.13) nothing yet known about these two usages "can justify the assumption that their conceptual and operational meanings overlap in any way." (It appears to me that these two usages are not contradictory or mutually exclusive.)

Be that as it may, for the remainder of this thesis I will be using the terms "mental image," "imagery," or "imaging" etc, as defined below by Richardson because it is closer to the word "imagery" as used in parapsychological studies. He gave a working definition that was intended to cover all types of perceptlike experienced imagery (Richardson, 1969, pp.2-3; 1983, p.15):

> Mental imagery refers to (1) all those quasi-sensory or quasi-perceptual experiences of which (2) we are self consciously aware and which (3) exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts.

By "quasi-sensory or quasi-perceptual experiences" is meant any concrete re-presentation of sensory, perceptual, affective or other experiential states (e.g. hunger or fatigue). Four (arbitrary) types or classes of imagery have been identified by researches as quasi-perceptual experiences (Richardson, 1969, pp.127-128; also relevant is Holt, 1972). Each class has been supported with both theoretical and empirical considerations.

(1) After imagery: This refers to the effect of prolonged and/or intense stimulation (noted in at least four sensory modalities) that has sensorylike consequences when the stimulation ceases (e.g., Brown, 1965, Richardson, 1969). After being exposed to a lightning flash, we continue to have a visual sensation of light in the darkness that follows.

(2) Eidetic imagery: This has been defined as a visual image that persists after stimulation and is relatively accurate in detail (Haber & Haber, 1964, p.131). It is colored positively (in contrast to an after image, which is usually negative), and can be scanned with ease without any apparent lessening of its intensity or clarity.

(3) Thought imagery: Richardson (1969, p.43) described this type of imagery as "the common and relatively familiar imagery of everyday life. It may accompany the recall of events from the past, the ongoing thought processes of the present or the anticipatory actions and events of the future. Though it may occur as a spontaneous accompaniment to much everyday thought of this kind it is far more amenable to voluntary control than all other forms of imagery."

(4) Imagination imagery: This refers to the more intense image experiences, the content of which may be unexpected and apparently unconnected with any identifiable memories from one's personal past (i.e. novel images). The images may have the appearance of being physically present (i.e., substantiality), and may be very detailed in texture and vividly colored. This type of imagery includes hypnogogic images (e.g. Barber, 1969; Barber & Wilson, 1979; Hilgard, 1970) and drug related hallucinations (e.g. Masters & Houston, 1966).

A Possible Explanation of the Interaction of Feedback with Imagery

Levi (1979) proposed a hypothesis of the interaction of feedback with imagery, which he called "cognitive effort". Before describing the cognitive effort hypothesis, we should briefly look at previous ideas to which cognitive effort purportedly relates, and which were referred to in the paper by Levi (1979) where it was presented.

Concepts derived from cognitive psychology. The view of the mind as a system for processing information (or a person as a processor of information) has been referred to as the information processing approach (see e.g., Lindsay & Norman, 1977; Underwood, 1978a). Attention has been considered as one of the central features of information processing theory (Underwood, 1978b, p.235). One characteristic of attention appears to be its selectivity, and the fact that it does not have the capacity to perform two "demanding" tasks simultaneously (Lindsay & Norman, 1977, pp.285-286). Information processing models assume that the processor and its components have a limited amount of so-called processing capacity available at any one time (Underwood, 1978a, p.10), and attention is conceived of as being a very limited mental resource (Anderson, 1980, p.26).

Kahneman (1973) proposed a capacity theory (referring to a theory of how one pays attention to objects and actions) that accounts for the selective aspects of attention. He postulated a general limit on man's capacity to perform mental activity. This limited capacity can be allocated amongst the competing demands upon it from concurrent activities (ibid., p.10). Different mental activities impose different demands on the limited capacity. By and large, allocation is made primarily to the processing of mental activities that are relevant to the individual at that time. According to the model, an activity can fail, either because there is altogether not enough capacity to meet its demands or because the allocation policy channels make available capacity to other activities.

One of the major correlates of capacity allocation is thought to be the individual's level of arousal (ibid., pp.17-24). Thus as level of arousal and allocation of processing capacity concomitantly increase to an optimal level, task performance improves. Under this model it is also possible for allocation of processing capacity to a particular mental activity to be excessive (ibid., pp.37-42). High level of arousal produces excessive allocation of capacity to an activity. The result is that processing becomes far too selective and relevant informational cues are ignored. In turn, this causes performance to deteriorate. In other words, attention narrows under high arousal.

Ideas derived from parapsychology. Irwin (1978; also relevant is Irwin, 1979) examined the application of the phenomena of attention and the associated construct of processing capacity (as discussed by Kahneman, 1973) to the nature of psi effects. To start with, he distinguishes processing capacity utilized in the information processing system from the energy responsible for the work done on PK displaced objects. Irwin argues that since high PK scores can be attained in tasks of quite high complexity, it suggests that the processes underlying PK itself require very little capacity for their execution, i.e., the capacity demands of PK are small. As an intention to succeed is often important for high PK scoring, allocation of some processing capacity is nevertheless required. He suggests that if this analysis is valid, then the association between level of arousal and capacity allocation would lead to the prediction that successful PK performance would usually be attained at low arousal levels. Furthermore, conditions associated with excessive allocation of capacity (such as in too much striving) would generally retard PK performance. This is, however, not consistent with the finding of Debes and Morris (1982) in that they found psi missing associated with "striving" for success, and psi-missing represents nevertheless psi. (Irwin did not say very much about PK psi-missing.)

Braud and Braud (1978a) suggested that under certain conditions the absence of feedback may facilitate PK performance. Feedback might sometimes be discouraging to subjects. The discouragement would result from a conflict between the intention that an event should happen and the perception of the event not happening. This could be minimized by eliminating feedback and hence knowledge of the event not happening. "Imaginary feedback" (as in the nonfeedback conditions of their experiments), in which subjects imagine a reality congruent with their intention, would seem psychologically optimal for success. Actually, several of their subjects commented that the visual feedback seemed to interfere with obtaining a PK effect and that PK seemed easier when the intended outcome was simply "imagined".

Morris (1980b) noticed in his imagery research that participants had some difficulty in handling negative as well as positive feedback. Subjects can react adversely to negative feedback (feedback for psi-missing) by losing confidence, but subjects also seem able to react negatively to positive feedback (feedback for psi-hitting). (We should note that this observation was based primarily on free response ESP work.) Sometimes the negative reaction simply seemed to involve confusion or development of inappropriate hypotheses to account for past success. On many occasions subjects seemed to change as a direct result of becoming aware of past success. Some became more self-conscious or stressed and were unable to return to the more relaxed, casual states of mind that had accompanied earlier successes. Others seemed to start questioning whether they really wanted to "become psychic" after all.

Stanford (1980) proposed that ESP performance is likely to be facilitated when the cognitive mode is "unconstrained". This mode / state of cognitive function, which he suggested encourages spontaneity, is approximated when the subject shifts away from rational, contextual and sequential constraints.

Cognitive effort. Levi (1979) proposed an interpretation of how feedback could have affected the three groups in his experiment (the control group and the process-oriented and goal-oriented imagery groups). Central to his idea is the concept of cognitive effort (Levi, 1979, p.283):

> Cognitive effort is presumed to increase with the allocation of information processing capacity (Irwin, 1978; Kahneman, 1973). The allocation of this capacity, in turn, is based on the information-processing demands of the situation. Informational inputs that increase allocation can be either environmental or self-generated in origin. Sometimes environmental and internally generated stimuli interfere with each other or "compete" for processing capacity.

In the goal-oriented (GO) group, subjects were instructed to imagine the desired outcome (a number higher than 16). For this group, seeing numbers on the digital display may have facilitated visualization of numbers since the form of the feedback was congruent with the imagery. There was little "competition" or interference between environmental and internally generated stimuli. In the absence of feedback, it may have been more difficult to visualize numbers. Thus, Levi argues, in the GO group, cognitive effort required of the subjects was greater in the nonfeedback condition than in the feedback condition.

For the process-oriented (PO) group, seeing the numbers on the digital display may have interfered with visualization as the form of the feedback was not congruent with the imagery. In contrast, the absence of feedback may have enabled subjects to visualize the internal workings of the machine more clearly. Thus, he argues, in the PO group the cognitive effort required of subjects was likely to be greater in the feedback condition than in the nonfeedback condition.

According to Levi, since subjects in the control group were primarily engaged in listening rather than visualizing, feedback (or absence of it) had little effect on the cognitive effort required.

Levi postulated that when the cognitive effort required is high, scoring tends to be low. When the cognitive effort required is low, scoring tends to be high. Absence of any interaction between PK scoring and feedback conditions in the control group is consistent with this interpretation. In both the GO and PO imagery groups, the feedback and nonfeedback conditions required different degrees of cognitive effort. The significant interaction between PK scoring and feedback conditions (GO scoring above chance in the feedback condition, and below chance in the nonfeedback condition, and the reverse for PO) may have been contingent upon a difference between the two experimental conditions in their requirement of cognitive effort.

Comments on cognitive effort. To sum up, cognitive effort can be described as follows: High cognitive effort refers to interference or "competition" of some sort between imagery (internally generated stimuli) and feedback (environmental stimuli). This results in PK scores below chance. Low cognitive effort refers to less interference between feedback and imagery. This results in PK scores above chance.

On commenting on the cognitive effort idea, George and Krippner (1984, pp.73-74) pointed out that it is not clear that invoking the construct of cognitive effort helps to explain parsimoniously the apparent facilitation of psi-missing in the nonfeedback condition for the GO group since there is no reason to assume that the absence of feedback should increase the cognitive effort required in the GO strategy. Furthermore, no explanation is offered as to why the two levels of feedback should both produce significant deviations from MCE with the GO strategy, but in opposite directions. Although cognitive effort is presumed to increase with the allocation of information processing capacity as discussed by Kahneman (1973) and Irwin (1978), the report is insufficiently detailed for me to see how Kahneman's and Irwin's ideas relate to cognitive effort as described and discussed by Levi.

2.7 SUMMARY

The main body of this chapter included an overview of studies that have explored potential PK facilitating conditions. Special emphasis was put into describing experiments that have essentially investigated visual-imagery strategies. Stanford in 1969 initiated research into visual-imagery strategies as a potential method of triggering the alleged PK function. So far these studies have been promising. All six studies that explored goal-oriented imagery found PK scores above MCE (but not necessarily significant) related to goal-oriented imagery. Three of these six studies produced significant PK effects in relation to the goal-oriented imagery. Before turning to the experiments that were conducted for this thesis on the use of visual-imagery strategies as a possible method of "training" PK, two additional issues will be addressed: The making of a micro-computer test that was supposed to measure PK will be described in next chapter, and three short exploratory experiments will be reported in chapter four.

CHAPTER THREE

THE COMPUTER TEST "SYNTHIA"

3.1 INTRODUCTION

This chapter deals with issues related to the measurement of PK by means of RNG computer tests and describes a specific one, called "Synthia" that was used in the present studies. The chapter starts by introducing to the reader the wide range of RNG computer games that have been used in an attempt to measure PK. Next comes a review of studies that have used pseudo-RNGs to generate PK targets. Then it describes the making of "Synthia". This is followed by a description of the pseudo-random number generator (referred to as a pseudo-RNG) that was used in the "Synthia" program. Finally two models are described that have been proposed to explain experimental PK findings.

3.2 RNG MICROCOMPUTER GAMES

Advantages of RNG Computer Tests/Games

Computer tests are considered to have some advantages over other tools in measuring PK (Broughton 1982a; 1982b). Firstly, computerizing a test automates some parts of the experiment, such as freeing the experimenter of data recording duties - the data collection being automatically stored. It sometimes obviates the need for a double blind set-up since the computer design may serve as a substitute data handler for the other experimenter. A psi computer test can therefore make a whole experiment easier to conduct and the experimenter can be freed while it is running. Secondly, computers have the advantage of not making human mistakes and are less prone to biases, recording errors or fraud on the participant's behalf. Thirdly, if one is already using a computer, additional programs can be incorporated to do the statistical work. Having the random number generator as the element of randomizing the target can rule out nonrandomness in the target sequence with reasonable confidence. Simultaneous control conditions can be used to accomplish checks on the computer and the randomness.

In general terms, a test can be considered as any procedure used to measure a factor or assess some ability (Reber, 1987, p.765), whereas a game can be considered very loosely as a form of play or a contest with rules. Implicit in this loose definition of a game is that the player(s) aims at achieving a certain outcome/goal. Typically, a PK computer game is a PK test that has been incorporated in a computer game. According to this definition, a PK computer game does not necessarily have to use a RNG (to randomize targets), although, to the best of my knowledge, all PK computer games have employed RNGs. We should also note that the game element of a PK computer game does not necessarily have to be incorporated through high-resolution graphics and sound effects. The game element may simply be induced via certain instructions. The main argument for using a PK computer game to measure PK is that it might elicit fun, excitement and interest, and in that way perhaps promote an environment which may produce greater evidence of psi (for discussion of the use of computer games, see Honorton, 1980).

Overview of RNG Computer Games in PK Research

The following overview looks at the existing RNG PK computer test that have strong game-like aspects and which have been described in the English parapsychology literature. No attempt has been made to describe the experiments in which the PK computer games were used or the results of those experiments. However, a brief, general evaluation of the effectiveness of the PK computer games in producing extrachance PK results is offered at the end of this section. The review is intended essentially as an introduction into the variety of available types of PK microcomputer games. Some descriptions are sketchy since the original reports have not provided enough details.

Game-like experimental PK testing environments can be traced back to 1945 when McMahan tested subjects in a social atmosphere of a party-like gaiety, called "PK parties" (McMahan, 1945; 1946; 1947). In a typical PK party session about four to seven subjects, mostly children and adolescents, attempted to influence (individually while the rest watched) the fall of two-sided discs. Prizes for good scores (candy, toys and movie tickets), together with refreshments at the end of the session helped to preserve the party-like atmosphere.

Broughton (1979, p.338) has traced predecessors of modern high-technology computer games for measuring PK to experiments done by Steen (1957), Ratte (1960) and Ratte and Greene (1960). Steen for instance, incorporated a PK test into a simulated baseball game played with dice. Ratte and Greene used a basketball style game with dice. Ratte (1960) used a dice game called PK Basketball. In PK Basketball three dice were used, two (the basket dice) numbered in the usual way, and a third (the foul die) having six different color faces. The subject tried to throw specified target faces on the numbered dice and to avoid throwing a specified colored face on the third. Ratte's general results favored the gaming technique over a noncompetitive situation but the differences were insignificant.

The first reports of experiments using PK computer games appeared around 1978 from exploratory experiments conducted by Weiner (1978) and Beloff, Broughton and Wilson (1978; cited in Broughton, 1979, p.338).

Beloff et al. (1978) did an informal experiment using a computer game, in which a PK test had been embedded. Only a few games were conducted. No description of the game is on record.

Horse racing. Weiner (1978) used a computer game simulating a horse race, where the computer assigned "bets" of low risk, $5, and high risk, $25. The game was based on 4 columns of numbers ("horses"), that counted upward from zero and were displayed on the computer terminal. A random number generator (p=1/2) determined whether or not the numbers in the various columns proceeded to the next higher numbers so that at the end of a 50 trial "race" the four columns showed different counts. Subjects chose one of the "horses" and tried to influence it to finish the race with the highest count.

Motor skills. Weiner (1979) used a computer game where participants used their motor skills to manipulate a dial in order to keep a bar centered on the computer screen. The difficulty of the task increased in steps until the bar became so unstable that it moved off the screen. Motor skill was measured by a score proportional to the amount of time the bar stayed on the screen. A PK test was incorporated into this game by an RNG interface, such that PK hits would help the participant to keep the bar under control by preventing the task from becoming more difficult (p=1/2).

The Head of Jut. Previously I briefly mentioned the computerized PK test called The Head of Jut (Broughton et al., 1981). It was first introduced by Broughton in 1979, and involved a device, on which was mounted a column of 32 small red lamps (Broughton, 1979). Alongside the column of lights was a slot for a strip of paper which bore labels for different points on the scale. Lamp number 25 was labeled "Average" and this represented the MCE for a run. Other labels ranged from "Terrible" at 17 and "Outstanding" above the 32nd light. On top of the device over the column was a bell which rang with a single "ding" whenever the score exceeded 32. The participant initiated a run by pressing a button mounted in the base. The lights would begin lighting from the bottom upwards, very rapidly at first but with decreasing speed, as it came to a stop, and then fell back. The device was controlled by a computer. The subject's task was to try to make the lights on the column to go as high as possible through their PK.

Psi-Trek. Honorton (1980) did some preliminary experiments with a computer video game called Psi-Trek. In Psi-Trek the subject is seated in front of the cathode-ray tube (CRT) terminal and instructed to use psi ability to locate enemy "Klingon" spaceships. "These are random numbers hidden in one of four quadrants. If the subject succeeds, he prevents a Klingon invasion of his territory. Each game consists of 48 independent trials, with a constant hit probability of one fourth, and each hit triggers one of 28 animated graphic displays, selected randomly to sustain novelty" (ibid., p.5). Every third hit eliminates one of the invading Klingons. Certain randomly selected misses, which are identified by a red alert display, allow the Klingons to fire upon the player's spaceship. Successive Klingon hits inflict increasing damage to the player's spaceship, culminating in its destruction if the overall scoring rate is at or below chance. Statistically significant above chance scoring is rewarded by a special display which consists of congratulatory messages and variety of sound effects.

Although it is not clear in the report, it appears that for each trial a random number (with four possible values) is chosen by a RNG. A hit is registered if this number matches another random number (with one of the same four possible values) which indicates one of the four quadrants on the CRT. There are two ESP and four PK versions of

Psi-Trek. The PK versions involve three different ways of initiating a trial. In Soma-Trek the player triggers the selection of a random number by manually depressing the return key. In EMG-Trek the selection of a random number is triggered whenever the player's frontalis muscle tension level falls below a pre-set threshold. In Relax-Trek a random number is sampled at a randomly determined time and the player's role is purely observational. Graph-Trek is internally identical to Relax-Trek except for the feedback for each hit and miss, which is different.

Horizon. Also earlier described is the software program, Horizon (Debes & Morris, 1982; also employed by Talbert & Debes, 1982), which is a computer screen version of the Rhinean PK technique of dice throwing for positions referred to as the placement method/test of PK (e.g. Rhine & Pratt, 1957, pp.153-155). Horizon displays to the subject a jagged vertical line of 192 dots extending from top to bottom of a display screen. At the start of a run, the subject sees only one dot at the top of the screen. Successive dots are displayed one dot at a time until all 192 are visible. Each dot is displayed one step to the left or right of the dot just above it, as determined by a RNG. By chance alone, the end-point of the trail of dots would land equally often on both sides of the center line. The subject's task is to attempt to deflect the trail of dots as far as possible to either the left or the right side of the pyramid panel, depending on which side is the assigned target.

Thermometer-style display. Honorton et al. (1983) conducted a microcomputer based RNG study comparing immediate versus delayed feedback on noise-diode "RNG hit rates." The feedback source was displayed to participants via a thermometer-style computer graphics display showing a bar rising and falling in relation to the "current feedback source byte value" (ibid., p.158). (The delayed feedback was limited to an end-of-trial statistical summary.) "Centered horizontal lines on either side of the bar demarcated target/nontarget areas of the display. Arrows on either side of the bar displayed the vertical target location" (ibid., p.158). Bar color provided feedback on cumulative performance within the trial; a white bar was associated with scoring above chance, a red bar with below chance, while a yellow bar showed scoring at chance. A special "Jackpot" display was activated at the end of the trial if a preset scoring threshold was met.

Psi Ball. Schechter, Barker and Varvoglis (1983; also employed by Schechter, Barker & Varvoglis, 1984) combined a computer controlled video game, Psi Ball, with a noise-diode RNG. The player moved a lever to keep a "ball" on the TV screen away from the screen's "walls" for as long as possible. About five times each second, a ten-event RNG trial was taken. If there were fewer than five hits in the trial, the game's difficulty was increased by making the ball slightly more sensitive to small lever movements (and thus probably harder to control). The difficulty did not change if five or more of the RNG events were hits. According to the report, it seems to have been optional whether the RNG hits affected the game's difficulty level. In Psi Ball there was no direct PK feedback as individual changes in difficulty were too small to be detected.

Volition. Schechter, Honorton, Barker and Varvoglis (1984) reported an experiment they conducted on the relationship between RNG scores on two computer controlled RNG games (Volition and Psi Ball), and some of the participants' psychological characteristics. In the game Volition, the participants received immediate trial-by-trial feedback which included both auditory as well as visual components for directional performance. In Volition the RNG feedback display was presented as an on-line graph of the cumulative deviation from chance (thus providing the player with a clear picture of cumulative performance relative to chance). The computer-graphics display in Volition showed "zones of significance, the developing cumulative deviation line, and a variety of audio/visual rewards for individually strong trial scores" (ibid., p.32). The player's task was to produce high or low RNG values (above or below chance) according to whether "high aim" or "low aim" was displayed and selected at the start of the game. Each game consisted of 100 trials with 100 RNG events each.

P-Oink. Broughton and Perlstrom (1985a; 1985b) modified an existing commercially available APPLE II microcomputer game called Oink (Beagle Bros., Inc.). The game consisted of a number of "turns" of five rolls of a pair of dice displayed on the computer screen. The player's goal was to obtain as high a number as possible. If a double was obtained, that score was not counted and all points accumulated up to that point in the turn were erased. Major modifications were made to the original program such that it became the PK test, P-Oink. The main modifications were to use a hardware RNG as the source of random numbers 1-6 and to remove the subject's control of an option of terminating his turn. The latter feature was replaced by a fixed "turn" of five rolls of the pair of dice. Participants were able to play against the "computer" and the game terminated when the player or the computer exceeded 200 points.

Psi Invaders. Gissurarson (1986) used a RNG-PK microcomputer-controlled video game called Psi Invaders, to elicit PK performance from 15 subjects tested in the U.S. and 15 subjects tested in Iceland. The RNG-based APPLE computer game, Psi Invaders, is a software package included in "PsiLab", which is a computer hardware/software system for psi researchers with APPLE series computers. It was produced and developed by the Psychophysical Research

Laboratories in Princeton, New Jersey (for details see <u>PsiLab - A Manual</u>, 1985; Berger & Honorton 1985). PsiLab comes with a hardware RNG, and floppy diskettes that contain the Psi Invaders program, tests to verify randomness of the RNG and statistical tests to analyze data files. The package also includes the Myers-Briggs Type Indicator.

Psi Invaders is an adaptation of the popular arcade game Space Invaders. The purpose of the game for the participant is to shoot down invaders from space with a laser gun, while trying to avoid being hit by them. Players press a button on a game paddle to fire their laser. Laser firing is contingent upon the output of the RNG. With each press of the game paddle, the RNG is sampled one "run". Each run consists of 100 binary trials (where p=.5). For each trial a bit from the RNG is compared to a target bit which alternates between 0 and 1 (thus avoiding bias in the RNG). If the RNG sample bit and the target bit are the same, the trial is counted as a hit. Run scores of 51 hits or greater are required for the laser to fire. Run scores of 50 or less result in a "misfire".

<u>Algernon.</u> One can also mention the BASIC program Algernon, a computer oracle which may provide "meaningful information" and answers to important personal queries if psi is manifested (Braud & Schroeter, 1983). Stored in Algernon's memory are 512 statements judged to be meaningful. Albeit brief, those commentaries are on the problems and significance of life collected from philosophical, literary, and popular sources, and others invented by the authors. Braud and Schroeter reasoned that the subject might clairvoyantly scan the computer memory for the most appropriate answer, and then psychokinetically influence the answer selection process to increase the likelihood of obtaining that answer. The higher the subject's rating of whether Algernon's answer was meaningful the greater the score.

Comments. Eleven RNG PK computer games were described in this section. Most of them make use of high-resolution graphics and sound effects, with the exception of Horizon and Algernon. Some of the games require the player/subject to use his motor skills, and sometimes the player is matched against another player or particular score. In a review of the PK computer games that have been illustrated here (with the exception of Psi-Trek), Gissurarson (1986) did not find any support for the notion that purportedly exciting PK computer games promote an environment which produces greater evidence for PK than other methods of measuring PK.

3.3 THE USE OF PSEUDO-RNGs IN PK RESEARCH

RNGs in General

In parapsychology, experimental research on micro-PK depends on having a device that produces targets as randomly as possible according to statistical tests, since subjects' performance (attempted influence upon these targets) is compared to what would be expected by chance. One such device is the random number generator (RNG). A "true" RNG produces numbers on the basis of a physical source of randomness (e.g. radioactive decay and electronic noise diodes). It is often referred to as a "live RNG" or simply a "RNG". A live RNG produces sequences of numbers, where each successive number provides no new clue as to the value of the next number and cannot be inferred from knowledge of earlier numbers. The numbers are independent of each other and they are considered in principle to be unpredictable.

"Pseudo-RNG" (or "PRNG") is a term that has been used when random numbers are generated on the basis of an algorithm. This algorithm can be electronic circuits or a program. The sequences of numbers produced by such an algorithm can be said to exhibit or simulate the properties of a sequence produced by a true RNG. For instance, one can use the same statistical tests to evaluate the randomness of both live and pseudo-RNGs. Pseudo-RNGs do not, however, produce true random sequences in the sense that all successive numbers beyond the first one are completely determined by the algorithm regardless of the method of generation. One number is in one way or another correlated to the generation of the next or previous number. The first number of a sequence is called the seed. If one knows the algorithm and the seed, then in principle all subsequent numbers are known. In a pseudo-RNG the pseudo-random sequence repeats itself after a certain number of trials. Radin (1985) has pointed out that the origin of the random number should not be confused with whether the numbers are pre-existing. For instance, Schmeidler and Borchardt (1981) compared psi performance with true random and what they called pseudo-random targets. Their pseudo-random targets were produced by selecting numbers from a table of random numbers whose origin was truly random. Because the origin of the pseudo-random sequence was random, Radin regarded both sequences used by Schmeidler and Borchardt as truly random.

A pseudo-RNG was used in the first version of the PK computer test/game "Synthia", which was constructed in order to measure the alleged PK function in the present project (see the following section). The main reason was that there was no live RNG available in the psychology department or in the University of Edinburgh to the best of our knowledge at the time when the experimentation was scheduled to start. We also felt that a pseudo-RNG would be good enough (see below) for the preliminary research.

Overview of Pseudo-RNG PK Studies

In the following studies the subjects attempted to exert mental influence upon a target generated by a pseudo-RNG, that is, they "wished" for or "willed" a successful outcome of the pseudo-RNG. This is the main argument for labelling them as PK (rather than ESP) studies in the present discussion. By demonstrating that pseudo-randomly generated targets have been used successfully in PK research, a rationale is provided for using a pseudo-RNG in "Synthia" to generate the PK targets.

Lowry (1981) conducted two studies in which he served as the only subject. He programmed a microcomputer in BASIC to generate trial series of random digits between 1 and 4 inclusive, following a keyboard entry of a randomly preselected target digit. (The report does not say how this preselection was done.) A hit was recorded and displayed on the computer screen whenever a randomly generated digit matched the target digit. The subject was to will and wish for a successful comparison. His first series had 20 sessions of 20 trials each, each trial composed of 40 digits, for a total of 16000 randomly generated digits. The results showed an extreme decline effect within trials between the first 20 digits of each trial and the second 20 ($p<<.00006$, 2-T). The first half of digits (within trials) showed significant psi hitting ($p=.0006$, 2-T) and significant psi missing for the second half ($p<<.0006$, 2-T). In a second series, with additional 20 sessions of 20 trials each (with only 20 digits per trial this time), Lowry replicated the significant psi hitting ($p<.00006$, 2-T).

As a check on randomness, the programs used in the two experiments were automatically run through twice the number of trials in each experiment, but no significant deviations from MCE were observed. The report does not mention if each digit was expected 1/4 of the time in the control runs, as was the case in the experimental series. Apparently, once the target number was set for a trial, the digit generation was automatic (and as determined by the pseudo-RNG) within the trial. The initial seed for the digit sequence was selected "from relatively pure random seed numbers" (ibid., p.210).

Schmidt (1981) reported two experiments that made use of a pseudo-RNG program that generated random numbers in the range 1,2...16, and which had a cycle length of half a million digits. In a test run the random numbers (between 1 and 16) served to generate two types of random time intervals: The run started with an ON-interval (light rotating clockwise, one step for each generated number in a lamp circle) which lasted until a "3" had been obtained. Then followed an OFF-interval (the light stopped) which continued until a "12" was detected. The subsequent ON-interval lasted again until the next "3" and so forth. Each run consisted of 16 ON-OFF pairs, and the PK task was to extend the duration of the ON-intervals and to shorten the OFF-intervals. The target was thus to depress 3's and to increase 12's. The report does not mention if Schmidt did control checks on the abundance of 3's and 12's in the absence of attempted influence.

In a pilot experiment, Schmidt served as the only subject and did ten sessions of five runs each. Before the sessions began, the seed numbers for all runs to be conducted were generated (with radioactive decays as source of randomness) and stored on a memory chip in the test machine. A pre-recorded true-random process thus generated an entry point for the pseudo-random sequence which in turn determined the trials. He scored significantly above chance (z=2.12, p=.02, 1-T). (More will be said about pre-recorded targets later in this section.)

In the main experiment four selected (S) and 11 unselected (U) subjects attempted to use PK on a pseudo-random sequence of "pre-recorded" targets as was done in the pilot experiment. A total of 100 test runs was done with the U group, and 50 test runs with the S group. Prior to the test sessions, two blocks of 100 (for U) and 50 (for S) random seed numbers were generated and recorded in different sections of a memory chip. Both groups scored significantly above chance: the S group obtaining z = 3.42 (p=.0005, 1-T), and the U group obtaining z = 2.19 (p=.05, 2-T). Schmidt had pre-inspected half the seed numbers, and on these the S group got z = 2.68 (p=.005, 1-T), and the U got z = 1.45 (n.s.). Schmidt concluded that the results indicated that PK effects can be obtained even in cases where the seed numbers which determine the outcome of the test runs are pre-inspected by the experimenter.

Radin (1982a) reported four experiments in which two selected subjects attempted to influence computer-generated pseudo-random number sequences through PK. His algorithm was written in the "C" computer language. Experiment I consisted of two identical series. The subject's task was to influence a moving marker either to land on or to avoid landing on a target square (in a 3x3 matrix display) on the screen. In each series, the subject did 200 runs under either hit or avoid conditions. In a visible condition of the test, the subject started each trial with a keypress, whereupon the computer read the system clock and generated a seed number by setting it equal to the current time in increments of 1/60 second. With each keypress, the marker jumped to an adjacent square until it hit the target. A new seed was thus generated for each random decision (i.e. each trial). Although it is not stated in the report, the pseudo-random number(s) probably determined what square was jumped to.

In experiment II, the terminal displayed a line with five randomly mixed letters (Hs and Ts). When the subject hit a key the letter H or T would appear below the target letter in the line above. If a match occurred, the trial was counted as a hit. One run consisted of 100 trials, where each trial was initiated by a single keypress. Overall 100 runs were completed. Experiment III was set up similarly to experiment II, except that it had 10 practice trials at the beginning of each run and the run length was reduced to 50 trials. 100 runs were completed. In experiment IV each keypress simply displayed the current computer clock value modulo two. The resulting binary digits were displayed 10 to a line, with 50 trials per run. The first task was to produce more 1s than 0s. This version ran for one week; then the task was reversed and the subject tried for one week to produce 0s. It is not clear in the description of experiments II-IV whether each keypress initiated one "fresh" seed according to the computer clock and one resulting random number.

A randomization test comparing theoretical and empirical distributions indicated that under control conditions the pseudo-RNG was unbiased. Five of 18 independent tests for deviation from chance within the four experiments were statistically significant at the .05 level (2-T), resulting in an exact binomial probability of $p<.005$.

Radin (1982b) reported six experiments in which a "microprocessor based PK test machine" used gamma radiation to produce two types of random events: (i) It was used to produce "direct" events that were generated whenever a Geiger tube detected gamma particles. (ii) The gamma radiation was also used to produce a truly random seed number for "seed" events, that were a string of pseudo-random numbers determined by that first seed and a mathematical algorithm. Feedback was provided by clockwise (CW) and counterclockwise (CCW) illumination of 16 lamps arranged in a circle. "As each random event was detected, the illumination pattern was reversed" (ibid., p.141). (Although it is not clear in the report, Radin is probably referring here to a target random number in as string of random numbers, but not every random number in the string.) The first event caused a CW motion, the second a CCW motion and so on, until one run of 16 CW-CCW pairs had occurred. According to the report, the PK task was "to produce more CW steps than CCW steps" or vice versa (ibid., pp. 141,142). Hits were defined as CW or CCW steps according to the target direction.

The first three experiments were conducted with the true RNG. Radin acted as the only subject in experiments 4, 5 and 6, which were conducted with the pseudo-RNG sequence. In experiment 4, Radin performed 50 runs in the seed mode. The task was to produce as many CW steps as possible. Results were nonsignificant. However, the subject knew that after a seed was generated the rest of the run would be predetermined and reported having felt unconfident as he thought that the task was extremely difficult. In experiment 5, the subject performed 200 runs in the seed mode, only this time whether the task was to produce more CW or CCW steps was randomly determined (the report does not mention how) for each run after the seed number had been generated. Results of the experimental conditions were very significantly above chance ($p<.0005$). In experiment 6, the subject performed 50 runs in the seed mode. The target assignment was randomly determined as in experiment 5, but was not revealed until after the run was complete. Results of the experimental condition were significantly below chance ($p<.05$, 2-T). Control series of random numbers for experiments 4, 5 and 6 were nonsignificant. The report did not provide any procedural information on the control random series.

Shafer (1983) tested 20 preselected subjects to see if extrachance scoring would be obtained with randomly generated and/or pseudo-randomly generated targets. The PK test was a Schmidt machine with a circular display of 16 lamps: Initially the topmost lamp is illuminated and once a run is started, the lamps are illuminated one at a time successively clockwise around the circle. After a randomly determined interval, the clockwise "movement" of the illuminated lamp is halted and it remains fixed in position for a second randomly determined interval. After that the apparent movement resumes, again for a randomly determined time. A run is terminated automatically after 16 move/stop pairs of random intervals. (This is probably the same display which Schmidt, 1981, used. What determined the starting and stopping of the lights in Schmidt's apparatus was the selection of the numbers 12 and 3.) There were two sources of randomness. The first was based on radioactive decay. The second was based on a pseudo-RNG, in which the length of each interval was determined according to a sequence of pseudo-random numbers. The first seed was chosen by the live RNG source at the beginning of a run.

The subject's task was to try to keep the light moving clockwise as long as possible, and to shorten the duration of stopped intervals. A total of 400 runs were conducted, 200 with the live RNG and 200 with the pseudo-RNG. For the live RNG mode, the total score for target direction intervals was 44,585 (it is unclear in the report what sort of units these are), for nontarget intervals, 46,735, suggesting a marginally significant psi missing effect (p=.07, 2-T). For the pseudo-RNG mode, the target interval total score was 50,756, and for nontarget intervals, 51,041, a nonsignificant difference in the missing direction. Control tests before, during and after the experiment yielded nonsignificant differences between target and nontarget intervals. No further information is provided in the report on the control test results. Shafer concluded that some evidence was obtained in the experiment for apparent PK missing in both the random and pseudo-random target generation modes.

Braud (1980) hypothesized that labile systems, such as live RNGs, are more susceptible to psychic influence than inert systems, such as pseudo-RNGs (the fewer true seeds in the pseudo-RNG the more inert it becomes). By "lability" he meant "characterized by a ready capability for change", the ease with which a system can change from one state to another. By the opposite term "inertia" he meant the tendency of a system to resist change and to continue in its present condition. Braud and Schroeter (1983) conducted an experiment with Algernon the computer oracle (described earlier in this chapter). The subject typed a meaningful question on the keyboard, then waited for an answer to be displayed on the screen. 512 statements or commentaries on the problems and significance of life were stored in Algernon's memory. Sixteen subjects rated 16 answers from Algernon to 16 questions they had according to the degree of relevance, meaningfulness, and appropriateness of the answer. The authors reasoned that if suitable answers had been obtained through psi, consistently high ratings would be expected. They hypothesized that more "labile" processes would be more susceptible to PK influence than more "inert" (more deterministic) processes.

The greatest degree of lability was obtained through the use of a radioactivity based RNG. The next greatest was obtained through a pseudo-RNG seeded 16 times (once for each question) by key presses which varied randomly in time. The next degree was provided by the same algorithm seeded only once by a key press early in the session. The least labile condition provided no degree of freedom for selecting one's own answers; answers for these subjects were retrieved from a "disk record of the answers obtained by a predetermined previous subject" (ibid., p.164). The results showed that the order of the mean meaningfulness ratings of the four conditions was almost as predicted (live RNG > pseudo-RNG with 16 seeds > answers determined by order of subjects > pseudo-RNG with one seed). However, the group differences did not reach significance, and they concluded that the lability prediction was not confirmed.

Katz (1983) reported an experiment in which he served as the only subject. An electroencephalogram (EEG) recorded evoked potentials of the subject during his PK efforts in a single session with 600 trials. The targets were generated by a true RNG and a pseudo-RNG. Target generation and display were controlled by a computer. The subject only received feedback on whether each trial was a "hit" or a "miss" (typed out on the display terminal), and no information was given about whether the targets were generated by the true RNG or the pseudo-RNG. Targets for each trial were generated "internally" (no display) and placed in the computer's memory (ibid., p.219).

True RNG values were transformed to one of four numbers (1-4). Pseudo-RNG output could be one of eight values (1-8). If the pseudo-RNG value was <= 4, it was compared with the result derived from the true RNG. If the two values matched, a "true hit" had occurred, and if the two values did not agree, a "true miss" had occurred. If the pseudo-RNG result was 5-8, then a pseudo trial had been generated. The trial was a "pseudo hit" if a 6 had occurred, otherwise it was considered a "pseudo miss". The report does not say when or how often new seeds were selected for the pseudo-RNG: "The intrusion of psi in selecting seed numbers of pseudo-RNGs was prevented by minimizing such selections" (ibid., p.218). Apparently, no psi scores were significant, but "there was a trend toward a difference between evoked potentials with" true hits and with pseudo-hits (Schmeidler, 1987, p.15).

Jacobs (1985) investigated whether PK can be measured using a target process that is deterministic in nature (pseudo-RNG) but that proceeds from a random initial state. He also examined whether such a process yielded PK test results comparable in magnitude to those using a truly random process generator (live RNG). Two experiments were conducted, in which Jacobs served as the only subject. The PK display was a circle of 16 grey dots. One of the dots lit up white, and then turned grey and an adjacent dot lit up, either in the clockwise or counterclockwise direction, in a random walk. The lit dot thus seems to jump in either direction on the screen. The PK task was to make the dot rotate as far as possible in the target direction. A hit was defined as a light jump in the target direction, and a miss was defined as a jump in the nontarget direction.

"An experimental run consists of 16 periods during which the lit dot rotates clockwise and 16 periods of anti-clockwise motion" (ibid., p.20). (Jacobs is probably referring here to the assigned target direction.) Within a run, the 16 periods in each of the directions were split into 8 periods in which the light jumps were controlled by a true RNG and another 8 periods in which the jumps were controlled by a pseudo-RNG. The pseudo-RNG was seeded only once per session. There were 100 runs in each experiment, each with 10 sessions and on the average 10 runs per session. The findings for both experiments pooled together showed a significant PK effect for the live RNG condition ($z=1.98$, $p=.02$) and a nonsignificant PK effect for the pseudo-RNG condition ($z=1.04$). The "variance of hits-misses" (I presume this means deviation regardless of sign) in the live RNG control series was significantly larger than expected, thus, according to Jacobs, casting doubt on the randomness of the live RNG. The results of true and pseudo-RNG conditions did not differ significantly. Jacobs reported a nonsignificant decline in PK scores for both RNGs.

Previously mentioned was the report of Jahn and Dunne (1987; see also Nelson et al., 1986) which describes the Princeton Engineering Anomalies Research program. Their particular pseudo-RNG used an array of 31 microelectronic shift registers (Jahn & Dunne, 1987, p.120). It produced a sequence of $2x10^9$ bits (at a set clock frequency) that did not repeat itself for about sixty hours of continuous operation. This source was switched into the standard RNG apparatus to replace the noise diode, leaving all attendant processing and display equipment identical. The "time of incursion initiated by the operator" designated the seed for the pseudo-RNG.

The results using this pseudo-RNG were described as "strikingly" similar to those achieved with the true RNG. Ten subjects completed 29 experimental series (a grand total of 145,000 trials), obtaining probabilities beyond chance; when aiming for high numbers, p=.078; when aiming for low numbers, p=.005; and the total on pseudo-RNG trials (combined conditions) yielded p=.003. Five of the pseudo-RNG series were statistically significant in the high-aim condition, five in the low-aim condition and six in combined conditions (compared to one or two expected by chance). Five of the subjects achieved significance in their total data bases. Jahn and Dunne (1987, p.121) concluded that the pattern of results exceeded chance expectation, indicating that the basic phenomenon was not necessarily tied to true RNGs.

From the two reports cited above it is not clear how often a new seed was selected during a session. Either trials could be initiated, one at a time manually or only the first trial initiated and the remainder followed automatically. The number of trials per "single effort" in the automatic mode varied between 50, 100, and 1000.

Pre-Recorded Targets

This subsection is intended to: (i) introduce to the reader unfamiliar with parapsychology the complexities of the alleged PK function, (ii) prepare the ground for a description of two models in parapsychology by demonstrating what sort of issues they have to address, (iii) show that PK effects have not just been reported on true and pseudo-RNGs but upon a pre-recorded random sequence with either a true or pseudo-RNG as its initial source.

One feature of pseudo-RNG studies is that once the initial seed of a pseudo-RNG has been determined, all the later events are fixed. The subjects continue to exert a PK effort as these determined events unfold, yet, this effort seems to be wasted if we assume that PK works in real time. Some parapsychologists have suggested that PK may also involve a retroactive effort, i.e., an effort exerted backwards in time, contributing to the process of the initial seed selection. Such backward causation (referred to as "retroactive PK") will be discussed in more detail in this subsection.

In addition to the pseudo-RNG PK studies, there have been experiments which examine the possibility of retroactive PK more directly. Those involve attempts to influence pre-recorded targets. (A pseudo-random sequence is similar to a pre-recorded random sequence in that both are determined.) To the best of my knowledge, Bierman and Houtkooper (1975) first published a study which involved retroactive PK. I chose however to describe a study in three experimental series conducted by Schmidt (1976), because it illustrates the main features of such research more clearly than the Bierman and Houtkooper study. In Schmidt's study the random events to be affected were generated and recorded in the absence of both the subject and experimenter. The subject became involved later when the pre-recorded events were played back to him.

Experiment I: This experiment was in three parts, the first two testing conventional aspects of PK. In the first two parts, 20 and 30 subjects participated, respectively. For each test run, subjects were asked to put on headphones and listen for clicks. The clicks were controlled by a RNG and occurred at random intervals. The RNG produced numbers ranging from 1 to 64, at the rate of 10 per second. Whenever the number 64 was encountered, a click was produced and this was counted as a hit. Schmidt presumed that subjects would like to hear the clicks. He expected, therefore, that subjects' eager and expectant concentration on the next click would activate a PK mechanism such that more clicks than expected by chance would result. In each part an increase in click rates above MCE was obtained (p=.001, 1-T). In the third part the clicks were first recorded on a magnetic tape and later half of them played back to the 30 subjects that participated. Those subjects were thus the first observers of the random sequence. The other half of the pre-recorded sequences was used as control data. The experimenter was unaware of which runs would serve as test or control. In the third part an increase in click rates above MCE was again obtained (p=.001, 1-T), and the control pre-recorded sequences were at chance.

Experiment II: In this experiment 20 subjects participated. Loud clicks were randomly channeled to the right or left ear while the subject tried to enforce an increased click rate at the right ear (hit probability = 1/2). Half of these events were concurrently generated while the other half came from a replay of an earlier recording. The pre-recorded targets were generated and recorded at the high speed of 300 per second, whereas the replay of the same data in the test sessions occurred at the low speed of 10 per second. This arrangement was made to test the prediction that the outcome of the experiment would not depend on the method of target preparation (i.e., the target generation). Furthermore, each recording was used for four sessions so that subjects (without knowing) spent four times as much effort on each pre-recorded event than they did on each momentarily generated event. Schmidt hypothesized that N repeated attempts at the same target should add linearly leading to an N-fold increase in the average deviation from the chance level.

The scoring rates on the pre-recorded and concurrently generated targets were 52.9% and 50.8%, respectively (p=.0005 and .05, 1-T). The difference between the pre-recorded and concurrently generated targets was significant at the .025 level. According to Schmidt, this confirmed the existence of a PK effect on pre-recorded targets and suggested that repeated replay of the same targets might lead to higher scoring rates. Scoring rate was not affected by the high speed generation and recording of the pre-recorded targets.

Experiment III: This experiment was in two parts and 10 and 28 subjects participated, respectively. The task was the same as in experiment II, but the binary events came from an "easy" RNG with a hit probability of 7/8 and a "difficult" RNG with a hit probability of 1/8. The results were not significant enough according to Schmidt, to permit a detailed comparison between the direct PK effect and the PK effect on the pre-recorded sequences. Nevertheless, the results showed that subjects scored significantly above chance on pre-recorded targets in both parts (.01 and .05 respectively).

Several other experimenters have attempted to replicate the retroactive-PK experiments, with mixed results (e.g. Bierman &

Houtkooper, 1981; Broughton et al., 1978; Houtkooper, 1977a; Morrison & Davis, 1979; Schmidt, 1979; Schmidt, Morris & Rudolph, 1984; 1986; Schouten, 1977; Terry & Schmidt, 1978). The various findings of the retroactive PK studies will not be pursued here.

Comments on the Pseudo-RNG PK Studies

The literature on research making use of pseudo-RNGs is growing in parapsychology (e.g., Jahn & Dunne, 1987; Nelson et al., 1986; Puthoff, 1985; Radin, 1982a; 1982b; Radin & Bosworth, 1985; Schmidt, 1981; Schmidt et al., 1984; 1986; Shafer, 1983; Tart, 1983b; see on the practical use of pseudo-RNGs in parapsychology, Radin, 1985). Investigators in parapsychology have repeatedly failed to find a significant difference between scores with random and pseudo-random targets (Schmeidler, 1987, p.37). Psi experiments employing pseudo-RNGs have shown significant effects similar to those obtained with true RNGs (e.g. Nelson et al., 1986; Radin, 1982a; Radin & Bosworth, 1985; Schmidt, 1981). This suggests that there may be a similar mechanism responsible for the observed effects.

Roughly speaking, of the nine pseudo-RNG PK studies reviewed in this section (Jahn & Dunne, 1987, and Nelson et al., 1986, counted as one database), five reported significant PK effects on pseudo-random number sequences. In the above pseudo-RNG studies it is assumed that any observed bias in random sequences can be a result of one of two functions: (i) PK affecting the computer system clock or a live RNG, which is used to generate "fresh" / "pure" seed numbers that initiate the pseudo-RNG (Jacobs, 1985; Schmidt, 1981; see also theoretical arguments on this point in Vassy, 1985 and Walker, 1984a, p.321). (ii) Precognition of favorable moments for selecting these seed numbers (Radin, 1982a). At our current level of understanding, however, the "real" cause of the bias is unknown. Our present understanding of psi phenomena is so meager, that theoretical and practical effects of pseudo-RNGs in PK experimentation is still widely open for exploration.

3.4 THE COMPUTER TEST "SYNTHIA"

In order to measure subjects' psychokinetic abilities I constructed a computer game/test called "Synthia" (see program in appendix A). After an attempt to program in ProPascal I turned to IBM BASIC as the graphics facilities were more accessible in BASIC. The computer test was written in BASIC (version A3.21). I based the test upon a game made by Haraldsson and Broughton that was written in Applesoft Basic for Apple IIe. Their test has been used to measure ESP (e.g. Haraldsson et al., 1987; Haraldsson & Gissurarson, 1987).

An IBM PC/XT (16-bit architecture machine with 80286 microprocessor) was used. It had one 5 1/4 inch high capacity diskette drive (storing approximately 1.2 MB), 20 MB hard disk memory capability accompanied by a color screen (CRT), IBM enhanced color display, and an attached Epson LQ-800 printer. The XT286 has 640K RAM and runs at roughly 6 MHz (which should be a system clock cycle time of 167 nanoseconds). The operating system was DOS 3.20. Following is a description of one of the first versions of "Synthia". The other versions, which had minor changes and additions, are reported along with each experiment to show the chronological development of the test.

Basic Description of "Synthia"

Before the test display comes on the screen. There are two modes or versions of "Synthia", a feedback version and a nonfeedback version. The player is seated at a standard IBM-style keyboard viewing the CRT. At the start, "Synthia" asks for the subject's name and whether a feedback version or a nonfeedback version is to be played. (In present research, these information were keyed in by the experimenter.) Then "Synthia" reminds the participant to press the space-bar to initiate a trial. To continue to the test display one can press any key.

The test display. Target selection: In the test display of "Synthia" four green windows or boxes appear in a row in the upper half of the computer screen against black background. A pseudo-random number generator which produces the numbers 1,2,3 or 4 is embedded in the computer program. Each of the four numbers (1,2,3 or 4) produced by the pseudo-RNG matches one of the four windows on the screen such that 1 represents the window on the far left while 4 represents the window on the far right. In the beginning of a 40-trial run, the pseudo-RNG automatically produces a random designation of one of the four windows which then becomes the target. (The exact set-up of the pseudo-RNG and the timing of when a random number is chosen is discussed in the method section of each experiment.) A brown arrow appears beneath the designated window showing that it is the target for this trial (see Fig. 3.1 at the end of this chapter). The random source selects a target window for every 10 trials of a 40-trial run. The pseudo-RNG cannot select the same target window consecutively. A reminder text ("New Box") appears in the left upper corner for about 2 seconds whenever the target box is changed.

Trials: On each trial, subjects are to attempt to "make the computer" select the designated target window by pressing the space-bar, thus initiating the pseudo-RNG once more (again producing the numbers 1,2,3 or 4). If the "trial selected random number" matches the "target window number" as tallied by the computer the trial is counted as a hit.

If trial number and target number do not match the trial is counted as a miss. The probability that the trial selected random number matches the designated target number is 1/4. A text appears on the computer screen below the four boxes showing how many trials are left.

The space-bar: If a subject wants to initiate a single trial, the space-bar is quickly pressed down and the pressure released immediately. If the space-bar is held down continuously the computer continues to generate trials one after the other up to a maximum of 12 trials, depending upon how long it was held down. It takes about 5 seconds to initiate 12 trials. If the target box designation is changed in the middle of this semi-automatic trial generation, the computer changes the target designation and then keeps on making the trials (comparing its random number selection to the new target box). This option was made such that if a subject thought or felt that he was in an exceptionally favorable state and could obtain many hits, he could hold the space-bar down in order to have the computer rapidly select a few trials in a row while this "feeling" lasted.

After the test display. At the end of a 40-trial run, after the last trial, the four windows' test display disappears. It is replaced by a text which, after saying "Well Done", tells the player how many hits he got and asks him to call the experimenter.

The feedback version. Feedback it is provided for hits only in the feedback version of Synthia (see Fig. 3.2). Immediate feedback is provided as a beep sound immediately if a hit is made, occurring before the screen lights up into a blue star with blue stripes radiating out from behind. As cumulative feedback the number of hits is continuously displayed at the bottom of the computer screen in the feedback version. Another cumulative feedback is a small green bar in the lower left corner, that lengthens with hits. If the trial was a miss the blue star does not appear and the cumulative feedback displays remain unchanged.

The nonfeedback version. In the nonfeedback version, no information is provided as to whether each trial was successful or not. The text on the test display which tells the player how many trials are left appears in both the feedback and the nonfeedback versions of Synthia, as well as the text which appears on the screen after the test display informing the participant how many hits he got. The nonfeedback version could perhaps more appropriately be called delayed feedback. For the sake of simplicity we shall refer to the trial-by-trial immediate feedback condition of Synthia as the feedback version, and the delayed feedback condition, where there is no such trial-by-trial immediate feedback, as the nonfeedback version.

Reasons for Using this Computer Test

The reasons behind making this particular game/test instead of adopting one of the available games described in section 3.2 can be put as follows:

(1) I wanted to have the computer game simple to understand and straightforward. Games utilizing high-resolution graphics and requiring motor skills (see section 3.2) may only appeal to a certain age group. I wanted to create a quasi-game like PK computer test that would appeal and be a challenge to people of various ages. In Synthia, feedback for hits is simple, vivid and can probably easily be imagined. Morris and Garcia-Noriega (1982) pointed out that a display providing simple feedback of PK scoring may perhaps be more psi conducive than a complex one. Although this study was not instrumental in my choice of display it is worth mentioning here:

In a study designed to assess whether some characteristics of displays seem psi-conducive and others psi-inhibitory, they tested 12 subjects under four different PK display conditions. One PK test was a circle of 16 lights. Binary RNG decisions were used to advance an illuminated light one step clockwise or counterclockwise each trial. The other PK test was a small box with two rows of eight light bulbs, only two of which (juxtaposed) were used in the study. Binary RNG outcomes were displayed by lighting one or the other light bulbs for a fraction of a second. Each display was activated either at high speed (60 RNG decision per second) or at low speed (one RNG decision per second). Subjects did significantly better on the two light bulb display than on the circle of lights ($p<.01$, 2-T). Morris and Garcia-Noriega suggested that some feedback displays, such as the rapidly moving circle of lights, are providing subjects with too much rapidly changing information to be processed, and may therefore be too disruptive of the subject's "internal state." It is not clear from the report whether the slow or the fast version of the two light bulb display showed a greater deviation from chance.

(2) I wanted to allow the participants to choose when to start each trial by pressing the space-bar when they are ready and to rest between trials if they want to. I have tried out the PK computer game Psi Invaders (Gissurarson, 1986). Although in Psi Invaders each press on the game paddle initiates one shot from the laser gun (if run scores of 51 hits or more are obtained), the player has to move the laser continuously in order to avoid being hit by the "Psi Invaders" from space. I did not feel entirely satisfied with this arrangement because it made me feel less in control with the game.

(3) I wanted to be able to change various features in the computer test according to what I wanted to investigate. In Synthia for example,

it was easy to include a time measurement to measure time between trials and to include a simultaneous "hidden" RNG generation (as was done later on).

(4) In the past I have acted both as an experimenter as well as a subject in experiments that have used the Broughton and Haraldsson Apple IIe ESP microcomputer test/game (e.g. Haraldsson, 1987). Their game had a similar four boxes' test display as Synthia. I liked their game because it was simple and in general subjects seem to enjoy it.

(5) Finally, but not least, I reasoned that by making a computer test on my own, I would achieve a better knowledge of computer programming (which was limited when this project began).

A Few Words About the Feedback Sequence

The feedback sequence was designed to simulate an operant conditioning sequence where the immediate, conditioned reinforcer (the immediate feedback being the beep sound) precedes the reinforcing stimuli (the trial-by-trial feedback being the blue star). In operant conditioning technically the noise of the pellet dispenser is the conditioned reinforcer (e.g. Ferster et al., 1975, pp.36,228). This stimulus becomes a reinforcer because it signals when it is possible for the animal (typically a pigeon or a rat) to eat. It precedes the food pellet and can be given quickly, thus instantly strengthening the required performance. No negative feedback was used (such as irritating sound effects). One can, however, easily notice in the feedback version if a trial was a miss since the trials left decrease by one. This simulates the reinforcement set-up, where responses that are not being reinforced are not followed by a negative reinforcer and only preferred responses are reinforced. Although I do not consider feedback necessarily to be a reinforcer (see section 2.6), I decided on above set-up for later exploration. (I can manipulate the feedback as if it was a reinforcer in order to see whether PK performance is dependent on feedback frequency in the same way operant performance is dependent on schedules of reinforcements.)

Interval Time

The time that passes between space-bar presses (trials) is automatically recorded as number of seconds and hundredths of a second. During the experimentation, this time measurement came to be called interval time (IT), to distinguish its function from response time as employed in cognitive psychology. The reason for labelling the time between trials as IT and not reaction time (rt) is that what is measured by IT may not be the same thing that is measured by rt. On one hand, in research on e.g. mental rotation of the letter "R" (Cooper & Shepard, 1973), subjects are asked to mentally rotate the R to a certain position until they think they have accomplished it. On the other hand, in research on possible PK conducive visual-imagery strategies, subjects are asked to generate their imagery strategy until they feel satisfied with vividness of their image, and then feel if it is the right moment to initiate the trial. When I started using the interval time measurements, to the best of my knowledge, no one in parapsychology had ever tried to get to grips with possible "mental processes" behind psi as measured by response time of some sort.

Mental processes appear to be the analog of corresponding physical processes when subjects perform spatial tasks or solve problems as measured by reaction time. The assumption behind IT is the same. Roughly speaking, the interval time may tell the time that mental processes take between trials. One could say that IT is an example of a shift in emphasis away from trying merely to demonstrate that psi exists and towards "process oriented research" (see section 1.5). One of my original ideas was to see if more time spent on a task would result in higher PK scoring with subjects that were allowed to work freely on the computer test (i.e. without any instructed strategy). During a PK task the mental processes measured by IT may represent in large part the "amount" of "willing" / "wishing" of some sort. Equating "willing" with time is of course subject to a debate. At any rate, if more "willing" as measured by IT was associated with higher PK scoring, more time would, at face value, correlate with higher PK scoring. An alternative would be that more IT, correlating with higher PK scoring, represented more care in waiting for the appropriate state of consciousness in a rapidly changing series of states. The issue might be clarified to some extent in the course of research by introspective reports from subjects.

I also wanted to see whether it was at all possible to operationalize imagery practice. IT measurement may represent ongoing mental processes when subjects have been instructed to attempt to use an imagery strategy to "will" success on the PK computer test. If two groups of subjects are instructed to practise two different strategies (one very basic, the other requiring a more elaborate visualization work-up), we would expect to find different ITs for the two groups if the mental processes involved are analogues of corresponding physical processes. If it turns out that the simple strategy takes a significantly shorter time than the other, we can say that the two groups of subjects were probably practising two different strategies.

Outfiles and Security Measures

In Synthia, the random number (1,2,3 or 4) generated on each trial, and whether the feedback or the nonfeedback version was being played, is stored in an outfile along with the designated target window (1,2,3 or 4) and interval time between trials. Furthermore, the outfile writes the date and time, and calculates how many hits were made and the mean IT for that run. It automatically does not calculate the IT for the first trial, as it may often reflect unfamiliarity with the test or some preparation reaction.

As a precaution against fraud, two outfiles are made each time Synthia is run. One is "hidden" on the hard disk for each subject (under the label "<name>.lrg"). The other one is a cumulative file collecting all the data. The cumulative file was "hidden" on the floppy disk under the name "autoexec.bat" which in the IBM system is a name of a file that controls various functions. Having two data files allowed comparison between them in order to see if somebody tried to break into either one. The main program itself was file protected. The security against fraud was tested before experimentation started by two computer specialists (Konrad Morgan and Kevin Mack) to see if they could deliberately produce "wrong" PK scores. Each attempt took about an hour and both were unsuccessful.

The sound-attenuated room in which the computer test was run was monitored by a line voltage conditioner called "Stabilac" (Claude Lyons ltd., type TRX 5000). Electrical interference and power fluctuations can result from lightning, radio transmissions or nearby electrical equipment being switched on and off. This can result in data dropouts, memory malfunctions, disk error, data falsification, head crashes and so forth in a computer that is turned on. The Stabilac is supposed to filter the power supply and protect against mains surges, spikes and radio frequency interference.

3.5 THE WICHMANN-HILL PSEUDO-RNG

The Search for a Pseudo-RNG

My colleague (Konrad Morgan) and I tested a few pseudo-RNGs all of which proved to have a short cycle length and started repeating themselves after a few hundred trials. Finally we decided to use a pseudo-RNG that we can refer to as the Wichmann-Hill (W-H) RNG (Wichmann and Hill, 1982a; see also for further discussion and remarks, Jacobs, 1987; McLeod 1985; Wichmann & Hill, 1982b; 1984; 1987; Zeisel, 1986). The translation of the W-H RNG into BASIC can be seen in table 3.1 at the end of this chapter. The W-H pseudo-RNG produces numbers uniformly distributed between 0 and 1. It is reasonably short to program, reasonably fast and machine-independent. It has a very large cycle length, approximately 6.95×10^{12} numbers, so that even using 1000 random numbers per second continuously, the sequence would not repeat for about 220 years.

I tested the W-H pseudo-RNG for first order effects, both for large series of numbers (1/2 to 1 million digits each time) as well as for small series (1000 to 10000 numbers), in doubles (i.e. range of random numbers = 1-2, p=1/2) and quadruples (range 1-4, p=1/4) by chi-square and z-test. I decided to use it as it did not show any unexpected significant deviations from expected chance distribution. I want to record one comment, however, which follows.

A Remark on the Wichmann-Hill RNG

Wichmann and Hill argued that they were prepared to extrapolate their experience and "infer that the sequence [of their pseudo-RNG] is satisfactory throughout" (Wichmann & Hill, 1987, p.188). (It is unclear in the report what "throughout" refers to.) However, we found one significant deviation from chance in numbers produced by their RNG which was persistent over 1 million numbers (Gissurarson & Morgan, 1988). We had been testing the W-H RNG on our IBM^{xt} 286 16-bit machines in programs that use an algorithm dividing the numbers generated by the RNG into four groups (thus simulating the four targets in "Synthia") each expected by chance to occur in equal numbers (for 1/2 million numbers by chance about 125,000 digits should fall into each group). We noticed that once in a while the W-H RNG produced significant deviations from chance by applying a one sample z-test for the mean of the deviation of the numbers (z=D/sqrt(pqn); where p = probability of chance hit; n = sample size; q = 1 - p; D = difference between observed and expected bin-counts and |z|>=1.96 i.e., p<=0.05, 2-T as the observed result can match both directions of the sampling distribution).

By keeping a record of the initial seeds that we used, we were able to spot the seeds that produce these deviations, and furthermore, to reproduce the distribution of numbers according to these seeds. (These tests did not involve a tally against randomly selected targets.) Our program had a proposed amendment from McLeod (1985), which is an improvement of the original W-H algorithm to avoid round-off errors: The W-H algorithm is supposed to generate random numbers from the open interval (0,1), that is, excluding the numbers 0.0 and 1.0. Once in a while, however, the generator produces exactly the numbers 0.0 and 1.0, depending on the single-precision arithmetic of the computer used. In essence, McLeod proposes the use of double-precision arithmetic for computing the random number. According to McLeod, in some situations the zero values could cause "program errors" (ibid., p.199). It is unclear in the report what these "program errors" are.

As can be seen in table 3.2, group one (numbers that were

>0-<=0.25) was selected significantly more often than the other three groups, z = 2.912 (p=.0036, 2-T). We reconstructed the distribution produced by the three initial seeds given in table 3.2: Numbers are selected more often into group one than we would expect by chance to such an extent that these three initial seeds produce a sequence of 1 million trials where numbers >0-<=0.25 are generated always more often than the expected distribution. The numbers that are selected into group four (>0.75-<=1.0) are less often generated and, in fact, they never go above the expected chance baseline.

Any RNG should have "rough" patches, for instance, with spinning a coin, one should obtain long sequences of "heads" by doing enough trials. What we found was one such rough patch. The question is whether this is acceptable on the basis of randomness. By looking at how likely it is to obtain this particular contingency table by chance alone, one can apply a chi-square test. Taking the 4 frequencies given, we get chi-square = 9.479 on 3 degrees of freedom (since the sum is 1), corresponding to p=.0236. This is roughly 1/42. According to Jacobs (1988) this single occurrence of a deviation from chance should be of no consequence. He performed a goodness-of-fit test for uniform distribution and a second-order randomness test on the W-H pseudo-RNG but did not find any reason to suspect it (Jacobs, 1987).

3.6 TWO MODELS TO EXPLAIN STATISTICAL PK

The data from the various experiments in parapsychology (see for instance sections 2.4, 2.5 and 3.3) seem to suggest that human mental activity can somehow be linked without any known physical medium to the behavior of very "noisy" systems in the environment. There are many theoretical ideas that attempt to explain how this can be. As one might expect, however, given the uncertainties of the empirical evidence, very few have attracted serious attention in the sense that they have led to much research with the prospect of real replicability. I have chosen to describe two kinds of models that have recently become attractive experimentally. Both deal with live and pseudo-RNG effects.

One is the Intuitive Data Sorting (IDS) model of May et al. (1985), which attempts to explain anomalous bias in RNGs without invoking PK. It suggests that we may have been wrong all along in presuming that human volitional acts are directly responsible for PK effects. The other is really a group of theories, known as the Observational Theory (see below), from which I have chosen one specific example. I decided upon Schmidt's (1982; 1984; 1987) quantum collapse model because it takes into account his earlier versions and it does not necessarily call for retroactive or transtemporal influences.

I chose these two models on the basis of their dissimilarity. I reasoned that by doing so I could perhaps arrive more easily at clearly different hypotheses. I decided upon only two models instead of three or more, since I felt it was the maximum I could afford to spend time pondering over. The reasons for including a theoretical discussion in this dissertation are: (i) I wanted to demonstrate that a theoretical background is available that justifies the use of a pseudo-RNG in PK experimentation. (ii) These models are called upon in discussing some results of the experiments. (iii) They attempt to provide an explanation of why PK acting where chance processes are involved is possible at all.

It should be borne in mind that neither one necessarily represents the author's view. It may well be the case that many scientists, unfamiliar with the large body of RNG research, would be reluctant to accept the validity of either model. The models have, however, been constructed to account for, or at least systematize, the available and puzzling RNG data. It should also be noted that the following theoretical discussion is not a part of the thesis' main issue. As parapsychology is in need of a model, it is important to see how results fit, if at all, available models. The data in this thesis were collected with neither of the two models in mind. The two models discussed are reported as they were presented and argued for by the authors.

Schmidt's Quantum Collapse Model

Models relevant to the quantum collapse model. A few theories have been constructed in attempting to explain psi that share the common factor of drawing upon ideas from quantum theory (e.g. Donald & Martin, 1976; Lucadou & Kornwachs, 1977; Mattuck, 1976; Schmidt, 1975a; 1975b; 1978; Walker, 1975; 1976; 1977). They have collectively been called the "observational theory" (OT) (Schouten, 1977; see also discussion in Houtkooper, 1983; Millar, 1978; Stokes, 1987; and review of criticism in Walker, 1984a). Our concern here will be with an OT as recently outlined by Helmut Schmidt (1982; 1984; 1987).

The quantum collapse model. On the basis of experimental results and criticism of an earlier model (see on that model, Schmidt, 1975a; 1975b; 1978; and criticism in Houtkooper, 1977b), Schmidt proposed an amended version, the quantum collapse model (Schmidt, 1982; 1984; 1987). This model is an attempt to organize RNG PK data, and it is designed primarily as a basis for experimentation for further development of the model. It applies to a situation in which a random process can have two outcomes, a favorable outcome (a hit) with probability p, and an unfavorable outcome (a miss) with probability q.

The quantum collapse model assumes a close link between psi, consciousness, and quantum theory. In general, light and atomic particles of matter can either behave as waves or particles according to quantum theory (e.g. Heisenberg, 1959; Hund, 1974; criticism in Popper, 1982; general in Jones et al., 1973). Quantum theory describes a physical system at the atomic level (such as an electron orbiting a nucleus) in terms of a state vector (or wave function). This vector can be considered as a set of parameters (eigenvectors), each representing the system in one of its allowed states (i.e. each specifying a possible location of the electron). The state vector can only give the probability that the electron will be observed in a specified location. In an actual position measurement, however, the electron is observed to be in a particular location. The measurement somehow results in (or forces) a decision about the location of the electron. In technical terms the measurement (observation) leads to the "collapse of the state vector" into one of its eigenvectors (or "reduction of the wave packet"). Generally speaking, there is no way of describing what actually happens between two consecutive measurements (Heisenberg, 1959, p.49). Quantum theory has nothing to say about how (or when exactly) a system evolves from a state vector prior to measurement to one of its eigenvectors after. Bohm and Bub (1966, p.454) wrote:

> ...the role of the measuring instrument in the phenomenon of the "collapse" of the wave packet in a quantum mechanical measurement process is obscure. This has been referred to as the measurement problem in quantum mechanics.

In describing his model Schmidt (1984) considers the example where a decision from a binary RNG results in a red or a green lamp being lit and red has been selected to be the target. The probability that the RED (hit) and GREEN (miss) events will be selected by chance are p and q, respectively. According to Schmidt, when the RNG has been activated, but <u>prior to</u> any observation of the outcome, the "state vector" of the system can be stated as:

$$\text{STATE} = \text{RED} + \text{GREEN} \qquad (1)$$

In Eq. 1, the state vectors RED and GREEN correspond to potentially real, physical states, with the red or the green lamp lit. The form of the total state vector STATE is represented "as a superposition of two different possibilities" (ibid., p.264).

Now Schmidt wonders if "nature" has already "decided" for one outcome, or whether physical reality at this stage is actually some "intuitively" implausible "ghost state" suspended between two possibilities. He argues that according to present knowledge we cannot tell when such a decision is "really" made. On the contrary, comparison with the formalism of quantum theory may suggest that the appearance of a RED or a GREEN event remains unreal until the outcome has been observed. When an observer looks at the outcome, he sees either the red or the green lamp lit. At this stage, writes Schmidt, "nature must have definitely decided" for one outcome (ibid., p.264). The original state vector, STATE, has been reduced (or collapsed), into either the RED state or the GREEN state.

How is this transition brought about, asks Schmidt, and what is the nature of the mechanism that transforms the STATE of Eq. 1 into either one of the "macroscopically" unambiguous states, RED or GREEN? He argues that with the outcome of the random decision not observed, nature has made no decision yet. The human subject encounters a physical reality composed of two equally real potential states and equally likely. The subject's observation transforms the still ambiguous reality into one of the macroscopically unique states. In this process of "state vector collapse" there is an opportunity for PK and the subject may produce a PK effect, vis., a slight bias in the conventional probabilities.

The model introduces a mathematical formalism that proposes that the act of observation induces a gradual reduction from the original ghost state into the well-defined states, RED or GREEN. To formulate this transition, Schmidt introduces three time-dependent functions:

```
GHOST      = STATE
RED    (t) = probability that at time t nature has decided for RED
GREEN  (t) = probability that at time t nature has decided for GREEN
GHOST  (t) = probability that at time t nature is still in the
             ambiguous, undecided state.                   (2)
```

At the beginning of an observation (at time t = 0), nature is still completely undecided, and we can say: GHOST(0)=1; RED(0)=0; GREEN(0)=0.

The change of these parameters with time is given by equations (omitted here) that show an exponential decay of the ghost state (for details see Schmidt, 1982). According to Schmidt, PK may affect the way in which the disappearing ghost state is "redistributed among the final states" RED and GREEN (ibid., p.267). As the ghost state declines, the efficiency of the PK effort declines as there is less and less left for PK to operate on. When the reduction is completed, there is nothing left for PK to operate on. The momentary mental state of the observer during this reduction is determined by a parameter, k, which measures the "alertness" (probably in a very broad sense) of the observer. The value of the alertness parameter determines the speed of the state vector reduction. (Schmidt predicts that a highly alert observer might produce a faster reduction than a sleepy one.)

In the final result, after "a sufficiently long time" of observation has occurred to ensure the collapse of the state vector (ibid., p.267), the observed proportion of hits and misses (p' and q', respectively) is given as follows:

$$\begin{aligned} \text{GHOST (END)} &= 0 \\ \text{RED (END)} &= p(1 + qf) = p' \\ \text{GREEN (END)} &= q(1 - pf) = q' \end{aligned} \qquad (3)$$

Although state vector reduction is necessary for PK to operate, the speed of this reduction (as determined by the k value) does not determine the size of the PK effect. That is given by the other parameter, f, which is the strength or size of PK effect. (Roughly speaking f in turn is determined by the subject's PK ability.) The value of the PK coefficient f makes p' and q' different from the original probabilities p and q, and we may have a PK effect. The PK coefficient can be said to be responsible for altering the probabilities in such a way as to increase the probability of a hit.

Some features of the model. The most important features of the model are: (1) PK influence appears only in connection with random processes and does not violate the established conservation laws of physics (like the laws for energy). Only statistical laws are affected. (2) The outcome of a PK experiment is independent of the distance in space and time between the subject PK effort and the random event. The model implies that the subject's PK effort does not have to coincide in time with activation of the RNG. (3) Because the formalism makes no reference to the internal structure of the RNGs psi appears "goal oriented". Accordingly, PK success is independent of the complexity of the RNG and is directed only at the desired end result. (4) To demonstrate a PK effect the subject must receive feedback on his effort. A subject who receives no feedback cannot influence the outcome.

Example of a prediction. From the model it should be possible to make the following prediction (this was suggested to me by Houtkooper, personal communication, 1987): In an experiment, we have consistent high- and low-scorers scoring positively and negatively respectively. It should be possible to have a high-scorer press a button in order to initiate "fresh" seed number for a pseudo-RNG. Then we could produce the resulting pseudo-random sequence and have it observed by a low-scorer.

We could also do this the other way around and have the low-scorer producing a "fresh" seed number that results in an output sequence only to be observed by the high-scorer. Arguments might be found for either a zero result, or a result opposite to the tendency "natural" to the observer, but in accordance with the "nature" of the subject who pressed the button. According to Schmidt's model the high-scorer observer would produce positive results. Through PK he brings about more hits than misses, whose undecided probabilities remained in a "ghost" state until the moment of observation.

Comments on Schmidt's model. Central to the above model is the assumption that it should be possible for human observers to influence the output of a RNG by affecting the "collapse of the state vector" of probabilities p and q. Furthermore, the model implies that only a noncollapsed state (unobserved outcome and where a binary RNG outcome is not deterministic) would respond to PK efforts. Thus, for pseudo-RNGs the only opportunity for a PK effect would be upon the initial "fresh" seeds.

There appear to be some problems with this approach: (1) Is the RNG situation legitimately comparable to that of quantum theory and is Schmidt necessarily attempting to claim that it is? I prefer to proceed cautiously as though the concept of a state vector has been "borrowed" from quantum theory as an analog to denote essentially the situation where a binary RNG decision has not been scrutinized by an observer. (This situation is represented as a superposition of two different possible future states, a hit or a miss.) (2) What constitutes an observation? Is it possible for a RNG decision to take place in the absence of an observation? If the answer to the latter question is "no", as Schmidt is implying, then we have to assume that random numbers generated by a RNG are in a ghost state, suspended between the probabilities p and q, until we observe them. If the ghost state collapses upon observation or measurement, how are we ever going to find out whether it exists or not? (3) It is postulated in the model that the state of a random process is undecided until the moment of observation. The act of observation of an event with an uncertain outcome determines that outcome. In this sense, sensory feedback regarding the outcome of a psi trial is seen as crucial to the operation of PK. However, feedback apparently becomes both the cause and the result of PK, i.e. feedback reflects the outcome of the PK trial, yet it also "triggers" the PK function (see also Braude, 1979). In other words, feedback of results triggers PK that simultaneously creates the results to provide the feedback.

In conclusion, although Schmidt's Quantum Collapse Model seems to me to be unclear on some important points (and some aspects of it may even be unfalsifiable), it may lead to some novel predictions.

The Intuitive Data Sorting (IDS) Model

In challenging the idea that RNG findings are "caused" by subjects May, Radin, Hubbard, Humphrey and Utts (1985) introduced a different way of analyzing results of binary RNG experiments. They attempted to propose a model which both accounts for the observed RNG data and, furthermore, allows a distinction between the effect of PK and of precognition. We should note that the idea that statistical PK findings could be explained in terms of precognition and vice versa, had been considered much earlier by the Rhines and Pratt (e.g. Rhine & Pratt, 1957).

The reasoning. May et al. start by formulating the null hypothesis of no psi. Then they formulate two "causal" PK models and one informational model. By examining how these three hypothetical models fit a database of 425 binary RNG experiments carried out over a period of 15 years (see Radin, May & Thomson, 1986), they reject the two "causal" models on the basis of the data. According to their analysis, the data supports the informational model, called Intuitive Data Sorting (IDS).

Basic assumption. The PK models are causal in the sense that they assume that individuals would use PK to influence the RNG and induce or "force" changes in the RNG hardware to produce a biased output. This sort of PK effect would result in for example, changes in the physics of a noise diode such that the probability of the device producing a one bit is greater than 0.5. The fundamental postulate of the IDS model is that psi allows one to optimize future results by choosing favorable times to act in the present. IDS would say that in RNG experiments, subjects can sort (on the basis of information received via psi) locally deviant subsequences from longer, overall random sequences, by responding at the "right" time. In the IDS model the hardware of the RNG is undisturbed, but psi would be observed as a broader z-score distribution than expected.

May et al. turn to trial length to decide between the models. They use the fractional hitting rate minus the expected hitting rate (D = hits/trials - trials/2) and the sequence length (n = number of samples collected from an RNG as a result of a single button press) as the dependent and independent variables respectively. For both PK models, they assume that if "causal", PK may perturb the RNG on a bit-by-bit basis independent of the number of bits in the sequence. Long sequences composed of many bits gives PK more opportunity to act than short ones and therefore psi success (e.g. level of significance) will correlate with sequence length. In the precognitive model, however, a button push determines the entire outcome, thus, psi success is independent of length of the sequence. May et al. use the logarithms of D and n in their calculations to transform these values into a more easily handled form. The task for all three models is to calculate the expected value of the log of D as a function of the log of the sequence length (n).

The null hypothesis. Under the null hypothesis, as formulated by a novel analytical technique, May et al. calculated the expected relationship between log(D) and log(n) to be a straight line with a slope of -0.5 and an intercept of -1.32. They confirmed the relationship (between log of D and log of n) empirically with a Monte Carlo simulation of 300,000 RNG experiments. There was no significant difference between the null hypothesis, as formulated by the new analytical technique, and empirical simulated results. Therefore, they argue, since it worked for the null model it is valid to use the technique for formulating the three models and then compare them to empirical PK results (ibid., p.243).

Two causal psi models. May et al. calculated the expected value of the log of D as a function of sequence length (n), and assumed two possible different causal PK modes of action:

(i) PK affects the expected hitting rate of the RNG. Psi perturbs a binomial distribution by shifting its mean. In order to formulate this causal model, they defined mathematically how (when the properties of a binary RNG device have been modified by PK) the mean probability of producing a binary one has been shifted from .5 to a variable that could be dependent on the sequence length (n) (and knowing that z is distributed normally). Then, they examined how the log of these n-dependent changes in mean affected the expected value for the log of D.

(ii) PK affects the variability of the RNG device. Psi perturbs a binomial distribution by changing the variance, while its mean remains the same. In order to formulate this causal model, they defined mathematically how (when properties of a binary RNG device have been modified by PK) changes in variance of the binomial distribution were dependent on the sequence length (n). Then, they investigated how the log of these n-dependent changes in variance affected the expected value for the log of D.

The IDS model. IDS refers to individuals being able to select locally deviant sub-sequences from a longer random sequence by using psi-acquired information. The experimenter or the subject makes psi-mediated decisions as to when to initiate the collection of data. Accordingly, May et al. argue, it should be possible to account for any RNG effects on the basis of "correct" decisions based upon precognitive "glimpses" of the future. They assume for the IDS model that the binomial distribution remains unperturbed (as there are no causal effects on the RNG device). Psi is demonstrated, however, as an increase in the variance of the resulting z-score distribution when compared to the expected z-score distribution.

In order to formulate the informational model, they defined mathematically how (when properties of a binary RNG device remain the same) changes in variance of the z-score distribution could be dependent on n (the formula included a parameter that allowed various types of n-dependencies). Then, they calculated the expected value for the log of D as a function of the log of n when the parameter for n-dependent changes in variance was put to 0.0, i.e. when no PK influences are assumed on the random bit sequence produced by the RNG device.

Comparison with database. The database consisted of a total of 332 individual binary RNG experiments and 95 additional, nonsignificant hypothetical ("filedrawer") experiments (i.e., hypothetical studies that represent experiments that were perhaps not published because they were nonsignificant). This gave a total of 427 experiments. (It is not explained why the number of experiments is sometimes 427, but on other occasions it is 425 in the report.) In a preliminary analysis of these data the overall evidence for psi during experimental conditions was $p<=3.9x10^{-18}$, and under control conditions $p>=0.78$ (Radin, May & Thomson, 1986). The data from the 425 experiments were displayed in a log-log format.

May et al. fitted a straight line to the RNG database with sequence lengths from 10^0 to 10^7. They compared log-log plots of the three theoretical models to the straight database RNG line. The results showed that the PK shift of the mean model did not describe the data and they concluded that all models that had such n-dependencies had to be rejected (except one with n-dependency of alpha = -0.5). The PK shift of the variance was also in disagreement with observation and they suggested that all PK models that had such n-dependencies had to be rejected (except one with n-dependency of beta = 0.0). According to May et al. the alpha = -0.5 mean-shift model and the beta = 0.0 variance-shift model are completely identical and they call it goal-directed model of PK. When the parameter for n-dependent changes in variance was put to 0.0 the IDS model could not be rejected by the database. The z-score standard deviation (which was 1.4) observed in the data was in good agreement (nonsignificantly different) with the IDS model prediction (which had a z-score distribution with a standard deviation of 1.304).

The conclusion of May et al. While on the basis of the data the goal-directed PK and the IDS models are inseparable, May et al. favor the IDS model. For the goal-directed PK model to be true, many subjects in about 10 different laboratories participating in over 300 studies run by 28 different experimenters for 15 years would have to adjust the "strength" of their PK ability to exactly match a certain n-dependency - which seems "unlikely".

Example of a prediction. The IDS model implies that the effectiveness of intuitive data sorting may be proportional to the number of opportunities (decisions) provided for such sorting. Therefore higher psi scoring on RNGs may be observed under multiple than under single opportunity condition (e.g. Braud & Schlitz, 1987). The PK interpretation would predict equivalent scoring under the two conditions. Causal PK effects should be the same whether the influencer or experimenter has many or few degrees of freedom in deciding when to initiate sampling epochs, unless the feeling of freedom was linked to the volitional activity possibly involved.

An important distinction between the IDS model and the quantum collapse model seems to be that in the IDS model the button presser is the intuitive selector of the data (Houtkooper, personal communication, 1989, also came to that conclusion), whereas in the quantum collapse model the observer is the PK agent. This important distinction was later used to draw opposite predictions based on the two models (see discussion sections 5.5 and 6.6).

Comments on the IDS model. The IDS model may explain why, so far, investigators have failed to find a significant difference between scores with true and pseudo-RNGs (for comments on the IDS model see Schmeidler, 1987; Walker, 1987). According to IDS, "success" on a RNG is based on single actions, i.e. a single button press to initiate a sequence length of n. It should not make any difference whether a sequence is pseudo-random or truly random if the task is to "guess" when to start a sequence such that it results in above chance (getting a hit) scoring.

According to May et al. (1985, p.262), precognition "is a possible mechanism for IDS." (It is not clear in their report what else, if anything, could be responsible for IDS if it is not mediated by precognition.) IDS is apparently assumed to be an unconscious process: Subjects in a RNG PK experiment, in which instructions require subjects to attempt to use their "mind" to influence the target, try to use their PK. They are in fact using "precognition" to make correct decisions based upon glimpses of the future. Those who succeed on pseudo-RNG targets and score above chance have managed to select a seed (for an extrachance period in a random sequence) based on the computer clock that is running at an enormous speed.

I noticed in the report of the PEAR program (Nelson et al., 1986, p.274) that, when the true RNG generated 100, 200 and 2000 samples of random bits/pulses per trial, the total PK results reached p-values of 0.271, 0.002, and 0.001 respectively. This incline in significance with increase in sequence length is in accordance with the effect predicted by the PK models described above. However, the datapool for 100 bits per trial was only based on a single subject and the datapool for 2000 bits per trial was based on two subjects. Also, we get a reverse relationship when examining the pseudo-RNG trials, thus contradicting the PK interpretation.

3.7 SUMMARY

Two reviews were presented in this chapter, one on the existing RNG PK computer games in parapsychology, and the other on the existing pseudo-RNG PK studies. The main body of this chapter described the making of a quasi-game like RNG PK microcomputer test called "Synthia". Considerable time was spent on making this test. The chapter concluded by describing two models current in parapsychology that have been proposed to explain RNG PK results. It was stressed that the author was not committed to either model. The models were illustrated because they were taken into account when the data of present research were interpreted.

TABLE 3.1

Translation of the FORTRAN version of the W-H RNG into BASIC for IBM XT 286 by Konrad Morgan and the author. Subroutine 10000-10080 starts by reading the TIMER and results in input seed values X,Y,Z (with integer seeds between 1-30000). Subroutine 20000-20130 is the actual W-H pseudo-RNG. It returns a random number (RESULT#) greater than zero and less than 1. A trailing exclamation point (!) means a single-precision number. A trailing number sign (#) means a double-precision number (suggestion from McLeod, 1985).

```
10000  REM subroutine, clock seeder
10001  REM initial seeds set up
10002  RANDOMIZE TIMER
10010  X# = RND: X# = X# * 10000
10020  IX# = INT(X#) + 1
10030  X# = RND: X# = X# * 10000
10040  IY# = INT(X#) + 1
10050  X# = RND: X# = X# * 10000
10060  IZ# = INT(X#) + 1
10080  RETURN

20000  REM subroutine that results in a random digits
20010  IX# = 171 * (IX# - INT(IX#/177) * 177) -  2 * (IX#/177)
20020  IY# = 172 * (IY# - INT(IY#/176) * 176) - 35 * (IY#/176)
20030  IZ# = 170 * (IZ# - INT(IZ#/178) * 178) - 63 * (IZ#/178)
20040  IF IX# < 0 THEN IX# = IX# + 30269
20050  IF IY# < 0 THEN IY# = IY# + 30307
20060  IF IZ# < 0 THEN IZ# = IZ# + 30323
20070  FX# = IX#
20080  FY# = IY#
20090  FZ# = IZ#
20100  X# = (FX#/30269!) + (FY#/30307!) + (FZ#/30323!)
20110  RESULT# = X# - INT(X#/1!) * 1!
20112  IF RESULT# > 0 THEN GOTO 20120                         REM This is
20114  RESULT# = ((IX#/30269!)+(IY#/30307!)+(IZ#/30323!)) MOD 1 REM McLeod's
20116  IF RESULT# > 1 THEN RESULT# = .999999                  REM amendment
20120  RETURN
20130  REM End
```

TABLE 3.2

Example of a deviation from chance of the Wichmann-Hill algorithm.

groups	criterion	bin-count	z	start-seeds	end-seeds
one	> 0- <=.25	251,261	2.912*	ix=24869	ix= 158
two	>.25-<=.50	249,974	0.060	iy= 7425	iy= 4993
three	>.50-<=.75	249,292	1.635	iz= 2185	iz=10547
four	>.75-<=1.0	249,473	1.217		

* p=.0036 (2-T)

FIGURE 3.1. Picture of the test display of the feedback version of "Synthia". The brown arrow points to the target box.

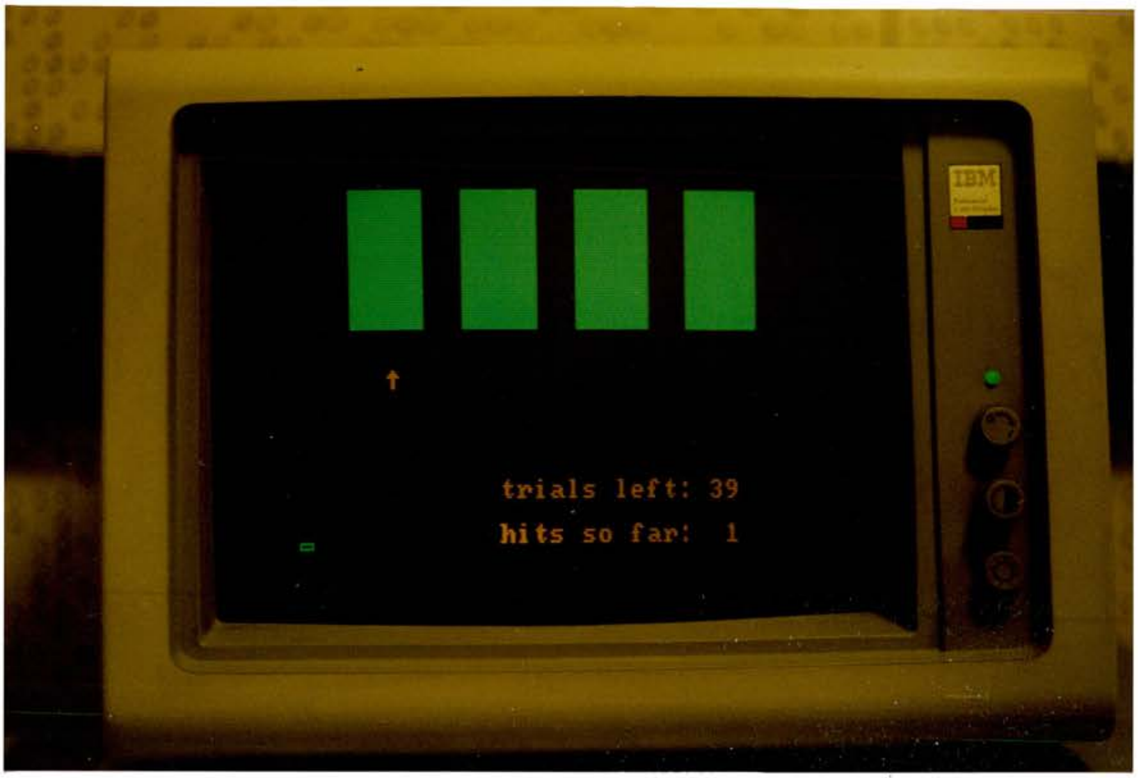
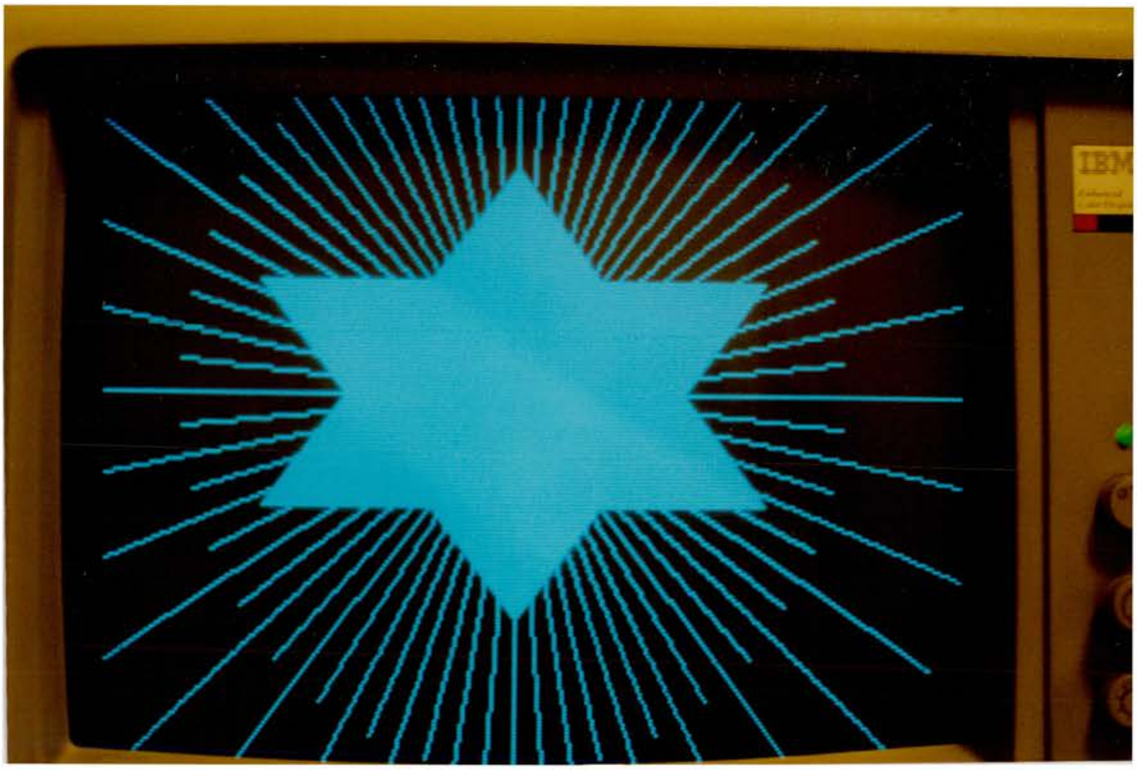


FIGURE 3.2. Picture of the blue star feedback display provided for hits in the feedback version of the microcomputer test "Syntha".



CHAPTER FOUR

EXPERIMENTS 1-3: THREE EXPLORATORY STUDIES

4.1 INTRODUCTION

This chapter reports the exploratory part of the thesis. Three pilot studies were conducted to: (1) Test and refine the experimentation environment and the computer test. (2) Explore the use of questionnaires to look for individual differences correlates of initial PK performance. (3) Investigate the effects of different set-ups of the W-H pseudo-RNG on PK performance. (4) Explore for additional ideas and hypotheses such as a possible relationship between interval time (IT) and PK performance. The specific purpose germane to each experiment is reported in the introduction to that experiment.

Before moving on to the pilot studies themselves, I will briefly introduce and discuss three psychometric scales.

Psychometric Scales and PK Performance

In my research I wanted to look at possible relationships between scores on three scalar instruments and PK performance. These were an imagery scale, a sheep-goat scale and a luckiness questionnaire. One way of exploring the psychokinesis (PK) hypothesis is to see whether scores on a PK test correlate with some measurement of individual differences such as paper-and-pencil tests. If such a relationship is found it could be possible to predict performance on PK tests and select subjects who would be higher performers or perhaps more trainable. Self-report inventories have the benefit of taking only a short time to administer. See Anastasi (1982) and Selltiz et al. (1976) for a discussion of the nature and use of psychometric tests.

Imagery and PK. Previous studies already noted, have suggested that imagery may be connected with PK ability. Subjects visualizing feedback provided for PK hits tend to obtain more hits, than subjects using other types of visual imagery or no imagery (e.g., Levi, 1979; Morris et al., 1982; see further studies in section 2.5). Three studies have attempted to correlate imagery scale scores and PK performance (Stanford, 1969; 1981; Steilberg, 1975). All employed a free-association test to measure the tendency to organize one's thinking around sensory imagery. Only Stanford (1969) found a significant relationship suggesting that the more subjects tended to use sensory imagery in thought the higher PK scores resulted if subjects were using a visual-imagery strategy in attempting to influence their target. Stanford (1981) obtained a correlation of only r=+.03 in the expected direction. Steilberg did not report any results at all. For the present visual-imagery training research I was curious to know whether good visualizers would do better (be more trainable) than bad visualizers in PK training through visual-imagery strategies. I chose the Vividness of Visual Imagery Questionnaire (VVIQ) to measure the vividness of visual-imagery. Honorton (1975, p.330) wrote:

> ...while the Betts QMI appears to be satisfactorily reliable, the failure of the test to relate significantly to a variety of verbal and visual recall tasks calls into question its construct validity as a measure of individual differences in vividness of mental imagery.

He concluded that a better measure of imagery for parapsychology studies was needed. George (1981, p.140) urged that future researchers in parapsychology should employ "strongly validated measures such as the Vividness of Visual Imagery Questionnaire" to evaluate vividness of imagery.

Marks (1973) introduced the VVIQ. It is simply an expansion of the visual section of the QMI (Betts, 1909; cited in Richardson, 1969, pp.148-153; see shortened version in Sheehan, 1967). The VVIQ seems to be fairly reliable (Marks, 1973; McKelvie, 1986; McKelvie & Gingras, 1974; Rossi, 1977) and reasonably valid (Gur & Hilgard, 1975; Marks, 1973; McKelvie, 1979; 1986; McKelvie & Demers, 1979; McKelvie & Rohrberg, 1978; Rossi & Fingeret, 1977). See Hall et al. (1985), White, Sheehan and Ashton (1977), Sheehan et al. (1983), and White, Ashton and Brown (1977) on the assessment of mental imagery.

Sheep-goat scale. The sheep-goat scale, well known in parapsychology, was first introduced by Schmeidler (Schmeidler, 1943; see also Schmeidler & McConnell, 1958, pp.21-31). She found that subjects who accepted the possibility of ESP under the conditions of the experiment (termed as "sheep") scored above chance in ESP tests whereas subjects who rejected the possibility of ESP (termed as "goats") scored below chance (see review in Palmer, 1978, p.153 ff).

I have been able to locate seven studies that have tested a relationship between "belief" in PK and performance on a PK test (Dale, 1946; Mischo & Weis, 1973; Nash, 1946; Van de Castle, 1958; Weiner, 1979; 1982a; 1982b). Using somewhat different questions about belief, only Weiner (1982a) demonstrated a significant effect related to belief (see table 4.1). Interestingly, two studies have reported a positive relation between PK success and subjects' answers to questions about their belief in ESP, and not PK (Rubin & Honorton, 1972; Watkins, Watkins & Wells, 1973). It is not mentioned in these two studies whether an attempt was made to get at subjects' belief in PK.

The sheep-goat classification has, in my opinion, not been adequately tested for PK. The results so far are ambiguous, the reports are sketchy, and the number of subjects participating in these studies is low with the exception of Dale (1946). However, I am not convinced that Dale's question, about whether subjects thought they could demonstrate PK, is really a sheep-goat question. Her question is much more specific than typical sheep-goat questions about overall belief in the existence of ESP/PK. For the visual-imagery training research it made sense to me to investigate whether those who believed that PK existed would do better (be more trainable) than those who believed it did not exist in "PK training". In the popular literature surveyed in the Airport Project (Morris, 1980b), a positive attitude towards psi was strongly recommended for those who wished to develop psi skills.

Luckiness dimension. Three studies have examined a possible relationship between PK performance and self-perception of one's "luckiness", as measured by a scale called the Greene Luck Questionnaire (Greene, 1960; Ratte, 1960; Ratte & Greene, 1960). The first cited study produced nonsignificant results (self-perceived unlucky subjects had nonsignificantly more scores above chance than self-perceived lucky subjects). The two latter cited studies produced a significant difference in PK scores in favor of self-perceived lucky subjects over self-perceived unlucky ones. The questions on the Greene Luck Questionnaire were for instance, whether the subject expected to win or lose when it came to games of chance, and whether he had ever had the feeling that he could not lose when playing a game of chance. Stanford (1977b) pointed out that the statistical analyses were inappropriate for supporting the conclusion that self-perceived lucky individuals may perform better at PK than unlucky ones in the Ratte (1960) and Ratte and Greene (1960) studies. To the best of my knowledge, nobody has tried to follow up the work of Greene and Ratte, and no other questionnaires have included luckiness items as a factor. For the present visual-imagery training research I was interested in seeing whether self-perceived luckiness played any role in how subjects performed in "PK training."

General Information About the Experiments

For all experiments the raw data (questionnaires, and so forth) and computer files (on floppies) have been kept and can be obtained from the author. All versions of the Synthia program have been preserved and can be made available. All randomization test results are available except for pilot study 1 (see appendix C for results of control randomness tests), which seem to have been misplaced or destroyed accidentally. Most results are reported with exact 2-T p-values whether significant or not. (The few results that do not include p-values had z- and t-test values so close to chance that the tables that I used did not include them.) The few 1-T tests reported were pre-planned and used only to test formally stated hypotheses with an existing empirical foundation. When 1-T tests were used, any reversal (no matter how large) was to be treated as nonsignificant. All names of subjects have been removed from questionnaires and only identity numbers have been kept. All experiments were conducted fully in accord with the moral requirements set by the Parapsychological Association (P.A. Guidelines, 1980). (Experiments 5 and 6 were approved by the ethics committee of the psychology department that had been set up after experiment 3.)

4.2 PILOT EXPERIMENT 1

Introduction

The first pilot experiment was conducted between 13-21 July, 1987.

Specific Purpose. This pilot experiment was conducted in order to try out the equipment that was to be used in the project, namely, to:

(a) Get feedback on the computer test "Synthia" and correct any errors that the program might possess. (b) Develop a PK attitude questionnaire and try out an imagery scale and a luckiness questionnaire. (c) Start developing instructions to subjects. (d) Get feedback on the environment (the room used for filling out questionnaires and the sound-attenuated room used for execution of the computer test). (e) Start developing hypotheses.

Method

Subjects. A pre-determined number of ten subjects (Ss) participated (4 F and 6 M; aged 24-45 yr.; mean age = 30). These were research staff at the parapsychology laboratory and friends of the experimenter (E). Prior to participation all had at some time mentioned to E that they were interested in, and available for, his research.

Psychometric material. Three questionnaires were used: the Vividness of Visual Imagery Questionnaire (VVIQ; see final version in appendix B), a questionnaire that measured general attitude towards psychokinesis (Gissurarson's General Psychokinesis Questionnaire, GGPQ; see final version in appendix B) and the Greene Luck Questionnaire (Greene, 1960). The questionnaire developed by Greene in 1960 measuring self-perceived luckiness was edited for an U.K. sample (e.g. dollars were changed into pounds). I designed the GGPQ in order to measure what I considered to be a general attitude germane to PK. I reasoned that many questions, covering different aspects, could possibly yield an overall picture of an underlying, general attitude towards PK. I considered the following factors important:

(1) Belief in the existence of PK. The first two questions of the GGPQ determined a sheep-goat scale (i.e. whether S thought that the existence of PK was possible, and if he thought that some people might

be able to affect physical conditions, move objects, or influence other people with their "minds"). For each individual the point-score for each response were summed up, the theoretical range of the sheep-goat scale thus being 0-6; 0-3 = goat and 4-6 = sheep. (2) (Un)certainty about one's own PK abilities. There were two questions about whether S thought he personally could demonstrate PK. (3) Luckiness. A few questions were on self-perceived luckiness (e.g. whether S had experienced his hopes or wishes about the future coming true). Here I attempted to get at a more general self-perceived (un)luckiness than Greene (1960) who only asked about luckiness in terms of betting and playing casino games. (4) Fear of PK. A few questions asked Ss about their fears of PK (e.g. whether S would be afraid of possessing PK abilities). This was an attempt to get at fear factors that might possibly block the PK function as suggested by Tart (1986a; 1986b), Batcheldor (1984b; 1987) and others (e.g. Isaacs, 1986a). (5) Prior experience of PK. One question (with five possible answers) asked Ss to relate the occurrence of possible prior experience of PK (i.e. if S had ever had a psychokinetic experience). (6) Previous involvement in PK-related activities. Some questions were concerned with activities indicative of a general interest in PK (e.g. if S read books about psychic phenomena). Haraldsson (1981) used one such question in his ESP sheep-goat scale. (7) "Will-power" and success. Two questions asked Ss to evaluate their own will-power and success in life. I am not aware of any study that had explored if self-rated will-power and success might be connected with PK performance.

The PK apparatus. The computer test "Synthia" was used to measure PK. Randomization of targets was generated by the Wichmann-Hill pseudo-RNG. The initial "fresh" seed (which can be any number less than 30,000 in the W-H pseudo-RNG) was selected automatically by the computer program at the beginning of Synthia, in fact, immediately after the test was "run" and before the prompt for S's name appeared on the screen. After the selection of the first "fresh", true seed, the algorithm automatically called "pseudo-seeds" between trials, although these were determined by the algorithm and the initial "fresh" seed. These pseudo-seeds thus determined the RNG output for each trial. Only one opportunity was possible for realtime PK per run of 40 trials.

In this version of "Synthia" the selection of the initial "fresh" seed was based on the RANDOMIZE TIMER statement in the beginning of the program. TIMER is a "read only" function (i.e. it is not possible to change it via commands or programming) and returns a single precision number representing the number of seconds that have elapsed since midnight or System Reset (switching the computer from "off" to "on"), whichever is more recent. In all the experiments System Reset was always more recent. On many occasions when subjects came one after another continuously, once started in the morning, the computer was left on into the afternoon. The TIMER is based upon the internal clock in the computer, and it starts counting when the computer is turned on. Roughly speaking, in experiment 1 when the computer "read" the Synthia program and came to the RANDOMIZE TIMER statement, the computer stopped the timer, checked the number and used that number as an entry point into a pseudo-random sequence. Thus in experiment 1 the final fixing event of a "fresh" seed took place when the computer was asked to read (run) the program. In pilot 1 the experimenter always initiated (started) the program. Theoretical justification of this pseudo-RNG set-up can be found in Schmidt (1982; 1984; 1987). Schmidt argues that the observer of a RNG outcome can, via PK, bring about more hits than misses, whose undecided probabilities remain in a "ghost" state until the moment of observation. Since the observer is the PK agent according to Schmidt's model, it is possible to predict that PK scores are not dependent on who initiated the random sequence.

The experimental rooms. Two rooms in the parapsychology laboratory were used; one for filling out questionnaires and another sound-attenuated one for doing the computer test. The "parapsychology laboratory" was established just a few months before pilot experiment 1 started. It is on the second floor of the psychology department building of the University of Edinburgh. One enters the lab through a single door and once inside there are six small rooms, two of which are sound-attenuated. Standing in the doorway and viewing a short corridor, on the left hand side of the corridor there are two rooms, both of which were unused at the time. Straight ahead (at the end of the short corridor) are two rooms, one an unused sound-attenuated room and the other occupied as an office by a research assistant. On the right hand side of the corridor are the two rooms that were used in pilot study 1. Furthest from the main entrance is the sound-attenuated room in which the IBM computer with the PK computer test was located on a desk. At the desk was a comfortable chair. Closer to the single entry door of the lab is the room, containing a desk and a chair, in which S completed the questionnaires (the questionnaire room"). All six rooms were newly painted and not much furniture had been put in them. Pilot study 1 was the first experiment to be carried out in the lab. The sound-attenuated rooms had no windows, but the four other rooms had a window each.

Procedure. The subject was greeted by E when attending the session, either in the entry hall on the ground floor of the psychology department, or if he knew his way around the department building S went straight to the lab to meet E. The subject was then left alone in the "questionnaire room" (see above) to answer the three questionnaires; the

VVIQ, the GGPQ and the Greene Luck Questionnaire. After completing the questionnaires S called E. Then S and E went to the sound-attenuated room where E initiated the computer test.

In pilot experiment 1, S completed 60 trials on the computer test without being instructed to adopt any strategy; 30 trials in the feedback version, where immediate trial-by-trial feedback (the beep sound and the blue star) was provided for each hit, and 30 trials in the nonfeedback version, where there was no immediate feedback. S was asked to take a break after the first run of 30 trials and call E. After the break E initiated the other version of the test (producing a "fresh" seed for the next run of 30 trials). Half of the Ss received feedback in the first half of their sessions but none in the second half. The other half obtained the feedback in the second half of their sessions but none in the first half.

The first S had a random selection of which version of the computer test (the feedback or the nonfeedback version) he would start with. A flip of a coin by E decided which. The second S got the reverse sequence to that of the first S. Which version came first continued to alternate throughout the series.

Ss filled out a general post-session information questionnaire at the end of the session. Besides full name, address and telephone number, S was asked how he liked the computer test and the experimental environment, if he had used any particular strategies in his attempt to influence the test, whether he wanted to participate in experiments carried out at the lab in the future, if he preferred one version of the test and not the other, and so forth (for details of this post-session questionnaire, see appendix B).

Pseudo-RNG control runs. The pseudo-RNG was tested both before (500,000 trials) and after (500,000 trials) pilot experiment 1.

According to my "lab-book" which I kept on each experiment, these randomness tests were nonsignificant. As noted above, however, for this study only, the exact results have been misplaced and the p-levels are not available.

Selection of statistical tests. Parametric tests are based on three assumptions about the type of data which are obtained in the experiment (e.g. Miller, 1975, p.64 ff). The variables are assumed to have been measured on an interval or ratio scale, each sample of scores is assumed to follow a normal curve, and it is assumed that the samples studied have the same variance (homogeneity of variance). On the last item, however, it has been shown that as long as there are equal numbers of subjects in each condition, it actually makes little difference whether the variability in scores in different conditions is homogeneous or differs quite widely (e.g. Greene & D'Oliveira, 1982, p.80). Interval time is measured on an interval scale (we know the interval between IT measurements in milliseconds). One way of assessing whether the IT measurements are near enough to being normally distributed is simply to plot their distribution. I did that and the distribution was symmetrically bimodal for pilot experiment 1 (and asymmetrically positively skewed for all the other experiments). Therefore it was not justified to use parametric tests on IT.

PK scores (and scores on the psychometric tests) probably reflect an ordinal scale variable since it is only possible to determine the relative size of the scores. The scores can be ranked according to size, but we do not know how much larger or smaller a given score is relative to any other score. Therefore, we have to use nonparametric tests on PK scores. Nonparametric tests make very few assumptions about the nature of experimental data. They make no assumptions about the shape of the population distributions, nor do they assume that the two populations have equal amounts of spread. Most such tests assume only an ordinal level of measurement. (When comparing PK scores to what would be expected by chance I chose the one-sample z-test for the mean when I was primarily interested in the effect itself, and wanted to compare the sample mean to a known theoretical mean. Later on, in the two visual-imagery experiments, I selected the parametric one-sample t-test for the mean when I intended to generalize the results from my group sample onto the population. The rationale for my choice of one-sample t-test is discussed later in the thesis.)

I used nonparametric tests for all comparisons of two or more variables on ordinal level of measurement. I decided to use the Wilcoxon Matched Pairs Test as a nonparametric alternative to the t-test for correlated samples and the Mann-Whitney U Test as an alternative to the t-test for independent groups. I chose the Mann-Whitney test for two independent samples instead of, for example, the Wald-Wolfowitz "Runs" Test for two samples. The Mann-Whitney U test is more sensitive than the Wald-Wolfowitz "runs" test regarding comparisons of central tendencies. The runs test, in contrast, is more powerful in situations in which the groups differ only slightly in central tendency but substantially in dispersion or form, i.e. in shapes of distributions of the dependent variable (Blalock, 1960, p.202). I chose Kruskal-Wallis ANOVA by Ranks (Kruskal-Wallis H test, as a nonparametric equivalent of Analysis of Variance. Finally, I chose the Spearman Rank Order correlation coefficient (Spearman Rho, or just rs) as an appropriate nonparametric alternative for Pearson's product moment correlation coefficient (Pearson r, or just r) since it is applicable to ordinal data that may be ranked according to size (and its power is considered reasonably good).

Results and Discussion

Ten Ss doing one session each contributed overall to 600 trials. No significant results were found in the data. All statistical tests were post hoc and 2-T as no formal hypothesis had been developed at this stage. The PK computer test did not provide significant evidence for PK. The combined PK score (total hits=154, MCE=150) for both versions of the computer test gave z = .38 (n.s.). There was no difference between PK scores on the feedback version (hits=77) and on the nonfeedback version (hits=77), both yielding z = .27 (n.s.).

Interval Time (IT). Ss spent on average 3.78 seconds between trials in the feedback version and 3.53 seconds in the nonfeedback version. This difference was not significant on a Wilcoxon test: T (N=10) = 23.000 (z=.46, p=.65). Subjects spent about the same length of time on the PK task irrespective of whether they received feedback on their performance or not.

Hits from the feedback version correlated marginally and positively with the IT in that version; Spearman R(9) = .57 (z=1.72, p=.082). Hits correlated nonsignificantly and in the negative direction with the IT in the nonfeedback version; Spearman R(9) = -.18 (z=.55, p=.59). Although possibly interesting correlations should they reach significance level with a large enough size of trials, it is far too early to offer any interpretations.

Questionnaires. (1) I assumed that total GGPQ score could possibly represent a general underlying attitude germane to PK. The correlation between the total GGPQ score and total PK scores on the computer test yielded Spearman R(9) = .25 (z=.74, p=.47).

I decided to select out questions that correlated with the total PK score with a Spearman R z>=+1.25. Questions 4, 6, 7, 8, 10, 11 and 12 met that criterion. After adding these questions' ratings together, combined they correlated marginally, but nonsignificantly with the total PK scores; Spearman R(7) = .68 (z=1.80, p=.069). In essence, these questions were on self-perceived luckiness (more "lucky" resulting in higher PK scores; questions 4 and 7), fear of PK (less "fear" resulting in higher PK scores; questions 8 and 12) and previous involvement in PK related activities (more "PK activities" resulting in higher scores; questions 6, 10, 11).

(2) I chose correlational analyses (Spearman R) instead of dichotomization (Mann-Whitney U test) when evaluating the sheep-goat effect. Correlation may be more appropriate because it makes use of more of the available information. The sheep-goat scale (question 1 and 2 combined) produced a nonsignificant correlation with the total PK score; Spearman R(8) = .14 (z=.40, p=.69). This was in the expected direction, i.e. the more sheep-ish Ss were the higher PK scores they tended to get.

(3) The correlation of the VVIQ score with the feedback PK score was at chance; Spearman R(9) = -.003 (z=.009, p=.94). The correlation of the VVIQ score with the nonfeedback PK score was flat chance; Spearman R(9) = 0.00 (z=0.00).

(4) The correlation between the score from the Greene scale and the total PK score yielded Spearman R(8) = -.18 (z=.50, p=.63), i.e. the more Ss perceived themselves as unlucky the higher PK scores they tended to get.

Changes made after pilot study 1. Since the Greene scale scores were in a nonsignificant negative direction to that expected with the total PK score, and some Ss voiced reservations regarding it (e.g. that people did not go so much to casinos in Edinburgh and therefore the questions were irrelevant), I decided not to use it any further.

Questions on the GGPQ were amended according to comments (e.g on the English, some questions were also reported to be confusing, or asking about two different things), and basic instructions were developed. No changes had to be made on the two sheep-goat scale questions. In the above experiment, Ss were required to visualize and rate the items on the VVIQ twice, once with eyes open and once with them closed. It was not clear to me what the rationale was behind this arrangement. I wrote to McKelvie (personal communication, 1987) for consultation on this point. He informed me that the rationale for this practice was unclear and the psychometric properties of the VVIQ do not vary with it. This is in accord with Dowling, cited in White, Sheehan and Ashton (1977, p.146). Therefore, I adopted McKelvie's (1986) method of not mentioning the eyes at all on the revised VVIQ forms such that Ss would rate the items only once. I felt that 30 trials in each version of the computer test were too few. Since nobody reported becoming tired or bored (and even reported wanting to have more trials), and usually the subjects finished the test in a short time I decided to increase the number of trials from 30 to 40 for each version. Trials of 40 also made the statistical analysis more attractive (chance being 10 hits instead of 7.5). Finally, some calculation procedures were added to the outfiles.

4.3 PILOT EXPERIMENT 2

Introduction

This experiment was conducted on 15 September to 2 November, 1987. Prior to the experiment a copy of the hypotheses and a list of items stating what action was to be taken if something went wrong was kept with Robert Morris and laboratory manager, Deborah Delanoy. The following two items are an example from the list of what could go wrong:

> A flip of a coin will decide if the first subject is presented with the feedback or the nonfeedback condition of the computer test. The second S will obtain the reverse order. If this order of feedback and nonfeedback becomes the same for two Ss in a row by mistake, the next subject will be presented with the reversed order of the latter subject (of the two that had the same order).
>
> If S walks out in the middle of answering the questionnaires without having started the computer test, he will be asked if he wants to come again and finish what is left of the session. If he does not want to come back and finish the session all his data will be removed from the datapool.

Specific Purpose. This experiment was designed primarily as a screening phase of the first visual-imagery training experiment. The criteria (discussed in detail in chapter 5) for passing to the visual-imagery study were a modest total PK score of 20 hits (MCE) or more from both conditions of the computer test and an expressed interest in participation. The VVIQ scores obtained in the screening sessions were to be used to put an equal number of good and bad visualizers into three visual-imagery strategy groups to be used in the first visual-imagery training study. By having a screening pretest session, I reasoned that effects such as stress related to unfamiliarity with the PK test and so forth, could to some extent be eliminated for the selected subjects. Running subjects through a pretest gives them an idea of how experimentation is carried out and therefore, possibly, minimizes the drop-out rate in the visual-imagery study. Furthermore, knowing how they did on Synthia on this occasion, might encourage Ss to try to score higher in the main experiment.

Hypotheses

The following hypotheses were made formally prior to the experiment:

H1. Both conditions of the computer test were expected to show a psi-hitting PK effect. One-tailed z-tests were to be used.

The computer test was predicted to produce PK scores above chance. I felt confident enough to make this hypothesis 1-T since researchers in parapsychology have in the past reported significant PK results with pseudo-RNGs.

H2. It was predicted that total scores from the PK computer test would correlate positively with questions 4, 6, 7, 8, 10, 11 and 12 collectively on the GGPQ. Nonparametric correlation, Spearman R (2-T), was to be used.

This prediction was based on the pilot 1 data. It was kept 2-T since I was not too confident about the relationship. I also wanted to be able to explore this possible relationship even if it turned out to be in the reverse direction to that predicted.

H3. The more vivid imagery tends to be on the VVIQ (lower scores) and on a Vividness of Auditory Imagery Questionnaire (lower scores; see VAIQ below) - the higher the PK scores were expected to be in the feedback condition of the computer test. Spearman R (2-T) was to be used.

At this early stage, it seemed to me to be reasonable to expect that if visual-imagery is somewhat connected with the alleged PK function (i.e. a visual image of success might result in extrachance PK scoring), PK scoring would be connected with the vividness of the imagery and the relationship would show most clearly when visual feedback is provided for success/hits on a PK task. The assumption behind this reasoning is that good visualizers will develop strategies that involve visualizing the immediate trial-by-trial feedback (the blue star). Additionally, it is likely that everybody will at some time or another visualize success and that good visualizers will be superior to bad visualizers at the task. I did not feel confident enough about this prediction to make it 1-T.

H4. There will be a difference in Interval Time (IT) between the feedback condition and the nonfeedback condition of the computer test, as measured by a Wilcoxon test (2-T). A longer time was expected to be associated with the feedback display condition.

Prima facie, getting immediate feedback of hits may evoke some mental processes that are not evoked in the absence of such feedback.

H5a. According to the suggestion from the pilot 1 data, increasing IT was expected to correlate with more PK hits in the feedback condition of the computer test. Spearman R was to be used (1-T).

As this correlation was close to significance in pilot 1 only a 1-T test of this relationship was to be accepted. This was also in the direction that I anticipated, i.e. the more time Ss spend on the task (perhaps suggesting more "willing") the higher the PK scoring.

H5b. According to the suggestion from the pilot 1 data, decreasing IT was predicted to be associated with more hits in the nonfeedback condition. Spearman R was to be used (2-T).

As this relationship was not as strong as the one in 5a both directions of this relationship (2-T) were accepted, vis., increasing IT being possibly associated with more hits in the nonfeedback condition.

Method

Subjects. A pre-determined number of 40 volunteers were tested (20 M and 20 F; aged 17-75 yr.; mean age = 37), from which 24 were to be selected. If more than 24 Ss passed the screening procedure the extra Ss would be given the opportunity to be used later. If more volunteers would be needed to produce the required 24, then more Ss would be run at a later date. The subjects came from three main sources: (i) Those responding to advertisements (that described the experimental session and gave location of the experiment and my contact address) put up in a few locations around the University of Edinburgh. (ii) Those who had indicated an interest in parapsychology research to someone at the parapsychology laboratory or who had attended one of the seminars in parapsychology at one time or another and had indicated an interest. (iii) Those who came via participants already tested (each participant was given a copy of the advertisement to give a friend who might be interested in the experiment).

Apparatus and questionnaires. I constructed a short scale called the Vividness of Auditory Imagery Questionnaire, VAIQ (see appendix B). It resembled the VVIQ in structure and was intended to measure vividness of imagery of sounds. The idea was that if imagery was connected with PK performance as measured by Synthia, it would perhaps not solely be visual imagery but also auditory imagery. When a hit occurs in the feedback version of Synthia, the computer gives a beep sound immediately after pressing the space-bar (as immediate feedback) and before the blue star appears, thus providing both auditory and visual stimuli.

After abandoning the Greene scale, I decided to substitute for it with a locus of control scale (Internal-External scale, or just I-E scale) in order to continue exploring the possible connection between PK ability and some sort of self-perceived luck. The I-E scale is a forced-choice self-report inventory, which first came into prominence with the publication of a monograph by Rotter (1966; see also Jackson & Paunonen, 1980, pp.535-537; Lefcourt, 1976; Phares, 1976). Low scores on the I-E Scale have been thought of as indicating that a person perceives environmental events in general as if they are contingent upon his own behavior (internal control). High scores have been thought of as indicating that the individual perceives a general environmental event as not being entirely contingent upon his own actions but the result of chance, fate, or luck (external control).

The reasons for using a locus of control scale at this stage were as follows: Firstly, after going through many psychological questionnaires, this one seemed to me to have the most potential for being connected with PK ability. My argument was that luckiness might be connected with PK and external control implies self-perceived dependence on chance, fate or luck. The more internally controlled a person was, I reasoned, the more he would feel directly responsible for, and the physical cause of, external events. Thus there would be less and less opportunity for hitherto unrecognized means of interacting with the environment, resulting in no place for PK with high internally controlled people. (I am aware of a different reasoning, i.e. that internally controlled Ss would feel so much in control of environmental events that they might feel that they could also control such events via their PK.) Secondly, the I-E scale has been used as a clinical tool (very high scores can in some instances suggest that the individual needs therapeutic help). The I-E scale could possibly help to screen out those individuals who might need clinical assistance and therefore skew the results on the various tests.

Only one study has explored whether high PK scoring individuals differed on an I-E scale from low scoring individuals (Schmeidler et al., 1976). Schmeidler et al. used Rotter's I-E scale but did not find any significant difference. However, no information is provided about the direction of the relationship. (Schmeidler et al. did not give any rationale for their choice of Rotter's I-E scale.) I was interested in exploring this further.

Nowicki and Duke (1974) attempted to overcome some shortcomings that had been leveled at Rotter's scale which had been criticized for its relationship with social desirability, for confounding different types of locus of control and for difficult reading level. They published the adult Nowicki-Strickland Internal-External control scale (ANS-IE). The ANS-IE was selected for the present experimentation (see appendix B). The expected direction was that individuals scoring high on the I-E scale (those who perceive themselves as relying on luck) would tend to score high on a PK task.

In pilot experiment 2 the initial "fresh" seed for the PK computer test "Synthia" was selected by E (i.e., E initiated the computer test) in the beginning of the computer test before the test display came on the screen. This was the same set-up of the pseudo-RNG as in pilot 1.

The same two rooms in the parapsychology laboratory were used as in pilot 1, one for filling out questionnaires (the "questionnaire room") and another adjacent sound-attenuated room for doing the computer test.

<u>Procedure.</u> When a subject attended the experimental session he was greeted by E. E then gave the following instructions aurally and from memory (and thus with minor modifications):

> Aim: This experiment takes only about an hour. The first aim of the experiment is to see if there is any connection between three questionnaires and a computer test that measures psychokinetic abilities. The second purpose is to attempt to produce evidence for PK on this particular test, and thirdly to see whether it matters if people receive feedback or not of their PK scores while doing the test.
>
> Questionnaires: The first questionnaire measures how vivid your images are. The second one measures your general attitude towards, and your prior experience of PK. The third questionnaire measures whether you believe that you are the cause of your own actions or whether you believe that luck or chance determines to some extent what happens to you. What we want to do later on, is to find out if there is any connection between the results on the computer test and the scores on the questionnaires.
>
> Your scores on all tests will be held strictly confidential. Your name will be removed from the questionnaires and only an identity number will be kept. After the session you will receive your results on a couple of sheets of paper.
>
> Computer test: Now, before we do the actual session, I want to give you a demonstration of the computer test which is supposed to measure psychokinesis. This is by no means a test that can tell if you possess PK abilities in general. It only tells how well you manage to do on this particular test. [A demonstration of the computer test was given at this stage. E

did the first half of the trials of the demonstration feedback and the demonstration nonfeedback games. S completed the remaining trials of both demonstration games.]

You are left to your own devices as to how to go about trying to influence the test. You can use whatever strategy you want to or no specific strategy at all. As an example, you can think of the three non-target windows as dungeons, and the preselected target box as a door to freedom. Receiving the blue star signals that you managed to open the door and can escape to freedom or marry a prince or a princess. Put your own imagery into the test as you do when reading a book.

Pressing the space-bar: Pay special attention to the space bar. If you press it and hold it down for a while, it will generate many trials in a row. If you want to initiate just one trial, just press the space-bar down and then immediately release the pressure. If you get any particular feeling, that you might get a hit after a hit, you can hold down the space bar. Otherwise don't. If you hold down the space-bar in order to select a few trials in a row, and it comes to changing a target box, the computer will change the target box and then keep on making the trials left comparing its selection to the new target box. [A demonstration was given on this point.]

Feeling ill: By all means, if you feel ill at some time before or during the session, please let me know immediately, so that we can make the proper arrangements. If you feel ill and try to continue the session your results may perhaps not give the right picture of your potential.

After explaining to S what the experiment was about and giving him a demonstration of Synthia, E asked S if he wanted to proceed (nobody declined the offer). Next S was brought to the "questionnaire room" where he filled out the VVIQ and the VAIQ, followed by the GGPQ and finally the I-E scale alone. When completed, S called E. Then E and S went into the sound-attenuated room where E initiated the computer test for him. The experimenter then left the sound-attenuated room leaving S alone with the computer.

The subject did 80 trials on the computer test (40 trials in the feedback and 40 trials in the nonfeedback version), without being instructed to use any particular strategy. A break was taken (usually about five minutes) after 40 trials during which E chatted with S. E then initiated the other version of the test (thus calling a new "true" seed for the pseudo-RNG).

Half of the Ss always received feedback in the first half of their sessions and none in the second half. The other half always obtained the feedback in the second half of their sessions and none in the first half. A flip of a coin decided whether the first S started with the feedback version or the nonfeedback version of the computer test. The second S started with the reverse order and the third S with the same order as the first S, continuing to alternate.

When S had finished the PK trials, he called E who entered the room. After the session S was asked to fill out the same post-session general questionnaire as in pilot 1 (see appendix B). All subjects received a printout of the PK computer test results and an interpretation of their I-E scores (see appendix B).

Pseudo-RNG control runs. Two types of control random tests were run on the pseudo-RNG: (i) Special test runs were done three times before and five times after the experiment by using an algorithm that produced 1/2 million random numbers between 1 to 4 per run (see results in appendix C). Overall chi-square (df=3) = 1.25 (p=.74) for the 8 runs. (ii) I made a program that simulated pilot experiment 2. The simulated experiment was run five times without Ss after the experiment showing no significant deviation from chance (see results in appendix C).

Results

Forty Ss doing one session each contributed to a total of 3200 trials.

All scoring of questionnaires were double checked by Caroline Watt (C.W.), who is a research assistant in the lab (the author did the scoring and first checking). C.W. and the author double checked the computer data files by comparing them with the raw data, such that E read each raw data point out loud followed by C.W. reading the relevant computer entry out loud. The assistance of Cynthia Milligan (C.M.) is also acknowledged. C.M. conducted some time-consuming calculations, fed some of the data into the computer, and compared some of the raw data to the computer data with the author by the same procedure which is described above.

In an attempt to check for cheating by subjects, the cumulative outfile (hidden under the name "autoexec.bat", see section 3.4) was compared with the separated outfiles for each S. This comparison showed that each separate outfile corresponded to an exact replica in the cumulative outfile.

The VVIQ and the VAIQ had no missing values, the GGPQ had one missing value, and the I-E scale had two missing values.

Hypothesis 1. Both feedback and nonfeedback PK scores were slightly above chance. The PK scores in the feedback condition (hits=426, MCE=400) of the computer test yielded z=1.50 (p=.067, 1-T). The PK scores in the nonfeedback condition (hits=409, MCE=400) gave z=.52 (n.s., 1-T). (Combined PK score from both versions, total hits=835, produced z=1.43, p=.076, 1-T.)

Hypothesis 2. Total scores from the computer test did not correlate with combined questions 4, 6, 7, 8, 10, 11 and 12. This relationship turned out to be in an opposite direction to that expected; Spearman R(39) = -.26 (z=1.63, p=.098, 2-T).

Hypothesis 3. Vivid imagery as rated on the VVIQ and the VAIQ correlated nonsignificantly with PK scores in the feedback condition; Spearman R(39) = -.15 (z=.96, p=.34, 2-T) and Spearman R(39) = -.06 (z=.36, p=.72, 2-T) respectively. This hypothesis was therefore not confirmed. A low nonsignificant relationship was obtained in the expected direction for both scales, although essentially at chance for

VAIQ.

<u>Hypothesis 4.</u> The difference in Interval Time (IT) between the feedback condition (mean=6.06 sec.) and the nonfeedback condition (mean=5.01 sec.) of the computer test was not significant on a Wilcoxon test: T (N=40) = 404.000 (z=.08, p=.89, 2-T). IT was slightly higher in the feedback version than in the nonfeedback version as expected.

<u>Hypothesis 5a.</u> For IT and feedback PK scores; Spearman R(39) = .18 (z=1.10, p=.14, 1-T). Thus increasing IT was correlated with more hits in the feedback condition, as was expected, but not significantly so.

<u>Hypothesis 5b.</u> Spearman R(39) = -.31 (z=1.93, p=.051, 2-T) for IT and nonfeedback PK scores. The hypothesis that decreasing IT would be associated with more hits in the nonfeedback condition was nearly confirmed.

<u>Post-hoc analysis of questionnaire data.</u> The sheep-goat scale (made out of the two first questions of the GGPQ by summing up each individual score, resulting in a scale with a theoretical range being 0 - 6) correlated highly with the total PK score; Spearman R(39) = .57 (z=3.58, p=.0006, 2-T). Questions 1 (whether people thought that PK existed) and 2 (whether people thought that others could demonstrate PK) both produced a positive significant relationship with the total PK scores; Spearman R(39) = .62 (z=3.89, p=.0003, 2-T) and Spearman R(39) = .47 (z=2.91, p=.004, 2-T), respectively. Apart from the two sheep-goat questions only question 15 (whether people had previously had any PK experience) correlated significantly and in the expected direction with total PK score; Spearman R(39) = .36 (z=2.24, p=.02, 2-T). Although some other questions on the GGPQ were in the expected direction, they were not significant.

The I-E scale did not correlate significantly with the total PK scores; Spearman R(39) = .20 (z=1.23, p=.22, 2-T). This relationship was, however, in the expected direction (which was that the more external a locus of control S has, the higher a PK score will result). The VVIQ correlated significantly with the total score on the GGPQ; Spearman R(39) = -.45 (z=2.81, p=.0052, 2-T). The more vivid visual-imagery reported by S, the higher he tended to score on the GGPQ. The total GGPQ score did not correlate with the total PK score; Spearman R(39) = -.06 (z=.36, p=.72, 2-T). VVIQ correlation with nonfeedback PK score was at chance; Spearman R(39) = .06 (z=.40, p=.69, 2-T).

Post-hoc analysis of PK scores. A nonsignificant decline effect was noticed in PK scores between the first half (first 20 trials) and the second half (last 20 trials) in both games (the first game and the second game in the session). For the first game there were 211 hits in the first half, but 207 hits in the second half. For the second game there were 215 hits for the first half, but 202 hits in the second half. Correlating session number with total PK score showed a nonsignificant decline effect from session 1 to 40; Spearman R(39) = -.12 (z=.75, p=.46, 2-T).

Did it affect the PK score when the space-bar was held down to produce many trials in a series? For the feedback version when IT was 0 (occurring when the space-bar was held down) then the mean PK score divided by the mean number of trials was .23. When IT was greater than 0, the mean PK score divided by the mean number of trials was .27. For the nonfeedback version when IT was 0 then the mean PK score divided by the mean number of trials was .29. When IT was greater than 0, mean PK score divided by the mean number of trials was .25. These differences are clearly nonsignificant, which suggests that holding down the space-bar in order to initiate many trials in a row does not affect the PK score.

Changes made after pilot study 2. After the session, some subjects complained about the two experimental rooms being formal, barren and cold on the post-session questionnaire. As a result, a few flowerpots were placed in both rooms and posters put on the walls. A book case was set up and popular book about psi phenomena were placed in the shelves.

Discussion

Main predictions. None of the predictions was confirmed. The feedback scores marginally approached significant deviation from mean chance expectation at the 5% criterion level ($p<.05$, 1-T). The hypothesis that decreasing IT is associated with more hits in the nonfeedback condition was nearly confirmed.

This study employed a same-subject design. This type might favor so-called differential effects or "preferential effects" (Rao, 1966, p.123 ff), or more traditionally within psychology, "task-juxtaposition" effects. Possible consequences could include order effects. Combining PK results for both orders (feedback-nonfeedback and nonfeedback-feedback) could therefore distort the meaning of the results of this work. When combining results for the two orders of the study, we must do statistical analyses to ascertain that the effects of these two orders of testing are comparable. Only such analyses can justify pooling results across these two orders. This is important because it is reasonable to suppose that the psychological consequences (including, possibly, the satisfaction) of having a nonfeedback condition prior to a feedback condition may be different than those of having nonfeedback following feedback.

This can be tested by comparing PK scores of those who got the feedback version first to those who got the nonfeedback version first, assuming that the order in which subjects were tested is random or at least unbiased. PK scores in each condition (feedback and nonfeedback version PK scores) were subject to a Mann-Whitney U Test that involves one independent variable (whether the feedback or nonfeedback game was played first). In both versions, the means for those who got the feedback first were slightly higher than the means for those who received the nonfeedback first. These differences were not at all close to being significant (see details in table 4.2). Therefore, Ss' PK performance was not affected by which version of the computer test came first. Assuming that an experimental manipulation of pooling feedback and nonfeedback PK scores is of no serious consequence, analyses such as those already presented using total PK scores can be justified.

Post-hoc effects. On the face of it we would expect PK performance to be associated positively with more "mental preparation". That is, more time spent on "wishing / willing" should result in higher PK scoring. The assumption here is that realtime effort matters which is probably debatable when pseudo-RNGs are used. The data from pilot experiments 1 and 2 suggest a nonsignificant trend in that direction for the feedback version, but a reverse relationship for the nonfeedback version. Looking at the expected direction in the feedback version, we can ask if IT is higher when Ss get hits compared to misses. The mean IT when Ss got a hit in the feedback version was 6.59 sec. The mean IT when Ss got a miss in the feedback version was 5.82 sec. Albeit in the expected direction the difference was not significant according to a Wilcoxon test: T (N=40) = 308.000 (z=1.37, p=.17, 2-T). Nothing conclusive can be drawn from this analysis and further experimentation has to decide if the effect is real, with live RNGs included.

Only four Ss reported on the post-session questionnaire not having used any strategy at all. Thirty-six Ss reported having used a strategy of some sort. Those who reported using a strategy often changed from one strategy to another. Reported strategies ranged from relaxation, concentration and relaxed meditative approach, commanding the computer to produce hits, talking in a friendly way to it, asking it to work - to watching light spots on the screen and mediumistic communication with controls. This seems to suggest that most subjects presented with a PK task (without instructions to use a particular strategy), try out various strategies in their attempt to be successful on the task.

Was there any evidence that VAIQ was measuring imagery? A high relationship between the VVIQ and the VAIQ was found, thus yielding some evidence for the validity of the VAIQ; Spearman R(39) = .54 (z=3.391, p=.001, 2-T).

The VVIQ-GGPQ correlation suggests that more vivid visualizers (lower scores) may score higher on the GGPQ (higher scores). This indicates that vividness of visual-imagery may somewhat be connected with a general positive attitude towards PK, as measured by the GGPQ. Weiner (1982b) reported a similar connection. She found a positive relationship between belief in, and experience of PK as measured by a questionnaire, and preference for reliance on imagery processes in daily life; r(28) = .60 (p<.001, 2-T). No relationship between belief in PK and reliance on verbal processes was found; r(28) = .07 (n.s.). Weiner used the Individual Differences Questionnaire (IDQ) to measure a person's reliance on imagery and verbal processes in daily life. We do not know, however, what sort of questions her PK questionnaire included. The connection between preference for visual (as opposed to verbal) cognitive processes as measured by IDQ and PK performance on a visual PK task was, however, not demonstrated in an earlier experiment (Weiner, 1982a).

The relationship between the I-E scale and the PK scores was in the direction expected, i.e. higher rated external locus of control may be associated with higher PK scores. As this relationship was not strong enough to produce significance, any discussion must await further experimentation to decide if it is real or not.

Although the IT was slightly higher in the feedback condition than in the nonfeedback condition the difference was not significant. In general, this confirms the findings from pilot experiment 1 that feedback (compared to absence of feedback) does not seem to have any significant effect on mental processes that can be detected by IT. However, we must note that the nonsignificant trend is again in favor of the feedback condition (taking a slightly longer time to conduct than the nonfeedback condition).

The only strong post-hoc finding was that of the sheep-goat effect. The sheep-goat relationship has not been unambiguously demonstrated in PK research (see table 4.1). Pilot experiment 2 suggested that people who reported that they accepted the possibility of PK did better on the PK task. To some degree, this confirms Weiner's (1982a) finding where she obtained a relationship between belief and PK performance; $r(11) = .72$ ($p<.005$, 1-T). As this relationship was not a major prediction, and in the light of the number of analyses executed, further research has to be carried out to determine if it can be replicated. The sheep-goat effect, if real, is also of interest insofar as the outcome of a run was already determined before the subject made the "PK effort". The sequence of pseudo-random numbers that Ss were attempting to influence was initiated by E. By starting the test, E selected the "fresh" seed that determined a fixed pseudo-random sequence of 40 numbers. However, the first one to observe the pseudo-random sequence was the subject. If there is a relationship between Ss' belief in PK and actual performance on a PK test, Schmidt's (e.g. 1982) quantum collapse model would predict that it would show up irrespective of who initiated a pseudo-random sequence responsible for the PK target selection, as long as the Ss were the first observers of the result (see "Example of a prediction" in section 3.6).

4.4 PILOT EXPERIMENT 3

Introduction

Because of difficulties at the parapsychology laboratory in obtaining a live random source for the computers, the project expanded into more scrutiny of RNGs than originally planned. An additional pilot study was brought into this project because of concern about the pseudo-RNG that was used in pilot studies 1 and 2. Selecting only one "fresh" seed at the moment of initiation of the computer test after which a sequence of 40 random numbers is determined seemed to provide psi with unnecessarily few opportunities to operate. Pilot study 3 was conducted on 9-11 December, 1987.

A different way of producing random numbers from the set-up in pilot experiments 1 and 2 was figured out at this stage, i.e. by selecting a "fresh" initial seed between individual trials via the RANDOMIZE TIMER statement. In that way the pseudo-RNG would simulate a live source RNG where, for the generation of each random number, there is real time "opportunity" for PK. However, the authors of the W-H pseudo-RNG warn against selecting a new "fresh" seed other than by the call of the algorithm each time a random number is chosen (Wichmann & Hill, 1982, p.189). They did however not say why. One way of testing the authors' warning is to run extensive tests on the randomness of the W-H pseudo-RNG by having the RANDOMIZE TIMER statement selecting all seeds (i.e. a new seed for each trial). I tested the W-H pseudo-RNG with this type of a set-up by making a program that simulates the exact procedure of experiment 2. By having a random time interval between selecting the "fresh" seeds Wichmann and Hill's warning appeared not to be relevant to my usage. (The original raw data seems to be missing of these tests. My notes, that I kept as I went along, say that the results were promising, and that when the experiment was run repeatedly in the absence of Ss with a random time interval between selection of seeds it seemed to result in chance scores.)

In order to distinguish between the two set-ups of the Wichmann-Hill pseudo-RNG, the one used in pilot experiments 1 and 2 was hereafter referred to as pseudo-RNG1. Pseudo-RNG1 has only one "fresh" seed selected at the moment of initiation of the computer test, after which all random numbers are determined via the algorithm. The set-up described above (with a "fresh" seed for each trial) was referred to as pseudo-RNG2.

Specific purpose. I wondered whether pseudo-RNG2 was somehow more "susceptible" for psi influences than pseudo-RNG1, if already tested relationships would still show the expected direction (thus implying that the pseudo-RNG set-up did not matter), and if there would be any striking difference between the two set-ups of the pseudo-RNG. In order to find out, it was decided to run one additional pilot study before doing a preliminary experiment on visual-imagery training. No predictions were made, but the following analyses were to be conducted: (i) correlations of PK scores with the sheep-goat scale, question 15 on the GGPQ, IT, the VVIQ and the VAIQ, and (ii) comparisons of PK score and IT measurements obtained on this occasion with an earlier measurement of these two variables with the same Ss.

Method

Subjects. A pre-determined number of 10 Ss participated (6 M and 4 F; aged 23-56 yr.; mean age = 35), drawn from the research staff at the parapsychology laboratory and friends of the experimenter. Eight of the Ss had participated in pilot experiment 1 and two Ss came from pilot experiment 2. Those two were going abroad and would not be available for the first visual-imagery experiment. It would have been ideal to test all ten Ss from the first pilot study (because they would have had the same time interval between studies, same environment, same form of the questionnaires etc.). Unfortunately, two of those Ss were out of the country at the time.

Apparatus. Three questionnaires were used: the VVIQ, the VAIQ and the GGPQ. Everybody took the VVIQ and the GGPQ for the second time. The two experimental rooms previously used for experimentation were used.

The computer test, Synthia, was used to measure PK. The selection of the initial "fresh" seeds was changed such that for every trial a new "fresh" seed was automatically generated by the Synthia program based upon the RANDOMIZE TIMER statement. These seeds were then processed by the W-H algorithm to produce the trial decisions. New initial "fresh" seeds via the RANDOMIZE TIMER were also selected for which boxes were to be target boxes for each of the four 10-trial sequences. This meant that S's exact timing when pressing the space-bar for the next trial was the key event in what random number was generated.

Procedure. The same procedure was used as in pilot experiment 2. The subject started by answering the VVIQ, then the VAIQ, followed by the GGPQ after which he did two sessions of 40 trials each on the computer test with a break in between. E came in during the break. The first S had a random selection (a flip of a coin) of whether he would start with the feedback or the nonfeedback version of the computer test. The second S had the reversed order to the first S, and so forth.

Pseudo-RNG control tests. Tests of randomness were run before, during and after the experiment (see results in appendix C). (1) For 5 runs each containing 1/2 million random numbers (p=1/4), the overall chi-square (df=3) = 6.25 (p=.10, 2-T), which although nonsignificant is quite close to being significant. (2) However, for 17 runs of simulation of the experiment, without subjects but with a random time interval between each trial, produced no significant study at the .05 level (2-T). Thus, I concluded that the pseudo-RNG behaved in a random manner.

Results

Total PK scores (total hits=208, MCE=200) yielded z=.65 (n.s.). Scores in the feedback version (hits=100) showed z=0.00. Scores in the nonfeedback version (hits=108) yielded z=.92 (n.s.).

Questionnaire data. The sheep-goat scale (questions 1 and 2 combined) produced a nonsignificant positive correlation with the total PK score; Spearman R(9) = .37 (z=1.11, p=.27, 2-T). Question 15 on the GGPQ correlated nonsignificantly with the total PK score; Spearman R(9) = .41 (z=1.24, p=.21, 2-T). With a similar sample size to pilot 2 (n=40), both these relationships could perhaps have reached significance.

Lower scores on the VVIQ and the VAIQ (better visualizers and audiolyzers) correlated nonsignificantly and negatively with higher PK scores in the feedback condition; Spearman R(9) = -.41 (z=1.24, p=.21, 2-T), and Spearman R(9) = -.41 (z=1.22, p=.22, 2-T), respectively. This was in the expected direction. The correlation between the VVIQ and the VAIQ scores produced Spearman R(9) = .66 (z=1.98, p=.045, 2-T). The VVIQ scores correlated nonsignificantly and positively with total GGPQ score; Spearman R(9) = .32 (z=.95, p=.35, 2-T).

Interval Time. Spearman R(9) = -.42 (z=1.26, p=.20, 2-T) for IT and PK scores in the nonfeedback condition. Spearman R(9) = -.26 (z=.78, p=.44, 2-T) for IT and PK scores in the feedback condition. The difference in Interval Time (IT) between the feedback condition (mean=5.16 sec.) and the nonfeedback condition (mean=4.49 sec.) on the computer test was not significant although still in the expected direction, Wilcoxon test: T (N=10) = 20.000 (z=.76, p=.45, 2-T).

Feedback vs. nonfeedback first. Those who got the feedback version first obtained a feedback PK score mean of 10.20. Those who got the nonfeedback version first obtained a feedback PK score mean of 9.80. The difference was not significant (Mann-Whitney test: U = 11.000, z=-.31, p=.75, 2-T). Those who got the feedback version first obtained a nonfeedback PK score mean of 10.40. Those who got the nonfeedback version first obtained a nonfeedback PK score mean of 11.20. The difference was not significant (Mann-Whitney test: U = 10.500, z=-.42, p=.68, 2-T).

Comparison with prior PK scores. The eight Ss coming from pilot experiment 1 did only 60 trials on the computer test per session. The two Ss coming from pilot experiment 2 did 80 trials per session. To make all PK scores identical they were changed into z-scores. Ss' previous z-scores (previous PK results) correlated negatively with their present z-scores (present PK results); Spearman R(9) = -.27 (z=.80, p=.43, 2-T). Ss' prior PK scores were higher than PK scores obtained on the second occasion. The difference between PK scores on the two occasions was not significant, Wilcoxon test: T (N=10) = 26.000, (z=.15, p=.85, 2-T).

Comparison with prior IT. Interestingly, prior IT correlated significantly with present IT; Spearman R(9) = .72 (z=2.16, p=.03, 2-T). This relationship was mainly due to high consistency in prior IT and present IT in the nonfeedback version; Spearman R(9) = .82 (z=2.46, p=.01, 2-T). Prior IT and present IT in the feedback version produced; Spearman R(9) = .41 (z=1.22, p=.22, 2-T).

Discussion

No effect related to PK performance was significant.

The idea that increasing IT may correlate with more hits in the feedback condition was not confirmed. With pseudo-RNG2 this relationship turned out to be in the opposite direction. The correlation between prior PK score (z-score used) and prior IT for the feedback version yielded; Spearman R(9) = .70 (z=2.10, p=.034, 2-T), and for the nonfeedback version; Spearman R(9) = -.22 (z=.67, p=.51, 2-T). This shows that with pseudo-RNG1 hits increased significantly with increasing IT in the feedback version (see details in table 4.3). This also suggests that the negative correlation obtained in the present study between feedback PK score and IT was not due to selection of individuals who had previously produced such a negative effect.

Comparison of prior and present IT suggests that the time which Ss use between trials in the feedback version did not change very much from one study (or a pseudo-RNG) to another. Further indication that IT did not change much from the first occasion to the second, with 4-5 months interval and different pseudo-RNGs, is given by the comparison of present and prior IT: (a) Feedback version. The average IT between trials in the present study was 5.16 sec. The average IT between trials on the previous occasion was 5.45 sec. (b) Nonfeedback version. The average IT between trials in the present study was 4.49 sec. The average IT between trials on the previous occasion was 4.65 sec. (See table

4.3.)

The significant correlation between VAIQ and VVIQ adds further to the validity of the VAIQ. The VVIQ correlation with the total GGPQ score showed a direction contrary to that anticipated. More vivid imagery was expected to be connected with a more positive attitude towards and prior experience of PK. (I did not compare Ss' prior VVIQ and GGPQ scores since of the 10 Ss participating in pilot 3 only 2 Ss, those who came from pilot 2, completed the identical VVIQ and GGPQ versions on both occasions. The 8 Ss coming from pilot 1 did somewhat different versions of the GGPQ and VVIQ.)

Those who got the feedback version first did not differ significantly in PK scores of the two versions of Synthia from those who got the nonfeedback version first. Again this implies that it did not matter which version of the computer test came first.

The nonsignificant decline in PK scores between the first and second occasions may reflect a decline effect rather than any difference due to the two pseudo-RNG setups (see table 4.3). We do not know either way. The third pilot study was done some time after Ss had been tested on the computer test when it employed pseudo-RNG1. If properly done half of the group should get the pseudo-RNG1 version first whereas the other half would get the pseudo-RNG2 version first. Furthermore, S should have done the feedback and the nonfeedback versions reversed with his prior sequence.

<u>In conclusion.</u> As already mentioned, pilot 3 was unanticipated in the sense that it had not been planned as a part of the thesis. However, it was decided to conduct it because of concern about the set-up of the pseudo-RNG. As far as I can see, the two pseudo-RNGs do not differ in any striking manner, with the exception of the correlation of IT and PK

score in the feedback version: IT correlated positively with PK scores in the feedback version with pseudo-RNG1, but negatively with pseudo-RNG2. In conclusion, there was no striking advantage in using pseudo-RNG2.

4.5 OVERALL SUMMARY AND DISCUSSION

By and large, what seems to dominate the three pilot experiments are nonsignificant results related to psychokinesis.

A general attitude towards PK as measured by the combined question score of the GGPQ does not seem to be connected with PK performance as measured by Synthia. Vividness of auditory imagery as measured by the VAIQ is neither correlated with feedback nor nonfeedback PK scores according to the data. Some validity of VAIQ has been demonstrated as it correlates significantly with the VVIQ. The data suggests that Ss doing the computer test on two occasions seem to spend about the same average time between trials on both occasions even when there are 4 to 5 months between the sessions. It was somewhat a surprise to me how short a time Ss spent between trials, approximately 5 seconds. I expected Ss to spend some time on exerting their PK effort on each trial.

During pilot studies 1-3 the two experimental rooms had been made comfortable, basic instructions had been formed, the PK computer test had been developed and refined, two versions of the W-H pseudo-RNG had been tested and prepared and the first subjects had been screened and lined up.

Apart from preparing the environment and pseudo-RNGs and so forth, the main ideas related to the PK computer test resulting from the three pilot studies are five suggestive trends, all of which show consistency: The Sheep-Goat scale and question 15 on the GGPQ correlate positively with total PK score (see summary in table 4.4). The VVIQ score correlates negatively with the feedback PK score (see summary in table 4.4). IT is slightly higher in the feedback version than in the nonfeedback version and decreasing IT is slightly associated with more hits in the nonfeedback condition (see summary in table 4.5). In fact, pilot study 3 (in which pseudo-RNG2 was used to generate the PK targets) confirms pilot studies 1 and 2 (where pseudo-RNG1 was used to generate the PK targets) in all five cases.

Only the PK correlation with the sheep-goat scale and question 15 of the GGPQ results merit discussion at this stage. Otherwise, too much weight will be given in the discussion to the importance of nonsignificant trends. Neither effect was formally predicted and no attempt was made to control for Type I Error. We must therefore await further experimentation in order to determine if they can be considered valid or not. If results from these two and the other predictors turn out significant in further experimentation, however, they will be discussed further.

Sheep-Goat scale. The results suggest a possible relationship between belief in PK and PK performance. The sheep-goat scale correlated significantly with the total PK scores in pilot experiment 2; Spearman R(39) = .57 (z=3.58, p=.0006, 2-T). This indicates that higher self-rated opinion of the existence of PK may be connected with actual performance on a PK test (see table 4.4). This correlation was in the right direction, albeit nonsignificant, in pilot experiments 1 and 3. It is important to note, however, that most of the Ss in pilot 3 had also been in pilot 1.

The PK score correlation with the sheep-goat scale in all three pilot studies was solely done with degree of "sheepness". We can, however, term those who scored between 0-3 as goats and 4-6 as sheep. According to this classification there are relatively few goats in the subject pool (one goat in pilot 1; six goats in pilot 2; one goat in pilot 3). The low ratio of goats present is probably due to selecting subjects via advertisements. I would suggest that if properly tested for the sheep-goat effect, an unselected group of subjects would produce a larger goat group and therefore a better sample.

Prior experience of PK. Question 15 on the GGPQ (whether people think they have had any PK experience) shows a positive correlation with total PK score (see table 4.4). In pilot experiment 2 this relationship was significant (z=2.24). In pilot experiment 3 it was not (z=1.24). Looking back at the results from pilot experiment 1, this question correlated nonsignificantly but in the expected direction with total PK score; Spearman R(9) = .37 (z=.83, p=.41). This effect is worth looking at in future experimentation. One can argue that given large enough sample sizes in pilots 1 and 3, the sheep-goat effect and question 15 on prior experience of PK could have reached significance.

Interval Time. The use of time measurement such as reaction time (rt) or interval time (IT) has been minimal in parapsychology. Since the completion of the pilot studies four studies in parapsychology making use of time measurements have come to my attention. Van de Castle (1958) used reaction time to measure spontaneity. He measured the quickness with which S responded as he presented each Rorschach card in a standard Rorschach administration setting. He found that for Ss with an average reaction time of under ten seconds, 10 out of 15 scored above chance on a PK task. For Ss with an average reaction time of longer than ten seconds, 10 out of 14 scored below chance. In this case the rt measurement is taken on a separate task from the PK one and may be quite irrelevant to our usage of IT. The finding regarding speed of responding has been reported in ESP work by Stuart et al. (1947). They found that for the overall length of time it took Ss to make response drawings to an ESP stimulus, the fast drawers scored above chance and the slow drawers scored below chance. (The Stuart et al. report does not mention whether the above chance scores of fast drawers, the below chance scores of the slow drawers, or the difference between the two groups were significant.)

Hines, Lang and Seroussi (1987), dissatisfied with ESP research depending almost exclusively on measures of accuracy, argued that such measures are much less sensitive than reaction time (rt) measures. They described the use of a reaction time paradigm in the investigation of ESP. Hines et al. modified a lexical decision task (Shoben, 1982) by presenting a letter string (e.g. "DOOR") to one subject, the "sender." Four hundred milliseconds (ms) later they presented either the same or a different letter string to a second subject, the "receiver." They argued, that if semantic priming can occur via ESP, then the receiver's rt should be faster when the sender has 400 ms previously processed the same letter string. Hines et al. concluded that their results did not demonstrate any evidence for an ESP priming. In a second paper Hines and Dennison (1989) reported two studies with a similar design making use of rt as a measure of ESP. In both studies they reported failure to find evidence for ESP.

The two Hines ESP studies can probably not be considered relevant to the present PK studies, even if one assumes a close link between the ESP and the PK function (e.g. by interpreting RNG results in terms of precognition as the IDS model proposes). The Hines studies used rt to measure the presence or absence of ESP, whereas IT is used to make inferences about possible mental processes behind PK/psi. Thus only the

Stuart et al. (1947) study would be potentially relevant here, assuming that precognition is responsible for RNG findings. Our nonsignificant IT trends for the nonfeedback condition are in line with Stuart et al., i.e. the less time Ss take on the psi task the higher scoring will be. Before speculating more about this potential effect I prefer to proceed cautiously and await further confirmation about the validity of this trend.

TABLE 4.1

Reported PK sheep-goat studies. For the Nash, Dale and Van de Castle studies, "mean" stands for "mean PK score".

	The S-G Relationship		Results	Questions
Nash 1946	Sheep n=6 mean=4.43 chance=4	Goats n=3 mean=4.34 chance=4	Difference between groups n.s.	Do you belief that PK is a scientific fact?
Dale 1946	Sheep n=41 mean=4.12 chance=4	Goats n=13 mean=4.18 chance=4	Difference between groups n.s.	Do you think that there is any possibility that you can influence the dice as they roll down the chute?
Van de Castle 1958	Sheep n=13 mean=4.12 chance=4	Goats n=9 mean=4.03 chance=4	Difference between groups n.s.	Do you accept the theoretical possibility that PK might exists?
Mischo & Weis 1973	No significant relationship between a "attitude toward PK" questionnaire scores and PK scores. No information is provided about the nature of the PK questionnaire.			
Weiner 1979	"Persons with less strong beliefs in PK" scored significantly above chance (p<.01, 2-T), although not significantly higher than "high sheep." No further information is provided.			
Weiner 1982a	r(11)=.72		p<.005 1-T	Question(s) about belief in PK. No further information given.
Weiner 1982b	r(26)=-18		Negative and n.s. correlation	Question(s) about belief in PK. No further information is provided.

TABLE 4.2

Comparison of PK scores from those who got the feedback test first (n=20) and those who got the nonfeedback test first (n=20) in pilot experiment 2.

	Feedback version first	Nonfeedback version first
Feedback PK scores	hits = 218 MCE = 200 mean = 10.90	hits = 208 MCE = 200 mean = 10.40
	Mann-Whitney test: U = 179.500, z=-.56, p=.59, 2-T	
Nonfeedback PK scores	hits = 209 MCE = 200 mean = 10.45	hits = 200 MCE = 200 mean = 10.00
	Mann-Whitney test: U = 185.000, z=-.41, p=.69, 2-T	
Total PK scores	hits = 427 MCE = 400 mean = 21.35	hits = 408 MCE = 400 mean = 20.40
	Mann-Whitney test: U = 169.000, z=-.84, p=.41, 2-T	

TABLE 4.3

Comparison between present and prior results of Ss in pilot experiment 3. All p-values are 2-T.

	Feedback version	Nonfeedback version	Total
Present scores	hits=100 (0%) trials=400 z=0.00 (n.s.)	hits=108 (8%) trials=400 z=.92 (n.s.)	hits=208 (4%) trials=800 z=.65 (n.s.)
Prior scores	hits=87 (8.8%) trials=320 z=.90 (n.s.)	hits=83 (3.8%) trials=320 z=.39 (n.s.)	hits=170 (6.3%) trials=640 z=.91 (n.s.)
Present IT	5.16 sec.	4.49 sec.	
Prior IT	5.45 sec.	4.65 sec.	
Present corr. for PK hits & IT	rs = -.26 z=.78 (p=.44)	rs = -.42 z=1.26 (p=.20)	
Prior corr. for PK hits & IT	rs = .70 z=2.10 (p=.034)	rs = -.22 z=.67 (p=.51)	

TABLE 4.4

Summary of Spearman Rho correlation coefficients (rs) between PK hits and scores on scalar instruments. For VVIQ Spearman R is correlated with feedback ($_f$) PK score. For the PK and sheep-goat scale (S/G scale) correlation, the total sum of point-score was used (the range being 0-6).

	S/G-PK	VVIQ-PK$_f$	Q15-PK	VVIQ-VAIQ
Pilot 1 n=10	rs=.14 z=.40	rs=-.003 z=.009	rs=.37 z=.83	
Pilot 2 n=40	rs=.57 z=3.58**	rs=-.15 z=.96	rs=.36 z=2.24*	rs=.54 z=3.39**
Pilot 3 n=10	rs=.37 z=1.11	rs=-.41 z=1.24	rs=.41 z=1.24	rs=.66 z=1.98*

* p<.05, 2-T
** P<.01, 2-T

TABLE 4.5

Interval time (IT) measurements for pilot experiments 1, 2 and 3.

	Feedback version		Nonfeedback version	
	Mean IT in sec.	Corr. between PK hits & IT	Mean IT in sec.	Corr. between PK hits & IT
Pilot expm.1	3.78	rs = .57 z = 1.72 p = .08 (2-T)	3.53	rs = -.18 z = .55 p = .59 (2-T)
Pilot expm.2	6.06	rs = .18 z = 1.10 p = .135 (1-T)	5.01	rs = -.31 z = 1.93 p = .053 (2-T)
Pilot expm.3	5.16	rs = -.26 z = .78 p = .44 (2-T)	4.49	rs = -.42 z = 1.26 p = .20 (2-T)

CHAPTER FIVE

EXPERIMENT 4: FIRST IMAGERY TRAINING STUDY

5.1 INTRODUCTION

Experiment 4 started on 17 February and lasted until 19 May 1988. It was one of the two major experiments in my thesis. It was designed to investigate further the findings from experiments that have explored and compared process-oriented imagery strategy (PO) and goal-oriented imagery strategy (GO) in the production of extrachance PK scoring (e.g., Levi, 1979; Morris et al., 1982; see also section 2.5). Previous visual-imagery PK studies suggested a pattern summarized in the end of section 2.5, i.e., GO may produce above chance results, and be associated with higher PK scoring than PO under feedback conditions, whereas in the absence of feedback PO may possibly do better than GO. The main aim of the present study was to attempt to replicate these findings and furthermore, to extend the PK imagery research and explore the possibility of using these visual-imagery strategies as methods of training PK ability.

In experiment 4, PO is aimed at visualizing a process in which energy builds up inside the body and then is sent into the device (see instructions in section 5.3). GO is aimed at visualizing the trial-by-trial feedback provided for hits only (see instructions in section 5.3). I tried to keep the descriptions of the two visual-imagery strategies, GO and PO, as close as possible to the original descriptions reported in Morris et al. (1982) and Levi (1979).

In experiment 4 I decided to introduce a variation of the GO imagery, termed "end-oriented imagery strategy" (EO). EO is aimed at visualizing a preferred outcome / result at the end of each session (i.e., visualization of end-of-session feedback). The exact instructions for EO are presented in section 5.3. The reason why EO can be seen as a representative of GO is that in both strategies Ss are engaged in visualizing a goal which is the result of being successful. In both instances Ss are to visualize feedback which is provided when they are successful at the PK task. Instead of selecting strategies that are dissimilar, the EO strategy is introduced because of its similarity with GO. In order to carry research on GO one step further one can ask if the nature of the goal matters. Does visualizing success after trials (trial-by-trial feedback) as in GO or after the session (end-of-session feedback) as in EO make any difference? To the best of my knowledge previous visual-imagery PK research has not explored visualization of a goal which is simply a successful session.

A 3x2x2 mixed factorial design (imagery strategy, feedback assignment and pseudo-RNG condition) was used in which each participant was assigned to practise one of the three visual-imagery strategies. Half of the trials in each session were conducted with feedback and the other half without feedback. The feedback and the nonfeedback trials were each done with two different set-ups of the pseudo-RNG. Each participant took part in six sessions overall, approximately one week apart, to practise his particular strategy and to be tested on the PK computer test Synthia.

5.2 PREDICTIONS

The following pre-planned hypothesis were the major points of importance of experiment 4:

H1 Since psychic functioning with RNGs has been obtained frequently in experiments in the past and we have screened for positive scoring Ss in pilot experiment 2, we expect to produce overall evidence for PK in this experiment.

H2 There will be a statistically significant difference in PK scores (combined score for all 6 sessions) between PO and GO in favor of the latter strategy in the feedback condition. This follows from the prior research of Morris et al. (1982) and Levi (1979).

H3 EO will yield significantly higher scoring than PO in the feedback condition. This is a logical inference if we see EO being a variation of GO. The combined PK score for all 6 sessions will be used for this analysis.

H4 In the absence of feedback PO will result in higher PK scores than (a) GO and (b) EO. This is a suggestion from Levi (1979). The combined PK score for all 6 sessions will be used.

H5 There will be not be a decline effect: Ss' between-session scoring will not decline over time. This seems to follow from the research of Nanko (1981). Combined PK scores from sessions 1-3 will be compared with combined scores from sessions 4-6 for each strategy. (If training works, we would expect either an incline or stabilization of scores if they were initially high. I wanted to look at the two alternatives and in both cases I expected sessions 4-6 especially to be above chance.)

H6 Cognitive predictions: (a) The Interval Time (or IT, being time measured in hundredths of a second between trials) for PO will be longer than for GO (feedback and nonfeedback IT combined). (b) IT will be shorter in the first session than in the last session for all three strategies combined.

The reason for prediction 6a is basically that, prima facie, the instructions seem to ask Ss to indulge in a longer process in PO than in GO. This prediction is a logical inference from research on mental rotation within the field of cognitive psychology. For instance, Kosslyn (1975) had his Ss imagine different sized animals. He found that the size of an animal had no effect on response latency. The only factor affecting such times was the size of the image that was being constructed. More time was required to construct large images of any animal being imaged than was required for small images. Furthermore, Kosslyn, Ball and Reiser (1978) asked subjects to engage in mental travel, in which they memorized the map of a fictitious island, that had several landmarks (a beach, a rock etc.). When subjects engaged in a mental scan from one point on the map to another the reaction time increased as the distance between the points increased. The mental travel studies have been interpreted as showing that, just as some time is required to shift our gaze when looking at different parts of an external stimulus, some time is also required to shift the gaze of our "mind's eye".

Prediction 6b is based on the assumption that because of practice the imagery strategies will take less time. It seems logical to assume that if Ss speed up their imagery they will do so in all three imagery conditions. Practice could for instance result in more familiarity with the strategies. Familiarity seems to be no hindrance to mental rotation (for example in rotating the letter "R"). Moreover, familiarity with the stimuli seems to enhance the speed at which the rotation takes place (Cooper & Shepard, 1973).

H7 Feedback prediction: IT will be lower in the nonfeedback tests than in the feedback tests. This suggestion follows from the three pilot studies. (If such is the case, we can argue that feedback evokes some extra mental processes.)

H8 RNG prediction: For pseudo-RNG1, hits will correlate positively with higher IT in the feedback version, whereas in the nonfeedback version hits will correlate negatively with higher IT. When using pseudo-RNG2 IT will correlate negatively with hits in both versions. This prediction is based on prior results from the pilot studies.

A copy of the predictions was left with Robert Morris (R.M.) and laboratory manager, Deborah Delanoy (D.D.). At this stage, there was no group without a strategy (control). The reasons were as follows: (i) This was preliminary research. First of all I wanted to explore if the strategies yielded any extrachance scoring. If results were obtained, then an appropriate control could be placed in the final study. In a sense one can say that chance scores are the control condition to which each group is compared. (ii) I wanted to be able to expect all Ss to do well and give everybody something to work with. I did not want to have a group that I hoped would not show a strong effect (see Levi's control group for instance). (iii) It is difficult to have a control group that does not do anything. Most subjects seemed to develop a strategy of some sort in pilot experiment 2 without any instruction to do so. I could have a control group listening to white noise for example, but I, as well as many of my Ss in the past, have found it annoying.

5.3 METHOD

Subjects

24 unpaid volunteers participated (13 F and 11 M; aged 20 - 57 yr.; mean age = 33) selected from the initial pool of subjects. The aim of experiment 4 was to try to produce high scoring individuals. It had been decided in advance to test Ss who met a very modest screening criterion, vis., Ss who got a total of 20 hits or more (p=1/4 and thus MCE from 80 trials is 20 hits), from both conditions of the computer test in experiment 2. Some researchers in parapsychology have pretested Ss for psi and used them in later, formal experiments if they showed initial indications of being successful - with some success (e.g., Fahler, 1959; Honorton, Barker & Sondow, 1983; Johnson & Haraldsson, 1984; Sargent, 1980; Schmidt, 1970a; 1973; 1974; see also Tart, 1983a). After finishing experiment 2, Ss who got 20 hits or more were asked if they would like to proceed to a larger experiment that was to start after a few months. The others were kept unaware of this experiment. The following description was provided:

> In a couple of months we are going to conduct a larger experiment which is aimed at exploring a certain visual-imagery strategy to increase PK scoring on this same computer test. All participants who get hits at chance level

> or higher, are asked if they would like to proceed to this larger experiment. Now, when I say a larger experiment, I only mean that each person will attend on six occasions with a few days interval, for about an hour each time, to practice this particular visual-imagery strategy. You will of course make your own time schedule regarding which days you can attend and at what time to practice on the PK computer game.
>
> Would you be seriously interested in participating in the second experiment? There are no obligations. If you say "yes" now, you can, of course, say "no" when we contact you.
>
> I want you to think through with your friends and family for the next few months whether you are really ready to spend your time practicing this visual-imagery strategy on six occasions. Preferably, we will need participants that are, hopefully, not going to drop out of the experiment when they have once started.

It should be noted that all participants, regardless of their scoring rate in experiment 2, were asked if they wanted to be in a pool of Ss that would be contacted when experiments were in process at the parapsychology laboratory.

Drop-outs and new recruits. Only data from those who completed their six sessions were to be used. Data from drop-outs were to be put in an appendix. If 24 Ss from experiment 2 were, when contacted, not interested in taking part in experiment 4, or for some reason could not come or dropped out in the middle of experiment 4, more Ss were to be recruited. The recruits were to be run through the same procedure as used in experiment 2 until the number of 24 Ss was met (still fulfilling the criterion of >= 20 hits).

A note was kept with R.M. and D.D. stating how drop-outs were to be dealt with. As it turned out eight individuals from experiment 2 were no longer available when asked and eight new Ss had to be recruited. After running 20 Ss (9 M and 11 F; aged 20-61 yr.; mean age = 35) through the same procedure as utilized in experiment 2, eight individuals emerged who were successful at the PK task and wanted to continue with the visual-imagery study. As it turned out there were no drop-outs during the six sessions.

Pilot runs. The experimenter and three of the research staff at the parapsychology laboratory practised the three types of visual-imagery strategies on six occasions prior to the experiment in order to try out the procedure and the imagery instructions. After comments and discussions the experimental procedure and instructions were changed to their present form.

Apparatus and Questionnaires

The computer test. The same computer test (Synthia) as was used in pilot experiments 1-3 was used. A few changes were made to the program. Two versions of the pseudo-RNG were incorporated in the computer program and used within one 40-trial run of Synthia, one where the initial seed was selected before the actual test begins (pseudo-RNG1, as in pilot studies 1 and 2) and the other version where a new initial seed was selected every time a random number was chosen (pseudo-RNG2, as in pilot study 3). Thus half of the trials in the feedback version and half of the trials in the nonfeedback version were done with pseudo-RNG1 and half of the trials in both versions were done with pseudo-RNG2. After 20 trials the program automatically changed over to the other version. Whether the first 20 trials were to be generated by pseudo-RNG1 or pseudo-RNG2 was indicated by responding with "1" or "2" to the "Start system (1 or 2)" prompt by the computer. Ss were not told about the nature of this prompt in order to keep them blind as to the different pseudo-RNGs. In fact, they did not know that two pseudo-RNGs were used.

The initial seeds from pseudo-RNG1 were automatically entered into a separate outfile. This allowed a re-run of the exact 20 trials from the pseudo-RNG1, such that if significant PK hitting occurred we could check whether PK operated by actually changing and biasing the random numbers from that which the algorithm would normally produce. (The 20 pseudo-RNG1 trials were re-run for a few of the highest scoring Ss in experiment 4. However, no discrepancies were found between the re-run trials and the trials obtained in the actual sessions.)

In this latest version of Synthia, before the test display of the four boxes appeared on the screen, Synthia prompted the subject/player to decide the minimum number of hits he would aim for (chance being 10 hits). The number of hits aimed for was saved in the outfiles which kept the information about the trials (see the cumulative outfile and the separate outfiles for each S in section 3.4). One more feedback sequence was added. This was end-of-session feedback that appeared on the screen at the end of the feedback version if the pre-decided hit rate aimed for was met or exceeded. The end-of-session feedback consisted of the whole screen turning light blue with the exception of the middle which had a black diamond shape. Inside this black diamond was the number of hits aimed for highlighted in bold white letters. Accompanying this end-of-session feedback display was text saying above the black diamond "WELL DONE YOU MADE IT", and below the black diamond "YOU GOT THE SCORE YOU WANTED." This text blinked while the computer played a short song/tune. The end-of-session feedback display was specially referred to in the visual-imagery strategy instructions for the EO group.

Questionnaires. When discussing experiment 4 with Stanley Krippner he told the author of a diagnostic test, called Image-CA (Achterberg & Lawlis, 1984). I wrote to Achterberg and obtained a copy of the Image-CA manual. Image-CA can apparently predict with some accuracy if a patient is going to be cured or not of cancer. It is based on the type of imagery the patient reports of his cancer, white blood cells and the treatment he is undergoing (Achterberg & Lawlis, 1979; 1984; Achterberg, Lawlis & Simonton, 1977). I decided to try out this idea and made a self-report questionnaire called Image-PK based upon Image-CA (see appendix E). As I saw it there were possibly similarities between, on one hand, the situation where the role of the mind in the "cure" of cancer is suggested to be important in some instances (e.g. Simonton, 1972) and, on the other hand, the situation where it is postulated that the mind may be able to influence matter. This may be an unorthodox line of reasoning and it was purely speculative. At any rate, the important question for the present research was what type of imagery (or attitude / feelings / thoughts), if any, is connected with success or failure in PK training. In Image-PK Ss are asked how they perceive, imagine or think of their PK, the computer test and the visual-imagery training. In future research, if certain imagery seems to be connected with failure, it may be possible to find ways to alter it towards, or exchange it with, a more successful one that correlates with extrachance PK scoring.

The inspection time test. I was interested in attempting to measure somehow the effect, if any, of imagery training. After discussions with R.M. and Ian Deary, I decided to include for post-hoc analysis the so-called inspection time test. Brand and Deary (1982, p.134) described techniques employed in measuring inspection time as follows:

> ...what these techniques make possible is the presentation of visual stimuli extremely briefly and without the subject being able to retain any vivid image of the stimulus presentation in memory. Hence, any discrimination of the stimuli presented has to be based chiefly upon input that has only taken a small fraction of a second and which is not available to the subject in immediate memory. The stimulus duration which a subject requires to be able to make such discriminations reliably is called his inspection time.

In the inspection time test I used, which was run on a BBC computer, the subject was required to state the spatial position ("left" or "right") of the longer of two lines presented vertically on the CRT. If the long line was on the left the subject was to press the "Z" key on the bottom left half of the keyboard with his left hand. If the long line was on the right the subject was to press the "/" key on the bottom right half of the keyboard with his right hand. The subjects were given a series (10 trials in each series) of decreasing exposure duration of the two lines, ranging from a stimulus duration of 400 ms to as little as 10 ms. Each trial started and ended with a mask to completely overlap the visual area that had been occupied by the stimulus and thereby prevent the further accumulation of visual information by the subject. For each subject the computer program came to halt at the shortest exposure duration which a subject could reasonably reliably (85% accuracy) discriminate between the stimuli and this stimulus duration is called the subject's inspection time (in milliseconds). Inspection time has been shown to correlate inversely with IQ and is thought of being an index of "mental speed."

Firstly, the question of interest to me was whether mental speed could be affected by visual-imagery practice. Secondly, I wanted to look for correlations of inspection time with PK score and with other measurements such as IT and scores on the self-report inventories in order to expand my research and not concentrate solely on parapsychology.

The experimental rooms. The same two experimental rooms in the parapsychology laboratory were used as in pilot studies 1-3. The BBC computer for the inspection time test was placed in the "questionnaire" room, while the IBM computer for the PK computer test Synthia was in the sound-attenuated room as before.

"Mental exercises" for home practice. Besides the three visual-imagery strategies, a few "mental exercises" to "enhance" the imagery strategies were designed. They were to be practised immediately before practising the visual-imagery strategy, at home only. The first one was a 5 minute relaxation exercise (the same one as in appendix F). The rationale behind having a relaxation procedure preceding the imagery strategy was that S might find it easier to visualize if he was relaxed, because the body would be completely relaxed and thus not sending any signals to the brain to compete for attention. The second mental exercise was a concentration exercise (see appendix E; adopted from Morris, Unity I Training Procedure, unpublished). It involved tallying one's own breath for 5 minutes. The rationale behind having a concentration exercise preceding the imagery strategy was that it might help S to focus his attention more successfully when he employed the visual-imagery strategy. The third mental exercise was a simple visualization exercise (the same one as in appendix F; adopted from Morris, Unity I Training Procedure, unpublished). It involved visualizing a simple familiar object for 5 minutes. The rationale behind having a visualization exercise preceding the visual-imagery strategy at home was that it might develop S's visualization ability for the visual-imagery strategy. The fourth exercise was a 5 minute positive thinking exercise (see appendix E). The subjects could choose which one of three positive thinking exercises to practise at home before doing the visual-imagery strategy. The first one emphasized the possible use of PK to help others to feel well, help things to flourish, prosper and grow. The second one emphasized the use of PK to reduce accidents, malfunctions and illnesses for the benefit of others. The third one emphasized the use of PK to be lucky and successful in life.

Control pseudo-RNG test. (i) The experimental procedure was run without Ss with a program that simulated the trials to test the pseudo-RNGs (see results in appendix C). Twenty-one simulated studies were run, out of which two were significant, two-tailed. (ii) The algorithm was also tested for large series of numbers (see results in appendix C). For a total of 3 million random numbers chi-square = 2.75 (p=.43). I concluded that the pseudo-RNG produced sequences at chance.

Preliminary Interview Session

Participants attended one interview with E usually a week prior to the start of the experimental sessions. The following issues were covered in the interview:

a) The experimenter started by explaining the experiment to S and tried to make some sort of evaluation of S's expectations and interest in participation. E answered questions and gave S an opportunity to back out. The following instructions were given verbally:

> Aim: The aim of this study is to try to increase or stabilize your PK scores on the computer test through the practice of a certain visual-imagery strategy.
>
> The test: In this experiment you will be required to do the same computer test as you did in our previous study. You are to try to make the computer select one particular box out of the four boxes on the screen. We have reason to expect, on the grounds of prior successful experimental studies, that your imagery technique will increase or stabilize your PK scores.
>
> The sessions: You will have to come to the lab on six occasions with at least a one day interval to do the computer test. Each session will take about an hour. You will make your own time schedule as to when it suits you to come. We want you to practise your visual-imagery technique at home on a daily basis, but only for about 10 minutes per day. If, for some reasons, you are not able to do the home practice on a daily basis, that's fine. However, the more you practise the more likely it is that you will get the full benefit of the exercises. You may of course practise more than that if you want to. In the last session you will receive your personal results. At the end of the experiment you will get the main results of the experiment by mail, so that you can compare your score to the whole group that will be participating.

b) If S wanted to be in the "training" experiment the following instruction was made verbally:

> Before I give you the imagery strategy, I want you to go through an inspection time test. You will be doing the

> inspection time test again after finishing the last session. We want to measure whether practicing visual-imagery for some period of time affects inspection time in some way. We are not measuring how quick your responses are, but how accurate you can be. [Subjects were not told what the inspection time test measured.]

After softening the lights in the "questionnaire" room where the BBC computer was, S did the inspection time test. If mistakes were made in the first block of trials of the test it was restarted.

c) Next, E and S went into the sound-attenuated room, where E gave S one particular visual-imagery strategy on a sheet of paper, which he was to use to try to influence the output of the RNG. E then went through and answered questions about that particular visual-imagery strategy and gave a demonstration of the computer test (verbal instructions):

> While I explain your imagery technique, I'll give you a demonstration of the computer test. The test is by no means a test that can tell if you possess PK abilities in general - it only tells how well you manage to work on that particular test in this particular test situation. [Ss played the latter half of a demonstration feedback game, and the latter half of a demonstration nonfeedback game.]
>
> Again I want to remind you to pay special attention to the space bar. If you press it down for a while, it will generate many trials in a row. If you want to initiate one trial, just press the space-bar lightly. If you get any particular feeling, that you might get hit after hit, you can hold down the space bar. Otherwise don't. If you have held down the space-bar in order to select a few trials in a row, and it comes to changing a target box, the computer will change the target box and then keep on doing the trials left. [Demonstration.] If you feel that you have established a vivid image of your strategy I suggest that instead of holding down the space bar, you press it rapidly, such that if the feeling goes away, the trials will not go on without control.

The subjects were then given their imagery strategy instructions.

PO imagery instructions were as follows:

> Follow this procedure before each trial until you have established a clear vivid image. Once you have done this, you can go on for a while or until the image fades:
>
> Close your eyes. Take a deep breath, breathe in and out slowly

and deeply - repeat a few times. Allow yourself to relax. Try to go to a level (or state of mind) where you can mentally visualize, where images are clear, vivid, and stable.

Imagine energy building up inside you - flowing from your feet to head. Imagine this energy coming from you in the form of a white beam. This beam will be emanating from your mind's eye (midforehead). When you have this imagery of an energy beam, direct it in your imagery onto the display on the screen. Visualize the white beam going into the target window (where the brown arrow is located) and opening it such that the beautiful blue star can appear. In your imagery the beep sound can be the crack when the window opens. Or you may visualize the white beam gathering all the screen together as if with a strong hand and pulling the blue star out of the target window. Allow this image to form for a while in your mind.

Now open your eyes and gaze at the display panel while remaining in a relaxed and focused state. Try to maintain the imagined energy beam. You can use your arm and hand to guide your concentration to the desired target window. Don't let other thoughts or images interrupt your imagery and when you feel it is the right moment for starting, press the space-bar on the keyboard to initiate the trial.

Instead of energy, you may want to imagine an electrical pulse, laser beam or force. Use any such devices to picture the beam or light emanating from your mind's eye getting the blue star from the desired target window.

Imagery emphasis: Put energy into the display panel and have it produce the beep sound and the blue star.

GO imagery instructions were as follows:

Follow this procedure etc ... (same as above):

Close your eyes etc ... (same as above).

Concentrate on the display screen. Form a clear mental image of the beep sound and the blue star. Now, imagine and "will" the window to light up into the desired beautiful blue star pattern - make the window light up. Imagine that you hear the beep sound that precedes a hit and try to see the blue star with the stripes behind it rolling over the screen when you will press the space-bar.

See the colorful image in your mind, be confident and don't let other thoughts or images interrupt your imagery of the beep sound and the blue star. When you feel it is the right moment for starting, press the space-bar on the keyboard to initiate the trial. You can use your finger to help to guide your concentration and imagery to the desired target window (where the brown arrow is located).

The blue star can be a symbol for something you want; use any

> mental devices to help you to form a clear mental image of the beautiful pattern. When you practice this exercise at home you may want to draw the blue star on a sheet of paper to help your imagery.
>
> Imagery emphasis: Hear the beep sound in your mind's ear and visualize the blue star.

EO imagery instructions went as follows:

> Follow this procedure etc ... (same as above):
>
> Close your eyes etc ... (same as above).
>
> Select a number between 11 and 19. This number is your visualization target; your final goal you want to achieve in the end of the session. It may be easiest to select a low number to start with and increase it gradually from session to session, or you may always want to visualize the same number throughout all the sessions.
>
> The first step is knowing exactly what you want and when. Visualize the number you choose; see it in your mind's eye on the screen after having finished doing the test, and imagine that you hear the tune that is played if you succeed. Make it clear that you want your scores to be at least this number by the end of the session. Command your subconscious positively to get it for you so that it will bring the desired number to you automatically. Let your subconscious go about it in its own way.
>
> Now, focus on the specific number that you have chosen. The number may stand for a date when you are going to get a new car or going on a holiday. If you reach your desired number in the feedback version and still have trials left, imagine that your next hit will be the day when you drive your car, the hit thereafter the day when you polish your new car etc. In short, use any such mental devices to help you to form a clear mental image of the desired number. You are going to enjoy life when you get it. Let yourself feel the excitement now, and focus that excitement on the number itself.
>
> Imagery emphasis: Visualize your number appearing on the screen after the test along with the words, "Well Done", and hear the tune that is played if you succeed. Feel the excitement.

Ss were allocated to the three visual-imagery conditions so that their average results from the visual-imagery scale (VVIQ) and their previous PK scores were roughly the same for all three conditions. Friends were put in the same group. This was easily done before experiment 4 started for individuals who had been in experiment 2. The 8 newly recruited Ss were balanced as well as possible under the circumstances into the three groups (PO mean PK score = 23.25 and mean VVIQ score = 38.75; GO mean PK score = 22.75 and mean VVIQ score = 41.00; EO mean PK score = 22.88 and mean VVIQ score = 36.38). The difference between PK scores of the three groups was insignificant on Kruskal-Wallis test: H (2,N=24) = .081 (p=.95, 2-T). The difference between VVIQ score of the three groups was insignificant on Kruskal-Wallis test: H (2,N=24) = .44 (p=.80, 2-T).

d) Finally, there was a general discussion. Each S was told that if he was not feeling well, in a bad mood or down, he should make another appointment for that particular session. Ss were not told about the two other procedures. If they asked, as little information as possible was given. They were told that such was the case but that we hoped, and had reason to believe, that all three strategies would succeed. (As it turned out only one subject asked if there were other strategies involved.)

Each S was asked to practise for about 10 minutes per day his particular imagery strategy at home between sessions, and he was given a diary-form sheet of paper to keep a record of these practice sessions (same one in appendix F). In the diaries, Ss wrote down the date when they practised their imagery strategy, and how long they practised. They also rated how successful they were with the strategy, i.e., how vividly they managed to generate the imagery strategy (according to a five point scale of vividness). With the diary Ss got three pages with some information about the experiment. All Ss were given the same information. This information included suggestions regarding how to deal with any negative thoughts that Ss might encounter (such as "I cannot influence the test") and how to do the home practice sessions. Ss were also told that if they had any questions or wanted further explanations they should feel free to phone E either at the laboratory or at home. Finally, E made an appointment for the first experimental session to take place within a few days.

One S dropped out in the interview. Another S dropped out immediately following it and before the six experimental sessions started. All other Ss completed the full study.

Experimental Procedure

For each S, six sessions were required, each with 80 trials on the computer test (two games) in the sound-attenuated room. After 40 trials a break was taken. A flip of a coin decided whether the first S who attended started with the feedback version or the nonfeedback version. The next S had the reverse order of that of the first S, starting with the nonfeedback version if the first S started with the feedback version, and so forth, continuing to alternate. When the first S attended next time he started doing the test in the reverse order of his prior session.

A flip of a coin decided for the first S whether the first half of both the feedback version and the nonfeedback version would be started with pseudo-RNG1 or pseudo-RNG2. The program automatically changed to the other version after 20 trials. The second session for that particular S had the reverse order to the first session. The second S had the same order of pseudo-RNGs as the first S. The third and fourth Ss had the reversed order to the first and second Ss (see table 5.1).

Session I: The first experimental session already followed some home practice. E started by asking S about the home practice. S was given advice and suggestions for improving the quality of his practice based on his reports of how the strategy had gone the past week. E suggested that before each session S should try to start rehearsing his imagery strategy on the way to the experimental room and try to be optimistic. Then E and S went to the sound-attenuated room where S was to do the computer test. E typed the relevant information about the session into the computer (S's name, whether the feedback or the nonfeedback version was to be played and whether S was to do the first 20 trials with pseudo-RNG1 or pseudo-RNG2, etc.), unless (as was usually done) E had already done so before S attended the session. After E had asked S about how many hits he aimed for at least, E typed that number in on the screen and pressed the return key. E reminded S to do his visual-imagery strategy and pressed the return key for the last time (this was the starting point of IT for the first trial), upon which the four boxes' test display came on the screen. E then left the sound-attenuated room immediately and closed the door.

After the test S was given the Image-PK questionnaire to answer at home and told to bring it back when attending the next session or at latest before session 4 started. A record was kept of in what session S brought back the Image-PK questionnaire. Most Ss brought it back right away in session 2, but a few in sessions 3 and 4. The following instructions were given verbally:

> The Image-PK is designed as a preliminary questionnaire to see if there is any connection between certain imagery and how people may progress in their PK training. The Image-PK is designed by us and is being used for the first time. It will hopefully tell us something about how PK operates. Therefore your answers on it may be important for future research. The questionnaire is to try to help us and you to understand better how and why you may progress.

<u>Session II:</u> At the start of this session E and S discussed the Image-PK and how the home practice sessions were going. E answered questions about the visual-imagery technique and suggested a few items

if he thought S might benefit from a few good ideas, such as to do the exercises in a quiet place but not on the bus, and so forth. After S finished the computer test he was given a relaxation exercise which was to be practised immediately before practising the imagery technique at home:

> Do the relaxation exercise for about 5 minutes and instead you can shorten the practice on the imagery strategy down to 5 minutes instead of 10 minutes. You can of course do the exercises for longer time. The more time you spend on the practice, the more likely it is that you may be able to use the imagery-strategy efficiently. If you know any other relaxation exercise that you may prefer, feel free to use it instead, or feel free to do our exercise in your own way.

Then S received the relaxation exercise on a sheet of paper to keep, and was told that it was only a reminder. E went through the exercise with S and suggested how to do it.

Session III: After discussion about how the home practice sessions were going and suggestions regarding some items, S did the PK computer test. Next, E introduced a short breath count concentration exercise that was to replace, or be added to (depending on whether S wanted to keep on practising the relaxation) the relaxation exercise immediately before practising the imagery strategy at home.

Session IV: After some discussion and the computer test, E introduced a visualization exercise to replace the concentration exercise before doing the imagery technique at home.

Session V: After some discussion and the computer test, E introduced a positive thinking exercise to replace the visualization exercise before practising the imagery technique at home. S could choose between the three positive thinking exercises. S took the Image-PK home to fill out for the second time.

Session VI: This session started with a discussion about the home practice sessions and the Image-PK followed by the computer test. Finally, on this occasion S did the inspection time test again. After completion of the inspection time test S received his personal results of his progress at the end of this session (including the results of this session) on two sheets of paper. If S had no further questions, the session ended with good words and a handshake.

All Ss were sent the main findings from the experiment by mail when data analysis was finished.

5.4 RESULTS

144 sessions were conducted amounting to 11,520 trials in total. I decided to measure all results using two-tailed tests since I wanted to be able to look at relationships that would turn out to be in an opposite direction to that predicted.

In order to look at the effect of possible visual-imagery PK training the 144 sessions comprising the study were examined for overall scoring by means of a t-test, comparing the sampling distribution of our sample to Student's t-distribution. T-test computations allow us to see to what extent performance under the given set of conditions can be generalized to a subject population. One can question the use of t-test instead of a nonparametric alternative in measuring PK scores. However, statisticians have examined what happens to the accuracy of, for example, the t-test, when the basic assumptions of normality and homogeneity of variance are systematically violated. These studies show that the results of the t-test are not seriously distorted even when quite marked departures from the basic assumptions are introduced (Miller, 1975, pp.67-68).

Houtkooper (personal communication, 1987) had some reservations regarding the seed selection of pseudo-RNG1 in the procedure I was using. He thought it might be possible that the same seed was selected more than once, and therefore a whole run of 20 trials could be the same for 2 Ss (or more). After reading through the datafiles I could not find any two (or more) that had the same seed output. It would have been a surprise, since selection of "fresh" seeds is based on hundredths of a second. In theory, as far as I can see, we have 100 different seeds for every 100 milliseconds.

Inspection of the cumulative outfile and subjects' separate single outfiles did not indicate any manipulation of the data, which seemed to be intact. Behind many of the following analyses is the assumption that the three visual-imagery groups can be treated as one group. This is probably subject to debate. My argument for doing so is that all three have a common component, i.e. imagery of success on the PK computer test. (The mean PK score for each training session in experiment 4 can be found in appendix G.)

Predicted Results

Hypothesis 1. The t-test yielded overall nonsignificant below chance results; t = -.22 (n.s.). The total score (total hits=2870, MCE=2880) was slightly below chance (see table 5.2 for details). This prediction was therefore not confirmed.

Hypothesis 2. The difference in PK scores between PO and GO in the feedback condition was nonsignificant according to the Mann-Whitney test: U = 994.000 (z=-1.16, p=.25, 2-T). Ss doing PO scored above chance and higher than Ss doing GO who scored below chance. This relationship turned out to be in the opposite direction to that predicted, see table 5.2. So with a different PK task, we get a straight disconfirmation, although a nonsignificant one, of results from prior studies (Levi, 1979; Morris et al., 1982).

Hypothesis 3. The difference in PK scores between EO and PO in the feedback condition was nonsignificant according to the Mann-Whitney test: U = 928.000 (z=-1.64, p=.10, 2-T). Ss doing PO scored higher than Ss doing EO, which is the opposite direction to that predicted, see table 5.2.

Hypothesis 4. (a) In the nonfeedback version the difference in PK scores between PO and GO was nonsignificant according to the Mann-Whitney test: U = 968.000 (z=-1.35, p=.17, 2-T). Ss doing PO scored higher than Ss doing GO. This was in the direction predicted, see table 5.2. (b) The difference in nonfeedback PK scores between PO and EO was nonsignificant according to the Mann-Whitney test: U = 1061.000 (z=-.67, p=.51, 2-T). Ss doing PO scored lower than Ss doing EO which is the opposite direction to that predicted, see table 5.2.

Hypothesis 5. PO was the only strategy that showed a slight increase in PK scores. For PO the difference between scores on sessions 1-3 (hits=489, MCE=480) and sessions 4-6 (hits=492, MCE=480) was nonsignificant according to the Wilcoxon test: T (N=8) = 15.500 (z=.35, p=.72, 2-T).

For GO the difference between scores on sessions 1-3 (hits=479, MCE=480) and sessions 4-6 (hits=449, MCE=480) was nonsignificant according to the Wilcoxon test: T (N=8) = 10.000 (z=1.12, p=.26, 2-T).

For EO the difference between scores on sessions 1-3 (hits=490, MCE=480) and sessions 4-6 (hits=471, MCE=480) was nonsignificant according to the Wilcoxon test: T (N=8) = 13.000 (z=.70, p=.49, 2-T).

Hypothesis 6. For the following analyses, IT for the first trial was used in the computations. This is probably a debatable decision. It was based on the following observation: When looking at the raw data I noticed that Ss tended to spend most of their time before the first trial as if they were rehearsing their strategy. (a) Ss doing GO spent a slightly longer time on their strategy than Ss doing PO. The difference was not significant according to the Mann-Whitney test: U = 1044.000 (z=-.79, p=.43, 2-T). The total IT in seconds for PO was 929.33, and for GO, 936.59 (and for EO, 843.44). This is a nonsignificant and opposite relationship to that predicted. (For informal comparison, average IT for the first trial in PO=46.77 sec.; GO=66.10 sec.; EO=25.26 sec.) (b) The average time between trials in session 1 was 9.61 sec. and in session 6 it was 11.28 sec. The difference was nonsignificant on the Wilcoxon test: T (N=24) = 114.000 (z=1.03, p=.30, 2-T). This was the opposite direction to that predicted.

Hypothesis 7. The following analysis was done without IT in the first trial to make it comparable to pilot experiment 2. IT was significantly lower in the feedback version (mean IT = 10.09 sec.) than in the nonfeedback version (mean IT = 10.70 sec.) according to the Wilcoxon test: T (N=144) = 3626.000 (z=3.18, p=.002, 2-T). Hence, this prediction was not confirmed, and the relationship turned out to be in a significant opposite direction to that predicted.

Hypothesis 8. The following analysis was done without IT in the first trial to make it identical to experiment 2. When using pseudo-RNG1, hits correlated negatively but nonsignificantly with higher IT in the feedback version; Spearman R(143) = -.12 (z=1.39, p=.16, 2-T). This relationship turned out to be in the opposite direction to that predicted. In the nonfeedback version the correlation between hits and IT was at chance; Spearman R(143) = -.06 (z=.70, p=.49, 2-T). When using pseudo-RNG2, the correlation between hits and IT was at chance for both the feedback and the nonfeedback version; Spearman

R(143) = .04 (z=.42, p=.67, 2-T) and Spearman R(143) = -.02 (z=.22, p=.81, 2-T), respectively.

General Post-hoc Analysis

3-way ANOVA. I thought it might be informative to do a multiway ANOVA. I used a statistical package called STATS-2 (release 2.1, copyright StatSoft 1985) for that purpose. It is unclear in the STATS-2 manual whether the ANOVA option (i) assumes that different Ss are used for each of the conditions within each independent variable, or (ii) if it assumes independent groups for the conditions of the first independent variable but same (or matched) Ss to be used in the experimental conditions for the remaining independent variables (which was what I wanted). Bearing in mind that I might be violating some assumptions of the ANOVA test I was using, I still decided to go ahead with it in order to investigate where any possible interactions might lie. (Also, by using ANOVA I was assuming that my data fulfilled the three parametric assumptions discussed in section 4.2 which it did not.)

I did three-way ANOVA in order to explore possible interactions between strategy assignment (PO, GO and EO) x feedback condition (feedback vs. nonfeedback) x pseudo-RNG employed (pseudo-RNG1 and pseudo-RNG2), PK hits being the dependent variable. This analysis indicated no main effects for strategy, feedback or pseudo-RNG. The only suggestive main effect was for pseudo-RNG; F(1,564) = 2.60 (p=.10), indicating a nonsignificant difference among the two types of pseudo-RNGs. The three way (3x2x2) interaction was not significant; F(2,564) = 0.16 (p=.85), and none of the two-way interactions were significant at the .05 level. The only suggestive two-way interaction was between strategy assignment and feedback conditions; F(2,564) = 2.29 (p=.10). On closer inspection, this was mainly due to differences in means of EO feedback PK score and GO nonfeedback PK score, both below chance, and EO nonfeedback PK score that were above chance (see analyses of these conditions with nonparametric tests below).

Difference between strategies. The difference between overall PK scores in PO and GO was nearly significant, Mann-Whitney test: U = 887.500 (z=-1.94, p=.052, 2-T). Unexpectedly, Ss scored above chance in PO but below chance in GO, see table 5.2.

I had anticipated that GO and EO would behave similarly. PK scores in GO were however significantly lower than EO in the nonfeedback version, Mann-Whitney test: U = 862.000 (z=-2.13, p=.03, 2-T), see table 5.2.

PK scores in feedback and nonfeedback conditions did not differ significantly within PO and GO, but a significant difference was found between PK scores in the two conditions for the new condition, EO, according to Wilcoxon test: T (N=48) = 375.000 (z=2.185, p=.027, 2-T).

Pseudo-RNG1 and pseudo-RNG2. The assumption behind the following analysis was that if PK operates better on one version of the pseudo-RNG, it should do so equally for all three visual-imagery groups. Ss scored higher but nonsignificantly above chance with pseudo-RNG1 (hits = 1472, MCE=1440) than with pseudo-RNG2 where they scored nonsignificantly below chance (hits = 1398, MCE = 1440), see table 5.3. The difference between PK scores on the two pseudo-RNGs was not significant, Wilcoxon test: T (N=144) = 4453.000 (z=1.53, p=.12, 2-T). On a closer inspection, the slight difference between PK scores using the two pseudo-RNGs was mainly due to the difference in scores in the feedback version being significant, Wilcoxon test: T (N=144) = 4205.500 (z=2.023, p=.04, 2-T).

Hits aimed for and home practice. Hits aimed for did not correlate with obtained hits, for nonfeedback; Spearman R(138) = .08 (z=.91, p=.37, 2-T), and for feedback; Spearman R(138) = -.08 (z=.97, p=.33, 2-T). One anecdotal observation can be mentioned on this point. Apparently what determined how high S decided to go was how he felt when E asked about the minimum number of hits he wanted to aim for (S would say for instance, "I'm feeling pretty good now, why don't I go for ...").

Those who did the home practice did not achieve significantly higher scores than those who did not practice at home, Mann-Whitney test: U = 61.5 (z=-.36, p=.72, 2-T). 15 Ss practiced at home (mean PK score = 120.13), while 9 did not (mean PK score = 118.56).

Order effect. Did inter-subject variables play a role, such as Ss preferring one version of the computer test but not the other? The difference between the feedback PK score (for all sessions) of those who got the feedback version first (mean feedback PK score = 9.65) and those who got the nonfeedback version first (mean feedback PK score = 10.06) was not significant, Mann-Whitney test: U = 2398.000 (z=-.78, p=.44, 2-T). The difference between nonfeedback PK scores of those who got the feedback version first (mean nonfeedback PK score = 9.82) and those who got the nonfeedback version first (mean nonfeedback PK score = 10.33) was not significant, Mann-Whitney test: U = 2333.500 (z=-1.03, p=.30, 2-T).

Interval Time. Does IT remain consistent throughout the six sessions? I looked at IT in the first session (mean feedback IT = 7.66 sec.; mean nonfeedback IT = 10.19 sec.) and IT in the last session (mean feedback IT = 10.73 sec.; mean nonfeedback IT = 9.75 sec.). Correlation between first session IT and last session IT in the feedback version yielded; Spearman R(23) = .30 (z=1.45, p=.14, 2-T). Correlation between first session IT and last session IT in the nonfeedback version yielded;

Spearman R(23) = .50 (z=2.41, p=.02, 2-T). The six feedback and nonfeedback sessions did not differ significantly from each other according to a Kruskal-Wallis test (see details in table 5.4), and there is no obvious pattern to be found from run to run.

Questionnaires. (a) The VVIQ. To the best of my knowledge, there is no single way of dividing Ss into good and bad imagers (this was confirmed later in a personal communication with Marks, 1989). In the research literature on questionnaire measures of imagery some experimenters have chosen a certain number of the lowest and highest scorers to form two groups, high and low visualizers (e.g. Marks, 1973; McKelvie & Demers, 1979; McKelvie & Rohrberg, 1978). Others have divided Ss into high and low visualizers via measures of central tendency, such as a median split (e.g. Gur & Hilgard, 1975; Honorton, Tierney & Torres, 1974; Schechter, Solfvin & McCollum, 1975) or a mean split (e.g. Sargent, 1978). As my sample was somewhat small I chose the latter method and decided to use the median. Median is the most stable of the three measures of central tendency in that it will fall between the mean and mode when a distribution departs from perfect symmetry (Kohout, 1974, p.22). Imagery researchers have often looked at males and females separately. Sheehan, Ashton and White (1983, pp.202-203) in a recent assessment of imagery scales wrote that the data "strongly supports the position that sex differences in self-reported imagery are nonsignificant." I chose not to divide Ss into males and females. I split Ss' VVIQ score via the median of 39 into good and bad imagers. There was not a significant difference between total PK scores (for sessions 1-6 combined) of the 12 good imagers (mean PK score = 118.50) and the 12 bad imagers (mean PK score = 120.58), Mann-Whitney test: U = 54.500 (z=-1.01, p=.31, 2-T). In fact, bad imagers did slightly better than good imagers.

It is probably arguable whether or not it is legitimate to split Ss into high and low scorers on the GGPQ. My original assumption was that the GGPQ might be measuring a general, underlying attitude towards PK, while it is true that empirically I do not know if that assumption is valid. To the best of my knowledge nobody has published a multi-question forced-choice questionnaire in an attempt to get at an overall attitude germane to PK and due to lack of time, factor analysis has not yet been conducted on the GGPQ. Bearing in mind what has been said, I was curious to know if a general attitude towards PK as measured by the GGPQ could predict how Ss performed in PK "training." I split Ss' GGPQ scores via the median of 26 into high scorers and low scorers. (Four Ss who had an exact median of 26 were excluded). The 11 high scorers on the GGPQ tended to score higher, and above chance (mean PK score = 121.73), than the 9 low scorers who scored below chance (mean PK score = 118.67). The difference was not significant, Mann-Whitney test: U = 40.00 (z=-.72, p=.48, 2-T).

Post-hoc Linear Relationships

To examine possible linear developments across sessions and look for indications of improvement of scores, I employed the Spearman Rank Order correlation coefficient to correlate the PK score with session number.

Overall PK score. Overall PK score correlated nonsignificantly and negatively with session number; Spearman R(143) = -.12 (z=1.42, p=.15, 2-T), see Fig. 5.1.

The strategies. PO showed a slight nonsignificant incline in PK scores across sessions in both feedback and nonfeedback versions; Spearman R(47) = .05 (z=.32, p=.74, 2-T) and Spearman R(47) = .02

(z=.15, p=.85, 2-T), respectively. Combined PK scores for both versions in PO yielded; Spearman R(47) = .05 (z=.35, p=.73, 2-T), see Figs. 5.2 and 5.3.

GO showed a slight decline in PK scores across sessions in both feedback and nonfeedback versions; Spearman R(47) = -.06 (z=.39, p=.70, 2-T) and Spearman R(47) = -.03 (z=.19, p=.83, 2-T), respectively. Combined feedback and nonfeedback conditions yielded; Spearman R(47) = -.15 (z=1.01, p=.32, 2-T), see Figs. 5.2 and 5.4.

EO showed a decline in PK scores across sessions in both feedback and nonfeedback versions; Spearman R(47) = -.17 (z=1.15, p=.25, 2-T) and Spearman R(47) = -.12 (z=.79, p=.43, 2-T), respectively. This was not significant for feedback and nonfeedback conditions combined; Spearman R(47) = -.24 (z=1.65, p=.094, 2-T), see Figs. 5.2 and 5.5.

Pseudo-RNG1 and pseudo-RNG2. When breaking PK score down between pseudo-RNG1 and pseudo-RNG2, both correlated negatively but nonsignificantly with session number. Pseudo-RNG1; Spearman R(143) = -12 (z=1.40, p=.16, 2-T). Pseudo-RNG2; Spearman R(143) = -.03 (z=.41, p=.69, 2-T).

Post-hoc Analysis of the Inspection Time Test

I decided to use parametric statistical tests for analysis of the inspection time test measurements. The reasons were that inspection time measurements are on the interval level, and they show a close connection with IQ, which is known to approximate the normal curve in distribution. Three persons asked if they could skip the inspection time test. Scores on the inspection time test for the other 21 Ss did not go significantly down from first to second occasion (from mean duration = 20.95 ms. down to mean duration = 18.62 ms.) on t-test for correlated samples; t(20) =

.54 (p=.60, 2-T). No significant correlations (or suggestive trends) were obtained between inspection time (duration measured before the six sessions started) and scores on the self-report measurements, PK scores and IT measurements.

PO increased nonsignificantly (p=.21, 2-T), EO decreased nonsignificantly (p=.58, 2-T), and GO decreased significantly (p=.025, 2-T) in inspection time between first and last measurement (see for details table 5.5).

Test-retest reliability estimate of the inspection time test was obtained using the Pearson correlation method. The obtained retest reliability was; r(19) = .21 (t=.94, p=.36, 2-T), which seems rather low.

Those who increased in inspection time (slowed down or got worse) showed some decline effect in their PK scores, but scored above chance (n=5), see Fig. 5.6. Those who decreased in inspection time (speeded up or got better) showed some incline in their PK score, but scored below chance (n=7). The difference between PK scores of those who showed an increase and decrease in inspection time was significant, Mann-Whitney test: U = 5.00 (z=-2.03, p=.04, 2-T).

Predicting Increase in PK Scores

Is there any group of Ss that is more likely to increase in PK score? In other words, is it possible to predict which Ss will do better in visual-imagery training? For the following analyses, as a rough index of S's tendency to increase or decrease in PK scores across sessions, I obtained the difference in total PK scores between the first half (sessions 1-3) and the second half of the experiment (sessions 4-6). This is a different way of evaluating increase / decrease over time to that of correlation. The benefits are that while correlation assumes a linear development, the comparison between first and second half of the experiment makes no assumptions about the shape of the curve. It only looks at whether Ss do better in the second half compared to the first half.

A simple way of evaluating whether a certain scale can predict PK performance is to split Ss into high and low scorers (either via central tendency or by using extreme groups) and look at each group in turn to see if they increase or decrease significantly in PK score between the two halves of the experiment. This was done for the sheep-goat scale, the VVIQ and the GGPQ. Another method occurred to me later on, and that was to obtain the PK score difference between the two halves of the experiment (thus getting a range of PK score differences from low "-" to high "+" depending on whether Ss decrease or increase between the two halves respectively). This difference could then be correlated with a scale score. I tried out this method on the Image-PK.

Sheep-goat scale. The three goats in the study obtained a mean PK score of 62.33 in sessions 1-3 combined and a mean PK score of 56.67 in sessions 4-6 combined. The decline was not significant, Wilcoxon test: T (N=3) = .000 (z=1.60, p=.10, 2-T). The 21 sheep in the study obtained a mean PK score of 60.00 in sessions 1-3 combined and a mean PK score of 59.14 in sessions 4-6 combined. The decline was not significant, Wilcoxon test: T (N=21) = 97.000 (z=.64, p=.53, 2-T). I wanted to evaluate this difference in PK scores from first to second half of the training sessions between sheep (low decrease) and goats (great decrease). One way of doing it is to run a Mann-Whitney test on the PK score decrease between the two halves with sheep and the PK score decrease between the two halves with goats. This analysis yielded a nonsignificant difference between sheep and goats, Mann-Whitney test: U

= 23.000 (z=-.74, p=.46, 2-T).

The three goats obtained a mean PK score of 119.00 and scored nonsignificantly below chance. For informal comparison, the three highest scoring sheep (obtaining 6 on the scale) remained above chance in 5 of the 6 sessions and got a nonsignificant mean PK score of 125.00 (where MCE was 120 hits).

Males vs. females. Males obtained a mean PK score of 64.27 in sessions 1-3 combined and a mean PK score of 59.27 in sessions 4-6 combined. The decline in PK scores between the first and second half of their sessions was close to significance, Wilcoxon test: T (N=11) = 11.500 (z=1.912, p=.053, 2-T). Females obtained a mean PK score of 57.77 in sessions 1-3 combined and a mean PK score of 58.46 in sessions 4-6 combined. The incline was not significant, Wilcoxon test: T (N=13) = 42.000 (z=.25, p=.79, 2-T).

VVIQ. The 12 good imagers dropped from a mean PK score of 60.42 to 58.08, while the 12 bad imagers dropped from a mean PK score of 61.08 to 59.58.

GGPQ. The 11 high scorers dropped from a mean PK score of 61.55 to 60.18, while the 9 low scorers dropped from a mean PK score of 60.44 to 58.22.

Image-PK. A forced-choice scoring sheet (giving 5 possible ratings to each question on the Image-PK) was made to score the free-response answers on the Image-PK questionnaire. Two judges independently scored the Image-PK, the author and Eric Darley (E.D.), a research assistant. Three subjects did not answer their Image-PK, thus the following analysis is based on data from 21 Ss. The expected direction for this relationship was that higher scores on the Image-PK would correlate positively with an increase in total PK scores (obtained by subtracting PK scores on the second half of the experiment from scores on the first half). The ratings of the author and E.D. of the Image-PK (that was completed and returned before session 4 took place) correlated nonsignificantly with the total PK score increase; Spearman R(20) = .17 (z=.75, p=.46, 2-T) and Spearman R(20) = .34 (z=1.54, p=.12, 2-T), respectively. For both judges this relationship was thus in the expected direction. The inter-rater reliability of the two judges was satisfactory; Spearman R(20) = .75 (z=3.36, p=.001, 2-T). This is perhaps not surprising, since E.D. spent two days reading about how to evaluate and score Ss' responses to the Image-CA (Achterberg & Lawlis, 1984), and the author spent considerably more time pondering over the Image-CA manual.

Post-hoc Analysis of Screening Session for Recruited Ss

I analyzed the screening sessions for the additional 20 Ss used to recruit the last 8 Ss. These 20 Ss were run through an exact replica of pilot study 2 (employing the pseudo-RNG1-based PK computer test). The 20 recruited Ss scored slightly above chance in both the feedback (hits=202, MCE=200) and the nonfeedback (hits=210, MCE=200) conditions, z=.16 (n.s.) and z=.82 (n.s.), respectively, together yielding z=.69 (n.s.). These 20 screening sessions were analyzed for trends suggested by the three pilot experiments. They are reported here for the record, but will not be discussed until in chapter 7, where all the screening sessions are lined up and discussed together:

(a) The sheep-goat scale correlation with the total PK scores was at chance; Spearman R(19) = .01 (z=.06, p=.91, 2-T). (b) Although in the expected direction, the VVIQ correlated nonsignificantly with feedback PK scores; Spearman R(19) = -.21 (z=.93, p=.36, 2-T). (c) The I-E scale correlated nonsignificantly with total PK scores; Spearman R(19) = .35

(z=1.53, p=.12, 2-T). (d) VVIQ correlated nonsignificantly with VAIQ; Spearman R(19) = .22 (z=.98, p=.33, 2-T). (e) Question 15 on the GGPQ correlated positively, but nonsignificantly with total PK scores; Spearman R(19) = .32 (z=1.40, p=.16, 2-T). (f) Average IT between trials in the feedback version was 4.85 sec. Average IT between trials in the nonfeedback version was 4.90 sec. The IT correlation with feedback and nonfeedback PK score was at chance; Spearman R(19) = -.05 (z=.23, p=.81, 2-T) and Spearman R(19) = .06 (z=.26, p=.78, 2-T), respectively. (g) The difference between feedback PK scores of those who got the feedback version first (mean feedback PK score = 10.50) and those who got the nonfeedback version first (mean feedback PK score = 9.70) was not significant, Mann-Whitney test: U = 50.000 (z=0.00). (The reason why z=0.00 is probably that the two populations have the same central tendency, e.g. identical medians, in which case the Wald-Wolfowitz test might be relevant. The Wald-Wolfowitz test yielded a nonsignificant difference, z=.46, p=.65, between feedback PK scores of those who got the feedback version first and those who got the nonfeedback version first.) The difference between nonfeedback PK scores of those who got the feedback version first (mean nonfeedback PK score = 10.40) and those who got the nonfeedback version first (mean nonfeedback PK score = 10.60) was not significant, Mann-Whitney test: U = 47.000 (z=-.23, p=.81, 2-T).

5.5 DISCUSSION

None of the predictions were significantly confirmed. Ss practising PO did not do significantly better than Ss using GO and EO in the nonfeedback version of the PK computer test. Ss practising GO and EO did not do significantly better than Ss using PO in the feedback condition.

The eliciting of overall significant above chance PK score was anticipated in experiment 4 by the use of visual-imagery strategies, but was not achieved. This study provides no direct support for any of the three imagery strategies as a method of increasing PK scores in psi experimentation with a pseudo-RNG.

The results do not support Nanko (1981), Morris et al. (1982) and Levi's (1979) findings regarding effectiveness of goal oriented imagery in producing extrachance PK scores. Ss practising PO (who scored above chance) tended to do slightly better on the PK task than Ss using GO (who scored below chance). With Levi and Morris et al. the opposite was the case. We should note, however, that experiment 4 was not an exact replication of prior studies. The displays and feedback were quite different. Our subject population included goats, while in the Morris et al. study Ss were students and sheep (Morris, personal communication, 1988). Study 4 employed two pseudo-RNGs (pseudo-RNG1 and pseudo-RNG2) that produced one decision per trial, whereas the Morris et al. experiment used a live RNG producing 16 trials at regular intervals, following Ss' initiation of the run. Study 4 was a conceptual replication in the sense that the imagery strategies (PO and GO) were tested, but not the exact procedure. It was designed such that if the results agreed with prior findings it would also extend the generality of the strategies. As it turned out, the findings of our study were not in agreement.

A few post-hoc analyses yielded statistically significant results. These results should, however, be considered in the context of the large number of analyses carried out, which by chance would be expected to give rise to a few spurious significant findings.

Is There Any Evidence of Psi?

There is no unambiguous indication of PK in the data. There are a few indirect hints that PK may perhaps have been operating.

Differences between conditions. (a) The significant difference between nonfeedback PK scores in GO and EO (p=.03, 2-T) suggests that two different processes may perhaps have been operating. It was a surprise to find this difference between GO and EO, and we will have to await further research to verify the difference, if any. (b) Although EO demonstrated overall chance results, this was due to Ss scoring above chance in the nonfeedback version and below chance in the feedback version. The difference between the two conditions was significant (p=.027, 2-T), which suggests that possibly some real effect had been demonstrated. (c) Those who increased (slowed down) in inspection time from one occasion to the other scored above chance overall, while those who decreased (speeded up) scored below chance overall. The difference was significant (p=.04, 2-T). I prefer to postpone any discussion on this curious post-hoc finding until it has been replicated. (d) There was a marginally significant difference (p=.052, 2-T) between overall PK score in PO and GO. This goes against prior research, but if significantly replicated, may suggest different effects of the two visual-imagery strategies.

(e) Ss scored significantly higher in the feedback version with pseudo-RNG1 (above chance) than with pseudo-RNG2 (below chance) (p=.04, 2-T). Although we should probably await further experimental verification before attempting to offer an explanation of this difference, I am tempted to suggest the following speculation. Let us look at which of the two models described in section 3.6, Schmidt's (1982) quantum collapse model and the IDS model of May et al. (1985), fits the data better. The quantum collapse model would say that S via his PK would influence the results at the moment of observation. In this case we would expect PK scores from both pseudo-RNGs to be similar (since S is the first observer of both pseudo-random sequences). This is not the case. The IDS model would say that precognition is responsible for the results. In this case the pseudo-RNG1 score would be the result of E's "button presses" and precognition (since E initiated the computer test and thus the pseudo-RNG1 sequence), and the pseudo-RNG2 score the result of S's "button presses" and precognition. Furthermore, if IDS is the responsible mechanism we might expect a discrepancy between consistency in pseudo-RNG1 scores found across both feedback and nonfeedback conditions, in comparison with consistency in pseudo-RNG2 scores found across both conditions. According to table 5.3 there is such a discrepancy. Pseudo-RNG1 scores for both conditions were above chance and pseudo-RNG2 scores for both conditions were below chance.

A special subject. A sample of 24 Ss with 8 practicing each strategy may prove problematic. It has often been warned against drawing inferences from statistical analysis based upon a small sample without first examining the raw data on which the analysis is based. This warning is given because with a very small sample the computed correlation can be very misleading as to the nature of the relationship within the population. In our data pool there seems to be one individual, case 26, who may have skewed the profile of PO. He was, in fact, the highest scoring individual in the whole experiment 4. In the feedback version, case 26 scored consistently above chance from session to session and obtained a highly significant extrachance PK score (obtained hits = 81, MCE=60, z=3.13, p=.0017, 2-T). He was, however, practicing a strategy that had been shown in the past to do better without feedback (Levi, 1979). This suggested that case 26 might perhaps have some "natural" PK talent - if such a talent exists. When case 26 is removed from the data pool, PO demonstrates the same slope as Levi found: Ss score higher and above chance in the nonfeedback version, and lower, and below chance in the feedback version, see Fig. 5.7. After this post-hoc manipulation of the data, some consistency with prior findings is suggested although it is not significant.

Case 26 can be considered as having possibly, but not definitely, demonstrated PK. Case 26 only suggests a PK effect because of the following reason. In examining for individual above deviations from chance, 72 z-tests were conducted (24 tests for the feedback version, 24 tests for the nonfeedback version and 24 tests for both versions combined). We can look at the probabilities that the conclusions drawn from this analysis is a Type I Error (e.g. Schechter, 1984; Spiegel, 1961). Using alpha at the conventional .05 level, we have to set individual analysis at .05/72 = .0007. Case 26 obtained z-score of 3.13, p=.0017, 2-T (or, p=.00087, 1-T). He would not have passed this sort of correction for multiple analysis.

Decline effect. The decline effect which, although not significant, seems to be consistent in most of the analyses of linear relationships can be considered as another indirect indication of psi. If we compare the initial PK scores obtained by the 24 Ss in the pretest session in experiment 2 to the PK scores obtained by the same Ss in the last session in experiment 4, the difference becomes highly significant, Wilcoxon test: T (N=24) = 47.000 (z=2.94, p=.0036, 2-T). This shows a highly significant decline effect. The slope of a curve which shows steady performance (and not significantly above or below chance) is what one would expect under the assumption of no PK. Decline effects have been repeatedly noted in the PK research literature.

Other Implications in the Data

Ss were not able to estimate or guess how many hits they would obtain. This is in line with Levi's (1979) observation, in that his Ss' trial-by-trial predictions of their own scoring did not correspond with their actual scoring. Watkins, Watkins and Wells (1973) also found that an attitude towards success in a PK experiment was significantly negatively related to actual performance in the experiment.

The average time that Ss spent between trials on the computer task remained constant from session to session according to table 5.4. Furthermore, in the nonfeedback condition, those who had a long IT in the first session also had a long IT in the last session, whereas those who had a short IT in the first session continued to have a short IT in the last session. This confirms the finding from pilot experiment 3 where such consistency was observed also in the nonfeedback version.

The test-retest reliability estimate for the inspection time test seems to be low for an interval of only 5-6 weeks ($r=.21$, $p=.36$). This may be due to some Ss (in PO) increasing in inspection time from one occasion to the other, while others (in GO and EO) decreased. I tested this and the test-retest reliability estimate for the inspection time test without the PO condition was; $r(12) = .52$ ($t=2.12$, $p=.053$, 2-T). This is much higher (than $r=.21$), although still not very impressive, and only marginally significant two-tailed.

The maximum "training" period for each individual turned out to be about 6-7 weeks. Usually, Ss preferred to do about one session per week. There were no drop-outs. The procedure of selecting Ss for experiment 4 gave them three occasions on which they had the opportunity to drop out of the experiment. They could say no immediately after the pretest procedure, or when E phoned them for experiment 4, and finally in the interview session. The reason why eight Ss did not want to continue to experiment 4, may have been due to the time lapse (approximately 5 months) between the two experiments. Of those recruited later on, closer to the time of the actual experiment, none said no when asked if they wanted to proceed to experiment 4. This was kept in mind for the next experiment.

In pilot experiment 2, the PK score means of those who got the feedback first (in both feedback and nonfeedback versions) were nonsignificantly higher than the PK score means of those who received the nonfeedback first. In the present study the reverse was found, again to a nonsignificant degree. Furthermore, analysis of the screening sessions of the 20 recruited Ss did not confirm the trend suggested by experiment 2. This indicates that the nonsignificant trend found in experiment 2 was chance and that it does not matter which version of the computer test comes first.

So far there is no indication that increasing time (possibly suggesting more willing and wishing) results in a higher PK score. A slight tendency has been observed that decreasing IT correlates with higher nonfeedback PK scores. These correlations have, however, been virtually at chance.

It may be worth looking closer at PO since it was the only strategy that showed a slight incline in PK scores across sessions. The graph of PO in Fig. 5.2 suggests a curvilinear connection between PK scores and session number. Tart (1975a) in his feedback training used linear regression to evaluate the effect of training. He was criticized by Stanford (1977a) for not having done trend analysis on the data, because one does not know if the curve for learning ESP is linear or not - if such learning exists. In trend analysis the idea of regression equations is extended to situations where a relationship (between two variables) is not best described by a linear rule. I did trend analysis for a second-degree or quadratic regression for PO (as outlined in Hays, 1963, pp. 555-558). The F-test for quadratic trend did not reach the .05 alpha level (see details in table 5.6).

Other trends in the data. There are four nonsignificant trends that are worth looking for in future experiments: High scorers on the GGPQ scored above chance while low scorers scored below chance. The three "super-sheep" (those who obtained 6 on the sheep-goat scale) scored above chance whereas the three goats scored below chance. Sheep declined less in PK score than goats. Females had a tendency to incline in PK score whereas males declined. A possible reason why these trends did not reach significance may be that for most of the subjects many months had passed between filling out the scalar instruments and doing the training study. A second reason may simply be that the size of the sample was not large enough.

The z-score distribution of total PK scores (feedback and nonfeedback PK score combined) of the 144 sessions from experiment 4 is slightly positively skewed. 65 sessions are above chance (45.14%), 57 sessions are below chance (39.58%) and 22 sessions (15.28%) are exactly at chance. Although overall results turned out to be slightly below chance, to some extent this may be due to a bulge at the lower end consisting of three sessions that were significantly below chance at $p < .025$ (2-T), compared to one significant session at the same p level above chance.

Reasons for Overall Chance Score

One can only speculate why overall scoring did not yield any firm evidence for PK. The following reasons/criticism may be suggested: (i) The RNG was not appropriate to the task. Although other studies with similar pseudo-RNGs have obtained significant results, prior visual-imagery strategy experiments employed a live source of randomness and we should have done the same. (ii) The strategies simply do not work as a training method in this type of experiment. (iii) Psychological factors due to too many sessions are to blame. Ss feel more pressure as sessions go on, or they simply get bored with practising the same strategy over and over, or the prospect of having to do six sessions somehow puts the Ss off. (iv) The number of Ss was too small. A group size of 144 sessions is probably sufficient when looking at some effects in the data. When the data is broken down to analyze the interplay of various effects, a larger sample of subjects may have been required to allow the effects to reach significance. Because of constraints upon the author's time and resources it was not possible to conduct a larger study. Future experiments could be designed with a sufficient number of trials for the effects, if real, to manifest.

Cognitive Effort

Levi (1979) proposed that the interaction between imagery and feedback could be understood in terms of the degree of cognitive effort required for the visualization task. When cognitive effort is high, scoring tends to be low. When cognitive effort required is low, scoring tends to be high. In both the goal- and process oriented groups, the feedback and nonfeedback conditions required different degrees of cognitive effort. Levi suggested that in the GO group the cognitive effort required of Ss was greater in the nonfeedback condition than in the feedback condition. Since the form of the feedback was congruent with the imagery in the feedback version, there was little competition or interference between environmental and internally generated stimuli. In PO, seeing numbers on the digital display may have interfered with visualization, since the form of the feedback was not congruent with the imagery. In contrast, the absence of feedback may have enabled subjects to visualize the internal workings of the machine more clearly.

I was careful to design both PO and GO in the present study to be as close as possible to the original descriptions of the two strategies reported in Levi (1979) and Morris et al. (1982). As far as I can see, the situation where numbers on a digital display are considered to be feedback of performance can be generalized to the present situation where blue stars on a computer screen are considered feedback of performance. IT may provide us with an objective measure of how to test some parts of the cognitive effort idea (see section 2.6), assuming that it can be generalized to the present situation. Let us sharpen the concept of cognitive effort a bit. According to Levi, cognitive effort refers to conflicts or interference resulting when "external" stimuli (feedback) and "internally generated" stimuli (e.g. imagery of the blue star or visualization of an energy beam) are not in congruence. Thus the independent variable is the interplay of feedback and imagery. The dependent variable, the consequence, is cognitive effort. The consequences of less congruence between feedback and imagery is, according to Levi, more conflict or interference, that is, higher cognitive effort.

Firstly, I assumed that the consequence, i.e. cognitive effort, is measurable, and will show, for example, on the IT measurements. Secondly, just like we would expect "more" thinking to take a longer time than "less" thinking, on the face of it I thought it reasonable to expect "more" conflict / interference to take a longer time than "less" conflict / interference. Hence I predicted:

> Feedback (or no-feedback) that is not congruent with visualization will result in more cognitive effort (measured as more time). Feedback (or no-feedback) that is congruent with visualization will result in less cognitive effort (measured as less time).

If the preceding reasoning is correct it should take Ss practising PO more time to do the feedback version (where cognitive effort is high) than the nonfeedback version (where cognitive effort is low). It should take Ss practising GO more time to do the nonfeedback version (where cognitive effort is high) than the feedback version (where cognitive effort is low). In table 5.7 we see that the reverse is the case for both PO and GO, and that EO displays a pattern similar to that of PO. PO and EO took more time in the nonfeedback condition than in the feedback condition, PO to a significant degree and EO almost significantly. GO took a significantly longer time in the feedback condition than in the nonfeedback condition. Two conclusions can be drawn: (a) Something is obviously going on. Feedback and nonfeedback versions of the PK computer test have different effects upon the three visual-imagery strategies. (b) Our data do not support the cognitive effort hypothesis as detailed above. At this stage, it is probably too early to suggest a revision of the cognitive effort idea or to offer an alternative explanation. We must wait and see if the time difference between feedback and nonfeedback conditions in the three groups is real by further experimentation.

On Practising the Strategies

Many Ss reported being busy people, and could not find time to do the home practice. The data did not show a significant difference between those who reported practising at home compared to those who did not. Also, both those who practised at home and those who did not practise declined in PK score; Spearman R(89) = -.11 (z=1.08, p=.28, 2-T) and Spearman R(53) = -.14 (z=1.04, p=.30, 2-T). Can we conclude that it does not seem to matter whether we select Ss who have got time and interest to practise at home. This would probably be true if those who did not practise had shown good scores. Basically we still do not know whom to select for training (or, for that matter, whether to incorporate training that does not require home practice, or make the practice more attractive to do).

Does imagery get better with more practice at home? In the present study we answered this question by looking at the diaries which Ss filled in at home. Ss differed in the number of home practice sessions; some practised nearly once every day, whilst others did so perhaps twice a week. A novel method was designed by the author and E.D. to evaluate if vividness of the visual-imagery strategies got better with practice at home (for details of the procedure, see appendix E). We wanted to make all Ss identical with respect to number of home practice sessions and make sure that we were comparing relatively early to relatively late home practice sessions for all Ss. In order to do that, in essence, we divided the number of home practices for each S into five chronological groups or cells. For each home practice session there was a corresponding self-rating of vividness of the visual-imagery strategy. The mean of these ratings was taken for each cell. Thus in the first cell was the mean of the self-rated vividness of the imagery strategies in the beginning of the experiment, while in the last cell was the mean of the self-rated vividness of the imagery strategies by the end of the experiment (hence chronological). In turn, these cell means were correlated with numbers from 1 to 5 (denoting a time sequence from the beginning to the end of the experiment). The result showed that self-rated vividness of the visual-imagery strategies did not get significantly better over a period of practice; Spearman R(59) = -.24 (z=1.83, p=.06, 2-T).

Did Ss engage in their strategies while doing the PK task? Ss reported that they tried their best to use the strategies, but were they consistent in using the assigned strategy? I am inclined to argue that it is likely. This conclusion is based on the following observations:

(a) Comparison of the average time that Ss spent before the first trial and the average time they spent on the rest of the trials suggests that they were engaging in some "preparation" procedure before starting the trials. (We can rule out "unfamiliarity" with the computer test out to some extent, since Ss were introduced to the test in the screening and interview sessions.) The mean IT in the first trial was 46.04 sec., whereas the mean IT in the following 39 trials was 10.40 sec. The difference was significant using the Wilcoxon test: T (N=144) = 1078.000 (z=8.26, p=0.0000, 2-T). This means Ss were doing something but not necessarily the assigned strategy.

(b) Perhaps more relevant, the mean IT when Ss were doing their strategies was 10.40 sec., while the mean IT for the same 24 Ss in the pretest session was 6.27 sec. This difference was significant using the Wilcoxon test: T (N=24) = 58.000 (z=2.63, p=.009, 2-T). When Ss were instructed to go through a visual-imagery strategy, the time they took on the task increased. As already demonstrated, under identical conditions, IT remains the same.

(c) If Ss engage in their strategies, and mental processes can be viewed as an analog of physical processes, we can expect the three different strategies to take different times to perform. According to table 5.7 GO took the longest time to perform and EO the shortest time.

The difference in total time for the three strategies does not, however, differ dramatically according to a Kruskal-Wallis test: H (2,N=144) = 3.314 (p=.19, 2-T). We should note that PO took a significantly longer time in the nonfeedback condition than in the feedback condition, GO took significantly more time in the feedback condition than in the nonfeedback condition, and EO took nearly significantly more time in the nonfeedback condition than in the feedback condition. This suggests that mental processes reflected in IT are different for the three strategies.

5.6 SUMMARY

The three visual-imagery strategies did not result in PK scoring above chance and were not successful as a method of training PK. Four possible reasons (criticism) were offered to explain the overall chance results. There were some post-hoc trends that, when considered in the context of the number of statistical analyses conducted, are suggestive but do not yield much information. Another experiment could shed some light on which effects were spurious and which were valid.

TABLE 5.1

Schema of the set-up of experiment 4. S1-S8 = subjects, N = nonfeedback version (40 trials), F = feedback version (40 trials), 1 = pseudo-RNG1 (for 20 trials), 2 = pseudo-RNG2 (for 20 trials). The first S who attended was in the PO group, the second Ss who attended was in the EO group and the third Ss who attended was in the GO group.

PO	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
S1=	N F 2,1 2,1	F N 1,2 1,2	N F 2,1 2,1	F N 1,2 1,2	N F 2,1 2,1	F N 1,2 1,2
S2=	F N 2,1 2,1	N F 1,2 1,2	F N 2,1 2,1	N F 1,2 1,2	F N 2,1 2,1	N F 1,2 1,2
S3=	N F 1,2 1,2	F N 2,1 2,1	N F 1,2 1,2	F N 2,1 2,1	N F 1,2 1,2	F N 2,1 2,1
S4=	F N 1,2 1,2	N F 2,1 2,1	F N 1,2 1,2	N F 2,1 2,1	F N 1,2 1,2	N F 2,1 2,1
:						
S8=	F N 1,2 1,2	N F 2,1 2,1	F N 1,2 1,2	N F 2,1 2,1	F N 1,2 1,2	N F 2,1 2,1
EO						
S1=	F N 1,2 1,2	N F 2,1 2,1	F N 1,2 1,2	etc.		
S2=	N F 1,2 1,2	F N 2,1 2,1				
etc.						
GO same as PO.						

TABLE 5.2

Number of hits and t-test statistics for the three strategies in the feedback and nonfeedback conditions.

	PO n=48	GO n=48	EO n=48	Total n=144
Feedb.	Hits = 497 Mean=10.35 s = 2.97 t = .83	Hits = 470 Mean=9.79 s = 2.14 t = -.67	Hits = 452 Mean=9.42 s = 2.97 t = -1.36	Sum = 1419 Mean=9.85 s = 2.73 t = -.64
Nonfeedb.	Hits = 484 Mean=10.08 s = 2.61 t = .22	Hits = 458 Mean=9.54 s = 2.74 t = -1.16	Hits = 509 Mean=10.60 s = 2.61 t = 1.61	Sum = 1451 Mean=10.08 s = 2.67 t = .34
Both	Hits = 981 Mean=20.44 s = 3.75 t = .81	Hits = 928 Mean=19.33 s = 3.36 t = -1.37	Hits = 961 Mean=20.02 s = 4.05 t = .04	Sum = 2870 Mean=19.93 s = 3.73 t = -.22

TABLE 5.3

PK scores broken down for pseudo-RNG1 and pseudo-RNG2 (n=144).

	Feedback score MCE=720	Nonfeedb. score MCE=720	Total score MCE=1440
Pseudo-RNG1	Hits = 734 Mean = 5.11 s = 1.83 t = .73	Hits = 736 Mean = 5.11 s = 1.94 t = .69	Sum = 1472 Mean = 10.22 s = 2.69 t = .99
Pseudo-RNG2	Hits = 683 Mean = 4.74 s = 1.99 t = -1.55	Hits = 715 Mean = 4.97 s = 1.90 t = -.22	Sum = 1398 Mean = 9.71 s = 2.65 t = -1.32

TABLE 5.4

Average Interval Time (IT) in seconds between trials in sessions 1 to 6 for the feedback condition and the nonfeedback condition.

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
Feedback condition	7.66	9.85	13.41	9.84	9.08	10.73
	Kruskal-Wallis test: H (5,N=144) = 1.217 (p=.94, 2-T)					
Nonfeedb. condition	10.19	10.83	11.33	10.41	11.69	9.75
	Kruskal-Wallis test: H (5,N=144) = 1.513 (p=.91, 2-T)					

TABLE 5.5

Difference in milliseconds between the three conditions in inspection time (duration) before and after experiment 4.

	Before		After		Combined	T-test
	mean	sd	mean	sd	mean	(correlated)
PO	15.14	9.97	26.57	21.89	20.86	t(6) = -1.39 p=.21, 2-T
GO	32.67	20.68	14.83	11.84	23.75	t(5) = 3.15 p=.025, 2-T
EO	17.25	12.83	14.50	9.37	15.88	t(7) = .58 p=.58, 2-T
Total	20.95	15.90	18.62	15.58		t(20) = .54 p=.60, 2-T

TABLE 5.6

Summary table for tests for linear and curvilinear regression (second-degree or quadratic regression) for total PK scores from process-oriented imagery, as demonstrated in Fig. 5.3.

Source	SS	df	MS	F	p-value
Between groups	27.69	5	-	-	
Linear reg.	0.088	1	0.088	0.0006	p > .05
Quadratic reg.	25.93	1	25.93	1.72	p > .05
Other trends	1.67	3	0.56	0.037	p > .05
Error	634.1	42	15.1		
Totals	661.81	47			

TABLE 5.7

Mean time (in seconds) spent on practicing the three imagery strategies. The Wilcoxon tests are reported as two-tailed.

Group	Time in feedback version	Time in nonfeedb. version	Wilcoxon test (N=48) between feedback & nonfeedback versions	Total time
PO	420.39	508.94	T=342.000 (z=2.52, p=.01)	929.33
GO	479.33	457.26	T=385.000 (z=2.08, p=.035)	936.59
EO	395.13	448.31	T=412.000 (z=1.81, p=.067)	843.44

FIGURE 5.1. Total PK score means (for the three strategies combined) from experiment 4 as a function of session number (MCE=20.00).

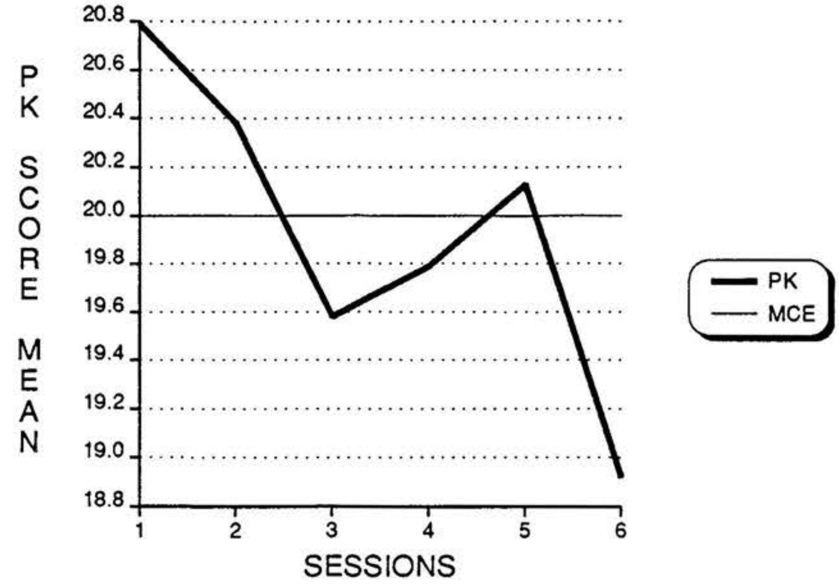


FIGURE 5.2. Mean PK scores of the three imagery groups (for feedback and nonfeedback conditions combined) as a function of session number (MCE = 20.00).

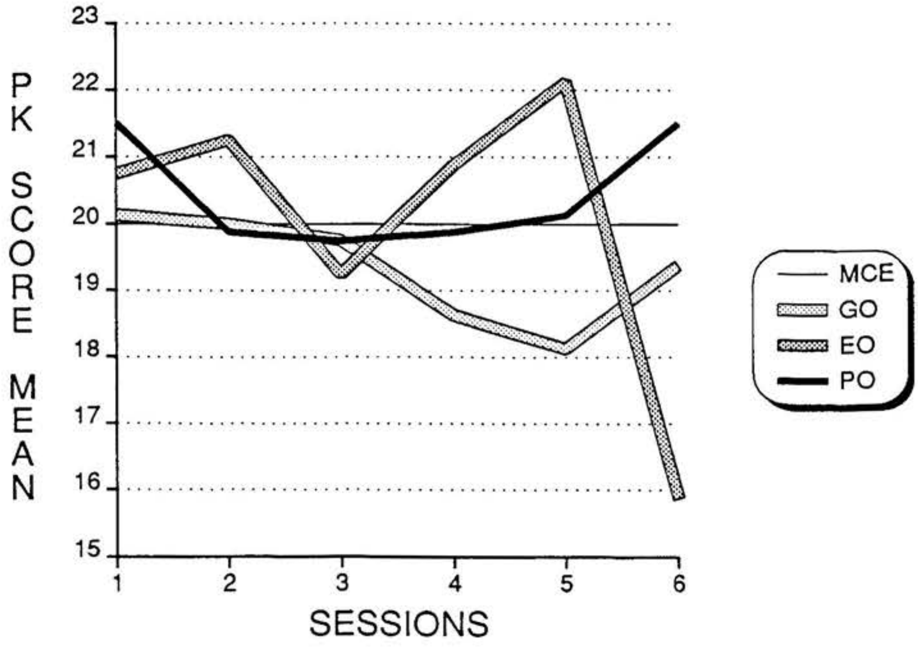


FIGURE 5.3. Mean PK scores in feedback (F) and nonfeedback (N) conditions in process-oriented imagery strategy as a function of session number (MCE=10.00).

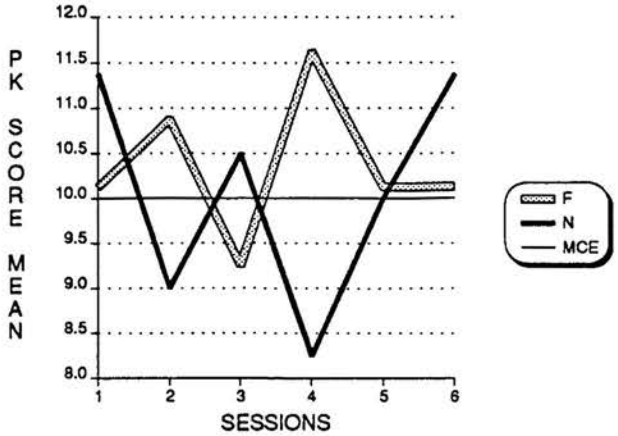


FIGURE 5.4. Mean PK scores in feedback (F) and nonfeedback (N) conditions in goal-oriented imagery strategy as a function of session number (MCE=10.00).

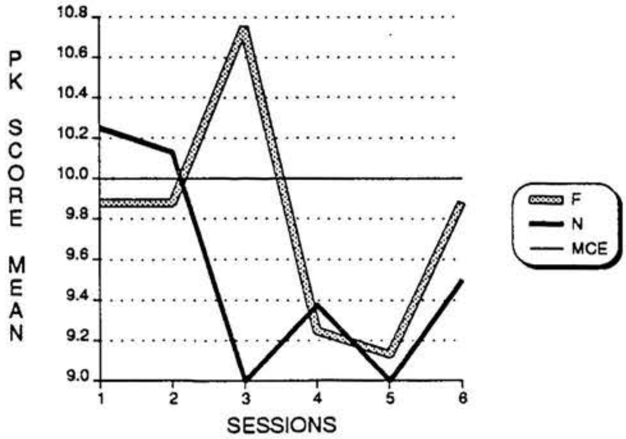


FIGURE 5.5. Mean PK scores in feedback (F) and nonfeedback (N) conditions in end-oriented imagery strategy as a function of session number (MCE=10.00).

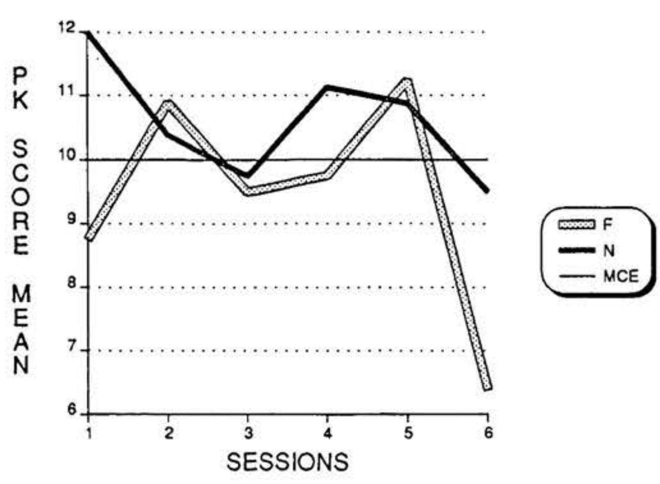


FIGURE 5.6. Mean PK scores for those who had an increase (I) in inspection time and for those who had a decrease (D) (MCE=20.00).

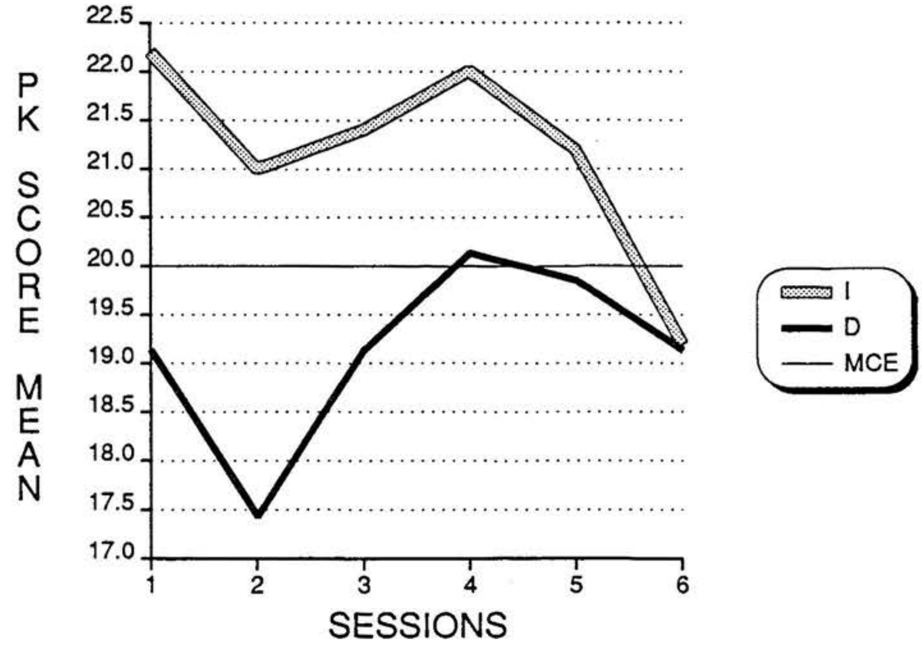
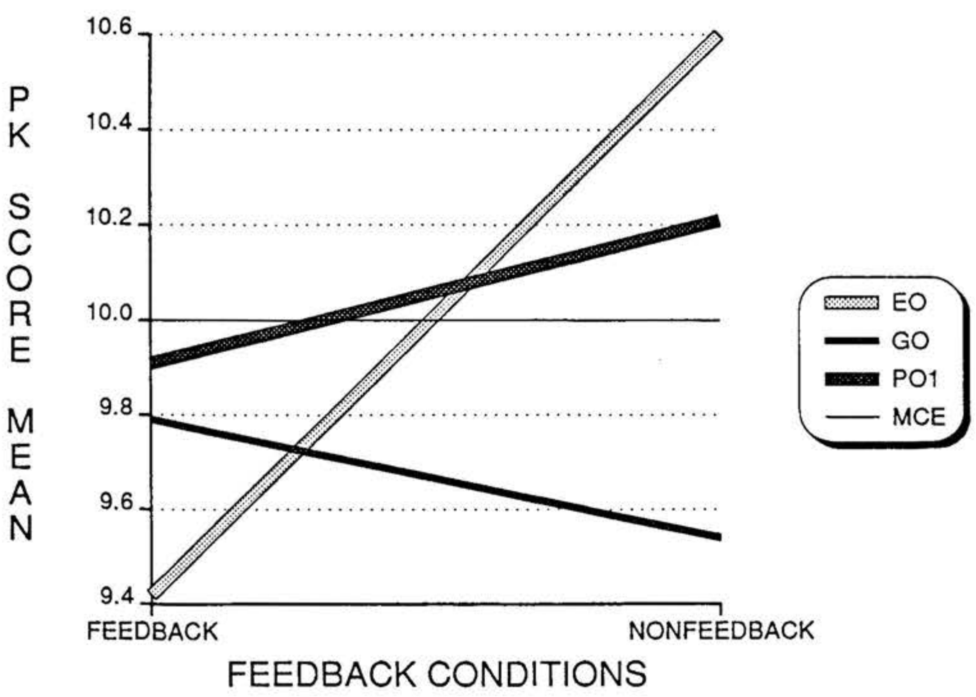


FIGURE 5.7. Mean PK scores of the three imagery groups when case 26 has been removed from the data pool - as a function of feedback (MCE=10.00). PO1 = PO data without case 26.



CHAPTER SIX

EXPERIMENT 5: SECOND IMAGERY TRAINING STUDY

6.1 INTRODUCTION

Experiment 5 started on 6 October and finished on 22 December, 1988. Its aim was to try either to increase PK performance or stabilize successful PK performance of individuals via the practice of three visual-imagery strategies. In designing this experiment the four possible reasons suggested for overall chance scoring in experiment 4 were taken into account: a) The RNG was not appropriate for the task, b) the strategies do not work as a training method, c) psychological factors due to too many sessions were to blame, d) or the number of Ss was too small. I felt that before item b) could be accepted or justified another experiment had to be conducted in order to attempt to overcome the criticisms raised in a), c), and d). Furthermore, there were some post-hoc trends in experiment 4, that, when considered in the context of the number of statistical analysis conducted, did not yield much information. Another experiment might shed some light on which effects were spurious and which were valid.

Experiment 5 consisted of one pretest screening session followed by four training sessions. The training sessions were cut from 6 down to 4. (Because of constrains of my time, I was not able to consider the possibility of having the training period longer.) Instead the number of Ss in each group was increased from 8 to 13. Experiment 4 employed pseudo-RNGs (vis., pseudo-RNG1 and pseudo-RNG2) to generate the PK targets, whereas the prior visual-imagery PK studies of Levi (1979), Morris et al. (1982) and Nanko (1981) used live RNGs. To account for the possibility that the type of the RNG mattered a live RNG was brought in.

The live RNG was used together with the pseudo-RNG in experiment 5. Using both types of RNGs in the PK target generation (and not only the live RNG) would allow comparison of PK results obtained by the two RNGs and would repeat, as well as extend my earlier research and that of Levi, Morris et al., and Nanko. A control group (CR) was used to control as well as possible for all instructions and effects (including the possible effects of expectancy, involvement and practice) other than those connected with the three visual-imagery strategies. This was done to allow for a direct investigation of the strategies.

There was a temptation to make experiment 5 simpler than the previous study and abandon perhaps one of the strategies. I did not feel entirely satisfied with such an approach as a direct continuation of my work. The reasons for keeping all three strategies were as follows: (1) PO was the only strategy that indicated a slight incline in PK scores across sessions. (2) GO had resulted in above chance scoring, and done better than other imagery methods, in prior PK experiments (Levi, 1979; Morris et al., 1982; Nanko, 1982). (3) EO demonstrated a significant difference between the feedback and the nonfeedback conditions. Furthermore, it was decided to use the inspection time test again because of the significant difference in overall PK scores between those who increased and those who decreased in inspection time.

6.2 PREDICTIONS

When making the hypotheses I decided to treat all PK scores (whether based on true or pseudo-random generated targets) as one group. Although half of all PK targets in experiment 5 were generated by a live RNG and the other half by a pseudo-RNG I did not necessarily expect to find any difference in PK scores based on the two different RNGs. The reasons were as follows: (1) Empirical reason: Researchers in parapsychology have repeatedly obtained significant PK results by using pseudo-RNGs (e.g. Lowry, 1981; Radin, 1982a; 1982b). (2) Theoretical reason: To the best of my understanding, both the IDS model and the quantum collapse model do not postulate that psi scoring will be stronger with one random process and weaker with another. On the contrary, both models assume psi effects on random targets irrespective of whether they are live or pseudo-randomly generated. (3) Comparison of live and pseudo-RNGs: Earlier work does not suggests that psi scoring will be stronger with one random process and weaker with another. This is suggested e.g. by Nelson et al. (1986), Jahn and Dunne (1987) and Schmidt (1981). The cited studies did not involve a direct comparison between live and pseudo-RNGs in the sense that both types of RNGs were responsible for target generation an equal number of times. Ss' PK performance on a pseudo-RNG was, however, considered in context of Ss' PK performance on a live RNG. On comparing results from pseudo-RNGs with live source RNGs amongst other things, Nelson et al. (1986, p.277) concluded after six years of experimentation:

> Thus it appears that although the observed effects [the PK scores] are clearly operator-specific [i.e. there appear to be individual differences], and in many cases condition-specific, they seem not to be nearly so device-specific, a characteristic that has been noted by other researchers. Such empirical evidence weakens phenomenological [it is not clear to me what this refers to] interpretations involving consciousness interacting directly with the random physical process itself, e.g. with the flux of thermal electrons in the REG, ... and favors models that deal with aspects generic to all of these systems, for example, the information implicit in their output distributions.

Although I hypothesized, a priori, similarity in RNGs for the preplanned predictions, I intended to analyze the data post-hoc in order to see if there were really any differences in PK effects upon the different RNGs.

The following predictions have been developed through experiments 1-4 and are the major focus of experiment 5:

H1. For GO, feedback scores will be significantly higher than nonfeedback scores. A Wilcoxon Matched Pairs Test will be used on combined scores for all 4 sessions (1-T).

H2. For PO, nonfeedback scores will be significantly higher than feedback scores. A Wilcoxon Matched Pairs Test will be used on combined scores for all 4 sessions (1-T).

H3. For EO, nonfeedback scores will be significantly higher than feedback scores. A Wilcoxon Matched Pairs Test will be used on combined scores for all 4 sessions (1-T).

H1-H2 were based on prior research into GO and PO (vis., Levi, 1979; indirect suggestions from Morris et al., 1982, and Nanko, 1981). Furthermore, in experiment 4, GO showed a trend towards doing better with feedback and PO showed a trend towards doing better in the absence of feedback (but only when case 26 was removed from the data). H3 is based on results from experiment 4, where the difference between feedback and nonfeedback conditions was significant for EO (p=.027). For H1-H3 it was stated in advance, that if there was an isolated individual who appeared to have a "natural" talent for scoring highly above chance (only) he was to be treated as an outlier and looked at separately. The criteria for designation as a high above chance scoring individual was; a) if that individual scored consistently above chance, including the pretest session, and continued to score above chance (neither decreasing nor increasing significantly in scoring) in the four training sessions, and b) if that individual got an alpha level of p =< .002 (2-T) in total PK score of the four training sessions of that condition. I chose p =< .002 because that was roughly the p-value which case 26 got and it could perhaps reflect a departure from the performance expected of the others.

H4. Training prediction: PK scores in the last two sessions (session 3 and 4) will be higher than in the first two sessions. A Wilcoxon Matched Pairs Test will be used to measure the difference between combined scores from session 1-2 and combined scores from session 3-4 for each of the three strategies (2-T).

In our training I expected either an incline or stabilization of scores if they were initially high. I did not expect many initial high scores since according to the PK research literature they are less frequent than scores around MCE. Thus I reasoned that if the few individuals who had initially high scores maintained their high performance and the many low scoring individuals increased in scores, we would obtain an increase in scores between the two halves of the experiment, assuming that this sort of visual-imagery training works.

H5. Screening session: Higher PK scores will correlate with a) lower scores on the VVIQ (better visualizer), b) higher scores on the Sheep-Goat scale (more sheep-ish) and c) higher scores on the I-E scale (external locus of control). Spearman R will be used to correlate questionnaire scores with PK scores (1-T). Total PK scores will be used for b) and c), but only feedback PK scores for a).

H5 is a set of hypotheses based on nonsignificant, but consistent trends from pilot studies 1-3 and from the 20 Ss recruits in experiment 4. (The sheep-goat scale correlated significantly with PK scores in pilot study 2.) If the reason for these effects not reaching significance was that too few Ss were used, they should become significant with enough Ss.

The following hypotheses were developed as secondary or minor to the purpose of the study, and are an extension of the project so far:

H6. Cognitive prediction: Total IT will be different for PO, GO and EO across feedback and nonfeedback conditions: a) For PO, IT will be longer in the nonfeedback condition, but shorter in the feedback condition. b) For GO, IT will be longer in the feedback condition, but shorter in the nonfeedback condition. c) For EO, IT will be longer in the nonfeedback condition, but shorter in the feedback condition. A Wilcoxon test will be used on total IT between conditions (2-T).

H6 is a set of hypotheses which are based on post-hoc findings from experiment 4, where the difference in IT between feedback and nonfeedback conditions was significant for PO and GO, and close to significance for EO.

H7. Inspection time test: Ss increasing (becoming slower) in inspection time from the first measurement (done before the training sessions start) to the second measurement (done after the last training session) will score higher than Ss decreasing (becoming faster) in inspection time from first to second measurement. A Mann-Whitney U test will be used to measure the PK scores difference between the two groups (2-T).

This hypothesis is based on post-hoc observation in experiment 4 where the difference in PK scores of those who increased in inspection time and those who decreased in inspection time was significant. Those increasing in inspection time scored above chance, whereas those who showed a decrease scored below chance.

H8. Control group: a) Ss doing PO will score higher than the control group in the nonfeedback version. b) Ss doing GO will score higher than the control group in the feedback version. A Mann-Whitney U test will be used to evaluate the difference between the groups (1-T).

H8 is based on results from Levi (1979) who used a control group (CR). He found that Ss using GO scored nearly significantly higher than CR in the feedback condition (p=.088, 2-T), and significantly lower than CR in the nonfeedback condition (p=.021, 2-T). PO scores were higher than CR in the nonfeedback condition, and lower than CR in the feedback condition. Although Levi does not mention it, judging from a graph he presented on the interplay of the three groups, the difference between PO and CR under the two conditions was probably not significant. Although I thought these were impressive differences due to feedback conditions, it may be arguable whether it was enough to build a prediction on. My argument was that if these effects were real, they would show up significantly with n large enough. The present study had many more sessions for each "strategy" condition than Levi had. For each "strategy" condition, Levi had 17 Ss, each completing one session, contributing to 17 sessions on the whole. I had 13 Ss in each "strategy" condition, each completing 4 sessions, contributing to 52 sessions on the whole.

Other results were to be looked at post-hoc as suggestive for future research. Before the experiment started a note was kept by Robert Morris (R.M.) and John Beloff (J.B.) stating what the formal predictions were. Experiment 5 had two phases, a pretest screening phase (unchanged from before) and the actual visual-imagery training experiment for the screened Ss. The screening method is reported first and then the actual training experimental method.

6.3 METHOD FOR SCREENING SESSION

Subjects

The Ss for the pretest session were selected through the same three sources as described in pilot 2, vis., those responding to advertisements, individuals who on a prior occasion had indicated interest in parapsychology research, and those who came via participants already tested. Ninety Ss went through the pretest (35 M and 55 F; aged 16-82 yr.; mean = 31). (Since extreme values can bias the mean, another index of central tendency can be reported here, vis., the age median which was 25 yr.)

Apparatus

Experimental rooms. The two rooms previously used for experimentation in the parapsychology laboratory were used in study 5.

Questionnaires. The same four self-report inventories as were used in pilots 1-3 were used; the VVIQ, VAIQ, GGPQ and I-E scale. The same post-session general questionnaire as used in pilots 1-3 was also used. One question was deleted from the I-E scale (question no. 22; see the I-E scale in appendix B), as it was the only question that had shown a negative correlation with PK scores in pilot experiment 2 and for the 20 recruited Ss in pilot experiment 4. An additional self-report inventory, the Gordon's Test of Imagery Control, was brought in at this stage for post-hoc analyzes. The Gordon's Test of Imagery Control was designed to differentiate autonomous from controlled visual imagery (Gordon, 1949). I wanted to investigate whether those who reported more control over their imagery did any better on the PK computer test than those reporting less control over their imagery when exposed to any particular strategy. Furthermore, I wanted to see if high self-rated imagery controllers would do any better in visual-imagery training in comparison with low self-rated imagery controllers.

The live RNG. While preparing experiment 5, I ordered a live source RNG (called RBG 04CA-S) from Jeff Jacobs at the Synchronicity Research Unit in the Netherlands (see for details, User's Guide Random Bit Generator RBG 04CA-S, 1988). The RBG is intended for parapsychological studies. Its output toggles between a HIGH and a LOW level. If properly operated, the probability at any given moment of a HIGH output level is equal to that of a LOW output level (0.5 +/-.02). The RBG is intended to be controlled by a computer system. This should be equipped with at least one digital input line and preferably with at least one digital output line. The User's Guide describes the principle of the RBG's operation as follows (ibid., p.2):

> The source of randomness is the Analogue Noise Generator, which produces wide-band noise (reversed biased PN-junction noise, recombination noise, sometimes called zener noise). The noise generator is designed so as to be minimally temperature

> dependent, either ambient or by self-heating. In the [a] following threshold detector the analogue noise is digitized. The digitized noise is fed to a modulo-2 counter, the output of which is a square wave which randomly varies in frequency and duty cycle. Upon latching triggered by the input control logic, the output of the modulo-2 counter is HIGH or LOW with equal probability (that is, +/-0.02; this slight bias is caused by the complex switching behavior of the components when triggered by a high-frequency noise signal). The output of the counter is fed to a computer via a buffer, which produces either TTL compatible voltages (logical 0=0 V, logical 1=+5 V) or RS232C compatible voltages (logical 0=+12 V, logical 1=-12 V).

Since the random bit output is slightly biased (p=0.5 +/-.02) the User's Guide recommends performing a debiasing in software. After adding a debiasing procedure to the RBG, I tested it for a few days but could not spot any fault in the randomness by using a chi-square test. (The record of these tests was not preserved.)

Synthia. The computer test, Synthia, was used. Two versions were made of the Synthia program, the live RNG version and the pseudo-RNG version. Each version had 40 trials and the trials could be run in either the feedback mode or the nonfeedback mode. In the pseudo-RNG version of Synthia the trials were generated via the pseudo-RNG. The program was changed such that when S played the 40 trials in the pseudo-RNG version, the live RNG generated 40 hidden trials selected simultaneously as the pseudo-RNG trials. In the live RNG version of Synthia the trials were generated via the live RNG. When S played the 40 trials in the live RNG version, the program simultaneously generated 40 hidden pseudo-RNG trials. The hidden trials were to be analyzed post-hoc. In the reminder of the thesis, the trials (and resulting PK scores) discussed are the observed ones (the trials that S saw on the screen), and not the hidden ones unless specifically stated.

The pseudo-RNG version included both pseudo-RNG1 and pseudo-RNG2 as in experiment 4. In the pseudo-RNG version, if S started doing the 40 trials with pseudo-RNG1, the program automatically changed over to pseudo-RNG2 after 20 trials. If S started doing the 40 trials with pseudo-RNG2 the program automatically changed over to pseudo-RNG1 after 20 trials. The initial seeds from pseudo-RNG1 were automatically written into a separate outfile.

Before the test was run, the program prompted for whether E or S would initiate the test. If "E" was typed, "E" was saved in the outfile. If "S" was typed, "S" was saved in the outfile. Either "E" or "S" had to be typed, otherwise the program would not continue. When "return" was pressed after this prompt, the test was run and initial "fresh" seeds were selected for pseudo-RNG1. In experiment 5 when E initiated the test, "E" was typed and when S initiated the test, "S" was typed after this prompt.

Both the pseudo-RNG and the live RNG versions were exactly alike in appearance. In order to make sure that E would know which version to run, while S would be kept as blind as possible as to the differences in the random process, different filenames were assigned to each version. "5P" was attached to the filename of the pseudo-RNG version and "6L" to the filename of the live RNG version. Ss in the pretest were never told anything about the different RNGs. Ss in the training study were told about the different RNGs after the last session and asked to keep quiet about it.

The computer test was also changed such that Ss could not initiate many trials in a row by holding down the space-bar. The reasons were as follows: (i) I looked at data from pilot experiment 2 to see if there was any difference in PK hits made when IT = 0 and when IT > 0. There was no evidence that it made any difference although many Ss made use of that option. (ii) Roughly speaking, an IT of 0 might often reflect irrelevant "noise" in the data. For instance, S unfamiliar with typing might simply hold the space-bar down for too long a time when intending to initiate one trial, and thus produce unintended trials. In the present version 1/2 second had to pass (following a trial/space-bar press) before one could initiate the next trial. If the space-bar was held down (say for 30 sec.), the computer would wait until the pressure was released, and then after 1/2 sec. the next trial could be initiated.

Procedure

As in the other experiments, S met E in the lobby of the psychology department building, or if S knew his way around the building, he came straight to the parapsychology lab where he was greeted by E.

a) Scalar instruments. The same procedure was used as in pilots 1-3. The same verbal instructions were provided as before, i.e., E chatted with S, then described the experimental session, its purpose and set-up, followed by a description of the questionnaires. This time, the description of Synthia and the demonstration game was not provided at the beginning of the session as in pilots 1-3, but after S had answered the questionnaires. (Thus any possible bias in questionnaire responses related to S's attitude towards the computer test was minimized.) The subject started by answering the five questionnaires: the VVIQ, VAIQ, Gordon's Test of Imagery Control, GGPQ and I-E scale, in that order in the "questionnaire" room. On average Ss took 30-45 minutes to answer the questionnaires. The questionnaires were followed by the computer test.

b) PK task. The following instructions were made verbally in the sound-attenuated room after S had filled out the questionnaires and before S did the computer test (the instructions were slightly changed from study 2):

> Before doing the computer test yourself, I'll give you a demonstration of it. "Synthia" is by no means a test that can

> tell if you possess PK abilities in general - it only suggests how well you manage to work on that particular test in this particular test situation. [Ss played the latter half of a demonstration feedback game, and the latter half of a demonstration nonfeedback game.]
>
> I want you to pay special attention to the space bar. If you press it down it will generate one trial at the time. After 1/2 second you can initiate the next trial but not sooner than that. If you get any particular feeling, that you might get a hit after a hit, you can press the space bar down rapidly. But remember that trials can only be generated at the rate of 1/2 sec. This is done so that if the feeling goes away and you release the pressure of the space-bar the trials will not go on without control.

The subject then did 40 trials in the feedback version and 40 trials in the nonfeedback version. The necessary counterbalancing of the conditions was obtained via four coinflips. Half of the subjects started with the feedback version and half started with the nonfeedback version. The first S had a random choice of which version to start with. A flip of a coin decided which. The second S had the reverse order of the first S, and the third S the reverse order of the second S, and so forth (for set-up see table 6.1).

Another flip of a coin decided for the first S whether he started doing the first 40 trials with the pseudo-RNG version or the live RNG version. The second part of the session (the remaining 40 trials) was done with the other version. The second S had the same order of pseudo- and live RNG versions of the computer test as the first S. The third and fourth S had the reverse order of the first and second S etc. I decided to have Ss going through both RNG versions of the computer test in the screening session because I wanted to be able to explore post-hoc whether there was any difference in questionnaire correlations with PK scores obtained by the two different RNGs. Any differential effect was to be ignored, such as if S scored high in either the feedback or the nonfeedback version and low in the other, or if S was more successful with either the pseudo-RNG or the live RNG and unsuccessful with the other. This was done in order to keep the screening procedure as simple as possible - Ss having only to get at least 18 PK hits (see below) in the screening session to move on to the training sessions.

The third flip of a coin decided for the first S if he initiated the computer test (and thus pseudo-RNG1) or if E initiated it for both feedback and nonfeedback versions in that session. The following three Ss had the same decision as the first S. The next four Ss had the opposite decision to the first four Ss, continuing to alternate. The fourth and final flip of a coin decided whether the first S started with pseudo-RNG1 or pseudo-RNG2. The second half of the first session (for the first S) was done with the reverse order to the first part. The following seven Ss had the same order of pseudo-RNG1 and pseudo-RNG2 as the first S. The next eight Ss had the reverse order to the first eight Ss, and so forth.

c) Post session procedure. After finishing the computer test S completed the general post-session questionnaire (in either the "questionnaire" room or the sound-attenuated room, whichever was more convenient at the time). Then all Ss were given two sheets of paper with their PK results and their scores from the I-E scale stating into which category they fell (whether they were externally controlled, internally controlled or both externally and internally controlled), with an interpretation of the three categories (see appendix B).

d) Dividing Ss into groups. While S was answering the post-session questionnaire and if S had obtained 18 hits or more, E placed S into either one of the three imagery groups or the control group. Ss were balanced into all four groups depending upon the VVIQ scores and the PK scores. An equal number of good and bad visualizers and high and low PK scorers were put into each group. Care was taken to distribute as well as possible extreme PK scorers equally between the four groups. E made sure that friends (if, when inquired by E, S said "Bill mentioned this experiment to me", and this "Bill" had passed the screening test, etc.) were put into the same group so that S did not know of other groups except his own. Since no subject in the whole study hinted at knowing about other groups than his own, there is reason to believe that E was successful at the task of keeping S blind as to the other conditions.

e) Instructions to screened Ss. After finishing this session Ss who got 18 hits or more were asked if they liked to proceed to do a four session training study. The others were kept unaware of the training study (see treatment of control Ss in section 6.4). The following instructions were given verbally (slightly changed from before):

> We are conducting a larger experiment which is aimed at exploring a visual-imagery strategy to increase or stabilize PK scoring. All participants who get hits at chance level or higher, are asked if they would like to proceed to this larger experiment. Now, when I say a larger experiment, I only mean that each person will attend on four occasions with about a one week interval, for about an hour and half each time, to practise this particular visual-imagery strategy. You will of course make your own time schedule regarding what days you can attend and at what time to practise on the PK computer test.
>
> You would also be given exercises to do at home as well, such as relaxation and visualization exercises that are widely advocated as important for the acquisition of general mental skills and psychic skills in particular. [I made no claims that participants would learn psychic skills.]
>
> Would you be seriously interested in participating in the second experiment? There are no obligations. If you say "yes" now, you can, of course, say "no" when you attend to the first session, or withdraw at any time for that matter.
>
> I want you to think through with your friends and family for the next few days, if you are really ready to spend your time in practising this visual-imagery strategy on four occasions. Preferably, we want participants who are going to remain with the experiment once they have started.

It should be noted that all participants, regardless of their scoring in the pretest session, were asked if they wanted to be in a pool of Ss who are contacted when experiments are in progress at the parapsychology laboratory. If S was interested, E at this point explained briefly the training experiment. The following instructions were given verbally (slightly changed from before):

> Aim: The aim of this study is to try to increase or stabilize your PK scores on the computer test through the practise of a certain visual-imagery strategy. We also want to learn more about how people use such strategies.
>
> The tests: In this experiment you will be required to do the same computer test as you were just doing. We have reason to expect, on the grounds of prior successful studies, that your imagery technique will increase or stabilize your PK scores. You will also be given one additional test as well, a so-called inspection time test. You will do the inspection time test before the first session and after the last session. We want to see if practising the visual-imagery strategy for some time will bias the inspection time in one way or another.
>
> The sessions: You will have to come to the lab on four occasions with about a week's interval to do the computer test. Each session will take about an hour and a half. We want you to practise your visual-imagery technique at home for about 10-15 minutes per day. If, for some reason, you are not able to do the home practice sessions once in a while, that's fine. However, we very much want you to practise at home because the more you practise the more likely it is that you will get the full benefit of the exercises. You may of course practise more than 10-15 min. per day if you want to.
>
> We know you are spending valuable spare time here with us, and therefore we want you to benefit from this study. Preferably, we want to see you increase or stabilize your PK scores. But although you may, perhaps, not succeed in that, you will very likely benefit from the home exercises. We suggest that you become involved in the exercises personally, and try to explore using them in your daily life - that you try to use them for your own benefit, so to speak.
>
> In the last session you will receive your personal results, and at the end of the experiment you will get the main results from the experiment by mail, so that you can compare your scores to the whole group that will be participating.

E answered any questions that S had and gave S an opportunity to back out. Finally, an appointment was made for the first training session.

6.4 METHOD FOR TRAINING SESSIONS

Subjects

From the pretest session 52 unpaid volunteers were selected to participate in the four session training study (18 M and 34 F; aged 16-69 yr.; mean = 30). Because of limited time it was decided to screen out only low scoring Ss. Ss obtaining a total of 18 hits (MCE=20 hits) or more from both versions of the computer test combined were asked if they wanted to participate in the training study.

Data from drop-outs were not to be included in any analyses, and were to be put in an appendix. If some Ss dropped out in the middle of the training process, or were not interested when attending the first training session, more Ss were to be recruited through the same procedure utilized in the pretest session until the number of 52 Ss was met. As it turned out there were no drop-outs.

Apparatus

The latest version of the Synthia program that had both a live and a pseudo-RNG was used.

Experimental environment. The same two rooms in the lab as were used in studies 1-4 were used in experiment 5. The inspection time test, unchanged from before experiment 4, was again run on a BBC computer. The sound-attenuated room was used for S to practise his strategy and do the PK computer test on the IBM machine. The other, an adjacent room which was used for S to answer questionnaires in the screening session, was used to do the inspection time test on the BBC computer and for E to control a tape-recorder (see below) and chat with S to make him comfortable (see diagram of the lab in appendix F).

Tape-recorded exercises. A tape-recorder was used in experiment 5 to play five audio-tape recordings (see below) for S and a reclining chair was brought in for a relaxation exercise. The tape-recorder, located in the adjacent "questionnaire" room, had an extended cable that led into the sound-attenuated room. Attached to the extension in the sound-attenuated room were headphones. When E, sitting in the "questionnaire" room, switched the tape-recorder on S could listen to the tape-recording that was being played through the headphones while remaining seated in front of the PK computer test in the sound-attenuated room. Simultaneously, E could listen to the same tape-recording through a loudspeaker in the tape-recorder in the "questionnaire" room. E could therefore tell when to turn the tape-recorder off, when the tape-recording was completed.

Five separate audio-tape recordings were made. In an attempt to induce a relaxed yet alert, "enthusiastic about doing well" and optimistic frame of mind, a 4-minute "pep-talk" of suggestions / instructions was designed (see appendix F). The first tape-recording started with this pep-talk followed by the PO visual-imagery strategy instructions (about 5 min.). This tape-recording was played for the PO group. The second recording started with the same pep-talk followed immediately by the GO strategy instructions (about 5 min.), and the third one started with the pep-talk followed by the EO imagery instructions (about 5 min.). These recordings were played to the GO and EO groups respectively. The fourth tape-recording comprised only the pep-talk. This was a tape played for the control group. The fifth audio-tape recording consisted of 25 minutes autogenic relaxation procedure (see appendix F). Most of the word-by-word autogenic phrases and images were adopted from Charlesworth and Nathan (1984). (This relaxation technique was developed by Johannes Schultz and Wolfgang Luthe.) The procedure (starting from the feet upwards instead of from the head downwards, and including some obscure parts of the body) and other phrases came from a yoga exercise that the author was acquainted with. After a few pilot audio-tapes and comments from J.B., R.M. and Caroline Watt (C.W.), the tape-recorded instructions were changed into their present form. All instructions and suggestions were read onto the tapes by C.W.

Procedure

For each S, four sessions were required, each with 80 trials on the PK computer game. After 40 trials a break was taken. With four coinflips the experimental conditions got counterbalanced within each other (for set-up see table 6.2). The coinflips were done by E about 10 minutes before the first S in the first group (which happened to be PO) arrived.

Order of feedback/nonfeedback conditions. A flip of a coin decided whether the first S who attended started with the feedback or the nonfeedback version. a) The next S in the same group: The next S arriving for the same group had the reverse order to that of the first S, starting with the nonfeedback version if the first S started with the feedback version etc. When the first S attended next time he started doing the test in the reverse order to his previous session. b) The next S in a different group: The first S in the second group had the reverse order to that of the first S in the first group. The first S in the third group had the same order as that of the first S in the first group. The first S in the fourth group had the same order as that of the first S in the second group.

Order of live or pseudo-RNG versions. A second flip of a coin decided for the first S whether he started doing the computer test with the live RNG or the pseudo-RNG. In the next session he started with the other version of the one he began with in the first session. a) Same group: The next S in the same group did his first session with same order of RNG versions as the first S. The third and fourth Ss did their first session with the reverse order of RNG versions to that of the first two Ss. b) Different group: The first S in the second group had the reverse order to the first S in the first group. The first S in the third group had the same order as that of the first S in the first group. The first S in the fourth group had the same order as that of the first S in the second group.

Order of pseudo-RNGs. A third flip of a coin decided for the first S whether he started always (in all four sessions) with pseudo-RNG1 or pseudo-RNG2 for the pseudo-RNG runs (hidden and observed). The program automatically changed from one pseudo-RNG version to the other after 20 trials. Thus, the second part of each of the four sessions started with the other pseudo-RNG. a) Same group: The second S in the same group had the reverse order to that of the first S, and the third S had the reverse order to the second S. b) Different group: The first S in the second group started with the reverse order to the first S in the first group. The first S in the third group had the same order as that of the first S in the first group. The first S in the fourth group had the same order as that of the first S in the second group.

Order of whether E or S initiated the test. A fourth flip of a coin decided for the first S whether E or S initiated the computer test (and thus the pseudo-RNG1 runs). If S was to initiate the computer test, then he did so for two sessions, and E for the remaining two sessions. a) Same group: The next S in the same group had the reverse order to that of the first S. b) Different group: The first S in the second group had the reverse order to that of the first S in the first group. The first S in the third group had the same order as that of the first S in the first group. The first S in the fourth group had the same order as that of the first S in the second group.

Session I. a) Greetings. When S attended the first session and still wanted to do the four training sessions he met E in the lobby on the ground floor of the psychology building. (Frequently later on when S got to know his way around the psychology department he met E in the parapsychology lab.) The subject was then brought whenever possible to R.M. or D.D. for welcoming remarks before proceeding to the "questionnaire" room.

b) Inspection time test. E then gave the following instructions verbally (the same as in experiment 4):

> Before I give you the imagery strategy, I want you to go through the inspection time test that I mentioned to you in the last session. You will be doing the inspection time test again after finishing the last session. We want to measure whether practising visual-imagery for some period of time affects inspection time in some way. We are not measuring how quick your responses are, but how accurate you can be.

After softening the lights in the room where the BBC computer was, S did the inspection time test. An attempt was made to have the lighting level constant from test to test. The inspection time test was restarted if mistakes were made in the first block of trials of the test. Mistakes were defined in advance and could be of two types: (i) S got too many wrong responses (resulting in the computer program giving the message "Pay close attention") after the first series of trials when the stimuli were displayed for 400 ms. on the screen. This followed a suggestion by Ian Deary. Ss could be nervous and so forth, and therefore the first measurement would not show their real inspection time. (This happened once.) (ii) The program broke down because of electricity problems or possible bugs in the program, and so forth. (This happened twice, see section 2.5.)

c) Instructions. Next, E gave S a pamphlet, which included S's particular visual-imagery strategy on a sheet of paper (see pamphlet in appendix F). The experimenter went through and answered questions about

S's particular visual-imagery strategy. The subject was asked to practise it for about 10-15 minutes per day at home between sessions. The pamphlet that S was given also included a diary form sheet of paper to keep a record of these practice sessions, a few pages of information about the experiment, suggestions regarding how to deal with negative thoughts he might encounter (such as "I cannot influence the test"), how to do the home practice, and also relaxation and visualization exercises (that were to be discussed after sessions 2 and 3). The pamphlet covered more or less the same issues / instructions that Ss had been provided in experiment 4. The subjects were also told that if they had any questions or wanted further explanations they should feel free to phone E either at the laboratory or at home.

Thirteen Ss obtained no strategy (see control group at the end of this section). Thirteen Ss received the process-oriented visual-imagery strategy instructions both verbally and written down on the sheet of paper in the pamphlet:

> Follow this procedure before each trial until you have established a clear, vivid image. Once you have done this, you can go on for a while or until the image fades:
>
> Close your eyes. Take a deep breath from your diaphragm. Breathe in and out slowly and deeply - repeat a few times. Allow yourself to relax. Try to go to a level (or state of mind) where you can mentally visualize, where images are clear, vivid, and stable.
>
> Imagine energy building up inside you - flowing from your feet to head. Imagine this energy coming from you in the form of a white beam, perhaps from your midforehead. When you have this imagery of an energy beam, direct it in your imagery into the display on the screen. Visualize the white beam going into the target window (where the brown arrow is located) and opening it such that the beautiful blue star can appear. In your imagery the beep sound can be the noise when the window opens. Or you may visualize the white beam gathering all the screen together as if with a strong hand and pulling the blue star out of the target window. Allow this image to form for a while in your mind.
>
> Now open your eyes and gaze at the display while remaining in a relaxed and focused state. Maintain the imagined energy

> beam. You can use your arm and hand to guide your concentration to the desired target window. Don't let other thoughts or images interrupt your imagery and when you feel it is the right moment for starting, press the space-bar on the keyboard to initiate the trial.
>
> Instead of energy, you may want to imagine an electrical pulse, laser beam or force. The blue star can be a symbol for something you want. Use any such devices to picture the beam of light emanating from your mind's eye getting the blue star from the desired target window.
>
> <u>Imagery emphasis:</u> Put energy into the display panel and have it produce the beep sound and the blue star.

Thirteen Ss received the goal-oriented visual-imagery strategy instructions both verbally and written down on the sheet of paper in the pamphlet:

> Follow this procedure etc. ... (same as above).
>
> Close your eyes etc. ... (same as above).
>
> Focus your attention on the four window display on the computer screen in your mind. Now, in your imagery "will" the window to light up into the desired beautiful blue star pattern. Form a clear mental image of the blue star and the beep sound. Imagine that you hear the beep sound that precedes a hit and see the blue star with the stripes behind it rolling over the screen when you will press the space-bar. Allow this image to form for a while in your mind.
>
> Now open your eyes and gaze at the display while remaining in a relaxed and focused state. See the blue star image in your mind. Be confident and don't let other thoughts or images interrupt your imagery of the beep and the star. When you feel it is the right moment for starting, press the space-bar on the keyboard to initiate the trial. You can use your finger to help to guide your concentration and imagery to the desired target window (where the brown arrow is located).
>
> The blue star can be a symbol for something you want; use any mental devices to help you to form a clear mental image of the beautiful star pattern. When you practise this exercise at home you may want to draw the blue star on a sheet of paper to help your imagery.
>
> <u>Imagery emphasis:</u> Visualize the blue star and hear the beep sound that precedes it in your mind's ear.

Thirteen Ss obtained the end-oriented visual-imagery strategy instructions both verbally and written down on the sheet of paper in the pamphlet:

> Follow this procedure etc. ...(same as above).
>
> Close your eyes etc. ...(same as above).
>
> Select a number between 11 and 19. This number is your visualization target; your final goal you want to achieve in the end of the session. It may be easiest to select a low number to start with and increase it gradually from session to session, or you may always want to visualize the same number throughout all the sessions.
>
> See the number you chose in your mind's eye on the screen after having finished doing the test, and imagine that you hear the tune that is played if you succeed. Make it clear that you want your scores to be at least this number by the end of the session. Command your subconscious positively to get it for you so that it will bring the desired number to you automatically. Let your subconscious go about it in its own way.
>
> Now, focus on the specific number that you have chosen. The number may stand for a date when you are going to get a new car or going on a holiday. If you reach your desired number in the feedback version and still have trials left, imagine that your next hit (blue star) will be the day when you drive your car, the hit thereafter the day when you polish your new car etc. Use any such mental devices to help you to form a clear mental image of the desired number. You are going to enjoy life when you get it. Let yourself feel the excitement now, and focus that excitement on the number itself. When you feel it is the right moment for starting, press the space-bar on the keyboard to initiate the trial.
>
> Imagery emphasis: Visualize your number appearing on the screen after the test along with the words, "Well Done", and hear the tune that is played if you succeed.

The subject was told that if he was not feeling well, in a bad mood or down, had a busy day at work, or simply did not feel up to it, he should call E and make another appointment for that particular session. (The reason given was that S's performance would probably suffer - a bad mood sometimes resulting in negative results.) This occurred in fact rather often, and I would estimate on average once for each S. This may either indicate that Ss took this suggestion seriously, or that there was something in the procedure that somehow put Ss off. The latter point is made unlikely by the fact that there were no drop-outs in experiment 5. Once S started his four training sessions he remained in the study.

d) Tape-recorded instructions and PK task. Next, E and S went to the sound-attenuated room. The subject was told that before he started the PK computer test he should try to relax physically and listen through headphones to a nice female voice read his imagery strategy (the same as before) to him from a tape-recorder to give him an idea of how to use the strategy. When S was ready, E left the room and went into an adjacent room where he started the tape recording for S. When the strategy was finished on the tape E turned off the tape-recorder, upon which click-sound S was instructed to take off the headphones and start doing the computer test. To make sure that S knew the tape was finished, E knocked twice on the door of the sound-attenuated room. After listening to his strategy S did the computer test. After the session S answered a free-response question sheet/form. The question asked was:

Do you think you learned something from this session? If so, what?

The answers to this free-response question form were to be analyzed post-hoc at a later date. The session ended with a discussion of topics such as parapsychology, or E clarified something that S found unclear.

<u>Session II.</u> At the start of this session E and S discussed how the home practice sessions were going. The experimenter answered questions about the visual-imagery strategy and suggested a few items if he thought S might do with a few good ideas. (No record was kept of who got these hints and who did not seem to need them.) The subject then went to the sound-attenuated room. He listened through headphones to a tape recording of the pep-talk followed immediately by his particular imagery strategy (the same tape as in session I), after which he did the computer test. Then S answered the free-response question sheet on

whether he thought he had learned something in the session. At the end of this session S was given a relaxation exercise to practise at home before going through the visual-imagery strategy. The verbal instructions for the relaxation exercise were as follows (slightly changed from experiment 4):

> Go through the relaxation exercise for about 10 minutes and then practise the imagery strategy for about 5 min. You can of course do the exercises for a longer time. The more time you spend practising at home, the more likely it is that you may be able to use the imagery-strategy efficiently. If you know any other relaxation exercise that you may prefer, feel free to use it instead of the one we suggest.
>
> You may want to incorporate this relaxation exercise into your daily life. You can practise relaxation when you feel under pressure or if you feel stressed and need to relax. Feeling relaxed may help you concentrate on problems or tasks that lie ahead. Relaxing on a daily basis can also lower too high blood pressure and make you better able to deal with stress of one sort or another.

Everybody was played the relaxation exercise on the tape-recorder (including the CR Ss). A reclining chair was placed in one corner of the sound-attenuated room before session II started. The subject sat down in the reclining chair, got a blanket to keep him comfortably warm, and put headphones on. S was then played the relaxation exercise on an audio-tape that took 25 minutes. If S was short of time, he was asked if he could come back later sometime before session III (but not in the session III) to learn the relaxation exercise. Some Ss used this option, but no record was kept of who did and who did not. Then E pointed out to S that a shortened version of the relaxation exercise was in the pamphlet which he had received in the first session.

Session III. After discussion about how the home practices were going and suggestions regarding some items, S did the PK computer test after listening to a tape recording of the pep-talk followed by the visual-imagery strategy (same tape-recording as before). Then S answered the free-response question sheet on whether he thought he had learned something from the session. Next, over a cup of coffee or tea, E described a simple visualization exercise that was in the pamphlet which S had received in the first session (same visualization exercise as in experiment 4). It was to be practised after relaxation and before practising the visual-imagery strategy at home. E went through the exercise with S, explained it and made sure that S understood how to do it. E also asked S to bring his diary with him to the next session.

Session IV. This session started with a discussion about the home practices followed by the pep-talk and S's visual-imagery strategy on the tape-recorder and the PK computer test. Following the computer test S answered the free-response question sheet on whether he thought he had learned something from the session. He then did the inspection time test again, after which E discussed the experiment with S. The experimenter told S about the other strategies, his predictions and reasons for them and so forth. All Ss received their personal results of their progress at the end of this session on two sheets of paper. If S had no further questions, the session was ended with good words and a handshake. (Friends were discouraged from telling each other about the experiment until after they had all completed it.)

Treatment of the Control Group

The control group was included to control for the effects of all variables that I could think of, other than the visual-imagery strategies. All conditions were kept as similar as possible for the control group except that the control Ss did not receive any information about the imagery strategies. The reasons behind deciding upon a CR group of this type was that I wanted to investigate the effect of the visual-imagery strategies directly. If there would be incline in PK scores of the visual-imagery strategy groups, and not in the CR group, one could attribute it to the imagery strategies. If CR would show an incline in PK scores and not the imagery groups, one could, for instance, argue that it was the instructions other than the visual-imagery strategies, that were PK conducive. These were speculations, and as we will see later on, an interpretation of an increase in PK scores of one group and not the others depends on other experimental variables as well.

Instructions following screening session. Those who were selected for the control group were told after the pretest session that we were interested in seeing how people did on four more occasions with about a one week interval. It was attempted to induce in control Ss the possible effects of expectancy, involvement, and practice. They were not told about the three strategies. The following instructions were given verbally:

> We are conducting a larger experiment to test further those who got 18 hits or more from both versions of the computer test. Now, when I say a larger experiment, I only mean that each person will attend on four occasions with about a one week interval, for about an hour each time, to practise on the computer test. You will of course make your own time schedule regarding what days you can attend and at what time to practise on the PK computer test.
>
> You would also be given exercises to do at home as well, such as relaxation and visualization exercises that are widely advocated as important for the acquisition of general mental skills and psychic skills in particular. [Expectancy effect of home practice induced.]
>
> Would you be seriously interested in participating in the second experiment? There are no obligations. If you say "yes" now, you can, of course, say "no" when you attend the first session, or withdraw at any time for that matter. Preferably, we want participants that are, hopefully, not going to drop out of the experiment once they have started.
>
> Aim: The aim of this study is, firstly, to obtain more data on the computer test which you've just finished. It is a new test that we designed here at the lab to measure PK abilities. We are investigating the effect of practice on this computer test. We want to see if more practise and exercise on this test increases your PK scores. Practice on a particular test often increases one's performance on that test. [Expectancy effect induced.] We also want to see if the

> practice effect is somewhat different for the feedback and nonfeedback versions. Secondly, we want to see if people develop any skills or strategies when doing the test on four occasions. If such is the case we want to know if different people develop similar strategies and if it matters what type of strategy people develop.
>
> The tests: In this experiment you will be required to do the same computer test as you were just doing. You will be left to your own devices as to how to go about influencing the test on these four occasions. You will also be given one additional test as well, a so-called inspection time test. You will do the inspection time test before the first session and after the last session. We want to see if practising on the PK computer test will bias the inspection time in one way or another.
>
> You will be given the relaxation and the visualization exercises to practise at home for about 5-10 min. per day before session 3 and 4. If, for some reasons, you are not able to do the home practice sessions once in a while, that's fine. However, we very much want you to practise at home because the more you practise the more likely it is that you will get the full benefit of the exercises. You may of course practise more than 5-10 min. per day if you want to.
>
> We know you are spending valuable spare time here with us, and therefore we want you to benefit from this study. We suggest that you become involved in the exercises personally, and try to explore using them in your daily life - that you try to use them for your own benefit so to speak.
>
> In the last session you will receive your personal results, and at the end of the experiment you will get the main results from the experiment by mail, so that you can compare your scores to the whole group that will be participating.

The training sessions. Control Ss did the inspection time test both before the four sessions started as well as after they were finished. Ss in the CR group were given the same pamphlet which was given to the other groups, except that all information about the visual-imagery strategies was eliminated and no diary was included. Each session started with general chat, followed by the tape-recorded pep-talk suggestions (the visual-imagery strategy part excluded) and the PK computer test. After the PK task S wrote down a report of how he went about influencing the computer test. The CR group listened through headphones to the same relaxation exercise which the other groups had, also in the reclining chair after session 2, and were asked to practise it at home. They obtained the simple visualization exercise which the other groups had to practise at home after session 3. At the end of session 4 control Ss were told about the main purpose of the experiment.

Additional Considerations

Table 6.3 shows a schematic plan of experiment 5. Each training session took about an hour and half. A few pilot runs were conducted to test the visual-imagery training procedure. These were done by E himself in order to save time and E felt confident about the experimental set-up after having executed experiment 4 when considerable experience was gained on the procedure. All subjects (including CR) in the training study were sent by mail the main findings from the experiment when it was finished.

Towards controlling for experimenter effects. The experimenter was not blind as to the four conditions in present study. The potential influence of E was acknowledged and an effort was made to minimize the possibility of such an influence (on experimenter effect, see e.g., Rosenthal, 1980; and recently Palmer, 1989). E made an attempt to treat all Ss equally, with care and warmth. Furthermore, after each session all Ss, including the CR, were given a questionnaire form on which they were asked to rate any particular influence coming from E. Only one subject felt as if E had influenced her. This subject was an elderly lady, who though that this "influence" was quite nice. The question asked on this questionnaire form was as follows:

> Please rate if you felt that the experimenter influenced your performance such that you did well in one version of the test (the feedback or the nonfeedback version) and not as well in the other version (the feedback or the nonfeedback version).
>
> Session 1
>
> 1. - Felt no particular influence from the experimenter.
> 2. - Felt as if experimenter tried to make me do well in the

feedback version but not as well in the nonfeedback version.
3. - Felt as if experimenter tried to make me do well in the nonfeedback version and not as well in the feedback version.

Sessions 2-4

[Same as above.]

Control RNG runs. (i) The experiment was run without Ss with a program that simulated the trials and the sessions (see programs in appendix D). A total of 34 simulated experiments were run, none of which yielded a significant deviation from chance (above or below). (ii) The RNGs were also tested for large series of numbers, nine million overall, resulting in chi-square = 5.00 (p=.17, 2-T) (see exact results in appendix C).

6.5 RESULTS

A total of 16,640 trials (208 sessions) comprised the data for the four training sessions. There were 90 screening pretest sessions, involving 7,200 trials.

Eight subjects did not complete the inspection time test. Various reasons were to blame: Two elderly ladies were spared the effort on both occasions. With two Ss the computer broke down more than three times in a row on the 1st occasion and they were not given the inspection time test the 2nd time. One S complained about sore and dry eyes after finishing the PK task and did not do the inspection time test on the 2nd occasion. Finally, E terminated the inspection time test with three Ss as he noticed that they were becoming frustrated, angry or irritated. Of those three Ss, the inspection time test was terminated for two on the 1st occasion and they were not given it the 2nd time around, and for the remaining S it was terminated on the 2nd occasion. To explore Ss' inspection time was not a major issue of the project and E wanted Ss to feel good when starting the first PK session that followed. Total PK scores for each of the two Ss with whom the BBC broke down were slightly below chance, whereas with the other six subjects total PK scores were above chance.

One file got written over by mistake. Unfortunately the backup cumulative file got too big at the same time so that the backup data were not saved. Therefore that particular outfile was destroyed. Since the main data were also written down by E in his lab-book as each S completed his session, not all data were lost for this particular case. The separate pseudo-RNG1 and the pseudo-RNG2 PK scores and all the IT measurements were lost. The scores of this person were not unusual in any way as far as I could tell. (Missing values were issued for the missing data.) By mistake one subject got the live RNG in both the feedback and the nonfeedback conditions in the first session, and in the second session she got the pseudo-RNG in both the feedback and the nonfeedback conditions. (Missing values were issued for the relevant missing pseudo-RNG scores in the first session and the relevant missing live RNG scores in the second session.) Apart from these two instances, everything went smoothly during the execution of the experiment.

All questionnaire data were double scored. Raw data and computer data were double checked by C.W. and Eric Darley (E.D.), such that E read each raw data point out loud followed by either C.W. or E.D. reading the relevant computer entry out loud. All data except for the single file that was destroyed are available from the author. (The mean PK score for each session in experiment 5 can be found in appendix G.)

Three-way Analysis of Variance was not intended for experiment 5, the datafiles were not structured for such analysis and the number of trials was not kept equal for all RNGs, i.e. 40 live RNG PK trials were completed in the live RNG version of Synthia, whereas in the pseudo-RNG version, 20 pseudo-RNG1 and 20 pseudo-RNG2 PK trials were conducted. None of my hypotheses dealt with interplay between many variables, and multiway ANOVA in study 4 did not find any significant interactions.

Predicted Effects

No individual met the criteria for "natural talent", and therefore all Ss are included in H1-H3.

Hypothesis 1. The Ss practising the GO strategy scored about the same in both versions of the computer test (nonfeedback hits=527, MCE=520; feedback hits=525, MCE=520). The difference was not significant, Wilcoxon test: T (N=52) = 679.000 (z=.09, p=.44, 1-T), see Fig. 6.1 and table 6.4.

Hypothesis 2. The Ss practising the PO strategy scored nonsignificantly higher in the nonfeedback condition (hits=543, MCE=520) than in the feedback condition (hits=525, MCE=520) which was in the predicted direction. The difference between conditions was not significant, Wilcoxon test: T (N=52) = 587.500 (z=.92, p=.18, 1-T), see Fig. 6.1 and table 6.4.

Hypothesis 3. The Ss practising the EO strategy scored slightly higher in the feedback version (hits=522, MCE=520) than in the nonfeedback version (hits=519, MCE=520) which was the reverse direction to that predicted. The difference was not significant, Wilcoxon test: T (N=52) = 659.000 (z=.27, p=.39, 1-T), see Fig. 6.1 and table 6.4.

Hypothesis 4. There was a decline in PK scores between the first half (sessions 1 and 2 combined) and second half (sessions 3 and 4 combined) of the four training sessions for PO, the difference being nonsignificant, Wilcoxon test: T (N=13) = 41.500 (z=.28, p=.77, 2-T). This was in the reverse direction to that predicted, see table 6.5.

There was a decline in PK scores between the first half (sessions 1 and 2 combined) and second half (sessions 3 and 4 combined) of the four training sessions for GO, the difference being nonsignificant, Wilcoxon test: T (N=13) = 32.500 (z=.91, p=.37, 2-T). This was in the reverse direction to that predicted, see table 6.5.

There was a decline in PK scores between the first half (sessions 1 and 2 combined) and second half (sessions 3 and 4 combined) of the four training sessions for EO, the difference being nonsignificant, Wilcoxon test: T (N=13) = 37.000 (z=.59, p=.56, 2-T). This was in the reverse direction to that predicted, see table 6.5.

<u>Hypothesis 5.</u> This prediction applied to the 90 Ss participating in the screening session irrespective of whether they passed the screening criterion and continued to the training sessions. a) Higher feedback PK scores did not correlate with lower VVIQ scores. The relationship was close to chance; Spearman R (87) = -.02 (z=.18, p=.42, 1-T). b) Higher total PK scores did not correlate with higher sheep-goat scores (more sheep-ish) and the relationship was at chance; Spearman R (89) = -.01 (z=.07, p=.45, 1-T). c) Higher total PK scores did not correlate with higher I-E scale scores (external locus of control) and the relationship was slightly in the reverse direction to that predicted; Spearman R (89) = -.06 (z=.60, p=.28, 1-T).

<u>Hypothesis 6.</u> a) As predicted, Ss practising the PO visual-imagery strategy spent a significantly longer time in the nonfeedback condition than in the feedback condition, Wilcoxon test: T (N=52) = 461.000 (z=2.08, p=.036, 2-T), see table 6.6. b) As predicted, Ss practising GO spent significantly more time in the feedback condition, than in the nonfeedback condition, Wilcoxon test: T (N=52) = 302.000 (z=3.52,

p=.0007, 2-T). c) Ss practising EO spent more time in the nonfeedback condition than in the feedback condition. This effect was in the predicted direction, although the difference was not significant, Wilcoxon test: T (N=51) = 570.000 (z=.87, p=.39, 2-T).

Hypothesis 7. This prediction applied only to Ss practising the three visual-imagery strategies. The Ss increasing (becoming slower) in inspection time from the first measurement (done before visual-imagery training sessions started) to the second measurement (done when the training sessions finished) scored higher than Ss decreasing (becoming faster) in inspection time. This was in the predicted direction but not significant, Mann-Whitney Test: U = 39.000 (z=-.84, p=.41, 2-T). Six Ss increased in inspection time and got mean PK scores of 84.17 (above chance), whereas 17 Ss decreased in inspection time and got mean PK scores of 79.47 (below chance), see Fig. 6.2.

Hypothesis 8. a) The Ss doing PO scored higher than the control group in the nonfeedback version which was in accord with the prediction, but the difference was not significant, Mann-Whitney Test: U = 1206.000 (z=-.95, p=.17, 1-T), see table 6.4. b) The Ss practising GO scored exactly the same as the control group in the feedback version, see table 6.4.

General Post-hoc Analysis

Hidden trials. For each of the three strategies, the total observed hits were slightly higher than the hidden hits, see table 6.7. For the control group, total hidden hits were slightly higher than observed hits. I do not think we need statistical tests in order to see that the differences in table 6.7 are far from being significant.

Live RNG and pseudo-RNGs. Was there any particular set-up of the computer test that was overall more likely to be susceptible to psi influence? Ss scored nonsignificantly below chance while doing the trials on the live RNG (mean PK score = 9.91), but nonsignificantly above chance while doing the trials on the pseudo-RNG (mean PK score = 10.26), see tables 6.8 and 6.9. The difference between overall PK scores on the two RNGs came close to significance, Wilcoxon test: T (N=208) = 9299.000 (z=1.81, p=.067, 2-T). The Ss scored similarly on pseudo-RNG1 (mean PK scores = 5.10) and pseudo-RNG2 (mean PK score = 5.14), see table 6.8. The difference between PK scores on pseudo-RNG1 when S initiated it (mean PK score = 5.20) and when E initiated it (mean PK score = 5.00) was not significant, Mann-Whitney test: U = 5226.000 (z=-.30, p=.76, 2-T).

In the feedback version, pseudo-RNG1 PK scores when E initiated the test (mean PK scores = 5.06) and pseudo-RNG2 PK scores (mean PK scores = 5.08) were about the same. Thus the difference between pseudo-RNG1 and pseudo-RNG2 that was observed in the feedback version in experiment 4 was not replicated.

The condition that most resembles prior studies is the live RNG feedback condition for PO and GO (for reference see table 6.9). PK scores in the PO live RNG condition were nonsignificantly higher in the nonfeedback version (mean PK score = 5.94) than in the feedback version (mean PK score = 4.48), Wilcoxon test: T (N=52) = 615.000 (z=.67, p=.51, 2-T). However, PK scores in the GO live RNG condition were also nonsignificantly higher in the nonfeedback version (mean PK score = 5.31) than in the feedback version (mean PK score = 4.67), Wilcoxon test: T (N=52) = 642.000 (z=.43, p=.67, 2-T).

<u>The inspection time test.</u> Ss practising PO increased nonsignificantly in inspection time (t=-1.22, p=.25) and Ss practising GO and CR decreased nonsignificantly in inspection time between the

first and last measurement (t=.95, p=.36 and t=1.36, p=.21, respectively). EO decreased significantly in inspection time from the first measurement to the second (t=2.83, p=.02). See table 6.10 for details.

Test-retest reliability for the inspection time test was obtained by doing Pearson Correlation on duration time on the first occasion and duration time on the second occasion. As it turned out; r(42) = .46 (t=3.32, p=.0022, 2-T), which suggests consistency in responding on the two occasions.

Home practice sessions. Fourteen of those doing the visual-imagery strategies did not practise at home. If S did not bring his diary to the last session E gave him an addressed envelope to put the diary in and mail back. If that did not work E phoned S after Christmas and asked him to turn in the diary. The matter was not pursued any further. The 25 Ss who practised at home scored slightly higher (mean PK scores = 81.28) in combined total PK scores for the four sessions than the 14 Ss who did not practise at home (mean PK scores = 80.64). The difference was not significant on a Mann-Whitney test: U = 171.000 (z=-.12, p=.87, 2-T).

Vividness of the visual-imagery strategy as reported in the diaries when practised at home did not get better with more practice. The method developed in pilot experiment 4 to measure whether imagery gets better over a period of time (for details see appendix E), showed a nonsignificant correlation between the chronological time variable and the vividness ratings; Spearman R(119) = -.09 (z=.96, p=.34, 2-T).

Post-Hoc Linear Relationships

To examine the various possible linear developments across sessions the Spearman Rank correlation coefficient was employed to correlate PK scores with session number. One can question the use of correlation on only four values. I reasoned that correlation could give a rough indication of which relationships suggest linear connections, if any. Furthermore, the relationships that would reach significance would be the most robust ones and those were of most interest to me.

The four group. All three training groups showed nonsignificant declines in the combined feedback and nonfeedback PK scores from session 1 to session 4, see Fig. 6.3. The decline for combined PK scores of the three strategy groups was not significant; Spearman R(155) = -.08 (z=.94, p=.35, 2-T). The control group was the only group that showed a close to significant incline in total PK scores; Spearman R(51) = .27 (z=1.95, p=.051, 2-T), see Fig. 6.4. This incline in total PK scores in the control group was due to a highly significant incline in the nonfeedback version; Spearman R(51) = .39 (z=2.80, p=.0053, 2-T), as can be seen in table 6.11.

Live RNG and Pseudo-RNGs. Looking at table 6.12 the positive marginal significant correlation between PK scores and session number for the control group was mainly due to a significant correlation between total pseudo-RNG PK scores and session number; Spearman R(51) = .28 (z=1.98, p=.045, 2-T), and not total live RNG PK scores and session number.

To be more exact it was total pseudo-RNG1 PK scores that correlated significantly with session number; Spearman R(51) = .43 (z=3.08, p=.0025, 2-T), but not total pseudo-RNG2 PK scores and session number, see table 6.12.

Tracing this effect even further can be done by comparing whether it was due to E or S initiating the pseudo-RNG1, see table 6.13. Session number correlated positively and significantly with total pseudo-RNG1 PK scores when E initiated the test; Spearman R(25) = .49 (z=2.45, p=.01, 2-T). This correlation was not significant when S initiated the test; Spearman R(25) = .08 (z=.39, p=.70, 2-T).

Predicting Training Post-Hoc

Was there any group of Ss that was more likely to show increase in PK scores in visual-imagery training?

Sheep and goats in imagery groups. The following analyses were done on the three visual-imagery groups, and not on the control group. The 27 sheep scored nonsignificantly higher (mean PK scores = 81.30) than the 12 goats (mean PK scores = 80.50), Mann-Whitney Test: U = 155.000 (z=-.21, p=.81, 2-T).

For an informal comparison, the 2 highest scoring sheep (scoring 6 on the sheep-goat scale) got higher PK scores (mean PK scores = 87.00) than other sheep or goats, and scored above chance in three sessions out of four. The difference between these two sheep and the 12 goats was not significant, Mann-Whitney Test: U = 5.000 (z=-1.28, p=.20, 2-T).

The 27 sheep increased nonsignificantly in PK scores from first half of the experiment (mean PK scores from sessions 1 and 2 combined = 40.30) to the second half (mean PK scores from sessions 3 and 4 combined = 41.00), Wilcoxon test: T (N=27) = 171.000 (z=.43, p=.67, 2-T). The 12 goats decreased significantly in PK scores from first half (getting mean PK scores = 43.00) to second half (mean PK scores = 37.50), Wilcoxon test: T (N=12) = 5.500 (z=2.63, p=.009, 2-T).

I ran Mann-Whitney tests on the PK score increase between the first and second half of the training sessions with sheep and the decrease in PK scores between the two halves of the experiment with goats. This analysis yielded a significant difference between sheep and goats, Mann-Whitney test: U = 73.500 (z=-2.69, p=.007, 2-T).

<u>Sheep and goats in control group.</u> The 11 sheep increased in PK score from first half (mean PK scores = 39.00) to second half (mean PK scores = 40.64) of the experiment. The two goats also increased in PK score from first half (mean PK scores = 38.50) to second half (mean PK scores = 41.00) of the experiment.

<u>GGPQ.</u> This analysis applied only to those practising the three visual-imagery strategies. Those scoring high on the GGPQ (split via the median of 27.0) scored slightly lower on the computer test (combined PK scores from the four sessions) than those scoring low on the GGPQ, Mann-Whitney Test: U = 145.000 (z=-.23, p=.80, 2-T). This is nonsignificantly in the reverse direction to that found post-hoc in experiment 4. The 19 Ss scoring high on the GGPQ got mean PK scores of 80.26, whereas the 16 Ss scoring low on the GGPQ got mean PK scores of 80.56.

<u>Gordon's test.</u> This analysis was done only on the three visual-imagery groups. When the Gordon's test is split via the median of 20 into high and low self-rated imagery controllers, both the high and low self-rated imagery controllers decreased slightly in PK scores from the first half of the experiment to the second. The 17 high controllers decreased from a mean PK score of 42.35 down to 39.06 (MCE=40). The 17 low controllers decreased from mean PK score of 40.12 down to 40.06 (MCE=40). (The 5 Ss who had an exact median of 20 were excluded from the analyzes.)

Post-Hoc Analysis of the Screening Sessions

In addition to H5, the following four analyses were conducted on the 90 session pretest screening material: a) The Gordon questionnaire on imagery control did not correlate significantly with feedback PK scores; Spearman R(89) = .15 (z=1.37, p=.17, 2-T). This was however in the expected direction, i.e., higher self-rated imagery control was associated with higher PK scores. b) Scores on the Gordon questionnaire correlated significantly with those on the VVIQ and VAIQ; Spearman R(87) = -.46 (z=4.26, p=.0001, 2-T) and Spearman R(88) = -.27 (z=2.50, p=.01, 2-T), respectively. c) Scores on the VVIQ correlated significantly with those on the VAIQ; Spearman R(87) = .52 (z=4.82, p=.0000, 2-T). d) Correlation between answers to question 15 on the GGPQ and the total PK scores was close to significance; Spearman R(86) = .20 (z=1.88, p=.057, 2-T). These results are reported here for the record, but are not discussed until in chapter 7.

6.6 DISCUSSION

No hypotheses related to psychokinesis were confirmed. Subjects doing GO did not score higher in the feedback version than in the nonfeedback version, and Ss doing EO did not score higher in the nonfeedback version than in the feedback version. Ss practising PO showed a nonsignificant trend towards doing better in the nonfeedback version than in the feedback version, as predicted, and scored nonsignificantly higher than the control group in the nonfeedback version. The three visual-imagery groups demonstrated a nonsignificant decline in PK scores across sessions. In contrast, the control group inclined in PK scores across sessions to a degree close to significance, thus showing a trend that implies "learning" (although it does not necessarily mean learning effect). A multi-session set-up such as the one employed in experiment 5 does therefore not provide any support for the three visual-imagery strategies as tools to increase PK scores in psi experimentation with random number generators.

It should be noted that experiment 5 was not an exact replication of prior studies conducted by Morris et al. (1982) and Levi (1979) but a replication of the visual-imagery strategies they explored. A multi-session set-up such as the one used in experiment 5 neither brought out the difference between PO and GO that earlier studies have found nor GO's effectiveness in producing extrachance results. The condition that most resembles prior studies is the live RNG condition for PO and GO. The live RNG condition for these two groups did, however, neither produce evidence for PK nor did it differ in any obvious way from the pseudo-RNG conditions (see table 6.9).

Post-Hoc Implications

A number of post-hoc analyses were conducted giving rise to some findings that reached significance but whose importance, if any, could only be ascertained by further research. I prefer to discuss the main post-hoc findings from experiment 5 along with the relevant findings from experiment 4 in this section (instead of discussing both experiments together in the final discussion chapter). The reason is that it is difficult to discuss and interpret the present findings without referring to the relevant findings from the previous study since I was trying to replicate the prior findings.

Sheep and goats. (1) One of the more interesting post-hoc findings from the present study was that of sheep inclining nonsignificantly in PK scores between the first and the second half of the experiment, while the goats declined significantly ($p=.009$, 2-T). The difference between the incline with sheep and the decline with goats was significant ($p=.007$, 2-T). In experiment 4, goats declined more than sheep between the two halves of the six sessions (for goats the decline yielded $p=.10$, 2-T, and for sheep $p=.53$, 2-T). There were, however, only 3 goats in study 4. (2) Only two super-sheep (scoring 6 on the sheep-goat scale) practised the visual-imagery strategies. They scored higher (mean PK scores = 87.00) than other sheep and goats. It is important to stress that N is quite small, which makes this observation nearly useless. The three super-sheep in experiment 4 also scored higher than all other sheep and goats in the visual-imagery training, and scored above chance on five out of six occasions (mean PK scores = 125.00). In future research into visual-imagery strategies for the facilitation of PK one may want to screen for sheep, and perhaps in particular super-sheep.

Inspection time trends. The test-retest reliability of the inspection time test turned out to be reasonable ($r=.46$, $p=.002$), and Ss showed consistency in the number of trials they did on the two occasions. The two inspection time measurements that were analyzed in relation to PK scoring were not significant. Both of them, however, can be considered as nonsignificant trends that were in accord with the findings from experiment 4. Since neither was significant and 8 Ss did not complete the inspection time test in experiment 5, no serious interpretation will be offered. Further research must decide whether these effects are real or not:

(1) PO was the only condition that demonstrated an increase in inspection time after imagery training. This could indicate that when Ss have practised PO, and turn immediately to the inspection time test, the process type imagery gets in the way of, or interferes with the processes that are responsible for inspection time. This interference could relate to the effects of PO practice upon some strategies used in solving the inspection time task. If future research shows this observation to be valid, one may have some sort of an objective measure of whether PO has effectively taken place with a subject or not. In

other words, an increase in inspection time can be seen as measurable effect of PO imagery. (2) Ss practising the visual-imagery strategies that increased in inspection time from first measurement to second scored nonsignificantly higher than Ss who decreased in inspection time. If PO was the only strategy that increased in inspection time, then the Ss increasing in inspection time and scoring higher than those who decreased in inspection time may have been mainly the Ss who did well in the PO group. This seems to be the case. Of those who increased in inspection time (and scored higher than those who experienced a decrease), in experiment 4, 3 out of 5 were doing PO (while 2 did EO), and in experiment 5, 4 out of 6 were doing PO (while one did GO and one did EO). In both experiments 4 and 5, Ss using PO scored higher than Ss using either GO or EO.

Interaction Between Feedback and Imagery

The IT measurement in the present experiment confirmed the observation from experiment 4. In experiment 5, Ss "willing" the blue star to appear took more time on their task (987 sec.) than Ss "willing" in their mind's eye an energy beam going into the target box pulling out the blue star (727 sec.). Ss "willing" a final number of hits out of the session spent less time (466 sec.) on their task than any of the other groups. They even spent less time on their task than Ss who had not been provided with any instructed strategy (596 sec.). Duration of volition was longer when Ss doing PO did not obtain feedback on their performance (395 sec.), than when they received such feedback (331 sec.). Ss doing GO spent more time on their task when they received feedback on their performance (558 sec.), than in the absence of such feedback (428 sec.). Although nonsignificant, Ss practising EO showed a trend towards spending more time on their volition task in the absence of immediate feedback (240 sec.) than in the presence of such feedback (226 sec.).

The instructions required Ss to engage in one of three different mental processes. If mental processes can be seen as analogous to physical processes, we would expect Ss to take different times in employing their strategy, depending upon what strategy they are using. As it turned out Ss spent different times on their task depending upon which strategy they were practising (see table 6.6). Kruskal-Wallis test: H (3,N=207) = 16.313 (p=.0013) for the four conditions. This suggests that Ss were, in fact, practising three (or four counting the CR group) different strategies on the computer test. If they had not, we would expect Ss to have spent roughly equal time on the task. However, whether a strategy took a long or short time to perform was not connected with its effectiveness according to the data.

Let us put PK aside. We still have to explain the different effects of the presence and absence of immediate feedback on IT in PO and GO. As a starting point, let us look at the cognitive effort idea presented by Levi (1979). In the present study, the cognitive effort required of Ss in GO should have been less in the feedback condition than in the nonfeedback condition, since the form of the feedback (the blue star) was congruent with the imagery (of visualizing the blue star) in the feedback condition. In contrast, the cognitive effort required of Ss in PO should have been greater in the feedback condition, since the form of the feedback was not congruent with the imagery (visualizing an energy beam).

In the last chapter we argued that the IT measurements did not support the interpretation of the cognitive effort idea where more cognitive effort should be reflected by higher IT, and less cognitive effort by less IT. Another interpretation of the cognitive effort idea can be stated as follows:

> Less cognitive effort (as a consequence of less conflict between external feedback stimuli, or absence of stimuli, and internal imagery) is reflected in more time spent on a task because the imagery process is left undisturbed to take its time. Less time spent on a task indicates more cognitive effort, because the imagery activity that is going on is cut off when it conflicts with external feedback.

This may seem counter-intuitive. Feedback (or no-feedback) which is not congruent with the visualization will result in less time spent on a task. Feedback (or no-feedback) congruent with visualization will result in more time spent on the task. In this explanation no-feedback is "active" and has an effect, for example, in GO where no-feedback is considered not to be congruent with imagery and results in interference between imagery and no-feedback.

Feedback on its own, or the absence of it, is seen as crucial in the cognitive effort idea. We can look at the time that Ss take after making a hit and after getting a miss in the feedback version for both GO and PO:

(a) For GO in the feedback version: Since the criteria for less cognitive effort is the production of feedback congruent with imagery we can compare directly the IT after a hit and IT after a miss. No blue star after a miss is not congruent with imagery of a blue star. We would expect GO to take more IT after a hit than after a miss. The data shows a significant difference between IT after a hit (mean IT = 11.45) and after a miss (mean IT = 15.41), Wilcoxon test: H (N=52) = 460.000 (z=2.085, p=.03, 2-T). This indicates that Ss speed up after receiving a hit. Thus this part of the cognitive effort idea as detailed above, is not confirmed.

(b) For PO in the feedback version: Because the absence of feedback is congruent with PO imagery less cognitive effort occurs. We can compare directly the IT after a hit and after a miss. A blue star after a miss is not congruent with the image of an energy beam, whereas no blue star is more congruent with the imagery. We would expect PO to take more IT after a miss than after a hit. The data shows a significant difference between IT after a hit (mean IT = 6.98) and after a miss (mean IT = 9.02), Wilcoxon test: H (N=52) = 445.000 (z=2.22, p=.02, 2-T). This indicates that Ss speed up after receiving a hit. This seems to suggest a rise in cognitive effort immediately following feedback and is apparently in accord with the cognitive effort idea as detailed above. This, however, also suggests that Ss speed up after hits regardless of which strategy they use, PO or GO. The same statistical comparison for hits and misses has not yet been conducted on EO and CR, or on the nonfeedback conditions where it would be interesting to see if there is any tendency to respond in the same way, thus indicating that at some level Ss may be aware that they got a hit.

Do we have to invoke the concept of cognitive effort that represents interference or conflict between feedback and imagery? The following is a "simple" explanation of what could be happening (although there are probably other possible interpretations): Feedback is seen as information, e.g. in the feedback version of Synthia, a miss is not followed by any blue star, but still it provides feedback on performance. Ss speed up after receiving a hit because they feel more confident irrespective of what strategy they are practising. Or, since feedback is also information of failure, when Ss obtain "negative" feedback they loose confidence, slow down and spend some time getting set for the next trial. The absence of feedback (as in the nonfeedback version of Synthia) does not have any effect on imagery at all. When imagery is performed without feedback, or information about performance, it is left undisturbed to take its time. When trial-by-trial feedback is presented on performance (as in the feedback version), Ss practising GO concentrate (or focus) more on their task than in the absence of such information. Their attention is kept alert since they are constantly reminded of their image resulting in more concentration. In the absence of information on performance, Ss practising PO and EO concentrate more easily on their task than in the presence of such information. For PO and EO, Ss' concentration or attention is interrupted by any trial-by-trial feedback.

A possible relationship between concentration / attention and IT in feedback / nonfeedback conditions can be explored in future experiments by administering some sort of concentration / attention questionnaire in each session. One would probably need more elaborate apparatus to get at this hypothesis but this could be a start.

The "Learning" Effect

The control group (CR) was the only group that showed a marginally significant incline in PK scores across sessions. We traced this significant incline effect to the pseudo-RNG1 PK scores of CR. This significant incline in pseudo-RNG1 PK scores over sessions occurred when E initiated the test (and thus a random sequence of 20 trials), and not when S initiated the test. However, the pseudo-RNG1 trials when S initiated the test contributed to the overall significant correlation between pseudo-RNG1 PK scores and session number as can be seen in table 6.13 (rs = .28 for nonfeedback pseudo-RNG1 PK scores and session number when S initiated the random sequence). To sum up, the significant incline in PK scores over sessions for CR was mainly due to the random numbers that were produced when E initiated a determined run of 20 numbers, which then significantly matched the target order.

Possible reasons. Given the large number of analyses done, the marginally significant incline observed in PK scores of the control group could have been a chance result. Acknowledging the fact that this finding could be a chance result, we may nevertheless want to speculate on other interpretations. Following are three possible psi-based explanations.

(1) Interest-related variables: Practising the same strategy time after time may have been dull and repetitive. Ss may have got bored and lost interest in the strategy they were using. This loss of interest may have been reflected in the PK scores that declined over time and was most prominent with the goats. Another psychological factor may have been that Ss gradually tried harder and harder to "make" their strategy work. High striving associated with visualization of desired outcome has resulted in psi scores below chance (Debes & Morris, 1982; also relevant is Morris & Morrell, 1985). The third factor might have been that the imagery groups had high expectations of the effectiveness of their training. They became frustrated or "put off" somehow by the feedback from poor results. In contrast, Ss in CR may not have lost interest since they were free to play around with as many methods as they could think of. Their expectations may not have been as high as with the imagery groups and thus the CR Ss may have adopted a more relaxed attitude towards the sessions. Their interest in the PK task may have been more likely to grow as the sessions went on.

In these explanations, attentional factors and the novelty of a strategy are considered more important than the actual production of the strategy. Strategy instructions are more demanding and decrease attentional factors, while less defined instructions make these attentional factors high. Implicit in these explanations is that it is the not the strategies per se that would increase PK scoring, but some sort of hypothetical variable(s), like "interest". I would like to make three comments on these explanations: Firstly, if interest-related variables were solely responsible for high PK scoring, we would have observed high PK scoring in the first training session (where the novelty level would have been high, compared to the remaining three sessions). Indeed such was the case with the visual-imagery strategy groups (see Figs. 5.1 and 6.4), but it was not of the same caliber of what was obtained in the one or two session studies conducted by Morris et al. (1982) and Levi (1979). Secondly, these explanations include so many possible variables, that it is difficult to point out which ones are more likely than others to be responsible. Thirdly, these explanations may shed some light on the decline with the imagery groups, and to some extent the incline with the CR group. However, they do not explain why the incline in the CR group mainly occurred on pseudo-RNG1 when initiated by E.

(2) The quantum collapse model: Schmidt's model would probably explain PK influence on the RNGs as generated by S affecting the outcome when he observes it (at the end of the nonfeedback condition and after each trial in the feedback condition). S is the "interested" party who observes the results before anyone else. Assuming that S was influencing the random numbers, then we would expect S's influence to be equal on pseudo-RNG2 and pseudo-RNG1, both when S and E initiated it. This was however not the case.

(3) The IDS model would predict that all results are obtained via intuitive data sorting by precognition. It might explain the incline with the CR group by saying that the only way for E to enter the data via his own psi would be through pseudo-RNG1 when he initiated the

computer tests. The IDS model would say that the experimenter intuitively started the test at the right moment to get this "learning" effect. If this is the case we would expect psi scores to have increased in both feedback and nonfeedback conditions when E initiated pseudo-RNG1 (unless E was differentially "motivated"). Looking at table 6.13 this expectation is marginally confirmed: Feedback psi scores when E initiated pseudo-RNG1 were close to being significant (rs=.37, z=1.87, p=.06, 2-T). However, E predicted that the visual-imagery groups would show an incline effect and not the CR group, and he knew the condition for each subject. The CR group was expected to score at chance or to show a slight decline in PK scores. In a sense, E wanted CR to show no incline effect. So if we interpret this "learning" effect as possibly produced by intuitive data sorting by E, then we have to argue that it was psi-missing on behalf of E. (It is possible that there are multiple influences, and that during execution of CR, E was less confounded by complicated influences resulting from the imagery strategies, if any influences resulted from them at all.)

Of the three psi based interpretations discussed, the one offered by the IDS model can be presented as the most consistent with the incline in the CR group. A significant difference between performance on pseudo-RNG1 (which was initiated by E) in comparison with other RNGs (initiated by Ss) was also observed in experiment 4. There we noticed a significant difference (p=.04, 2-T) between feedback PK scores on pseudo-RNG1 (above chance) and pseudo-RNG2 (below chance). This was however not replicated in experiment 5, which casts doubt on this observation. Also, why should E's influence only be limited to the CR group? Why do we not notice more of E's influence in the data if E's precognition can play such a big role in forming the results? I do not have any ready-made answers to these questions, and the fact remains, that these "one-occasion" significant findings may be due to chance, given the number of statistical analyses conducted.

Imagery Practice

Two studies, both dealing with somewhat prolonged imagery practice, came to my attention after the completion of the visual-imagery experiments. Since they are related to the purpose of this thesis they will be described here at length.

Morris and Hornaday (1981) conducted a two session study with 31 subjects. They used the same PK device that Morris et al. (1979) had used (a display of 16 lights where a binary decision from a RNG determined whether the illuminated light would step clockwise or counterclockwise). Target direction (clockwise or counterclockwise) was counterbalanced for Ss and assigned prior to the study. (Although it is not clear in the report, it appears that the experimenter who treated the subjects did not know the assignment.) The subject started the first session by doing four runs of 16 trials each. He was then given written instructions on mental practice and attempted to imagine for about 4 minutes being successful at influencing the lights. Following this, the subject did four more runs of 16 trials each. Before the second session which would take place in a week's time, the subject was required to engage in the mental practice procedure once a day. In the second session the subject was again tested on the PK test.

The overall results were above chance but not significantly so (50.50%, z=.89). There was no significant difference between the first and second sessions. There was a "general trend towards improvement from first session through the first half of the second session, but the second half showed negative scoring" (ibid., p.104). No meaningful correlations were found between PK performance and the number of home practice sessions, average duration of session, vividness of experience or prior experience with mental development techniques.

Braud (1983) reported a pilot investigation of prolonged visualization / imagery training in facilitating PK. He examined PK performance by having 7 Ss individually try to exert a PK effect on a visual display attached to a thermal noise-based binary RNG. The display provided red illumination feedback for hits, but no feedback for misses. Each subject was tested twice on the RNG on each occasion doing five 100-trial runs, preceding (pre-test) and following the imagery training program (post-test). On both occasions the subject's imagery was assessed by Paivio's Individual Differences Questionnaire, Marks' VVIQ and Gordon's Test of Visual Imagery Control.

The training program had originally been developed by George (George, Imagery Enhancement, unpublished). It emphasized various visualization exercises. A tape recording of the exercises involved predominantly guided visualization of color and colored objects. Early exercises were simple and "static" while later exercises were more complex and "dynamic" (Braud, 1983, p.188). This training consisted of weekly group meetings as well as daily home practice for a period of six weeks. Before training, PK scoring did not differ significantly from chance, but following training PK scores were significantly above chance ($p=3.66 \times 10^{-6}$, 2-T), using the z-test. As predicted, the PK score had increased significantly from pre-test to post-test ($Z_{diff}=2.84$, $p=.0044$, 2-T). Furthermore, a significantly positive correlation between amount of imagery practice and increase in PK scores across training was also reported ($r=+.84$, $p<.02$, 2-T). Finally, all imagery scores on the questionnaires changed in the expected direction across training, and on the Gordon test to a significant degree ($p=.026$, 2-T), using the t-test.

Braud concluded that his preliminary findings were consistent with the idea that prolonged visualization training may facilitate PK performance (ibid., p.189).

In both the Morris and Hornaday (1981) and Braud (1983) studies Ss were apparently not instructed to use any particular visual-imagery strategy while attempting to exert psychokinesis. In that respect these two studies are not directly related to our purpose of exploring PO, GO and EO. Both are, however, important to the discussion of the hypothesized relationship between imagery and PK (George & Krippner, 1984). Morris and Hornaday failed to find a significant improvement in PK performance after a week of "mental practice" procedure. Unfortunately they do not report whether imagery got significantly better after one week's practice, or if they attempted to assess that at all. Braud reported a significant increase in PK scores after imagery training and he also reported a significant change in imagery in the expected direction after training, as measured by the Gordon's test. Thus, Braud's study seems to yield some confirmation of the hypothesized relationship between imagery and PK, in that imagery training significantly affected imagery and in turn PK performance improved to a significant degree. As I see it, it is unfortunate that Braud did not have a control group. Therefore we do not know whether the tendency to report better imagery control after prolonged practice was due to practice or something else.

The data from experiments 4 and 5 indicate that our training procedure did not significantly improve the vividness of the visual-imagery strategies for those Ss who practised at home. In that case the results of studies 4 and 5 may not be directly relevant to the PK-imagery hypothesis. We should however acknowledge that in both experiments 4 and 5 Ss tended to report that imagery practice at home improved slightly the vividness of the visual-imagery strategy they were using (correlation between the chronological time variable and the vividness ratings for experiment 4, rs=-.24, p=.06; and for experiment 5, rs=-.09, p=.34). Perhaps a better way to assess whether imagery improves with practice is to do as Braud did and administer imagery scales before and after imagery training. My reason for using the diaries as a basis for imagery evaluation was that I wanted to measure whether the vividness of a particular strategy that S was using improved, and not the general imagery ability.

Follow-up Investigation

One subject, case 26, scored consistently above chance in the feedback version of the PK computer test in experiment 4. He was practising the PO strategy that had been expected to yield extrachance PK scoring in the nonfeedback version. I decided to try to get case 26 again to the laboratory after experiment 5 for further experimentation. He agreed to this and we decided to do five more sessions without any instructed strategy. The five sessions were carried out between 21 January and 18 February 1989. Again, the PK task was the computer test "Synthia", but this time it was the same version as was used in experiment 5 (with both live and pseudo-RNGs generating the PK targets). For the five sessions, case 26 obtained feedback PK scores of 46 (MCE=50, z=-.65), and nonfeedback PK scores of 46 (MCE=50, z=-.65). He scored therefore below chance on this occasion. Unfortunately, the five sessions coincided with a difficult period in his life. Shortly before the five sessions started he had failed his exams in an evening school. During the experimentation, he attempted to resit the exams, but failed again, and finally quit his daytime job. For the last couple of sessions he was trying to decide what to do in the future. Be that as it may. For overall feedback PK scores (one pretest session, six training sessions and five additional sessions), case 26 obtained 140 hits (MCE=120, z=2.11, p=.03, 2-T). Although case 26 did not live up to expectations in the five additional sessions, his overall feedback scores are still significant. The results in the follow-up tests, however, leave it ambiguous as to whether he ever had any "natural" psi gift.

6.7 SUMMARY

It is acknowledged that the results from this study do not support the three visual imagery strategies (GO, PO and EO) as a method of increasing PK scores in a multi-session set-up with RNGs. Post-hoc examination of the data suggests the possibility of sheep doing better than goats in this type of imagery "training" research. The goats declined significantly in PK scores, whereas sheep showed a slight incline in PK scores. The difference between incline with sheep and decline with goats was significant. The control group was the only condition that implied any "learning" effect across sessions. Three psi-based explanations were offered on the marginally significant incline in PK scores of the CR group. The one most consistent with the results was psi-missing precognition on behalf of the experimenter. Ss practising PO spent a significantly longer time in the nonfeedback version than in the feedback version. Ss practising GO spent a significantly longer time in the feedback version than in the nonfeedback version. This effect was interpreted in terms of different levels of concentration.

TABLE 6.1

Organization of the pretest screening sessions in experiment 5. PRNG: pseudo-RNG.

s1*		s2		s3		s4		s5		s6		s7		s8		s9		
F	N	N	F	F	N	N	F	F	N	N	F	F	N	N	F	F	N	
L	P	L	P	P	L	P	L	L	P	L	P	P	L	P	L	L	P	
S	S	S	S	S	S	S	S	E	E	E	E	E	E	E	E	S	S	
2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	2	etc.

s: subject
F: feedback (40 trials)
N: nonfeedback (40 trials)
P: pseudo-RNG (40 trials)
L: live RNG (40 trials)
1: PRNG1 first (20 trials)
2: PRNG2 first (20 trials)
E: E initiates test (80 trials)
S: S initiates test (80 trials)

*A random selection decided if the first S started with feedback or nonfeedback version, if he did the test with PRNG or live RNG first, for the pseudo-RNG trials (whether hidden or not) if pseudo-RNG1 or pseudo-RNG2 came first, and finally if E or S initiated the test.

TABLE 6.2

Schema of the set-up of experiment 5. S1-S12 = subjects, N, F, 1, 2, P, L, E, S = same as in table 6.1. After flips of a coin for the first S, the starting point of "FPS1" was obtained.

PO	Session 1		Session 2		Session 3		Session 4	
S1 =	F	N	N	F	F	N	N	F
	P	L	L	P	P	L	P	L
	S	S	S	S	E	E	E	E
	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
S2 =	N	F	F	N	N	F	F	N
	P	L	L	P	P	L	L	P
	E	E	E	E	S	S	S	S
	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1
S3 =	F	N	N	F	F	N	N	F
	L	P	P	L	L	P	P	L
	S	S	S	S	E	E	E	E
	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
S4 =	N	F	F	N	N	F	F	N
	L	P	P	L	L	P	P	L
	E	E	E	E	S	S	S	S
	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1
:								
S13 =	F	N	N	F	F	N	N	F
	P	L	L	P	P	L	L	P
	S	S	S	S	E	E	E	E
	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
GO								
S1	N	F	F	N	N	F	etc..	
	L	P	P	L	L	P		
	E	E	E	E	S	S		
	2,1	2,1	2,1	2,1	2,1	2,1		
S2	F	N	N	F	F	N	etc..	
	L	P	P	L	L	P		
	S	S	S	S	E	E		
	1,2	1,2	1,2	1,2	1,2	1,2		
S3	N	F	F	N	N	F	etc..	
	P	L	L	P	P	L		
	E	E	E	E	S	S		
	2,1	2,1	2,1	2,1	2,1	2,1		
:								
etc..								

CR same as PO.
EO same as GO.

TABLE 6.3

Rough plan of experiment 5.

Sessions	Treatment of the four groups
Screening session	1. E chats with S 2. S fills out VVIQ, VAIQ, Gordon's test, GGPQ, I-E scale 3. S does the PK computer test 4. S fills out post-session questionnaire 5. E puts S into either one of the three imagery groups or the control group 6. E gives S basic instructions.
First session	1. S is greeted by senior laboratory members 2. S does the inspection time test 3. E gives S a pamphlet that includes instructions of how to do the home practices, the diary etc. 4. S listens via headphones to pep-talk followed by the visual-imagery strategy (the strategy groups) 5. S does the PK computer test. 6. S fills in free-response question sheet and rates E's influence.
Second session	1. E discusses home practices with S 2. S listens to pep-talk followed by strategy on tape 3. S does the PK computer test 4. S fills in free-response question sheet and rates E's influence 5. S listens to 25 min. relaxation exercise in a reclining chair.
Possible extra session	1. If S did not have time to learn the relaxation exercise at the end of last session he returns to the laboratory to learn the relaxation exercise.
Third session	1. Discussion 2. S listens to pep-talk followed by strategy on tape 3. S does the PK computer test 4. S fills in free-response question sheet and rates E's influence 5. S learns a simple visualization exercise 6. S asked to bring diary in next session.
Fourth session	1. Discussion 2. S listens to pep-talk followed by strategy on tape 3. S does the PK computer test 4. S fills in free-response question sheet and rates E's influence 5. S does the inspection time test again 6. Discussion, diary returned, results provided, etc.
After experiment	1. All Ss sent results of main findings of the experiment by mail.

TABLE 6.4

Hits and t-test statistics for the three strategies and the control group in the feedback and nonfeedback conditions.

	Feedback scores (MCE=520)	Nonfeedb. scores (MCE=520)	Combined scores (MCE=1040)
PO n=52	Hits = 525 Mean = 10.10 sd = 2.74 t = .253	Hits = 543 Mean = 10.44 sd = 3.06 t = 1.041	Hits = 1068 Mean = 20.54 sd = 3.86 t = 1.007
GO n=52	Hits = 525 Mean = 10.10 sd = 2.26 t = .307	Hits = 527 Mean = 10.14 sd = 2.74 t = .355	Hits = 1052 Mean = 20.23 sd = 3.36 t = .495
EO n=52	Hits = 522 Mean = 10.04 sd = 2.94 t = .094	Hits = 519 Mean = 9.98 sd = 2.59 t = -.054	Hits = 1041 Mean = 20.02 sd = 3.95 t = .035
CR n=52	Hits = 525 Mean = 10.10 sd = 2.29 t = .302	Hits = 510 Mean 9.81 sd = 2.74 t = -.505	Hits = 1035 Mean = 19.90 sd = 3.59 t = -.193

TABLE 6.5

Mean PK scores for first and second half of the four training sessions (sessions 1-2 combined and 3-4 combined) for the four conditions. "-" denotes decline, and "+" denotes incline in PK score means between the two halves at of the experiment.

	FEEDBACK			NONFEEDBACK			COMBINED		
	First half	Second half		First half	Second half		First half	Second half	
PO	21.31	19.08	-	20.08	21.69	+	41.39	40.77	-
GO	20.62	19.77	-	20.54	20.00	-	41.15	39.77	-
EO	20.08	20.08	=	20.77	19.15	-	40.85	39.23	-
CR	20.77	19.62	-	18.15	21.08	+	38.92	40.69	+

TABLE 6.6

Mean time (in seconds) spent on practising the three imagery strategies. Wilcoxon tests are reported as two-tailed.

	Time in Feedback version	Time in Nonfeedb. version	Wilcoxon test between feedback & nonfeedback versions	Total time
PO	331.20	395.47	T(52)=461.000 (z=2.08, p=.036)	726.67
GO	558.31	428.31	T(52)=302.000 (z=3.52, p=.0007)	986.62
EO	225.83	239.71	T(51)=570.000 (z=.87, p=.39)	465.54
CR	306.03	290.44	T(52)=624.000 (z=.59, p=.56)	596.46

TABLE 6.7

Mean hidden hits compared to mean observed hits for the four groups.

	HIDDEN			OBSERVED		
	Feedb.	Nonfeed.	Total	Feedb.	Nonfeed.	Total
PO	9.90	10.12	20.02	10.10	10.44	20.54
GO	9.77	9.92	19.69	10.10	10.14	20.23
EO	9.61	9.92	19.57	10.04	9.98	20.02
CR	9.88	10.29	20.17	10.10	9.81	19.90
Total	9.79	10.06	19.87	10.08	10.09	20.17

TABLE 6.8

Mean PK scores (feedback and nonfeedback combined) broken down for live RNG and pseudo-RNG, and pseudo-RNG1 and pseudo-RNG2. S init.= subject started pseudo-RNG1; E init.= experimenter started pseudo-RNG1.

		Mean PK scores	S init. mean PK	E init. mean PK
Live RNG		9.91		
Pseudo-RNG		10.26		
Pseudo-RNG2	Feedback	5.08		
	Nonfeedback	5.20		
	Combined	5.14		
Pseudo-RNG1	Feedback	5.15	5.23	5.06
	Nonfeedback	5.05	5.17	4.94
	Combined	5.10	5.20	5.00

TABLE 6.9

Mean PK scores broken down for live RNG and pseudo-RNG for both feedback and nonfeedback conditions for all four groups.

	FEEDBACK		NONFEEDBACK		COMBINED		
	Live	Pseudo	Live	Pseudo	Live	Pseudo	TOTALS
PO	4.48	5.62	5.94	4.50	10.42	10.12	20.54
GO	4.67	5.21	5.31	4.65	10.18	10.06	20.23
EO	4.33	5.42	5.40	4.58	9.73	10.29	20.02
CR	4.71	5.39	4.62	5.19	9.33	10.58	19.90
	4.55	5.41	5.32	4.73	9.91	10.26	20.17

TABLE 6.10

Difference between the four conditions in inspection time measured in milliseconds (duration) before and after experiment 5.

	BEFORE		AFTER		COMBINED	T-TEST
	mean	sd	mean	sd	mean	(corr., 2-T)
PO	33.55	24.36	54.75	45.93	44.15	t(10)=-1.22, p=.25
GO	33.69	37.66	31.25	33.46	32.47	t(11)=.95, p=.36
EO	42.00	26.37	27.00	23.89	34.50	t(11)=2.83, p=.016
CR	37.40	25.41	28.11	22.69	32.76	t(8) =1.36, p=.21

TABLE 6.11

Spearman Rho (rs) correlation between session number and PK scores for the four groups. All p values are 2-T.

	PO	GO	EO	CR
Feedback version	rs = -.19 z = 1.37 p = .17	rs = -.09 z = .65 p = .52	rs = .01 z = .05 p = .91	rs = -.00 z = .03 p = .93
Nonfeedb. version	rs = .13 z = .94 p = .35	rs = .00 z = .01 p = .94	rs = -.04 z = .25 p = .79	rs = .39 z = 2.80 p = .005*
Combined versions	rs = -.08 z = .55 p = .59	rs = -.09 z = .61 p = .55	rs = -.07 z = .47 p = .64	rs = .27 z = 1.95 p = .051

* significant p<.05.

TABLE 6.12

Spearman Rho (rs) correlation between session number and PK scores (feedback and nonfeedback combined) from pseudo-RNG (pseudo-RNG1 and pseudo-RNG2) and the live RNG.

	Pseudo-RNG1	Pseudo-RNG2	live RNG	Pseudo-RNG
PO	rs = .009 z = .06	rs = .04 z = .32	rs = -.001 z = .006	rs = -.02 z = .16
GO	rs = .05 z = .34	rs = -.12 z = .83	rs = .02 z = .17	rs = -.10 z = .73
EO	rs = .10 z = .69	rs = -.14 z = 1.01	rs = .04 z = .28	rs = -.08 z = .56
CR	rs = .43 * z = 3.08	rs = .07 z = .52	rs = .09 z = .67	rs = .28 * z = 1.98
3 strat groups	rs = .05 z = .56	rs = -.07 z = .83	rs = .03 z = .40	rs = -.06 z = .79
All 4 groups	rs = .15 * z = 2.10	rs = -.03 rs = .44	rs = .05 z = .67	rs = .02 z = .28

* p < .05, 2-T.

TABLE 6.13

Spearman Rho (rs) correlation between pseudo-RNG1 PK scores and session number for the control group when broken down according to whether S or E initiated the random sequence. All p-values are 2-T.

	Feedback	Nonfeedback	Combined
S initiated pseudo-RNG1 (n=25)	rs = -.30 z = 1.48 p = .14	rs = .28 z = 1.42 p = .15	rs = .08 z = .39 p = .70
E initiated pseudo-RNG2 (n=25)	rs = .37 z = 1.87 p = .059	rs = .48 z = 2.39 p = .016	rs = .49 z = 2.45 p = .014

FIGURE 6.1. Mean PK scores of the four groups (PO, GO, EO and CR) as a function of feedback (MCE = 10.00).

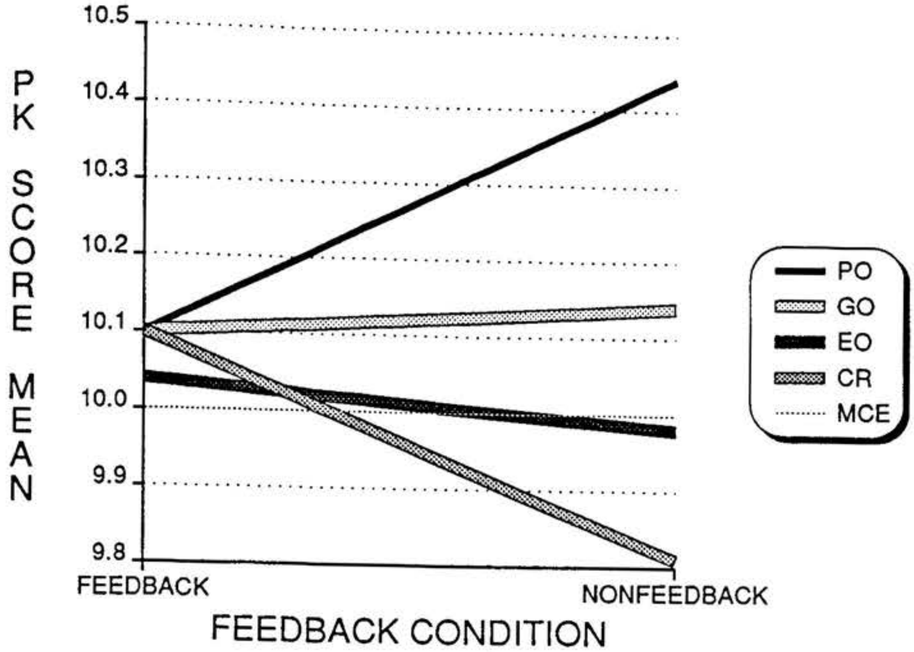


FIGURE 6.2. Mean PK scores of those who had an increase (I) in inspection time and those who had a decrease (D) as a function of session number (MCE = 20.00). The control Ss are not included.

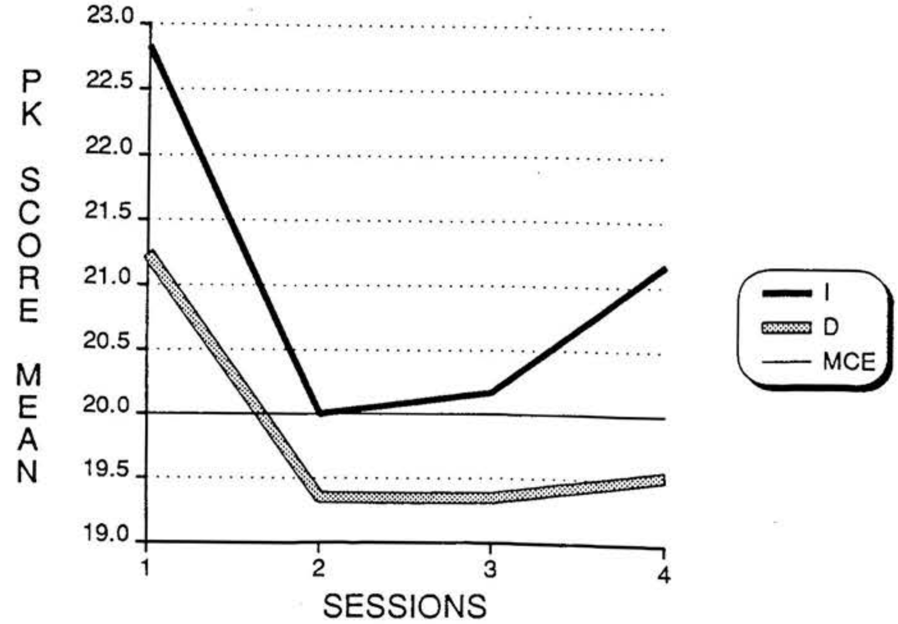


FIGURE 6.3. Mean PK scores (feedback and nonfeedback conditions combined) of the three imagery groups as a function of session number (MCE = 20.00).

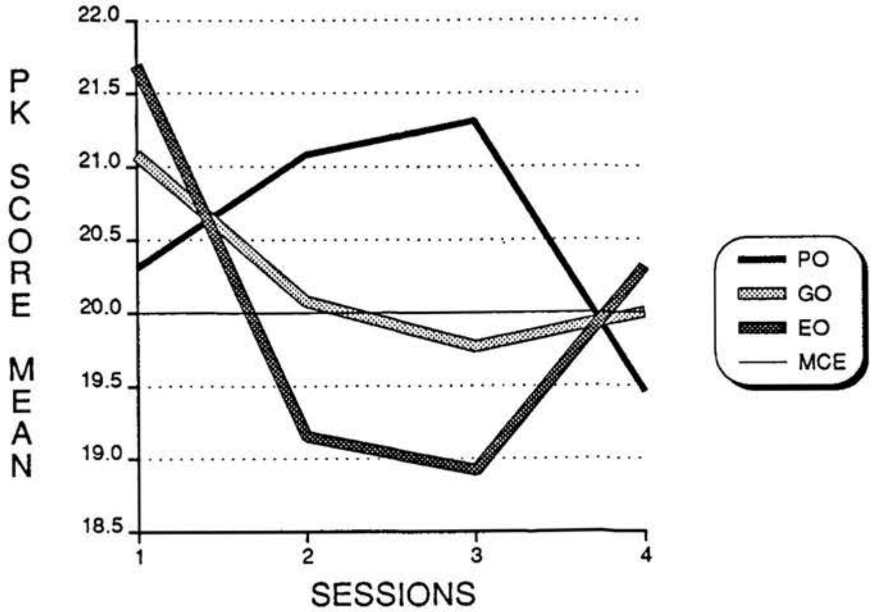
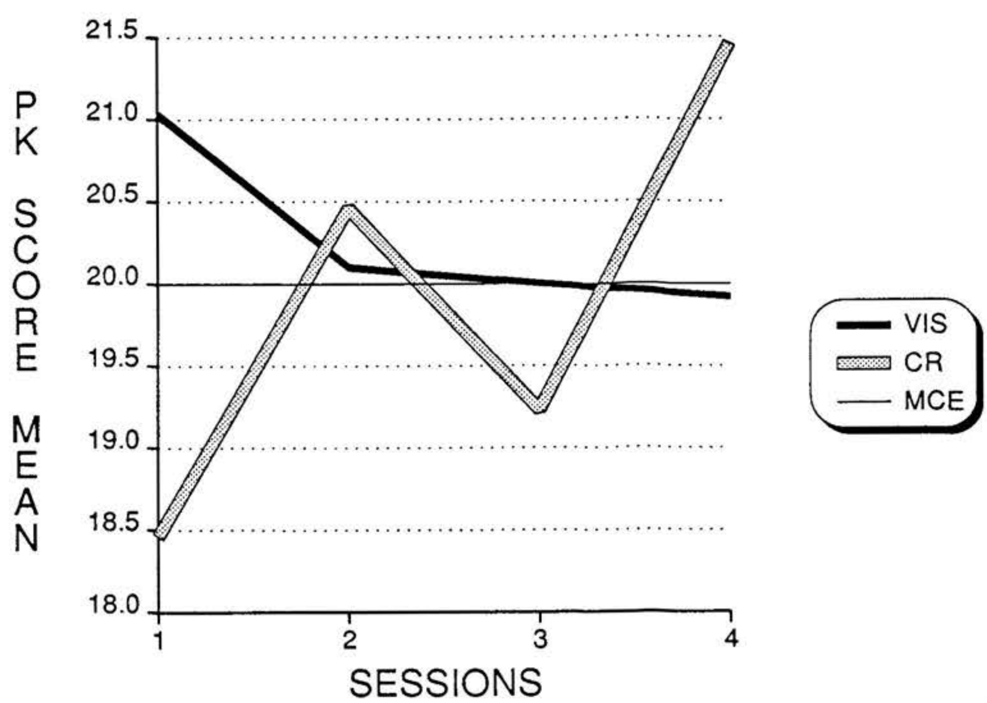


FIGURE 6.4. Mean PK scores of the three imagery strategy groups combined (VIS) and of the control group (CR) as a function of session number (MCE = 20.00).



CHAPTER SEVEN

DISCUSSION AND CONCLUSION

In this dissertation I reported 170 pretest sessions and 352 training sessions, totaling 522 sessions. Altogether 76 Ss participated in the "training" sessions.

7.1 CONCLUDING REMARKS ON VISUAL-IMAGERY EXPERIMENTS

Two experiments (studies 4 and 5) were conducted that attempted to increase PK scores of Ss. Ss practised one of three visual-imagery strategies over a period of six sessions in study 4 and over a period of four sessions in confirmatory study 5. The three strategies were process-oriented imagery (PO), goal-oriented imagery (GO), and end-oriented imagery (EO).

Summary of predicted effects. In both experiment 4 and 5, the three visual-imagery strategies (PO, GO and EO) resulted neither in overall extrachance PK scoring nor in an increase in PK scores over a period of time. In experiment 4, Ss practising PO did not do significantly better than Ss using GO and EO in the nonfeedback version of the PK computer test. Ss practising GO and EO did not do significantly better than Ss using PO in the feedback condition. In experiment 5, Ss practising GO did not score higher in the feedback version and lower in the nonfeedback version. Ss practising EO did not score higher in the nonfeedback version and lower in the feedback version. PO showed a nonsignificant trend towards doing better in the nonfeedback version than in the feedback version as predicted.

In both experiments 4 and 5, Ss spent different times on their PK task depending upon what strategy they had been instructed to use. Ss practising GO spent the longest time on the PK test while Ss using EO spent the shortest time on the test. Furthermore, within strategies, Ss doing GO spent a significantly longer time in the feedback version than in the nonfeedback version. Ss practising PO used significantly more time in the nonfeedback version than in the feedback version. Ss doing EO spent nonsignificantly more time in the nonfeedback version than in the feedback version. Whether Ss took more or less time to conduct their strategy in either the feedback or the nonfeedback condition was not in any way connected with actual performance on the PK test. At this stage it makes most sense to me to interpret this time effect in terms of different degrees of concentration.

Summary of post-hoc findings. Neither of the two following findings were predicted. (1) Sheep and goats: In both experiments 4 and 5 goats declined in PK scores between the first and second half of the experiment. In experiment 4 both sheep and goats declined in total PK scores across sessions. The sheep declined less than goats. There were only three goats in study 4. In experiment 5 the goats declined significantly, and sheep showed a nonsignificant incline. The difference between incline with sheep and decline with goats was significant.

(2) The control group: The control group (CR) in experiment 5 increased marginally significantly in total PK scores across sessions, whereas the three imagery groups decreased nonsignificantly. Whilst acknowledging the fact that this observation could be a chance result, three possible psi-based interpretations were speculated upon. Within these three interpretations the one of the IDS model is most consistent with the results: The experimenter psi-missed precognitively as to when to initiate the test, since this incline was mainly due to pseudo-RNG1 PK scores when E initiated the test.

Conclusion. Let us look back to the main objective, the empirical goal of the thesis (see section 1.1) which was to attempt to increase PK scoring with Ss through the practice of imagery strategies. Does my lack of success in using the three visual-imagery strategies as a PK "training" method imply that this approach at least can be crossed off the list? I would not feel justified in recommending further "training" work in this direction, at least not until some new considerations arise that will alter the situation. Although having invested considerable time and effort in this project I think I will have to conclude on the basis of the data, that PO, GO and EO do not work as a "training" method in a multi-session experimental setup with RNGs such as employed in experiments 4 and 5.

7.2 CONCLUDING REMARKS ON "SYNTHIA" AND IT

The computer test "Synthia". Let us look back to the second objective of the dissertation (see section 1.1) which was to develop a game/test to measure PK. Considerable time was spent on developing the random event based microcomputer test Synthia. In general, Ss' comments about it were positive, and they seemed to enjoy it. I set out to design and build on my own a simple, yet challenging quasi-game-like PK test with an automatic measurement of time spent between trials. At present, I am fairly satisfied with the different random processes involved. As I see it, the RNG set-ups in Synthia have possibly provided a novel way of differentiating between psi effects by the experimenter and by the subject(s), and between PK and precognition as presented in two prominent models in parapsychology. In the future, one might want to try out other types of immediate trial-by-trial feedback instead of the blue star. Or for the nonfeedback version, one may want to have no information provided at all. (In the present nonfeedback version of Synthia, Ss are informed about their performance at the end of the 40-trial run, and a counter provides information of how many trials they have done as they go along.) The outfiles could do with more automatic calculation procedures, such as an automatic count of separate total pseudo-RNG1 and pseudo-RNG2 PK scores. At present, I have had to do this count manually with a calculator, and then my counting has had to be double-checked by somebody else.

Interval Time (IT) as an indicator of volition. One trouble about volition is that the mental act of "wishing" or "willing" is not something that can easily be defined and isolated, much less controlled (Eisenbud, 1964, p.98; see also recently on volition Morris, 1989/90). Originally, I thought that the IT measurements might turn out to be an opportunity for investigating volition objectively. "Willing" is actually an inferred concept. In my experimentation, the instructions provided were to psychokinetically influence the computer test. Thus, I reasoned that because of the nature of the task Ss would engage in mentally "willing" or "wishing" the target box to provide a hit. If time spent on a task can be viewed as an analog of the ongoing mental processes during the solution of the task, I thought that IT might represent the act of volition in the present testing situation, and that more time spent on a PK task might indicate "more" willing. The results indicate however no connection between IT and PK scoring.

It may be possible to distinguish between two aspects of volition; duration and intensity. Volitional duration would be the time used to "will", since a person can "will" for long or short periods of time. Volitional intensity could be described by the following quotation from

William James who wrote on the concept of "will" (James, 1892, p.450):

> The essential achievement of the will, in short, when it is most 'voluntary,' is to attend to a difficult object and hold it fast before the mind. ...Effort of attention is thus the essential phenomenon of will.

Intensive volition does not necessarily have to take more time than less intense volition. "Longer" duration of volition takes however, obviously, longer time than "shorter" duration of volition. If we distinguish between the duration and intensity aspects of volition we may have measured its durational aspect but not its intensity which may still be connected with actual PK performance.

7.3 CONCLUDING REMARKS ON PRETEST SESSION DATA

A Type I Error would occur if we were to claim that psi exists when it does not. Doing very few analyses on the available data is one way to avoid Type I Errors. When correcting for Type I Errors such as by raising the accepted alpha level, we are trying to reduce the likelihood that any significant finding can be due to chance. In the present experimentation I have attempted to rule out chance to some extent by doing replications. A record has been kept of a few relationships throughout the pretest screening sessions (see table 7.1). Two PK relationships merit discussion:

Sheep-goat scale. Only in pilot experiment 2 was there a significant relationship between the sheep-goat scale and total PK scores (see table 7.1). Ss in pilot experiments 1-2 and the 20 recruits in experiment 4 all went through the one session screening / pretest procedure doing the PK computer test with pseudo-RNG1 only (where on all occasions E initiated the random sequence). The 90 Ss who went through the screening session in experiment 5 did the computer test with a complicated combination of RNGs. We may wonder whether there was any special RNG condition that correlated higher with the sheep-goat scale for the 90 screening Ss in experiment 5. As can be seen in table 7.2, such is not the case. The pseudo-RNG1 (when E initiated the computer test) condition, which is the same RNG condition as in pilot studies 1-2 (+ the 20 recruits), correlated nonsignificantly and in a negative direction with the sheep-goat scale; Spearman R(43) = -.10 (z=.40, p=.69, 2-T).

To sum up, the sheep-goat relationship was not repeated with success with first time PK scores, which indicates that the one odd occasion in experiment 2 may have been a coincidence. On its own it does not carry much weight. I would recommend for future research that an unselected pool of subjects would be used to test the sheep-goat classification, such that large number of goats could be obtained. There were considerably more sheep than goats in the present studies. We should note that although the sheep-goat scale did not correlate repeatedly with first time PK scores, in training experiment 5 goats declined significantly in PK scores between the first and second half of the experiment while sheep showed a slight incline.

Question 15. The other PK relationship in table 7.1 that is worth looking at further is that between question 15 (Q15) on the GGPQ (whether people report having had a psychokinetic experience in everyday life) and total PK scores. Shortly before the completion of this thesis, I carried out a meta-analysis on the consistent trend between answers to question 15 and total PK scores. The method is that of combining Z scores weighted by some reasonable criterion related to the studies in question. Following the method of Mosteller and Bush as described in Rosenthal (1984, pp.72-74), I weighted $Z = (W_1Z_1 + W_2Z_2)$ / sqr $(W_1^2 +$

W_2^2). The meta-analysis was based upon the Z scores associated with a given correlation as reported in table 7.1. For Q15-PK effect, each Z was weighted by sample size. The outcome yielded Z = 3.03 (p=.001, 1-T). Some commentators might question the use of a one-tailed test in situations such as this. The point is probably subject to reasonable debate. In any event, this effect across studies is certainly significant with a two-tailed test. This is perhaps one of my most promising findings.

Looking back over the work on which this experimental dissertation is based, I must admit that somehow making formal predictions based on Q15 and inquiring more about the purported PK experiences was never on the agenda. (In a sense, positive responses to Q15 may imply low "ownership resistance", see section 2.4.) No analysis has yet been carried out to see whether responses to Q15 can predict how Ss will do in a visual-imagery PK training.

Other psychometric tests. To sum up on the other self-report inventories, better visualizers (in terms of both vividness and control) did not do better than worse visualizers on the feedback version of the computer test. External locus of control people did not do better than internal locus of control people on the PK test. Scores on both the VAIQ and Gordon's control of visual imagery questionnaire correlated highly with the VVIQ, thus suggesting that all three scales measure to some extent the same faculty.

7.4 CONCLUDING THOUGHTS AND FUTURE RESEARCH

Possible further analysis on the data. It is tempting to conduct additional analyzes on the data. The following analyzes have not been done since the time they require has not been available. What I have done up to date was what I could reasonably accomplish within three years. (1) It would be interesting to do a Factor Analysis on the GGPQ questionnaire database. Firstly, in order to see if the questions group together in factors. Secondly, to see the relationship between these factors and the PK scores. (2) Ss' reports in the screening sessions, and those of the CR Ss, of what sort of strategies they used whilst attempting to influence the PK computer test can be analyzed. Firstly, to explore whether Ss come up with similar strategies, and if so, which one is the most popular. Secondly, to see which cluster of strategies, if any, is correlated with success on the PK task.

If I could do it all over again. What could have been done differently? There are probably many other ways of designing and conducting a visual-imagery strategy PK training experiment. I did what I set out to do which was to explore whether it was possible to use the visual-imagery strategies to "train" PK. My experiments became more complicated than I originally had in mind because there was not a live RNG available when I started my research. When I started the research I had not planned to explore possible differences between a pseudo-RNG and a live RNG, different set-ups of the pseudo-RNG, or investigate the literature of pseudo-RNG research.

One could argue that in order to develop psi abilities intensive and continuous "mental practice" over a long period of time (many months) would be more effective. As noted however in section 6.1, I was not able to consider the possibility of having the training period longer than it was, because of limited time available.

I could have excluded those who after their sessions reported that they did not use their visual-imagery strategy properly. One would though have to be sure that these Ss were not biased by poor results, that is, if S obtained low PK scores and excused himself by saying he did not use the imagery strategy he was supposed to use. Excluding Ss if they do not follow instruction was done by Morris et al. (1982) and Kosslyn, Ball and Reiser (1978, p.52). Case 26 in experiment 4 revealed to me while doing the five additional sessions, that he had not always followed the PO instructions. The same thing was reported by case 12 in experiment 5 when after the last session I inquired about how he went about getting such high scores. He reported that after session two he had decided not to use the PO strategy which he had been instructed to do. These Ss were not excluded from the data analysis, since this was not a preplanned option. S was kept blind as to other strategies than his own. It should not create too much of a problem if S improvised a bit on his own strategy. When analyzing the effect of particular strategies, most bias would probably result when S changed from his strategy to another being tested.

I could have used a more strict screening procedure, e.g. screen only those who score significantly above chance and use them for the training sessions. Or, I could simply have skipped the screening procedure altogether, hence making the whole experimentation simpler. Arguments can probably be put forward for both these points. One way of finding out more about Ss' training performance, as predicted by individual differences in initial performance, would be to test those who scored below chance in the screening sessions (and thus did not pass on to the two training experiments), in order to see how they respond to visual-imagery training.

Future research. Where do we go from here? As I see it, there are three possible areas that can be seen as a direct continuation of the present experimentation:

(1) Research in parapsychology: We could explore further the CR

condition. If the incline in PK scores of the CR group was not due to E psi missing precognitively, attentional variables may play a crucial role to the "training" of PK. Future visual-imagery "training" research could employ only sheep, or super-sheep (getting 6 on the sheep-goat scale). However, the data does not unambiguously support such a decision, since sheep did not increase significantly in PK scores. It would be interesting if other researchers attempted to replicate the PK score correlation with the question about Ss' prior experience of PK (question 15 on the GGPQ). In future research, one could also follow this question through by other questions in order to inquire more about these PK experiences, and perhaps gradually build up an effective self-report inventory in predicting PK performance.

(2) Imagery research: We may want to know more about the effect of presence or absence of feedback on imagery. The Ss in GO spent more time on their imagery when presented with feedback of the imagery, than in the absence of such feedback. Is this because they found it easier to concentrate or focus on the blue star when they got it on the screen once in a while? If so, does more concentration result in a clearer image of the blue star?

(3) Research into volition: If we can distinguish between duration and intensity of volition, how do we measure intensity? We may want to develop behavioral indices of volition, such as a self-report inventory to approximate some measure on intensity of volition. If that could be accomplished one could explore whether it is possible to "strengthen" volition, compare intensity of volition between various groups of people, and so forth.

Final remarks. I want to finish this experimental dissertation with a quotation from John Beloff who wrote after unsuccessful attempts to replicate the "waiting" technique (Beloff, 1967, p.128):

> However, the problem [replicability of psi results] is still with us. On the one hand, we have as yet no firm experimental evidence to support the claims of any of the methods that have been suggested as a means of training or cultivating paranormal abilities but, on the other hand, we still have an urgent need for one. In the circumstances, what else can we do but back our hunches and keep on trying?

TABLE 7.1

Summary of Spearman Rho (rs) correlation coefficients between PK hits and scores on scalar instruments. For VVIQ Spearman R is correlated with feedback ($_f$) PK score. For the PK and sheep-goat (S/G) scale correlation, the total sum of points was used (the range being 0-6). Question 15 (Q15) had five possible answers (the range being 0-5). I/E refers to the I-E scale.

	S/G-PK	VVIQ-PK$_f$	Q15-PK	VVIQ-VAIQ	I/E-PK	Gordon-PK$_f$
Pilot 1 n=10	rs=.14 z=.40	rs=-.003 z=.009	rs=.37 z=.83			
Pilot 2 n=40	rs=.57 z=3.58**	rs=-.15 z=.96	rs=.36 z=2.24*	rs=.54 z=3.39**	rs=.20 z=1.23	
Pilot 3 n=10	rs=.37 z=1.11	rs=-.41 z=1.24	rs=.41 z=1.24	rs=.66 z=1.98*		
Recruits in expm. 4 n=20	rs=.01 z=.06	rs=-.21 z=.93	rs=.32 z=1.40	rs=.22 z=.98	rs=.35 z=1.53	
Screening Ss in expm. 5 n=90	rs=-.01 z=.07	rs=-.02 z=.18	rs=.20 z=1.88	rs=.52 z=4.82**	rs=-.06 z=.60	rs=.15 z=1.37

*p<.05, 2-T
*p<.01, 2-T

TABLE 7.2

Spearman Rho (rs) correlations between the sheep-goat scale and PK scores broken down into their various RNG components.

	live RNG	pseudo-RNG	pseudo-RNG2	pseudo-RNG1	E initiated pseudo-RNG1	S initiated pseudo-RNG1
Sheep -goat scale	rs=-.04 z=.40 p=.69	rs=.06 z=.56 p=.59	rs=.07 z=.64 p=.53	rs=.04 z=.40 p=.69	rs=-.10 z=.66 p=.52	rs=.17 z=1.11 p=.27

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APPENDIX A

The latest version of the computer test "Synthia" that was used to measure PK in experiment 5. All versions of the PK computer test are available from the author.

```
1 REM ***************************************************************************
2 REM
3 REM 'SYNTHIA' A RNG-PK COMPUTER TEST - RNGHTEST.BAS - 28 July 1988
4 REM
5 REM made by Loftur Reimar Gissurarson, University of Edinburgh,
6 REM         Dept. of Psychology, 7 George Square, Edinburgh EH8 9JZ
7 REM
8 REM ***************************************************************************
9 REM ********************* main program ***************************************
10 REM
11 Y=0: L=0: N=0: IPAT=0: LIFEHITS=0
15 RTCOUNTER = 0: RNGCOUNT1 = 0: RNGCOUNT2 = 0
20 RTCOUNT1 = 0: RTCOUNT2 = 0: SEEDX=0: SEEDY=0: SEEDZ=0
25 DIM RNG(4), RGG(4,10), RT(4,10), SAMERNG(4), COUNTNAM(4,10)
27 DIM LIFERNG(4,10)
30 FOR K=1 TO 4: RNG(K)=0: SAMERNG(K)=0
35 FOR I=1 TO 10: RGG(K,I)=0: RT(K,I)=0: COUNTNAM(K,I)=0: LIFERNG(K,I)=0
40 NEXT I: NEXT K
41 GOSUB 36000
42 GOSUB 59100: GOSUB 59700
45 GOSUB 10000: SEEDX=IX£: SEEDY=IY£: SEEDZ=IZ£
50 GOSUB 45000
55 GOSUB 100
60 GOSUB 500
65 GOSUB 1000  'actual experiment
70 GOSUB 50000
75 GOSUB 9000
80 CLOSE
85 IF LIFEHITS => AIMHIT AND FEED$ <> "n" AND FEED$ <> "N" THEN GOSUB 60000
90 GOSUB 8000
99 END
100 REM ******************** subroutine text ***********************************
110 SCREEN 0,1,0,0
120 COLOR 14,1
130 CLS
135 PRINT
140 PRINT "The psychokinetic computer test 'Synthia'"
145 PRINT "Copyright (c) L. R. GISSURARSON 1987"
146 X$ = STRING$(50,3)
147 PRINT TAB(10) X$
150 PRINT:PRINT
155 PRINT TAB(11) "'Synthia' welcomes you to our psychokinetic test"
157 PRINT: PRINT
158 PRINT TAB(10) X$
159 PRINT
167 PRINT, DATE$: PRINT
170 INPUT "Feedback (y or n)"; FEED$
173 IF FEED$<>"y" AND FEED$<>"n" AND FEED$<>"Y" AND FEED$<>"N" THEN 170
178 BNAME$ = "a:AUTOEXEC" + ".bat"  'hide file on hard disk
179 OPEN BNAME$ FOR APPEND AS 2
180 INPUT "Name"; ANAME$: IF ANAME$ = "" GOTO 180
181 ANAME$ = +ANAME$+ ".lrg"     'hide file on floppy disk
182 OPEN ANAME$ FOR OUTPUT AS £1  'opens outfile
183 INPUT "Start system (1 or 2)"; RNGSTART
185 INPUT "Score you want to get at least (11 to 19)"; AIMHIT
188 PRINT £1, ANAME$: PRINT £3, "name of file = ", ANAME$
190 PRINT £1, DATE$
191 PRINT £1, "hits aimed for =", AIMHIT
192 PRINT £1, FEED$
193 PRINT £1, RNGSTART: PRINT £2, "rngstart = ", RNGSTART
194 PRINT:PRINT, "Remember to press the space bar to initiate a trial."
196 PRINT, "Good luck and may you have a nice psi-hitting session.":PRINT
198 PRINT "Press space-bar to continue."
200 A$ = INKEY$: IF A$ = "" THEN 200
210 RETURN
500 REM ********************* subroutine drawboxes ***************************
510 SCREEN 1,1
515 COLOR 0,0:PAINT(0,90),1,1:CLS
516 COLOR 0,0
520 DRAW "bm0,80"
530 FOR J = 1 TO 4
540 YY = 35
550 XX = 50
560 DRAW "bm+55,0"
570 DRAW "u=xx; r=yy; d=xx; l=yy;"
580 NEXT J
582 DRAW "bm0,78"    'drawing interior of boxes
584 FOR J = 1 TO 4
585 DRAW "bm+56,0": DRAW "p1,1"
588 NEXT J
590 RETURN
1000 REM ********************* subroutine choose-squares *********************
1003 FOR K = 1 TO 4
1005 IF RNGCOUNT1=20 AND RNGCOUNT2=0 THEN RNGSTART = 2
1007 IF RNGCOUNT2=20 AND RNGCOUNT1=0 THEN RNGSTART = 1
1008 IF RNGCOUNT2=20 AND RNGCOUNT1=0 THEN GOSUB 40000
1010 IF RNGSTART=1 THEN GOSUB 20000
1012 IF RNGSTART=2 THEN GOSUB 10000: GOSUB 20000
1030 GOSUB 3000
1040 RNG(K) = Y
1041 SAMERNG(K) = Y
1049 IF K<>1 AND SAMERNG(K-1)=SAMERNG(K) THEN 1010
1050 GOSUB 2000
1052 GOSUB 6000
1053 LOCATE 3: PRINT "New Box":FOR M=1 TO 4000:NEXT M
1054 LOCATE 3: PRINT X$  'blanks clearing text
1055 GOSUB 4000
1057 NEXT K
1060 RETURN
2000 REM ********************* subroutine arrow ******************************
2005 X$ = STRING$(30,32)   'blanks clearing for arrow
2006 LOCATE 13: PRINT X$
2010 IF RNG(K) = 1 THEN LOCATE 13,10: PRINT CHR$(24): RETURN
2020 IF RNG(K) = 2 THEN LOCATE 13,16: PRINT CHR$(24): RETURN
2030 IF RNG(K) = 3 THEN LOCATE 13,23: PRINT CHR$(24): RETURN
2040 IF RNG(K) = 4 THEN LOCATE 13,30: PRINT CHR$(24): RETURN
3000 REM ********************* subroutine same-number ************************
3010 IF RESULT£ <.25 THEN Y = 1: RETURN
```

```
3020 IF RESULT£ <.5 THEN Y = 2: RETURN
3030 IF RESULT£ <.75 THEN Y = 3: RETURN
3040 IF RESULT£ < 1 THEN Y = 4: RETURN
4000 REM ********************* subroutine trial ******************************
4005 REM
4010 FOR I = 1 TO 10
4015 ASTART = TIMER
4020 B$ = CHR$(32): B$=INKEY$
4025 IF B$ = "" OR B$ <> CHR$(32) THEN 4020
4026 AFINISH = TIMER
4028 FINSTART = AFINISH - ASTART
4029 IF FINSTART < .3 THEN 4015
4030 RT(K,I) = FINSTART
4035 IF RNGSTART = 1 THEN GOSUB 30000
4037 IF RNGSTART = 2 THEN GOSUB 35000
4040 GOSUB 3000
4045 RGG(K,I) = Y
4050 GOSUB 59280:                          REM get bit £1
4052 IPAT = IRB:                           REM ipat given IRB value
4054 GOSUB 59280:                          REM get bit £2
4056 IPAT = IPAT*2 + IRB + 1:              REM values put between 1-4
4058 LIFERNG(K,I) = IPAT:                  REM numbers from IRB in memo
4060 IF LIFERNG(K,I)=RNG(K) THEN LIFEHITS=LIFEHITS+1  'counter for lifeRNG hits
4068 IF RGG(K,I)=RNG(K) THEN L=L+1:        REM counter for PRNG hits
4070 IF LIFERNG(K,I) <> RNG(K) THEN GOTO 4075
4073 IF FEED$="y" OR FEED$="Y" THEN BEEP: GOSUB 5000
4075 N=N+1: GOSUB 6000
4080 NEXT I
4090 RETURN
4095 REM
5000 REM ********************* subroutine feedback ****************************
5005 CLS
5007 COLOR 0,1
5015 DRAW "bm60,120"
5020 DRAW "E90 F90 L180"
5025 PAINT (150,90),1,1
5030 DRAW "bm240,60"
5040 DRAW "L180 F90 E90"
5041 PAINT (150,121),1,1
5042 PAINT (100,63),1,1
5043 PAINT (200,63),1,1
5045 PAINT(150,90),1,1
5046 FOR D=0 TO 360 STEP 10: DRAW "ta=d; NU150": NEXT D
5047 FOR D=5 TO 360 STEP 10: DRAW "ta=d; nu100": NEXT D
5049 FOR M=1 TO 4000: NEXT M  'delay of feedback
5050 CLS:
5060 GOSUB 516
5070 GOSUB 2000
5080 RETURN
6000 REM ********************* subroutine text for trials left*****************
6010 REM
6100 LOCATE 18
6200 PRINT TAB(97) "trials left:" 40-N
6250 IF FEED$="Y" OR FEED$="y" THEN GOSUB 6300
6260 RETURN
6270 REM
6300 REM ********************* subroutine cumulative feedback *****************
6310 REM
6350 LOCATE 20
6400 PRINT TAB(97) "hits so far: " LIFEHITS
7050 XX=LIFEHITS+1                        'making a bar
7100 DRAW "bm30,160"
7200 DRAW "U=xx;R6;D=xx;L6;"
7300 RETURN
8000 REM ********************* subroutine text in end ************************
8010 REM
8050 SCREEN 2,,0: SCREEN 0,1,0,0: COLOR 14,1
8100 CLS
8150 LOCATE 7: PRINT, "You aimed for" AIMHIT "hits"
8200 LOCATE 9: PRINT, "You got" LIFEHITS " hits"
8300 LOCATE 11: PRINT,"Thank you"
8400 LOCATE 13: PRINT,"Call experimenter"
8425 RETURN
8450 REM ********************* subroutine music ******************************
8455 MARY$="GFE-FGGG"
8460 PLAY "MB T100 O3 L8; xmary$; P8 FFF4"
8470 PLAY "GB-B-4; xmary$; GFFGFE-."
8500 RETURN
9000 REM ***************** subroutine outfile *********************************
9100 REM
9110 REM
9120 PRINT £2, "Name of file", ANAME$
9130 PRINT £2, FEED$, DATE$
9150 PRINT £2, SES$,"initiated test"
9200 FOR K=1 TO 4
9210 PRINT £2,"BOX",K,":",RNG(K)
9250 NEXT K
9260 PRINT £2, "----------------------------"
9270 PRINT £2, "Observed hits             ", "Hidden hits"
9280 PRINT £2, "Life-RNG                  ", "Pseudo-RNG "
9300 FOR K = 1 TO 4: FOR I = 1 TO 10
9400 PRINT £2, " ", "", COUNTNAM(K,I)
9450 PRINT £2, LIFERNG(K,I), "", RGG(K,I)
9460 PRINT £2, USING "£££.££"; RT(K,I)
9470 IF COUNTNAM(K,I)=1 THEN RTCOUNT1=RTCOUNT1+RT(K,I)
9480 IF COUNTNAM(K,I)=2 THEN RTCOUNT2=RTCOUNT2+RT(K,I)
9490 RTCOUNTER=RTCOUNTER+RT(K,I)
9492 NEXT I: NEXT K
9494 PRINT £2, "Total observed hits (life RNG) = ", LIFEHITS
9496 PRINT £2, "Total hidden hits (pseudo-RNG) = ", L,
9500 RETURN
10000 REM ****************** subroutine fast clock seeder *******************
10002 RANDOMIZE TIMER
10010 X£=RND: X£=X£*10000
10020 IX£=INT(X£) + 1
10030 X£=RND: X£=X£*10000
10040 IY£=INT(X£) + 1
10050 X£=RND: X£=X£*10000
```

```
10060 IZ£=INT(X£) + 1
10070 REM having set up the seeds off we go..
10080 RETURN
20000 REM ********** subroutine that creates random binary digits *************
20010 IX£=171*(IX£-INT(IX£/177)*177)-2*(IX£/177)
20020 IY£=172*(IY£-INT(IY£/176)*176)-35*(IY£/176)
20030 IZ£=170*(IZ£-INT(IZ£/178)*178)-63*(IZ£/178)
20040 IF IX£ < 0 THEN IX£=IX£+30269
20050 IF IY£ < 0 THEN IY£=IY£+30307
20060 IF IZ£ < 0 THEN IZ£=IZ£+30323
20070 FX£=IX£
20080 FY£=IY£
20090 FZ£=IZ£
20100 X£=(FX£/30269!)+(FY£/30307!)+(FZ£/30323!)
20110 RESULT£=X£-INT(X£/1!)*1!
20500 IF RESULT£ > 0 THEN GOTO 21000
20550 RESULT£=((IX£/30269!)+(IY£/30307!)+(IZ£/30323!)) MOD 1
20600 IF RESULT£ > 1 THEN RESULT£ = .999999
21000 RETURN
30000 REM ******************* subroutine rng version 1 ***********************
30100 REM
30150 REM
30200 GOSUB 20000: COUNTNAM(K,I) = 1
30300 RNGCOUNT1 = RNGCOUNT1 + 1
30400 RETURN
30410 REM
35000 REM ******************* subroutine rng version 2 ***********************
35010 REM
35020 REM
35540 GOSUB 10000: GOSUB 20000: COUNTNAM(K,I) = 2
35550 RNGCOUNT2 = RNGCOUNT2 + 1
35600 RETURN
35610 REM
36000 REM ************** SUBR. IF ONE WANTS TO CONTINUE **********************
36005 REM
36010 REM
36020 CLS
36023 PRINT:PRINT:PRINT:PRINT
36025 PRINT, "REMEMBER THIS IS VERSION 'LIFE'"
36030 PRINT, "DO YOU WANT TO CONTINUE?"
36035 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
36040 INPUT "TYPE 'YES' OR 'NO'"; CONTIN$
36045 IF CONTIN$ = "" THEN BEEP: GOTO 36040
36050 IF CONTIN$ = "NO" OR CONTIN$ = "no" THEN GOTO 99
36060 IF CONTIN$ <> "YES" AND CONTIN$ <> "yes" THEN BEEP: GOTO 36040
36065 INPUT "Who will initiate test (S or E)"; SES$
36070 IF SES$="" THEN GOTO 36065
36075 IF SES$<>"s" AND SES$<>"S" AND SES$<>"E" AND SES$<>"e" THEN GOTO 36065
36077 PRINT: PRINT
36080 PRINT, "Please press space-bar to continue."
36085 A$ = INKEY$: IF A$ = "" THEN 36085
36090 RETURN
36100 REM
40000 REM *************** subroutine initial seeds put in memo ****************
40010 REM
40020 REM
42000 IX£=SEEDX: IY£=SEEDY: IZ£=SEEDZ
44000 RETURN
44010 REM
45000 REM ************* outfile for initial seeds ******************************
45100 CNAME$ = "a:initseed" + ".out"
46000 OPEN CNAME$ FOR APPEND AS 3
47000 PRINT £3, "---------------"
47100 PRINT £3, "seed x = ", SEEDX
47200 PRINT £3, "seed y = ", SEEDY
47300 PRINT £3, "seed z = ", SEEDZ
49000 RETURN
50000 REM *************** subroutine printing to outfile *********************
50050 REM
51050 REM
51100 PRINT £1, SES$,"initiated test"
52000 FOR K=1 TO 4
52100 PRINT £1,"BOX",K,":",RNG(K)
52200 NEXT K
52250 PRINT £1, "-------------------------------"
52300 PRINT £1, "Observed hits            ", "Hidden hits"
52400 PRINT £1, "Life-RNG                 ", "Pseudo-RNG "
53000 FOR K = 1 TO 4: FOR I = 1 TO 10
53100 PRINT £1, " ", "", COUNTNAM(K,I)
54000 PRINT £1, LIFERNG(K,I), "", RGG(K,I)
55000 PRINT £1, USING "£££.££"; RT(K,I)
55500 IF COUNTNAM(K,I)=1 THEN RTCOUNT1=RTCOUNT1+RT(K,I)
55510 IF COUNTNAM(K,I)=2 THEN RTCOUNT2=RTCOUNT2+RT(K,I)
56000 RTCOUNTER=RTCOUNTER+RT(K,I)
57000 NEXT I: NEXT K
57025 PRINT £1, "Total observed hits (life RNG) = ", LIFEHITS
57030 PRINT £1, "Total hidden hits (pseudo-RNG) = ", L,
57050 PRINT £1, "Total it (40) = ", RTCOUNTER
57075 PRINT £1, "Mean it (40) = ", RTCOUNTER/40
57100 RTCOUNTER=RTCOUNTER-RT(1,1):                 REM omit 1st RT measure
58000 PRINT £1, "Total IT w/out 1st trial (39) = ", RTCOUNTER
58050 PRINT £1, "Mean IT w/out 1st trial (39) = ", RTCOUNTER/39
58100 PRINT £1, "Total IT (20) for pseudo-RNG1 version = ", RTCOUNT1
58150 PRINT £1, "Total IT (20) for pseudo-RNG2 version = ", RTCOUNT2
58200 PRINT £1, "Mean IT for pseudo-RNG1 (20) = ", RTCOUNT1/20
58300 PRINT £1, "Mean IT for pseudo-RNG2 (20) = ", RTCOUNT2/20
58400 IF RNGSTART=1 THEN PRINT £1,"Pseudo-RNG2 mean IT w/out 1st trial (19) = ",
   (RTCOUNT2-RT(1,1))/19
58500 IF RNGSTART=2 THEN PRINT £1,"Pseudo-RNG1 mean IT w/out 1st trial (19) = ",
   (RTCOUNT1-RT(1,1))/19
59000 RETURN
59100 REM -----------DECLARATION AND INITIALIZATION OF VARIABLES -------------
59120 IRTS = &H3FC:           REM port address MODEM CONTROL REGISTER
59130 ICTS = &H3FE:           REM port address MODEM STATUS REGISTER
59140 ISTART = 2:             REM RTS at +12V to start RBG
59150 ISTOP = 0:              REM RTS at -12V to stop RBG
59160 IMASKCTS = &H10:        REM to mask out CTS, the Random Bit
59170 IMASKRING = &H40:       REM to mask out RINGINDICATOR, RBG signal IS
```

```
59180 RETURN
59200 REM -------------------------GET RANDOM BIT-------------------------------
59210 REM
59220 REM sample RBG 4 times to obtain 4 primary random bits, and perform
59230 REM a second order debiasing.
59240 REM input : none
59250 REM output: IRB debiased random bit (0 or 1)
59260 REM Then LRG changes the output into bits 1-4
59270 REM
59280 OUT IRTS,ISTART:                REM set RBG in running state
59290 OUT IRTS,ISTOP:                 REM set RBG in stopped state
59300 IRB1 = INP(ICTS) AND IMASKCTS:  REM read first primary random bit
59310 OUT IRTS,ISTART:                REM set RBG in running state
59320 OUT IRTS,ISTOP:                 REM set RBG in stopped state
59330 IRB2 = INP(ICTS) AND IMASKCTS:  REM read the MODEM STATUS REGISTER
59340 OUT IRTS,ISTART:                REM set RBG in running state
59350 OUT IRTS,ISTOP:                 REM set RBG in stopped state
59360 IRB3 = INP(ICTS) AND IMASKCTS:  REM read the MODEM STATUS REGISTER
59370 OUT IRTS,ISTART:                REM set RBG in running state
59380 OUT IRTS,ISTOP:                 REM set RBG in stopped state
59390 IRB4 = INP(ICTS) AND IMASKCTS:  REM read the MODEM STATUS REGISTER
59400 REM
59410 REM
59420 IRB1 = IRB1 XOR IRB2
59430 IRB3 = IRB3 XOR IRB4
59440 IRB = (IRB1 XOR IRB3)/16
59450 RETURN
59460 REM
59500 REM ---------------------SUBR. CHECK CONNECTION ------------------------
59510 REM
59520 REM check whether the RBG is connected or switched on
59530 REM input : none
59540 REM output: ICHECK = 0  okay  = -1 not connected or switched on
59550 OUT IRTS,ISTART
59560 ICHECK = INP(ICTS) AND IMASKRING
59570 IF ICHECK <> 0 THEN ICHECK = -1: GOTO 59620
59580 OUT IRTS,ISTOP
59590 ICHECK = INP(ICTS) AND IMASKRING
59600 IF ICHECK <> IMASKRING THEN ICHECK = -1: GOTO 59620
59610 ICHECK = 0
59620 RETURN
59630 REM
59700 REM -------------------------SUBR. CONTINUE-------------------------------
59710 REM
59720 GOSUB 59500
59730 IF ICHECK = 0 THEN GOTO 59830
59740 CLS: BEEP
59750 PRINT "RBG 04CA IS NOT CONNECTED OR SWITCHED OFF.
59760 PRINT "CHECK THE CONNECTION / SWITCH IT ON.
59770 LOCATE 23,1,0
59780 PRINT "HIT ANY KEY TO CONTINUE
59790 IF LEN(INKEY$)=0 THEN 59790
59800 CLS: PRINT "SYNTHIA DOES NOT WANT TO CONTINUE
59805 KEY ON
59810 GOTO 99
59830 KEY OFF
59840 RETURN
60000 REM ********* subroutine end of session feedback ************************
61000 SCREEN 1,0: COLOR 0,1: CLS
61100 LOCATE 12: PRINT TAB(16) CHR$(16) TAB(18) AIMHIT TAB(23) CHR$(17)
61110 DRAW "bm90,90"
61120 LOCATE 10: PRINT G$
61130 DRAW "e60f60g60h60"
61140 DRAW "be90"    'move up and outoff box
61150 DRAW "p1,3"     'paint
61155 GOSUB 8450
61160 Y$ = STRING$(40,32)
61170 FOR K=1 TO 14
61180 FOR J=1 TO 50: NEXT J
61190 LOCATE 3: PRINT Y$
61200 LOCATE 22: PRINT Y$
61210 LOCATE 3: PRINT TAB(6) "WELL DONE          YOU MADE IT"
61220 LOCATE 22: PRINT TAB(6) "YOU GOT THE SCORES YOU WANTED"
61230 NEXT K
61240 FOR I=1 TO 7000: NEXT I     'keep on screen
61260 RETURN
65000 REM ******************************************************************* FIN
```

APPENDIX B

Questionnaires and hand-outs used in the pretest/screening sessions.

GGPQ

Gissurarson's General PK Questionnaire

Name: ______________________________

Psychokinesis (usually abbreviated as "PK") is more commonly known as mind influencing matter or as "mind over matter". It is often considered to be direct influence exerted on a physical system (an external physical process, condition, or an object) by a person without any known intermediate physical energy or instrumentation. For instance, it would be counted as PK if a person would move an object with his/her "mind" and without any muscular interaction.

Think carefully about the following questions. Please answer all of the questions and mark "X" in front of only <u>one</u> of the given possibilities to each question. Your scores on this questionnaire will be held strictly confidential.

----

1. Do you think that the existence of psychokinesis is: Ratings:
   - (1) Impossible, 0
   - (2) Unlikely, 1
   - (3) Likely, 2
   - (4) Certain. 3

2. Do you think that some people may be able to affect physical conditions (or move objects or influence other people) with their "minds"?
   - (1) Definitely yes. 3
   - (2) Yes, I think so. 2
   - (3) Probably not. 1
   - (4) No. 0

3. Do you believe that you can demonstrate the psychokinesis effect (i.e. affect physical conditions or move objects or influence others with your "mind")?
   - (1) No, definitely. 0
   - (2) No, I don't think so. 1
   - (3) Yes, perhaps. 2
   - (4) Yes, definitely. 3

4. Do you experience your hopes or wishes about the future coming true? Ratings:
   - (1) Never, 0
   - (2) Seldom, 1
   - (3) Now and then, 2
   - (4) Often. 3

5. Do you consider yourself lucky?
   - (1) Not at all, 0
   - (2) Slightly, 1
   - (3) Fairly, 2
   - (4) Very. 3

6. Have you previously had experience of some sort of mind power training?
   - (1) Never, 0
   - (2) Once, 1
   - (3) Twice, 2
   - (4) Three times or more. 3

7. Which of the following alternatives do you consider to be the best description of your luckiness/unluckiness?
   - (1) I am lucky in terms of getting what I want. 3
   - (2) I am lucky in terms of receiving unexpected gifts. 2
   - (3) I am very rarely lucky. 1
   - (4) I am not lucky at all. 0

8. Would you be satisfied with yourself (or feel comfortable) if you were personally responsible for a PK event (for instance, if you were to break glass with your "mind")?
   - (1) Not at all, 0
   - (2) Unlikely, 1
   - (3) Likely, 2
   - (4) Certain. 3

9. If you get the opportunity do you then watch films like "Poltergeist" or read articles or books about people that have extraordinarily powerful influence/effect upon others with their "minds"?
   - (1) Never, 0
   - (2) Seldom, 1
   - (3) Now and then, 2
   - (4) Often. 3

10. Do you read books about psychic phenomena?
    - (1) Often, 2
    - (2) Seldom, 1
    - (3) Never. 0

11. Do you read books or articles on mind power training?
    - (1) Never, 0
    - (2) Seldom, 1
    - (3) Now and then, 2
    - (4) Often. 3

12. Would you be afraid of possessing psychokinetic abilities?
    - (1) Yes, 0
    - (2) Probably yes, 1
    - (3) Probably not, 2
    - (4) No. 3

13. Would it bother you to directly witness a PK event (for instance, a table levitation)?

	Ratings:
(1) No,	2
(2) Perhaps,	1
(3) Yes.	0

14. Do you think you could easily get over it (and not be concerned about it in the future)?

(1) No,	0
(2) Unlikely,	1
(3) Likely,	2
(4) Certain.	3

15. Have you had a psychokinetic experience?

(1) Never,	0
(2) Rarely,	1
(3) Likely,	2
(4) Now and then,	3
(5) Often.	4

16. How successful in general do you consider yourself to be?

(1) I am definitely not a very successful person.	0
(2) I am not as successful as the others.	1
(3) I think I am a rather successful person.	2
(4) I am definitely a very successful person.	3

17. Which of the following statements best describes you?

(1) I am definitely strong-willed.	3
(2) I am moderately strong-willed.	2
(3) I am fairly weak-willed.	1
(4) I am very weak-willed.	0

18. Which of the following statements best describes how you feel about the task that you are about to participate in?

(1) I will definitely not be able to influence the test.	0
(2) I will probably not be able to influence the test.	1
(3) I will probably be able to influence the test.	2
(4) I will definitely be able to influence the test.	3

19. A game is set up in which everyone bets 2 pounds. Half the players will win 4 pounds and half will lose their bet. A single roll of the dice will determine the outcome. Would you bet?

(1) Yes,	2
(2) Depends upon the situation,	1
(3) No.	0

VAIQ

Vividness of Auditory Imagery Questionnaire

Consider the following items. Rate them according to how well you can manage to imagine the sound/noise.

Rating scale:

1. 'Very clear sound/noise'
2. 'Moderately clear sound/noise'
3. 'Vague sound/noise'
4. 'No sound/noise at all'

----

a. Imagine the sound of a car driving in the road in front of a house. ____

b. Imagine a monotonous beep-like sound like in a telephone. ____

c. Imagine the sound of footsteps coming up a stair. ____

d. Imagine the sound of water dripping. ____

e. Imagine the sound of snapping twigs. ____

f. Imagine the noise of conversation as if there was a party taking place next door. ____

g. Imagine your favorite piece of music. ____

VVIQ

Vividness of Visual Imagery Questionnaire

Name: ______________________________

Sex: Male ______ Female ______

Use the following five-point scale of vividness to rate your image for each item on the next page.

Rating	Description
1	'Perfectly clear and as vivid as normal vision'
2	'Clear and reasonably vivid'
3	'Moderately clear and vivid'
4	'Vague and dim'
5	'No image at all, you only "know" that you are thinking of the object'

There are 16 items on the test. Before turning to them, familiarize yourself with the different categories on the rating scale, and throughout the test, refer to the scale when judging the vividness of each image.

Remember to go through all the items on the next page.

For items 1-4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye.

ITEM

1. The exact contour of face, head, shoulders and body. ___
2. Characteristic poses of head, attitudes of body, etc. ___
3. The precise carriage, length of step, etc., in walking. ___
4. The different colours worn in some familiar clothes. ___

Visualize a rising sun. Consider carefully the picture that comes before your mind's eye.

ITEM

5. The sun is rising above the horizon into a hazy sky. ___
6. The sky clears and surrounds the sun with blueness. ___
7. Clouds. A storm blows up, with flashes of lightning. ___
8. A rainbow appears. ___

Think of the front of a shop which you often go to. Consider the picture that comes before your mind's eye.

ITEM

9. The overall appearance of the shop from the opposite side of the road. ___
10. A window display including colours, shapes and details of individual items for sale. ___
11. You are near the entrance. The colour, shape and details of the door. ___
12. You enter the shop and go to the counter. The counter assistant serves you. Money changes hands. ___

Finally, think of a country scene which involves trees, mountains and a lake. Consider the picture that comes before your mind's eye.

ITEM

13. The contours of the landscape. ___
14. The colour and shape of the trees. ___
15. The colour and shape of the lake. ___
16. A strong wind blows on the trees and on the lake causing waves. ___

Locus of Control Scale

by Stephen Nowicki, Jr., and B. Strickland

Here are the directions Drs. Nowicki and Strickland include with their scale:

We are trying to find out what men and women think about certain things. We want you to answer the following questions the way you feel. There are no right or wrong answers. Don't take too much time answering any one question, but do try to answer them all.

One of your concerns during the test may be, "What should I do if I can answer both yes and no to a question?" It's not unusual for that to happen. If it does, think about whether your answer is just a little more one way than the other. For example, if you'd assign a weighting of 51 percent to "yes" and assign 49 percent to "no," mark the answer "yes." Try to pick one or the other response for all questions and not leave any blank.

Mark your responses to the question on the answer sheet in the next column. When you are finished, turn the page to score your test.

YES	NO
1. ______	1. ______
2. ______	2. ______
3. ______	3. ______
4. ______	4. ______
5. ______	5. ______
6. ______	6. ______
7. ______	7. ______
8. ______	8. ______
9. ______	9. ______
10. ______	10. ______
11. ______	11. ______
12. ______	12. ______
13. ______	13. ______
14. ______	14. ______
15. ______	15. ______
16. ______	16. ______
17. ______	17. ______
18. ______	18. ______
19. ______	19. ______
20. ______	20. ______
21. ______	21. ______
22. ______	22. ______
23. ______	23. ______
24. ______	24. ______
25. ______	25. ______
26. ______	26. ______
27. ______	27. ______
28. ______	28. ______
29. ______	29. ______
30. ______	30. ______
31. ______	31. ______
32. ______	32. ______
33. ______	33. ______
34. ______	34. ______
35. ______	35. ______
36. ______	36. ______
37. ______	37. ______
38. ______	38. ______
39. ______	39. ______
40. ______	40. ______

1. Do you believe that most problems will solve themselves if you just don't fool with them?
2. Do you believe that you can stop yourself from catching a cold?
3. Are some people just born lucky?
4. Most of the time do you feel that getting good grades meant a great deal to you?
5. Are you often blamed for things that just aren't your fault?
6. Do you believe that if somebody studies hard enough he or she can pass any subject?
7. Do you feel that most of the time it doesn't pay to try hard because things never turn out right anyway?
8. Do you feel that if things start out well in the morning it's going to be a good day no matter what you do?
9. Do you feel that most of the time parents listen to what their children have to say?
10. Do you believe that wishing can make good things happen?
11. When you get punished does it usually seem it's for no good reason at all?
12. Most of the time do you find it hard to change a friend's opinion?
13. Do you think that cheering more than luck helps a team to win?
14. Did you feel that it was nearly impossible to change your parents' minds about anything?
15. Do you believe that parents should allow children to make most of their own decisions?
16. Do you feel that when you do something wrong there's very little you can do to make it right?
17. Do you believe that most people are just born good at sports?
18. Are most of the other people your age stronger than you are?
19. Do you feel that one of the best ways to handle most problems is just not to think about them?
20. Do you feel that you have a lot of choice in deciding who your friends are?
21. If you find a four-leaf clover, do you believe that it might bring you good luck?
22. Did you often feel that whether or not you did your homework had much to do with what kind of grades you got?
23. Do you feel that when a person your age is angry at you, there's little you can do to stop him or her?
24. Have you ever had a good-luck charm?
25. Do you believe that whether or not people like you depends on how you act?
26. Did your parents usually help you if you asked them to?
27. Have you felt that when people were angry with you it was usually for no reason at all?
28. Most of the time, do you feel that you can change what might happen tomorrow by what you do today?
29. Do you believe that when bad things are going to happen they just are going to happen no matter what you try to do to stop them?
30. Do you think that people can get their own way if they just keep trying?
31. Most of the time do you find it useless to try to get your own way at home?
32. Do you feel that when good things happen they happen because of hard work?
33. Do you feel that when somebody your age wants to be your enemy there's little you can do to change matters?
34. Do you feel that it's easy to get friends to do what you want them to do?
35. Do you usually feel that you have little to say about what you get to eat at home?
36. Do you feel that when someone doesn't like you there's little you can do about it?
37. Did you usually feel that it was almost useless to try in school because most other children were just plain smarter than you were?
38. Are you the kind of person who believes that planning ahead makes things turn out better?
39. Most of the time, do you feel that you have little to say about what your family decides to do?
40. Do you think it's better to be smart than to be lucky?

PARTICIPANT'S INFORMATION SHEET

Name: ____________________

A. Scores from the psychokinesis computer test, where chance is 10 hits out of 40 trials:

Feedback version (40 trials): ____

Non-feedback version (40 trials): ____

Total computer test result (80 trials): ____

B. Locus of Control Scale (LCS) category: ____

INTERPRETING YOUR LCS SCORES

Low Scorers - Scores from zero to eight represent the range for about one third of the people taking the test. As a low scorer, you probably see life as a game of skill rather than chance. You most likely believe that you have a lot of control over what happens to you, both good and bad. With that view, internal locus of control people tend to take the initiative in everything from job-related activities to relationships and sex. You are probably described by others as vigilant in getting things done, aware of what's going on around you, and willing to spend energy in working for specific goals. You would probably find it quite frustrating to sit back and let others take care of you, since you stressed on the test that you like to have your life in your own hands.

Although taking control of your life is seen as the "best way to be," psychologists caution that it has its own set of difficulties. Someone who is responsible for his or her own successes is also responsible for failures. So if you scored high in this direction be prepared for the downs as well as the ups.

Average Scorers - Since you've answered some of the questions in each direction, internal and external control beliefs for you may be situation specific. You may look at one situation, work, for example, and believe that your rewards are externally determined, that no matter what you do you can't get ahead. In another situation, love perhaps, you may see your fate as resting entirely in your own hands. Some time spent thinking about what it is in those situations that makes you feel as though the control is or is not in your hands can help you better understand yourself.

High Scorers - Scores in this range represent the external control end of the scale. As a high scorer, you're saying that you see life generally more as a game of chance than as one where your skills make a difference.

There are, however, many different reasons for any individual to score in the external control direction. For example, psychologists have found that people in many minority and disadvantaged groups tend to score in the external direction. One recent suggestion for such scores is that people in these groups perceive their life situations realistically. In general, coloured people, women, and lower socioeconomic-class individuals really do have more restrictions on their own successes - fewer job options, lower pay, less opportunity for advancement - in many cases no matter what they do or don't do. An internal locus of control belief in such situations would be quite unrealistic and inappropriate. Thus your own high external control score could be a realistic perception of your current life circumstances.

On the other hand, your score may represent a strong belief in luck or superstition and a concurrent feeling of helplessness in controlling your life. Research studies have shown a relationship between unrealistic external control beliefs and problems like anxiety, depression, low self-concept, and poor physical health. Only you can decide exactly how much of your external belief system is accurate and how much of it is inappropriate given your life situation.

GENERAL INFORMATION

Surname: ______________________

First name(s): ______________________

Address: ______________________

____

Post code: __________

Date of birth: ________ Sex: ______

Marital status: __________ Age: ______

Telephone(s): ______________________

Could you please give a short description of how you liked the game/test.

Did you feel equally comfortable with both conditions (feedback vs. non-feedback) of the computer game/test? If not, which condition did you feel more comfortable with, and why?

Did you use any particular strategy (or ritual) while trying to influence the computer? If yes, can you give some details on the procedure.

Did you feel comfortable in the testing environment in general? If not, what didn't you like in particular?

Would you like to participate in coming experiments at the Parapsychology Laboratory? If so, can we phone you when something is going on?

Do you have any previous experience of computers, or have you ever played a computer- or a video game before? If you frequently play computer- or video games please state so.

Did you have your eyes open or closed, while answering a) the VVIQ and b) the VAIQ questionnaires?

Did you have your eyes open or closed, while trying to influence the computer test?

Please state any other comments here that may be helpful.

THE GORDON TEST OF VISUAL IMAGERY CONTROL

You have just completed a questionnaire that was designed to measure the *vividness* of different kinds of imagery. In this present questionnaire some additional aspects of your imagery are being studied.

The questions are concerned with the ease with which you can *control* or *manipulate* visual images. For some people this task is relatively easy and for others relatively hard. One person who could not manipulate his imagery easily gave this illustration. He visualized a table, one of whose legs suddenly began to collapse. He then tried to visualize another table with four solid legs, but found it impossible. The image of the first table with its collapsing leg persisted. Another individual reported that when he visualized a table the image was rather vague and dim. He could visualize it briefly but it was difficult to retain by any voluntary effort. In both these illustrations the people had difficulty in controlling or manipulating their visual imagery. It is perhaps important to emphasize that these experiences are in no way abnormal and are as often reported as the controllable type of image.

Read each question, then close your eyes while you try to visualize the scene described. Record your answer by underlining 'Yes', 'No' or 'Unsure', whichever is the most appropriate. Remember that your accurate and honest answer to these questions is most important for the validity of this study. If you have any doubts at all regarding the answer to a question, underline 'Unsure'. Please be certain that you answer each of the twelve questions.

1) Can you see a car standing in the road in front of a house?

Yes No Unsure

2) Can you see it in colour?

Yes No Unsure

3) Can you now see it in a different colour?

Yes No Unsure

4) Can you now see the same car lying upside down?

Yes No Unsure

5) Can you now see the same car back on its four wheels again?

Yes No Unsure

6) Can you see the car running along the road?

Yes No Unsure

7) Can you see it climb up a very steep hill?

Yes No Unsure

8) Can you see it climb over the top?

Yes No Unsure

9) Can you see it get out of control and crash through a house?

Yes No Unsure

10) Can you now see the same car running along the road with a handsome couple inside?

Yes No Unsure

11) Can you see the car cross a bridge and fall over the side into the stream below?

Yes No Unsure

12) Can you see the car all old and dismantled in a Car-cemetery?

Yes No Unsure

APPENDIX C

Results of control random tests for each experiment. Those tests were usually conducted before, during and after each experiment to check if the RNG was working properly. Two types of control randomness tests were done for each experiment. (1) The pseudo-RNG was tested for large series of random numbers, 1/2 million digits for each run. (2) The pseudo-RNG was incorporated in a program that simulated each experiment. It was run a few times, thus indicating how results of that experiment should look like without subjects.

Pilot Experiment 2

Results from random tests of the pseudo-RNG algorithm for long series of random numbers (p=1/4). Total random numbers tested = 4.000.000.

	One's	Two's	Three's	Four's	chisq (df=3)
Before experiment	125.581	124.842	124.634	124.943	4.00 (p=.26)
	124.909	125.203	124.737	125.151	1.13 (p=.77)
	124.785	125.057	125.070	125.088	.50 (p=.92)
After experiment	124.835	125.246	125.600*	124.319*	7.31 (p=.06)
	125.233	125.176	125.005	124.586	2.06 (p=.56)
	124.886	124.601	125.192	125.321	2.47 (p=.48)
Additional tests	124.935	125.044	125.420	124.601	2.75 (p=.43)
	124.982	124.913	125.035	125.070	.09 (p=.99)
Total	1.000.146	1.000.082	1.000.693	999.079	1.25 (p=.74)

* Significant deviations from chance (2-T).

Results of random tests of the pseudo-RNG when the experiment was run without Ss. By chance we would expect 800 hits (40 Ss each doing one session, each involving 80 trials; thus 3200 trials in the whole experiment, where expected hit rate is p=1/4).

	Run 1	Run 2	Run 3	Run 4	Run 5
After experiment 2	821	768	776	819	761

Pilot Experiment 3

Results from random tests of the pseudo-RNG algorithm for long series of random numbers (p=1/4). Total random numbers tested = 2.500.000.

	One's	Two's	Three's	Four's	chisq (df=3)
Before experiment	125.169	125.175	124.568	125.088	2.03 (p=.57)
	124.876	124.982	124.641	125.501	3.16 (p=.37)
During experiment	125.564	124.380*	125.093	124.963	5.69 (p=.13)
After experiment	124.919	124.771	125.249	125.061	1.00 (p=.80)
	125.322	124.526	124.662	125.490	5.47 (p=.14)
	625.850	623.834	624.213	626.103	6.25 (p=.10)

* Significant deviations from chance (2-T).

Results of random tests of the pseudo-RNG when the experiment was run without Ss. By chance we would expect 200 hits (10 Ss doing 1 session, each involving 80 trials; thus 800 trials in the whole experiment, where expected hit rate is p=1/4).

Hits from 17 simulated experiments

Before experiment	195	202								
During experiment	210	202	193	202	193	204	219	196	198	201
After experiment	200	192	191	205	201					

Total hits = 3404
Mean hit rate = 200.2

Experiment 4: First Visual-Imagery Training Study

Results from random tests of the pseudo-RNG algorithm for long series of random numbers (p=1/4). Total random numbers tested = 3.000.000.

	One's	Two's	Three's	Four's	chisq (df=3)
Before experiment	124.890	124.556	125.268	125.286	2.91 (p=.41)
	124.891	125.148	124.920	125.041	.31 (p=.95)
	124.677	125.305	124.984	125.034	1.59 (p=.67)
After experiment	124.929	124.420	125.449	125.202	4.66 (p=.20)
	124.929	124.963	125.220	124.888	.53 (p=.91)
	124.910	124.951	125.003	125.136	.22 (p=.97)
	749.226	749.343	750.844	750.587	2.75 (p=.43)

Results of random tests of the pseudo-RNG when experiment was run without Ss (including both version of the pseudo-RNG, and assigning random IT between trials for pseudo-RNG2). By chance we would expect 2880 hits (24 Ss doing 6 sessions, each involving 80 trials; thus 11520 trials in the whole experiment).

Hits from 21 simulated experiments

Before experiment	2863	2917	2802	2821	2856		
During experiment	2927	2844	2868	2995*	2878	2836	2862
After experiment	2777*	2865	2824	2881	2865	2907	2915
	2898	2940					

Total hit rate = 60.341
Mean hit rate = 2873 (chance = 2880)
* Significant deviation from chance (2-T)

Experiment 5: Second Visual-Imagery Training Study

Results from random tests of the pseudo-RNG algorithm for long series of random numbers (p=1/4). Total random numbers tested = 9.000.000.

	One's	Two's	Three's	Four's	chisq (df=3)
Before study:					
1 pseudo	125.097	125.025	124.998	124.880	.22 (p=.97)
	125.227	124.421	124.954	125.398	4.41 (p=.22)
	124.993	124.618	125.589	124.800	4.25 (p=.23)
2 live	124.791	125.042	124.908	125.259	.97 (p=.81)
	124.690	124.947	125.403	124.960	2.06 (p=.56)
	124.962	124.705	125.098	125.235	1.22 (p=.75)
During study:					
1 pseudo	124.983	124.699	125.035	125.283	1.34 (p=.72)
	124.693	125.034	125.294	124.979	1.47 (p=.69)
	124.742	124.500	125.489	125.269	5.03 (p=.17)
2 live	125.563	124.827	124.454	125.156	5.34 (p=.15)
	124.876	124.920	124.772	125.432	2.09 (p=.56)
	124.959	125.423	124.701	124.917	2.22 (p=.53)
After study:					
1 pseudo	124.889	124.876	124.964	125.271	.81 (p=.85)
	124.664	125.345	125.418	124.573	4.72 (p=.19)
	124.881	125.449	124.873	124.797	2.19 (p=.54)
2 live	124.565	124.946	125.241	125.248	2.50 (p=.48)
	125.228	124.602	125.129	125.041	1.81 (p=.62)
	124.919	124.673	125.313	125.095	1.78 (p=.62)
Total:	2.248.722	2.248.052	2.251.633	2.251.593	5.00 (p=.17)

Random numbers selected via program that simulated experiment 5. Expected hits are 4160 (52 Ss doing a total of 4 sessions, each consisting of 80 trials, thus total trials = 16640).

Hits from 34 simulated experiments

Before:							
Pseudo	4102	4221	4099	4200	4199	4171	
Live	4096	4073	4115	4203	4134	4235	4176
During:							
Pseudo	4124	4070	4170	4226	4136		
Live	4146	4122	4255	4173	4166	4144	
After:							
Pseudo	4060	4068	4019	4165	4105		
Live	4084	4201	4226	4178	4151		

APPENDIX D

Programs that simulate the second visual-imagery training experiment (study 5). All programs that simulated the various experiments are available from the author.

```
10 REM name of program is finalj.bas
20 OPEN "a:rndfile1.prn" FOR APPEND AS £1
30 L=0: TOTHITS=0
40 DIM RGG(4), REG(10)
50 FOR K=1 TO 416
60 GOSUB 350
70 HITS=0:BOX=0:TRIAL=0
80 FOR J=1 TO 4
85 IF J<=2 THEN GOSUB 450
90 IF J>=3 THEN GOSUB 350: GOSUB 450
100 IF RESULT£ < .25 THEN BOX=1:GOTO 140
110 IF RESULT£ < .5 THEN BOX=2:GOTO 140
120 IF RESULT£ < .75 THEN BOX=3:GOTO 140
130 IF RESULT£ < 1 THEN BOX=4:GOTO 140
140 RGG(J) = BOX
150 IF J<>1 AND RGG(J) = RGG(J-1) THEN GOTO 85
160 FOR I= 1 TO 10
170 IF J>=3 THEN FOR M=1 TO RND*100:NEXT M
175 IF J<=2 THEN GOSUB 450
180 IF J>=3 THEN GOSUB 350: GOSUB 450
190 IF RESULT£ < .25 THEN TRIAL=1 : GOTO 230
200 IF RESULT£ < .5 THEN TRIAL=2 : GOTO 230
210 IF RESULT£< .75 THEN TRIAL=3 : GOTO 230
220 IF RESULT£< 1 THEN TRIAL=4 : GOTO 230
230 REG(I)=TRIAL
240 L=L+1:PRINT L
250 IF RGG(J)=REG(I) THEN HITS=HITS+1
260 NEXT I: NEXT J
270 PRINT £1, "hits= "; HITS
280 TOTHITS = TOTHITS + HITS
290 NEXT K
300 PRINT £1, DATE$
310 PRINT £1, "tothits= "; TOTHITS
320 CLOSE
330 END
350 REM subroutine fast clock seeder ****************************
360 RANDOMIZE TIMER
370 X£=RND: X£=X£*10000
380 IX£=INT(X£) + 1
390 X£=RND: X£=X£*10000
400 IY£=INT(X£) + 1
410 X£=RND: X£=X£*10000
420 IZ£=INT(X£) + 1
430 REM having set up the seeds off we go..
440 RETURN
450 REM subroutine that creates random binary digits *************
460 IX£=171*(IX£-INT(IX£/177)*177)-2*(IX£/177)
470 IY£=172*(IY£-INT(IY£/176)*176)-35*(IY£/176)
480 IZ£=170*(IZ£-INT(IZ£/178)*178)-63*(IZ£/178)
490 IF IX£ < 0 THEN IX£=IX£+30269
500 IF IY£ < 0 THEN IY£=IY£+30307
510 IF IZ£ < 0 THEN IZ£=IZ£+30323
520 FX£=IX£
530 FY£=IY£
540 FZ£=IZ£
550 X£=(FX£/30269!)+(FY£/30307!)+(FZ£/30323!)
560 RESULT£=X£-INT(X£/1!)*1!
570 IF RESULT£ > 0 THEN GOTO 600
580 RESULT£=((IX£/30269!)+(IY£/30307!)+(IZ£/30323!)) MOD 1
590 IF RESULT£ > 1 THEN RESULT£ = .999999
600 RETURN
610 REM *********************************************************
```

```
10 REM name of program is finalk.bas
20 OPEN "a:rndfile2.prn" FOR APPEND AS £1
30 L=0: TOTHITS=0: I=0: K=0
35 GOSUB 900
40 DIM RGG(4), REG(10)
50 FOR K=1 TO 416
60 HITS=0
80 FOR J=1 TO 4
85 GOSUB 800: RGG(J)=IPAT
90 FOR I=1 TO 10
230 GOSUB 800: REG(I)=IPAT
240 L=L+1:PRINT L
250 IF RGG(J)=REG(I) THEN HITS=HITS+1
260 NEXT I: NEXT J
270 PRINT £1, "hits= ", HITS
280 TOTHITS = TOTHITS + HITS
290 NEXT K
300 PRINT £1, DATE$
310 PRINT £1, "tothits= "; TOTHITS
320 CLOSE
330 END
800 REM ---------------------- life RNG called ----------------------
830 GOSUB 1000:                            REM GET BIT £1
840 IPAT = IRB
850 GOSUB 1000:                            REM GET BIT £2
860 IPAT = IPAT*2 + IRB + 1
900 REM --- DECLARATION AND INITIALIZATION OF VARIABLES-------------
910 IRTS = &H3FC:                 REM PORT ADDRESS MODEM CONTROL REGISTER
920 ICTS = &H3FE:                 REM PORT ADDRESS MODEM STATUS REGISTER
930 ISTART = 2:                   REM RTS AT +12V TO START RBG
940 ISTOP = 0:                    REM RTS AT -12V TO STOP RBG
950 IMASKCTS = &H10:              REM TO MASK OUT CTS, THE RANDOM BIT
960 IMASKRING = &H40:             REM TO MASK OUT RINGINDICATOR, RBG SIGNAL IS
990 RETURN
1000 REM ----------------------GETRANDOMBIT----------------------
1001 OUT IRTS,ISTART:                  REM SET RBG IN RUNNING STATE
1010 OUT IRTS,ISTOP:                   REM SET RBG IN STOPPED STATE
1020 IRB1 = INP(ICTS) AND IMASKCTS:    REM READ FIRST PRIMARY RANDOM BIT
1030 OUT IRTS,ISTART:                  REM SET RBG IN RUNNING STATE
1040 OUT IRTS,ISTOP:                   REM SET RBG IN STOPPED STATE
1050 IRB2 = INP(ICTS) AND IMASKCTS:    REM READ THE MODEM STATUS REGISTER
1060 OUT IRTS,ISTART:                  REM SET RBG IN RUNNING STATE
1070 OUT IRTS,ISTOP:                   REM SET RBG IN STOPPED STATE
1080 IRB3 = INP(ICTS) AND IMASKCTS:    REM READ THE MODEM STATUS REGISTER
1090 OUT IRTS,ISTART:                  REM SET RBG IN RUNNING STATE
1100 OUT IRTS,ISTOP:                   REM SET RBG IN STOPPED STATE
1110 IRB4 = INP(ICTS) AND IMASKCTS:    REM READ THE MODEM STATUS REGISTER
1115 REM
1120 IRB1 = IRB1 XOR IRB2
1130 IRB3 = IRB3 XOR IRB4
1140 IRB = (IRB1 XOR IRB3)/16
1150 RETURN
1160 REM ----------------------------------------------------------
```

APPENDIX E

Information referred to in experiment 4.

IMAGE-PK

Loftur R. Gissurarson and Robert L. Morris

Name:______________________________________

Sex: Male________ Female________

Date:__________

This questionnaire is designed to help us to understand better how people may progress in practicing a visual-imagery strategy to enhance or stablize their PK scores.

Psychokinesis (usually abbreviated as "PK") is more commonly known as mind influencing matter or as "mind over matter". It is often considered to be direct influence exerted on a physical system (an external physical process, condition, or an object) by a person without any known intermediate physical energy or instrumentation. For instance, it would be counted as PK if a person would move an object with his/her "mind" and without any muscular interaction. There is evidence that suggest that there exists such an ability as PK.

Before answering the questions, try to imagine firstly, that all people have PK ability. Imagine it as a part of nature and the human mind. Secondly, visualize the PK task that you have been doing (the computer test). Thirdly, think of the visual-imagery technique that you are practising to enhance or stablize your PK scores.

Think carefully about the following questions before answering them. Please try to answer all of the questions in as much detail as you think possible. Take your time and let you mind flow freely and be relaxed. You may perhaps have a clear image of PK effects, or you may see your PK as energy. Your imagery may also be symbolic, such as PK may look like a fog, a wolf or a car etc in your mind's eye. Or you may not get any image of your PK at all. That can also be very helpful to us, and very legitimate, as we are trying to get some understanding of what type of imagery, feelings, thoughts and attitude is connected with progress in PK training, if any.

You may find it helpful to make drawings on the answer sheets - it may be easiest to draw one picture of how you see your PK ability and the PK task in your mind's eye, and then use the questions to explain the picture. You can use the back of the pages to write and draw your answers. Try to be as honest as possible as your answers may be important in understanding better how PK operates. Your answers on this questionnaire will be held strictly confidential.

1. Try to describe your PK. How do you see, feel or imagine your PK? What does it look like in your mind's eye?

2. Do you see your PK fluctuating? Changing? Coming and/or going? If so, how? Where? When? Do you see your PK as active or passive?

3. How large or big do you see your PK ability?

4. How strong do you think or feel your PK is?

5. Try to describe how the PK task (the computer test) looks in your mind's eye.

6. How strong (tough) do you think the computer test is? How easy / difficult is it to be successful on it? Why? When?

7. How does your PK work on the computer test? How do you imagine your PK getting hits on the computer test?

8. How do you think your visual-imagery practices work to strengthen / increase your PK?

9. How well does your visual-imagery practices work to "beat" (get above chance score) the computer test?

10. Have you noticed somekind of resistance or inhibition that prevents your PK ability to work or function efficiently? If so, how do you experience the resistance / inhibition? Does it turn up in practicing the imagery technique or is it a feeling you get? How does it look like in your mind's eye? How strong do you think it is?

Concentration exercise (for session 4):

Instead of practicing the relaxation exercise for about five minutes before visualizing your imagery technique, replace it with a simple concentration exercise. Exercising concentration can help you to focus your attention more successfully while visualizing the imagery technique. If you want to keep the relaxation exercise, then add the concentration exercise between relaxation and your visual-imagery technique.

Notice your own breathing and mentally tally each exhalation. Whenever your attention wanders, gently but firmly return your attention to the counting. If the count is lost, just start again with "one" since the goal is to keep the attention focussed rather than to keep an accurate tally.

IMAGE-PK: Imagery Scoring Sheet   Ss no._____
Give missing values -9999

1. Vividness of PK:

1	2	3	4	5
no imagery	somewhat unclear	moderately clear	quite vivid imagery	maximumly vivid

2. Activity of PK:

5	4	3	2	1
very active	quite active	passive & active	somewhat passive	very passive

3. Relative size of PK:

1	2	3	4	5
no awareness of size	quite small	combined small and large	somewhat large	very large

4. Relative strength of PK:

5	4	3	2	1
Very strong	quite strong	both weak & strong	moderately weak	quite weak

5. How is the task described:

1	2	3	4	5
very unclear response	somewhat unclear & factual	moderatly clear & factual	very clear imagery	maximumly vivid imagery

6. Relative strength of task:

5	4	3	2	1
quite weak	moderatly weak	weak & strong	quite strong	very strong

7. How PK is imagined to operate on task:

5	4	3	2	1
strong PK effect on task	somewhat strong PK influence	moderate PK effect on task	little PK effect on task	no PK effect on task

8. How the visual-imagery practices are thought to work:

1	2	3	4	5
S does not practice	unclear how they work	moderately clear	some idea of how they work	clear image of how they work

9. Effectiveness of the visual-imagery practices:

1	2	3	4	5
not effective	somewhat effective	moderately effective	quite effective	very effective

10. Resistance of some sort or other:

1	2	3	4	5
very strong and vivid	quite strong	moderately weak	quite weak	no resistance

General.

11. How symbolic are responses vs. how concrete:

1	2	3	4	5
very factual concrete	moderately factual, concrete	mixed symbolistic /factual	moderately symbolic	highly symbolic

12. Overall strength of imagery in responses vs. weakness:

1	2	3	4	5
very weak	quite weak	moderate	quite strong	very sound and strong

13. In your opinion, do you think the individual believes that he is going to do well:

1	2	3	4	5
no belief	substantial disbelief	moderate disbelief	some belief	strong belief

A novel method developed by the author and Eric Darley, a research assistant, to evaluate whether vividness of the visual-imagery strategies got better with practice at home. The method involves three steps. In the following hypothetical example, an experiment is considered with two subjects, A and B.

STEP A

In the first step, the number of home practice sessions are listed (as 1,2,3,4 etc.) in a chronological order in a column. Beside this column comes another column (one for each subject) which includes the relevant vividness rating of a visual-imagery strategy (as rated on a five point scale in the diaries by each subject when he practised it at home).

Number of home practice sessions	Vividness of a visual-imagery strategy as rated in the diaries by two Ss when they practised it at home.	
	subject A:	subject B:
session 1	5	5
2	4	5
3	4	5
4	4	3
5	3	4
6	2	4
7	1	3
8	2	2
9	2	3
10	1	2
11		3
12		2
13		

Subject A did 10 home practice sessions, whereas subject B did 12 home practice sessions.

STEP B

In step B, the vividness ratings of both subjects A and B are divided into 5 cells in order to make them identical.

Vividness of a visual-imagery strategy as rated in the diaries by two Ss when they practised it at home.	
subject A: 5 4	subject B: 5 5 5
4 4	3 4 4
3 2	3 2
1 2	3 2
2 1	3 2

Subject B practised 12 times at home. Thus, it is not possible to divide his ratings into 5 cells, each with equal number of ratings. This is solved by looking at how many extra home sessions there are. In the case of subject B there are 2 extra home practice sessions. Since there are two extra practices, the first two cells are enlarged, each to make room for one extra home practice session. (In the case of three extra home practice sessions, the first three cells are enlarged, and so on.)

If the number of home practice sessions is less than 5 for a subject, he is not included in the analysis.

[To exclude a subject from this analysis of diaries may be debatable (in experiment 4, one subject had to be excluded). Our reason for doing so was that it made the whole analysis more easy. (One can also argue that there is too little information available in such cases in order to do a meaningful correlation.) The choice of 5 cells was based on a subjective decision: (a) We figured that in order to do a meaningful correlation, the minimum number of cells we had to have was about 5. (b) By having the minimum number of cells, as few cases as possible were excluded from the analysis. If 6 cells had been chosen for experiment 4 another case would have been excluded. Six cells were chosen for experiment 5, because Ss practiced more at home in general in that experiment, in comparison to the Ss in experiment 4.]

STEP C

The means from step B are calculated for each of the five cells for each subject. Then the cell means for subject A are added to the cell means for subject B. In the case of 3 Ss (A,B,C), the cell means for A, B, and C are added together.

Subject A: +	Subject B:	A + B:
4.5 +	5.0	9.5
4.0 +	3.7	7.7
2.5 +	2.5	5.0
1.5 +	2.5	4.0
1.5 +	2.5	4.0

Only the figures in this final column are used. They are correlated with numbers from 1-5 which denote the chronological time from the beginning of the experiment to the end.

If there are six cells, as was the case in experiment 5, numbers from 1-6 are used to represent the chronological time variable.

<u>Positive thinking exercise 1</u> (for session 6):

Replace the visualisation exercise (that you did before practising the imagery strategy) with this exercise. You should practise the imagery strategy for about 5 min. after you have practised the positive thinking exercise. Again, you may want to start with the relaxation exercise before doing the positive thinking exercise and the imagery strategy. Try to keep an open mind; it may be easiest to approach this exercise as an adventure into suspending normal reality. If you find it seems inappropriate and would rather not practise it that's fine, but it can hardly hurt to give it a try. Try to imagine the world as you would like it to be. Talking out loud may help.

> I can improve my ability to do my best and think positive thoughts. Anything getting in my way is gone. Doubts are removed, they will not arise. My efforts are smoother and more effective. My imagery is getting clearer, more effective. I am eager to see my results get better. I am confident that any skills I acquire or develop will be used in helpful ways, for myself and others. I feel comfortable with the idea of PK as a productive contributor to society. I feel confident that I will not misuse PK. I deserve success. It is good for people to develop any of their abilities that can be made helpful to others. I will be lucky, and things will go better for everyone around me. If I get better at PK, I will help people feel well, help things grow, flourish prosper, function efficently and effectively. <Etc. improvise according to your own imagination.>
>
> Emphasis: I can do my best in bringing out my PK. I can help myself and others to feel well, help things flourish, prosper and grow.

This exercise is to help you get into a reactive, optimistic and confident mood, for your next and final PK session and perhaps for life in general. It can give you an additional lift, to help you do your best and to help you feel good about your efforts. It's not a fake confidence - we know there will still be times when things don't work out exactly as we want. But if our confidence and mood is good, it's bound to help us overall, for life in general and for whatever PK skills we may have.

Try to think of positive thinking as a frame of mind that can perhaps bring out the power of your mind to help things grow and prosper. Try to imagine that there are no boundaries between the possible and the impossible. Try to behave as if you are already a successful PK agent. Try to feel how good it is to be able to help others feel well and make things work effectively. Repetition is essential. You can practice this pep-talk at night before retiring. Be confident that your unconscious self / mind will work on bringing the necessary PK ability to you during the night. Your unconscious mind will go about it in its own way. If you like doing this exercise you may perhaps try to integrate thoughts and images of yourself as a person who increases happiness all around him into the flow of daily life. Perhaps those who spread happiness around them in life have done exactly that!

<u>Positive thinking exercise 2</u> (for session 6):

Replace the visualisation exercise (that you did before practising the imagery strategy) with this exercise. You should practise the imagery strategy for about 5 min. after you have practised the positive thinking exercise. Again, you may want to start with the relaxation exercise before doing the positive thinking exercise and the imagery strategy. Try to keep an open mind; it may be easiest to approach this exercise as an adventure into suspending normal reality. If you find it seems inappropriate and would rather not practise it that's fine. but it can hardly hurt to give it a try. Try to imagine the world as you would like it to be. Talking out loud may help.

> I can improve my ability to do my best and think positive thoughts. Doubts are removed, they will not arise. My efforts are smoother and more effective. My imagery is getting clearer, and more effective. I am eager to see my results get better. I am confident that any skills I acquire or develop will be used in helpful ways, for myself and others. I feel comfortable with the idea of PK as a productive contributor to society. I feel confident that I will not misuse PK. It is good for people to develop any of their abilities that can help to others and the society. I will be lucky, and things will go better for everyone around me. If I get better at PK, I may be able to help those around me, as well as myself. I will help to reduce accidents, malfunctions and reduce illnesses. <Etc. improvise according to your own imagination.>
>
> Emphasis: I can do my best in bringing out my PK. I can help myself and others to reduce accidents, malfunctions and illnesses for the benefit of others.

This exercise is to help you get into a reactive, optimistic and confident mood. for your next and final PK session and perhaps for life in general. It can give you an additional lift, to help you do your best and to help you feel good about your efforts. It's not a fake confidence - we know there will still be times when things don't work out exactly as we want. But if our confidence and mood is good, it's bound to help us overall, for life in general and for whatever PK skills we may have.

Try to think of positive thinking as a frame of mind that can perhaps bring out the power of your mind to help in reducing accidents and illnesses. Try to imagine that there are no boundaries between the possible and the impossible. Try to behave as if you are already becoming a better PK agent. Try to feel how good it is to be able to successfully help others with their problems. Repetition is essential. You can practice this pep-talk at night before retiring. Be confident that your unconscious self / mind will work on bringing success to you during the night. Your unconscious mind will go about it in its own way. If you like doing this exercise you may perhaps try to integrate thoughts and images of yourself as a person who helps things to get better into the flow of daily life. Perhaps those who are able to reduce malfunctions and problems in life have done exactly that!

Positive thinking exercise 3 (for session 6):

Replace the visualisation exercise (that you did before practising the imagery strategy) with this exercise. You should practise the imagery strategy for about 5 min. after you have practised the positive thinking exercise. Again, you may want to start with the relaxation exercise before doing the positive thinking exercise and the imagery strategy. Try to keep an open mind: it may be easiest to approach this exercise as an adventure into suspending normal reality. If you find it seems inappropriate and would rather not practise it that's fine, but it can hardly hurt to give it a try. Try to imagine the world as you would like it to be. Talking out loud may help.

> I can improve my ability to do my best and think positive thoughts. I remove my doubts, they will not arise. My efforts are smoother and more effective. My imagery is getting clearer, more effective and more vivid. I am eager to see my results get better. I am confident that any skills I acquire or develop will be used in helpful ways for myself and others. I can do my best, and I will succeed in doing my best because I am lucky and successful. I am a super-optimist and I have a good imagination. I will be successful in the next session. My unconscious self, bring me good results in next session! I can see success in the computer test coming to me. I can feel success coming to me. I know I can do my best because I am lucky and successful. <Etc. improvise according to your own imagination.>
>
> Emphasis: I can do my best in bringing out my PK. I can be lucky and successful in life.

This exercise is to help you get into a reactive, optimistic and confident mood, for your next and final PK session and perhaps for life in general. It can give you an additional lift, to help you do your best and to help you feel good about your efforts. It's not a fake confidence - we know there will still be times when things don't work out exactly as we want. But if our confidence and mood is good, it's bound to help us overall, for life in general and for whatever PK skills we may have.

Try to think of positive thinking as a frame of mind that can perhaps bring out the power of your mind. Try to imagine that there are no boundaries between the possible and the impossible. Try to behave as if you are already successful. Try to feel how good it is to be very successful. Repetition is essential: try to keep repeating the idea of success to yourself. You can practice this pep-talk at night before retiring. Be confident that your unconscious self / mind will work on bringing success to you during the night. Your unconscious mind will go about it in its own way. If you like doing this exercise you may perhaps try to integrate thoughts and images of yourself as a successful and lucky person into the flow of daily life. Perhaps those who are successful and lucky in life have done exactly that!

APPENDIX F

Information referred to in experiment 5.

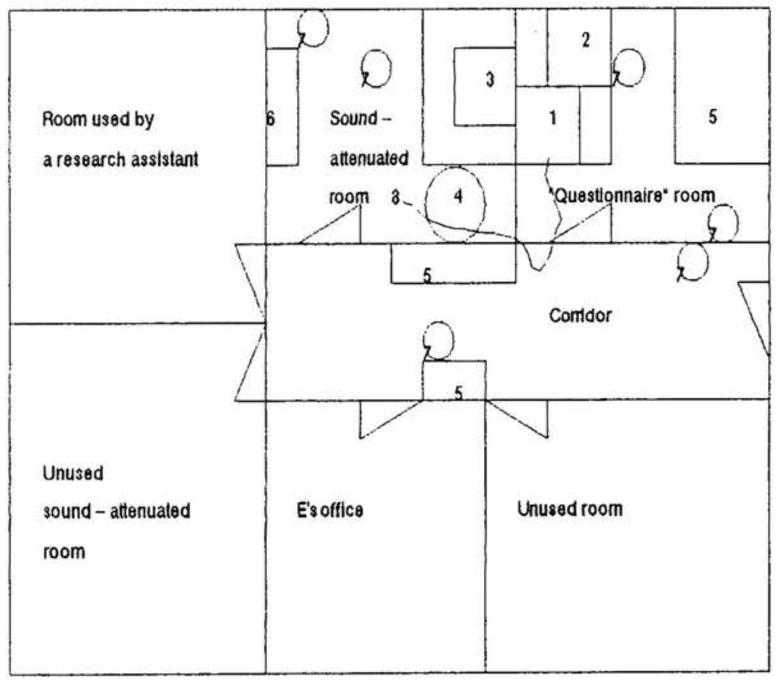

DIAGRAM OF THE PARAPSYCHOLOGY LABORATORY

1. Tape – recorder.	5. Tables.
2. BBC computer.	6. Book shelf.
3. IBM computer.	7. Chairs.
4. Reclining chair.	8. Headphones.

Tape Recorded Instructions: Pep-Talk

This recording is to help you get into a relaxed and yet alert, optimistic and confident mood for your session. It can give you an additional lift to help you do your best on the computer test and to help you feel good about your efforts. Optimism is not a fake confidence - we know there will still be times when things don't work out exactly as we want. But if our confidence and mood is good it's bound to help us overall, for life in general and for whatever PK skills we may have.

To begin with I want you to close your eyes. Take a deep breath, breathe in and out slowly and deeply a few times. <Long pause.> Breathe in and out, slowly and deeply. <Long pause.> Allow yourself to relax. <Pause.> Empty your mind of all worries. <Pause.> Let go off all thoughts about what you have been doing today. Imagine these thoughts to be like balloons, let go off them. <Pause.> Just concentrate on the task ahead. <Pause.>

Remember to keep an open mind: it may be easiest to approach the experiment in which you are participating as an adventure into suspending normal reality. Let yourself improve your psychokinesis ability by doing your best and thinking positive thoughts. Consider positive thinking as a frame of mind that can perhaps bring out the power of your mind. Imagine that there are no boundaries between the possible and the impossible. <Pause.>

Remove any of your doubts so that they will not arise. Your efforts will become smoother and more effective. You are eager to see your results get better. Feel confident that any skills you may acquire or develop will be used in helpful ways for yourself and others. You can do your best, and you will succeed in doing your best because you want to. Tell your unconscious self to bring you good results in this session! <Pause.> Tell it again to bring you success. <Pause.>

Now repeat after me in your mind: I feel comfortable with the idea of PK as a productive contributor to society. <Pause.> I feel confident that I will not misuse PK. <Pause.> It is good for people to develop any of their abilities that can help others and the society. <Pause.> I will be lucky, and things will go better for everyone around me. <Pause.> If I get better at PK, I may be able to help those around me, as well as myself. <Pause.>

Imagine achieving success in the computer test. <Pause.> Feel success coming to you. You are going to get many hits, you know you can do your best. Visualize yourself successful. <Pause.> Now, behave as if you are already successful with the computer. Feel how good it is to get many hits. <Pause.> Repetition is very helpful: keep repeating the idea of success on the computer test to yourself. <Pause.> Be confident that your unconscious mind will work on bringing success to you. Your unconscious mind will go about it in its own way. Integrate thoughts and images of yourself as successful and lucky into the flow of your daily life. Perhaps those who are successful and lucky in life have done that. Perhaps those who are able to reduce malfunctions and problems in life have done exactly that! <Pause.>

WORD-BY-WORD AUTOGENIC PHRASES AND IMAGES

PREPARATION

First get into a comfortable position. While you are finding a good position, you will also want to loosen any tight clothing. Become as comfortable as possible.

BREATHING - SMOOTH AND RHYTHMIC

Take a deep breath. ... Breathe in so that the air flows into your lungs and feels as though it's filling up your stomach area. Now, breathe out slowly. ... Feel yourself floating down.

Focus your attention completely and fully on your breathing. Imagine your breathing is as automatic as the ocean waves, rolling in ... and out ... in ... and out. ... Silently say to yourself, "Breathing, smooth and rhythmic. ..." "My breathing is effortless and calm. ..." "Breathing, smooth and rhythmic. ..." "My breathing is effortless and calm. ..." "Breathing, smooth and rhythmic. ..."

As you breathe, imagine relaxation flowing over your body, one wave after another. With each wave of relaxation, try to feel the heaviness and warmth in your body.

LEGS AND FEET

Your mind is becoming more passive and tranquil, and you have a placid, relaxed awareness of the feelings of relaxation throughout your body. All of the tensions and worries will slip away from you as you feel waves of relaxation flooding over you. There is a growing feeling of warmth and heaviness in your arms and legs and a passive awareness of your state of relaxation. Silently say to yourself, "I am relaxed. ..." "I feel very quiet, and my body is relaxed. ..." "My whole body is deeply relaxed. ..."

These feelings of relaxation, passivity, and peace will now become more and more profound as you concentrate on just your toes. Focus all your attention on your toes. Say to yourself, "my toes are heavy and warm; warmth is flowing into my toes. ..." Continue silently to repeat to yourself, "my toes are heavy and warm; warmth is flowing into my toes. ..."

Next bring your attention to your feet and calves. Silently say to yourself, "my feet and calves are heavy and warm; warmth is flowing into my feet and calves, and they feel pleasantly warm. ..."

Now, slowly move your concentration to your knees and thighs. Passively focus on your knees and thighs and the feelings of heaviness and warmth. "My knees and thighs are heavy and warm. Warmth is flowing up from my calves to my knees and thighs. ..." Remember, you do not want to try to force any of these things to happen, just allow them to happen. They will occur naturally and gently. Continue repeating to yourself, "my knees and thighs are heavy and warm. ..." Imagine the blood warming your legs.

At this time, carefully study the feelings in your legs; toes, feet, calves, knees and thighs. Attend to the feelings of heaviness and warmth. You may use any thoughts you care to in order to imagine your legs becoming warm. You can imagine that they are in warm water or that the sun is beating down on them.

Continue repeating to yourself: "My legs are heavy and warm: warmth is flowing into my legs, and it feels pleasantly warm. ..."

Can you feel the relaxation? Do your legs feel as if you would need help to lift them? Maybe the warmth reminds you of the summer sun. However you describe it is fine, as long as it is pleasant for you. Just continue to feel the heaviness and warmth, and feel the relaxation. "Warm and pleasant feelings are sinking into every part of my legs, and feet." "My legs are very limp."

HIP, STOMACH AND SMALL OF THE BACK

Now, I would like you to turn your attention to your hip muscles. Concentrate on this area of your body and focus all your attention there. Silently repeat: "My hips are heavy and warm: warmth is flowing into my hips. ..." The feelings of warmth may be deepened by imagining the sun shining on you hip muscles. Continue saying these words while focusing on your hips: "My hips are heavy and warm; warmth is flowing from my legs to my hips. ..."

Slowly turn your attention to the stomach muscles. Silently repeat: "My stomach muscles are heavy and warm; warmth is flowing into my stomach muscles. ..." And now, the lower back muscles: "The small of my back is heavy and warm; warmth is flowing from my stomach into the small of my back. ..."

Become fully aware of the feelings in your stomach and back muscles. Be sure to keep out all other thoughts as you continue to focus on heaviness and warmth in your stomach and back. If other thoughts come into your mind, you will find it possible to let them go as quickly as they came. You are passively concentrating on heaviness and warmth. Simply let these things happen; allow these feelings of heaviness and warmth to happen to you.

ARMS AND HANDS

Now, I want you to focus on your fingers, as you silently say to yourself: "My fingers are heavy and warm, warmth is flowing into my fingertips. ..." "All my fingers are heavy and warm, and they feel very pleasant ..."

Bring your attention to your hands. Feel them getting warm, as you say to yourself: "My hands are heavy and warm, warmth is flowing into my hands. ..." Move your attention slowly to your wrists. Silently repeat to yourself, "my wrists are heavy and warm, they feel warm and pleasant. ..." "Warmth is flowing into my wrists. ..."

Just continue to feel the heaviness and warmth, and feel the relaxation. Move your attention to the lower arm muscles, as you say to yourself: "My lower arm muscles are heavy and warm, warmth is flowing into my lower arm muscles. ..." Passively focus your attention to your elbows and upper arms and the feelings of heaviness and warmth: "My elbows and upper arms are becoming heavy and warm, warmth is flowing into my elbows and upper arms. ..."

Very good. You are relaxing all over as your arms become very heavy and warm. As the warmth flows into your hands, you will feel your whole body relaxing. You are letting everything go, all cares and worries are far, far away. This is your time to think only of pleasant relaxation and the feelings it brings. It is better for you if you think of nothing but the way your body feels. Let all other thoughts leave your mind.

Once again, focusing on both of your arms, think to yourself: "My arms are heavy and warm." "Warmth is flowing into my hands. ..." Continue passively to concentrate on your arms being heavy and warm. Be sure you gently push out any other thoughts. In our modern society, the mind is often not used to being quiet and relaxed, and it tends to wander. If you find this happening, do not become upset or disappointed. Just bring your mind back to the thought: "My arms are heavy and warm; warmth is flowing into my hands." "The muscles in my arms and hands are letting go, and I am becoming more and more relaxed."

SHOULDERS AND NECK

Now I want you to focus on muscles in the upper part of your back and the shoulder muscles. Silently say to yourself: "The muscles in the upper part of my back are warm and heavy. They are very heavy, pleasantly warm and thoroughly relaxed. ..." "Warmth is flowing into my shoulder muscles." "My shoulder muscles are becoming heavy and warm. Warmth is flowing into my shoulder muscles, and they are completely relaxed. ..."

Move your attention slowly to your neck muscles. Feel them getting warm and heavy. Silently say to yourself: "My neck muscles are warm and heavy, heavy and warm. ..." Become aware of your neck muscles. "Warm and pleasant feelings are sinking into every part of my shoulders and neck muscles." "My neck muscles feel very heavy, pleasantly warm and thoroughly relaxed. ..."

Very good. Take some time now while you keep your legs, arms and neck very heavy and warm, and check around your body to see if there is tension in any muscle. Check all around. You are becoming very relaxed, and you feel loose and limp - just like an old rag doll. And you really are that relaxed, as you continue to practice relaxation.

FACE MUSCLES

Now I want you to concentrate on your face muscles. Passively allow the warmth to spread as you silently say to yourself: "Warmth is spreading from my neck muscles to my face." Feel your chin getting warm and heavy, as you say to yourself: "My chin feels warm and heavy, warmth is flowing into my chin. ..." Let your mouth drop open for a moment and move your jaw gently from side to side. Now, close your mouth slowly, keeping your teeth slightly apart. As your attention is on your lips and jaw, repeat passively to yourself, "my lips and jaw are warm and heavy. ..." "My jaw and lips feel very warm and heavy, completely relaxed." Your jaw is loose and slack.

Focus on your cheeks, as you passively allow them to get warm and heavy. Move your attention to your nose. Repeat silently to yourself: "My nose is warm and heavy, warmth is flowing into my nose. ..." Next, your ears are becoming pleasantly heavy and warm. Silently say to yourself: "My ears are heavy and warm. ..." Your eyes are also warm and heavy. Your eyelids are gently closed. Say passively to yourself: "My eyes are pleasantly warm and heavy. Warmth is flowing into my eyes. ..." Be sure the muscles in your face are relaxed.

Relax your forehead. Your forehead is a little cooler than the rest of your body, but still very heavy and thoroughly relaxed. Gently say to yourself, "My forehead is relaxed, it feel heavy and relaxed. ..."

RETURN TO ACTIVITY

Very good. Now I want you to focus on your lungs. Focus your attention completely and fully on your breathing. Take a deep breath. ... Breath in so that the air flows into your lungs and feels as though it is flowing way down into your stomach area. Breathe very deeply down into your stomach area and, as you breathe out, say to yourself, "I am relaxed. ..." Expand your lungs by taking a nice deep breath. Fill your lungs with air. Feel the tension in your lungs. ... Experience the tension and then slowly exhale. Feel the relaxation returning as the air gently rushes out. Repeat the deep breathing. ..." Associate deep breathing with relaxed body and clear mind.

Now as we complete this relaxation practice, take a last deep breath and slowly let it out. When you open your eyes, you will be relaxed and alert. As you open your eyes, you will find yourself back in the place where you started your relaxation. The environment will seem slower and calmer, and you will be more relaxed and peaceful. Slowly open your eyes. ... Yawn and stretch as you do in the morning and shake your hands briskly.

PARAPSYCHOLOGY LABORATORY

University of Edinburgh
Department of Psychology
7 George Square
Edinburgh EH8 9JZ

Participant name: ________________________

The experiment in which you are about to participate is being conducted to examine the effects of imagery techniques as a training strategy on possible psychokinetic abilities on a computerized game of chance. This project will involve your completing one inspection time test in addition to playing our computerized test on four occasions and practicing a visual-imagery strategy at home for about 10-15 minutes on a daily basis. We hope you will find this enjoyable and challenging and if at any time you wish to withdraw simply tell us and your request will be honoured immediately.

All personal information obtained from you will be held in strict confidence and will never be made public in any manner which could identify you. If you wish, you are free to use a pseudonym in the test, as long as we have both your pseudonym and your real name for our confidential records.

When this project is completed, we expect to give you a brief report on the outcome and any other information which might be of interest to you. This experiment is not designed to determine if a given individual has psychic abilities but rather to look for general trends in a group of people. At no time has previous research indicated that any harm can come from this type of experiment.

____

Experimenter: Loftur Reimar Gissurarson

____

Date

GENERAL SUGGESTIONS

In order for you to do well on the computer test, you may want to read following suggestions more than once.

If you at any time lose your sheet with the visual-imagery strategy or want further explanations feel free to call the experimenter either at work (667 1011 ext. 4448) or at home (668 2518). If you feel down, tired, ill or in bad mood, please call the experimenter to arrange another appointment for your session. If you want to achieve good results it is important that your concentration is completely on the task ahead.

Feedback: When you receive the feedback after each trial try to be aware of its implication. Notice any particular "state of mind", "sensation", "feeling" or an "idea" that seems to precede a hit. Use the feedback as information - to guide you. Don't be discouraged if the computer fails to select the preferred window.

Negative thoughts: If you catch yourself thinking negative thoughts, talk positively to yourself. Either ignore unsuccessful outcomes or think of them as a step that will help you gradually to improve. Do not to think of failure. When you have pressed the space-bar, relax and watch your results with confidence.

Trying too hard: One sometimes tries too hard to get high score on the computer test. Too much effort might have reverse effect of that anticipated. The best suggestion we can give you is; do your best on concentrating on the task, be self-confident, do not think negative thoughts but be optimistic that the visual-imagery strategy works and develop a strong longing to get high score while remaining relaxed about it.

Home practice: The home practices are important if you want to achieve good results. Practise your visual-imagery strategy once a day for about 10-15 minutes each time. Feel free to spend more time on practicing if you want to.

Do the home exercises in a quite place when you are not tired. Sit down in a comfortable chair where you are free of interruptions. Loosen your collar and shoes and feel comfortable. Think of the home practice as important in strengthening your visual-imagery strategy, and perhaps your visualisation ability in general, like strengthening a muscle with exercise.

After each time you practice, please note: date and day; time of commencement; how long you practised; degree of success with the visual-imagery strategy (vividness); also make any comments that you feel may be relevant (e.g. if you had a great day and feel this may have helped to bring about a good practice session).

Scale for "rated success of visual-imagery strategy"
Item:
1 = I could visualize the visual-imagery strategy perfectly clearly and vividly.
2 = I could visualize the visual-imagery strategy reasonably clearly and vividly.
3 = I could visualize the visual-imagery strategy moderately clearly and vividly.
4 = I could only visualize the visual-imagery strategy vaguely and dimly.
5 = I could not get any image at all, I only "knew" that I was thinking of the visual-imagery strategy.

If you miss a day, or spend less than 10 minutes on practising that's fine, but please write it down so that there is a complete record of your development. We want you to bring the diary with you in the last session. Your diary may help you and us to understand better what may be important in enhancing or stablizing PK scores.

We know you are spending valuable spare-time with us, and therefore we want you to benefit from this study. Preferrably, we want to see you increase or stabilize your PK score. But, you may also benefit from the home exercises. We suggest that you become involved in the exercises personally and try to explore using them in your daily live. For instance, you can practice relaxation when you feel under pressure and need to relax. Feeling relaxed may help you concentrate on problems or tasks that lie ahead, and make you better able to deal with stress of one sort or another. In short, try to make use of the home exercises for your own benefit.

HOW TO DO THE HOME PRACTICES

Try to practise like an athlete before doing sport activity; imagining his task ahead, visualizing his performance and method, and seeing in his mind's eye a successful achievement of his goal.

Phase One - Exercises to enhance the visual-imagery strategy. This phase should be included in the home practices before sessions 3 and 4. Do a relaxation exercise before starting the visual-imagery strategy when practising at home before session 3. When practising before session 4, the relaxation should be followed immediately by a simple visualization exercise.

Phase Two - The visual-imagery strategy. (a) Deep breathing: Close your eyes and take a series of deep breaths from your diaphragm. Slowly breathe in and out (through your mouth if you prefer). According to sports psychologists and mental skills trainers, this type of breathing (called centered breathing) seems to increase the feeling of internal stability and enhancing your ability to focus. It is easier to enter your visual-imagery strategy after deep breathing. (b) The visual-imagery strategy: Now start practising your visual-imagery strategy. While doing it, imagine that you are at the lab. Visualize yourself in the sound-attenuated room and see the computer display in front of you in your mind's eye. It is important that you vividly imagine yourself feeling well and self-confident, being successful and getting many hits on the computer test.

When you come to the lab to do your session, you only have to use deep breathing followed by your visual-imagery strategy. Because your brain will be working full force during the home practices, it will be more experienced and confident during the actual session.

DIARY

Date & day of home practice	Hour of day when practiced	Time spent on practicing	Rating on vis-im. str. success	Session number & hits	Comments

Relaxation exercise (for session 3):

The following relaxation exercise is designed to help you in doing the visual-imagery strategy. Do the relaxation excercise for about 10 minutes before you practise your visual-imagery strategy. Then do your visual-imagery strategy for about 5 minutes, such that the time spent per day is about 10 to 15 minutes. If you do this exercise successfully, your should have more control over your visual-imagery strategy, in the sense that it is easier to visualise if one is relaxed. Practising relaxation before your visual-imagery strategy at home can help you to relax better in the next session and could bring about better visualisation: the body is completely relaxed and thus is not sending signals to the brain to compete for attention. Feel free to adjust this relaxation exercise to your needs:

If you are sitting, put your hands in your lap and close your eyes. If you are lying down, lie flat on your back on a bed. Make sure every part of you is comfortable, your legs not crossed and your hands resting calmly on the bed. Feel thoroughly and completely relaxed all through your body. Take some slow deep breaths and say to yourself, relax.

Start by relaxing your toes. Feel them getting warm and heavy. Next, bring your attention to your feet and calves, and then slowly move it to your knees and thighs. Imagine the blood warming your legs. Move your attention to the hip muscles and stomach muscles. Feel them getting warm and heavy. Bring your attention to your fingers, hands, lower arm muscles, then elbows and upper arms. Feel the muscles in your arms getting warm and heavy. Then let all tension flow out of the upper part of your back, the shoulder muscles and neck muscles. Feel them getting warm and heavy. Finally relax your face muscles; chin, lips, jaw, cheeks, nose, ears and eyes ending with your forehead. Feel pleasantly warm, heavy and thoroughly relaxed.

Finally, bring your attention to your lungs. Expand your lungs by taking a nice deep breath and holding it. Fill your lungs with air. Feel the tension in your lungs. Experience the tension and then slowly exhale. Feel the relaxation returning as the air gently rushes out. Repeat the deep breathing. Associate deep breathing with relaxed body and clear mind.

Simple visualization exercise (for session 4):

Instead of practising the relaxation exercise for about 10 minutes before doing your visual-imagery strategy, cut it down to about 5 min. Then do a simple visualization exercise for about 5 minutes followed immediately by the visual-imagery strategy. Think of this exercise as a step in developing your visualization ability for the visual-imagery strategy. Add the simple visualization exercise between relaxation and your visual-imagery strategy.

Hold up in clear view a small, simple, attractive, familiar object such as a pen or a cup. Look briefly at the object. Then, with eyes closed, picture the object in your mind's eye. As soon as an impression comes forth, open your eyes and get feedback, noticing similarities and differences between impression and reality. Close your eyes and picture the object again. Repeat the alternating of eyes closed for visualizing and eyes open for feedback several times.

Then start rotating the object while eyes are closed; open your eyes to receive feedback about the actual position of the object compared to the visualized position of the object. Repeat this exercise, ending it when about 5 minutes have passed.

When you do this exercise again next day, feel free to change objects. You can also move towards richer objects, having more detail, yet conveniently hand-held or placed within easy reach directly in front of you. Use objects that are of especial interest, or can possibly be seen from a new perspective when examined in detail.

APPENDIX G

Mean PK scores for each training session in experiments 4 and 5.

Experiment 4

Mean PK scores of experiment 4 for each of the six training sessions. Chance score for feedback and nonfeedback version = 10.0, and chance score for combined versions = 20.0. Se = session number; F = feedback version; N = nonfeedback version; 0 = screening session; 1-6 = all six "training" sessions combined; 1st = first half of the experiment (sessions 1-3 combined); 2nd = second half of the experiment (sessions 4-6 combined).

	Total scores			Process-oriented			Goal Oriented			End Oriented		
Se	F	N	F+N	F	N	F+N	F	N	F+N	F	N	F+N
0	11.4	11.5	23.0	13.0	10.3	23.3	10.6	12.1	22.8	10.6	12.3	22.9
1	9.6	11.2	20.8	10.1	11.4	21.5	9.9	10.3	20.1	8.8	12.0	20.8
2	10.5	9.8	20.4	10.9	9.0	19.9	9.9	10.1	20.0	10.9	10.4	21.3
3	9.8	9.8	19.6	9.3	10.5	19.8	10.8	9.0	19.8	9.5	9.8	19.3
4	10.2	9.6	19.8	11.6	8.3	19.9	9.3	9.4	18.6	9.8	11.1	20.9
5	10.2	10.0	20.1	10.1	10.0	20.1	9.1	9.0	18.1	11.3	10.9	22.1
6	8.8	10.1	18.9	10.1	11.4	21.5	9.9	9.5	19.4	6.4	9.5	15.9
1-6	59.1	60.5	119.5	62.1	60.5	122.5	58.8	57.3	116.0	56.5	63.6	120.1
1st	29.9	30.8	60.8	30.3	30.9	61.1	30.5	29.4	59.9	29.1	32.1	61.3
2nd	29.2	29.7	58.8	31.9	29.6	61.5	28.3	27.9	56.1	27.4	31.5	58.9

Experiment 5

Mean PK scores of experiment 5 for each of the four training sessions. Chance score for feedback and nonfeedback version = 10.0, and chance score for combined versions = 20.0. Se = session number; F = feedback version; N = nonfeedback version; 0 = screening session; 1-4 = all four "training" sessions combined; 1st = first half of the experiment (sessions 1-2 combined); 2nd = second half of the experiment (sessions 3-4 combined).

	Process-oriented			Goal-oriented			End-oriented			Control group		
Se	F	N	F+N	F	N	F+N	F	N	F+N	F	N	F+N
0	11.0	10.7	21.7	10.5	11.8	22.3	10.5	11.4	21.9	10.7	11.9	22.6
1	10.5	9.8	20.3	10.8	10.2	21.1	11.2	10.5	21.7	10.5	8.0	18.5
2	10.8	10.2	21.1	9.8	10.3	20.1	8.8	10.3	19.2	10.3	10.2	20.5
3	9.7	11.6	21.3	9.7	10.1	19.8	9.9	9.0	18.9	9.2	10.0	19.2
4	9.4	10.1	19.5	10.1	9.9	20.0	10.2	10.2	20.3	10.4	11.1	21.5
1-4	40.4	41.7	82.2	40.4	40.5	81.0	40.1	40.0	80.1	40.4	39.3	79.7
1st	21.3	20.1	41.4	20.6	20.5	41.2	20.1	20.8	40.8	20.8	18.2	38.9
2nd	19.1	21.7	40.8	19.8	20.0	39.8	20.1	19.2	39.2	19.6	21.1	40.7