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Basic Intuitive Judgments and Anomalistic Beliefs

by

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Abstract

This study examined the relationship between anomalistic beliefs and basic intuitive judgments. It was hypothesized that believers in the paranormal as compared to skeptics would (1) underestimate probabilistic chance baselines; (2) make more logical errors in syllogistic reasoning, (3) be less likely to withhold judgment, (4) underestimate the frequency of rare events, and (5) overestimate the frequency of commonly occurring events. A total of 230 students completed the Revised Paranormal Belief Scale (Tobacyk, 1988). One week later, they were given a Judgment Questionnaire involving frequency estimates, probability problems, and hypothetical syllogisms. Results confirmed hypothesis 3 in that skeptics withheld judgments on syllogisms more than believers (although they did not withhold more correctly). Results disconfirmed hypothesis 4 in that believers as compared to skeptics gave higher rather than lower frequency estimates and both groups overestimated rather than underestimated rare frequencies. Results of the present study failed to support the remaining hypotheses. Additional findings showed a high correlation in syllogistic accuracy among positive, negative, and withhold question types. Interestingly, in terms of response types, subjects tended to give either a high number of withhold answers to the syllogisms or a high number of positive and negative answers. Significant sex differences indicated that males as compared to females had lower paranormal beliefs (specifically on spiritualism and precognition) but higher syllogistic accuracy. The present sample, on the whole, was rather inaccurate in judging frequencies and probabilities. Possible explanations for the results were discussed.

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Introduction

According to Zusne and Jones (1982), "we refer to all behavioral and experiential phenomena that have traditionally seemed to constitute violations of the basic limiting principles [of science] as anomalistic . . . . The term anomalistic is neutral, whereas the term paranormal suggests influences and effects that lie outside the natural order of things" (p. 2). Equivalent terms include paranormal beliefs, occult beliefs, psychic beliefs, extraordinary beliefs, parapsychology, and the supernatural force. According to Kurtz (1986), paranormal refers to a phenomenon which is beside or beyond the range of normal experience and explanation. It cannot be explained in terms of science, and it is incompatible with everyday perceptions, beliefs and expectations (Tobacyk, Miller, & Jones, 1984). These various terms are used to depict unusual phenomena such as psychokinesis or PK (moving physical objects through the power of the mind) and extra sensory perception or ESP (perceiving through non-sensory channels), the latter including telepathy (reading other people's minds through psychic abilities), clairvoyance or remote viewing (seeing objects or events not present to the senses), and precognition or prophetic dreams (foreseeing the future). The paranormal also includes phenomena such as reincarnation (the process by which souls return to earth taking on a new life), UFOs (extra-terrestrial life forms), astral projection (out-of-the-body experience), bigfoot (extraordinary life form), and faith healing (curing a disease through psychic or spiritual means). As a matter of fact, the term paranormal seems to include "almost everything that comes within the range of human imagination" (Kurtz, 1986, p. 5).

The purpose of the present study has been to investigate how intuitive judgments relate to anomalistic beliefs. A possible approach would have been to examine believers and disbelievers in the paranormal on their

home grounds and from their distinctive perspectives. For example, one might have observed the rational judgments made by mediums during seances and compare the results with those obtained by observing principal investigators during the process of devising and carrying out laboratory experiments. This approach was not followed, however, because the hypotheses of interest to the present researcher were based on the claim often made by the scientific camp that believers in the paranormal are more inaccurate in their judgments than skeptics (Alcock & Otis, 1980; Blackmore & Troscianko, 1985; Hines, 1988; Rotton & Kelly, 1985; Weirzbicki, 1985).

The present study does not intend to deal at all with the issue of whether or not paranormal phenomena are real but elude explanation according to contemporary science. Similarly, the study does not intend to examine belief in the paranormal from the vantage point of believers, psychics, or spiritualists. Rather, the present study starts from the negative claims often made by the skeptical scientific community concerning believers' intuitive judgments and tries to re-examine their claims through a scientific study of basic human judgments.

Prevalence of Belief

Numerous studies have indicated that the prevalence of believing in the occult is rather high (Singer & Benassi, 1981; Jones, Russell, & Nickel, 1977; Zusne & Jones, 1982). Jones et al. (1977) found that of 129 college students, 67.2% accepted the existence of clairvoyance, 55.2% telepathy, 50.7% precognition, and 32.8% psychokinesis. Approximately 51% believed that there is scientific support for ESP (Extrasensory perception), while 38.8% reported personal experience with psychic phenomena. Singer and Benassi (1981) reported an even higher figure with 80-90% of the public believing in ESP. Zusne and Jones (1983) assessed the beliefs of

92 college students using 44 extraordinary concepts including ESP, faith healing, big foot, witches, lucky numbers, voodoo, palmistry, teacup reading and phrenology. They found that the endorsement rate differed depending on the paranormal phenomenon considered. The highest endorsement rate was found in two major categories, namely ESP and UFOs with adoption rates varying between 46.7% to 63%. The lowest endorsement rate was found among common superstitions such as Friday the 13th and more traditional occult concepts such as phrenology and palmistry (Zusne & Jones, 1983).

Paranormal Assessment Instruments

Numerous scales have been constructed by researchers who are involved in paranormal research. Gray (1985) developed a questionnaire which investigates 10 different occult phenomena. The questionnaire assesses beliefs such as ESP, UFO, astrology, ghosts, Bermuda Triangle, Von Daniken's Chariots of the Gods, psychic healing and surgery, miracles, biorhythms and reincarnation. Respondents are to check one of five boxes provided. The first box corresponds to do not believe, the next four boxes indicate acceptance of paranormal events ranging from weak to strong. Although this questionnaire taps into various supernatural beliefs, this scale does not measure how strongly one rejects a particular psychic phenomenon.

McGarry and Newberry (1981) made up a 21-item paranormal belief questionnaire. Within this scale, there are five questions regarding spiritual-religious views, five concerning the scientific value or validity of psychic phenomena, five pertaining to the existence of supernatural forces, and six concerning the development of psychic abilities. All questions are phrased so that agreement with the question indicates adoption of that belief. Because of this, response sets such as "acquiescence" may bias the

subject's responses.

In a mailed questionnaire survey of elite scientists, McClenon (1982) used a test which assesses subscription to paranormal beliefs using different types of formats. The questionnaire consists of 12 multiple choice questions regarding ESP and sources of the belief. Also included are seven explanations for the resistance of scientists to the work of parapsychologists. Respondents are to rank the seven explanations provided according to their importance. Furthermore, there is an open-ended question in which subjects are to briefly describe any psychic experiences they have had.

Other relatively short scales include Schmeidler's seven-item Belief-in-Parapsychology Scale (1971). The scale covers topics on telepathy, clairvoyance, precognition, and psychokinesis. Responses are made on a five-point Likert scale indicating acceptance of, rejection of, or uncertainty about each item. Kerber (1983) devised a similar scale which consists of 12 items.

Rotton and Kelly (1985) designed an instrument called the "Belief in Lunar Effect." This instrument has 9-items which are used to measure beliefs in how various phrases of the moon influence behavior. Lunar beliefs share common points with paranormal beliefs like astrology. Rotton and Kelly (1985) recommend that their scale be used to enhance other paranormal belief scales.

Jones, Russell and Nickel (1977) developed a more complete scale called the "Belief in the Paranormal Scale" (BPS). The BPS contains 25 items scored on a five-point scale. The scale covers seven content areas, namely, the supernatural, the occult, divination, psychic phenomenon, physical manifestations of paranormal creatures, and a general category. Reliability is reported at .92. Concurrent and construct validity are

moderately strong.

More recently, Tobacyk and Milford (1983) constructed the "Paranormal Belief Scale." This scale was developed on the basis of a factor analysis. Results of the factor analysis revealed seven independent dimensions comprising beliefs in the paranormal. These dimensions are traditional religious belief, psi belief, witchcraft, superstition, spiritualism, extraordinary life forms, and precognition. Three or four items are classified under each dimension, making a total of 25 questions. Respondents indicate their degree of agreement or disagreement with each of the items on a five-point rating scale. Test-retest reliability over a four-week period is .89. Intercorrelations among the paranormal subscales are found to be moderately low (.30-.49), showing discriminant validity of the subscales. Construct validity appears to be moderately strong.

Tobacyk (1988) has introduced within the last year the "Revised Paranormal Scale." Minor revisions of the earlier scale include the adoption of a seven-point rating scale. This allows respondents to describe their degree of beliefs with greater precision and also reduces the likelihood of a restricted range. Some of the items are rephrased to avoid ambiguity in meaning. These changes result in improved reliability (.92) and greater cross-cultural validity.

Sex Differences in Belief

Despite a marginal significant sex difference ($p<.06$) reported in McGarry and NewBerry's (1981) study, recent studies have not found any sex difference in psychic beliefs (Benassi, Sweeney, & Dreno, 1979; Blackmore & Troscianko, 1985; Jones et al., 1977; Rotton & Kelly, 1985; Tobacyk, Miller & Jones, 1984). Zusne and Jones (1982) point out that earlier studies (early 20s to 70s) in the paranormal area frequently reported a difference in beliefs between males and females with females

showing more intense beliefs than males. Zusne and Jones explain these inconsistent findings by suggesting that in the past, males may have had more scientific knowledge than females and may have engaged in different activities and held different interests. Because of this, females in the past may have been stronger believers in relation to males. In the modern world, however, the behavior of females has changed drastically. Now, women as well as men are less restricted as to how they should behave. Women are receiving as much education as men, and have much more freedom and rights than previously was the case. May be because of this change in norms of the society over the years, sex differences in paranormal beliefs have slowly diminished.

Explanations for Believing in the Paranormal

Fraud. Belief in the paranormal may be a result of repeated exposure to frauds (Hines, 1988; Randi, 1982; Zusne & Jones, 1982). According to Hines (1988), when someone claims to be a psychic and produces events which others cannot figure out, some may be led to believe that anomalistic forces are operating. There are a number of tricks fake psychics use to deceive the general public. One of the favorite tricks used by fraudulent psychics is called "billet reading" (Hines, 1988). A group of people are asked to write a question for the spirits on a card and enclose it in an envelope. The fake psychic can supposedly tell what is written inside the envelope without opening it. By directing the audiences' attention to other things, the psychic opens one of the envelopes and memorizes the question. Once this is done, the psychic picks up what the audiences think is the first envelope (actually the second), recites the question previously memorized, answers it, and then opens the envelope to supposedly verify the accuracy of the reading. The member of the audience contributing the question also confirms that this was the question contributed. The question in this

second envelope is quietly read and later recited for the next (supposedly unopened) envelope. Hines (1988) reports that people are rather easily convinced by such performances.

According to Randi (1982), fraud in UFO sightings occurs frequently for of 887 sightings in 1965, only 16 of them were unidentifiable; approximately 125 were hoaxes. Fake pictures can easily be obtained, and their effect is often impressive (Hines, 1988). According to Hines (1988), fraud is often found in seances, psychic healing, psychic predictions, psychic readings and purported miracles. It is possible, then, that some believers in the paranormal may have become convinced merely because of events occurring through trickery and deception.

Wish to believe. According to some researchers (Kurtz, 1986; Marks & Kammann, 1980; Sabbagh, 1985-86), people have a wish to believe. "We seem to have a profound yearning for a magic formula that will free us from our ponderous and fragile human bodies, from realities that will not obey our wishes, from loneliness or unhappiness, and from death itself." (Marks & Kammann, 1980, p. 156) Therefore, for some people believing in astrology and palmistry may relieve them from feeling responsible for their own actions, while still raising their expectations for increased personal success. Similarly, believing in reincarnation may serve to reduce one's fear of death, just as belief in faith healing may increase one's hope that life can be improved and decrease one's sense of helplessness.

Believing in the occult may also increase one's sense of predictability of and control over the environment. According to Zusne and Jones (1982), when something happens purely as a result of chance, some may believe in an explanation which makes them feel less vulnerable and more able to predict, control or avoid misfortunes. Therefore, they may believe

that the source of a traumatic event is "God's will" or interference from outerspace. According to Zusne and Jones (1982), by believing in such paranormal factors and forces (rather than by believing that chance accounts for the phenomena), these people may come to feel more secure, because a victim's fate is not necessarily the same as theirs. Otherwise, they would have to believe that random misfortunes could happen to anyone.

Singer and Benassi (1981) state "superstitions" are a function of environmental uncertainty. As an example, they indicate that Trobriand islanders show no superstitious behavior when fishing in a lagoon where it is rather safe and success is certain. However, superstitious behavior occurs when the islanders fish in the open sea where it is seen as dangerous and highly uncertain. Similarly, according to Gmelch (1978), baseball pitchers and batsmen are more superstitious than fielders, because the former have greater chance and uncertainty in their jobs, whereas fielders have greater control with a success rate close to perfect.

Media Distortion. Some researchers argue that the media has been irresponsible in portraying paranormal phenomenon. The mass media sometimes provides unquestioning and uncritical reports of psychic phenomena (Banziger, 1983; Hines, 1988; Marks & Kammann, 1980; Myers, 1983; Randi, 1982; Singer & Benassi, 1981; Zusne & Jones, 1982). Books, movies, magazines and television programs often dramatize supernatural forces in order to create greater entertainment. According to Zusne and Jones (1982), extensive coverage of paranormal happenings increases people's awareness of unusual events, while alternative explanations (which are less interesting) receive less coverage, leaving erroneous impressions among the public. However, according to Marks and Kammann (1980), it should not be the quantity of evidence that proves

something to be correct but the quality of the evidence. "The more that newspapers and TV bombard the public with unchecked occult happenings, the more believable they become, not by quality, but by quantity" (p. 194). In fact, according to Singer and Benassi (1981), some people tend to attribute the source of their paranormal beliefs to both the media and/or to personal experiences. In a survey (Singer & Benassi, 1981) done among college students, beliefs were reported to have sprung from scientific evidence. Nevertheless, the students were unable to give examples of the scientific sources. Magazines such as Reader's Digest and the National Enquirer were occasionally cited. Owing to the extensive coverage of paranormal events in the media, some people may be subjected to the "availability bias" (Tversky & Kahneman, 1974). That is, they may believe that the more an event can easily be brought to mind, the more likely they will see the highly publicized event as occurring more frequently than it really does. Hasher and Zacks (1984) point out that the more often someone is bombarded with a certain message, the more likely that person will believe in the validity or truth of the message, especially when the truth value is undefined or difficult to access. According to Kurtz (1986), beliefs in the occult are reinforced by the mass media industry.

Preexisting cognitive bias. Once a person establishes a belief, these beliefs may become highly resistant to change (Gray, 1985; Hines, 1988; Myers, 1983; Singer & Benassi, 1981, 1986; Zusne & Jones, 1982). According to Falk (1986), people have a way to explain away almost everything, so while evidence is fixed and explanations are unbounded, they may keep on searching until they find an explanation that fits their belief system. Various cognitive biases which may allow individuals to retain information consistent with their beliefs are selective attention, selective exposure, selective learning or remembering, and

subjective validation.

Selective attention involves situations which are more likely to be noticed (or unnoticed) because of a preexisting bias for (or against) the circumstance. One may even look for (or disregard) others' explanations for what one favors (or disfavors), a phenomenon known as selective exposure. Sometimes people choose to read books, newspaper articles, and magazine stories, or see television programs and movies merely because they conform to their personal views. Marks and Kammann (1980) provide a good illustration of this point. "People with an occult bent of mind read The Bermuda Triangle. People with a rational bent of mind read the Bermuda Triangle Mystery -- Solved. (Only the first one is a bestseller.) Give a lecture on ecology and you have an audience of ecologists. Put on a TV series to praise different ethnic minority groups, and each week the audience consists primarily of the group being featured" (p. 176).

However, there are many situations in which people must face information inconsistent with what they believe. Under these circumstances, people tend to employ their second line of defense. They are likely to forget information that disconfirms their beliefs while remembering information which confirms their beliefs (Falk, 1986; Hines, 1988; Jones & Russell, 1980; Marks & Kammann, 1980). This bias is commonly labelled as selective remembering. For instance, dreams which do not come true are easily forgotten; dreams which come true are well remembered.

A study conducted by Russell and Jones (1980) demonstrated that disbelievers incorrectly interpret and assimilate information contradicting their beliefs. Both believers and disbelievers were given articles to read on ESP. Some of the articles supported the idea that ESP can occur, while

some rejected the existence of ESP. Results indicated that both groups were able to correctly remember articles which supported ESP. Only the believers, however, failed to remember correctly those articles which did not support ESP. More than 15 percent of this group thought that articles unfavorable to the existence of ESP were actually favorable. Disbelievers, on the other hand, were accurate in both conditions. The findings suggest that believers in the paranormal may have misread or misunderstood the negative information. This phenomenon of misperceiving or misremembering unfavorable or neutral evidence as giving positive support to one's beliefs has been called subjective validation (Marks & Kammann, 1980).

Believers in the paranormal are reported to be illogical (Alcock & Otis, 1980; Randi, 1982; Rotton & Kelly, 1985; Zusne & Jones, 1982). Alcock and Otis (1980) found that believers have shown lower levels of critical thinking ability than skeptics. They were also more dogmatic than disbelievers (Alcock & Otis, 1980; Tobacyk & Milford, 1983). When people are given special courses which emphasize skeptical inquiry (Banziger, 1983) and critical analytic training (Tobacyk, 1983b), paranormal beliefs are significantly reduced. Gray (1985), however, found that students' beliefs were reduced immediately after the training course, but those beliefs had returned at the time of a one year follow-up. Tobacyk (1984) examined paranormal beliefs among high school students. He reported an inverse relationship between the number of science courses taken and beliefs in the paranormal. Rotton and Kelly (1985) found no relationship between the two. Rotton and Kelly (1985) designed a ParaLogic Test consisting of 16 hypothetical syllogisms. Half of the syllogisms related to paranormal phenomena, the other half to neutral events. Subjects were asked to indicate whether they thought that the

conclusions were valid or invalid (i. e., followed or did not follow from the premises). High scorers on the Belief in Lunar Effect Scale were found to be more illogical than disbelievers, for they made more errors in distinguishing between valid and invalid syllogisms. No relationship between paranormal beliefs and cognitive complexity was found (Tobacyk, 1983a).

Event misjudgment. Numerous studies have indicated that the majority of believers report having had some personal experiences in the paranormal area. Wagner and Ratzeburg (1987) found a moderate correlation between psychic experiences and occult beliefs. In a recent survey done on more than 1,400 Americans, 67 percent reported having had ESP experiences (Greeley, 1987). People seem to be convinced that they have had actual paranormal experiences. Perhaps psychic forces do indeed exist, and many individuals have come into direct contact with these forces. Although there may be insufficient scientific evidence at present to conclusively support paranormal claims, it may be closed-minded to reject these possibilities. However, according to several researchers (Blackmore & Troscianko, 1985; Falk, 1986; Marks & Kammann, 1980) there is an alternate answer, namely that people's beliefs in extraordinary events may be no more than misperceptions or misjudgments of what are basically normal events.

Researchers studying human inference processes reveal that, although intuitive judgments can be creative and productive, people in general are subject to numerous errors and biases when they employ an intuitive approach to problem solving (Fong, Krantz, & Nisbett, 1986; Kahneman & Tversky, 1982; Nisbett, Krantz, Jepson, & Kunda, 1983; Nisbett & Ross, 1980; Pollard, 1982; Tversky & Kahneman, 1974). Of the many cognitive biases and heuristics, some can plausibly account for the

prevalence of anomalistic beliefs.

One such bias is the heuristic labelled representativeness by Tversky and Kahneman (1974). In making judgments, people assess the degree to which salient features of an object are representative of or similar to the features presumed to characterize a particular category. Hence, according to Singer and Benassi (1981), the representativeness heuristic may come into play whenever we encounter an event which is mysterious, unusual, and difficult to explain through normal means, so we look immediately for a dramatic and "spooky" explanation. For example, as indicated by Singer and Benassi (1981), when an abandoned ship is found floating in the area known as Bermuda Triangle, people are likely to hypothesize that individuals on the ship were kidnapped by flying saucers or killed by death rays. Ordinary causes such as bad weather, gas leakage, or food poisoning, are usually ignored. The representativeness fallacy occurs whenever people attribute dramatic (paranormal) causes to unusual events by failing to consider the high likelihood of ordinary causes which could better explain these events (Singer & Benassi, 1981).

Another well-known bias involves the misconception of runs and patterns of events. One version of this misconception is termed the gambler's fallacy (Falk, 1986; Tversky & Kahneman, 1974). In a series of coin tosses, after observing a run of heads, most people erroneously believe that the next toss will very likely end up to be a tail. This is because people have a tendency to think that it is time for balance to be restored. Although one would expect something approximating a balance in the long run (law of large numbers), people often think that random events must show the same balance or representativeness in the short run (law of small numbers). Contrary to the popular view, an unbiased coin has neither memory nor conscience. The probability of obtaining a tail in

the next coin flip remains 50/50, regardless of its past history. Since similar events can occur in clusters in everyday life, the failure to understand the law of large numbers may lead people to think that some occult forces (creating these runs) are operating. These forces are either for or against them, thereby increasing or decreasing their likelihood of winning. Because of this, people attribute their good or bad luck to a benevolent or malevolent force which prevents the short run balance from taking place.

Misconceptions of runs and patterns often appear in another form as well. When a sequence of events are generated by a random process, people tend to expect that a truly random sequence will avoid runs and patterns (Kahneman & Tversky, 1982). For instance, most people regard one series of coin tossing (H-T-H-T-T-H) to be more likely than another series (H-H-H-T-T-T), which does not appear random. For individuals who misunderstand randomness, whenever they observe a random cluster of identical events (like accidents or misfortunes), they will tend to see them as nonrandom, and attribute them to some unseen cause, such as a paranormal force (Falk, 1986; Hines, 1988).

Another bias which may affect paranormal beliefs deals with the illusion of control. Any individual who believes he has control over an event (when in fact he does not) has committed this fallacy (Langer, 1975). In Ayeroff and Abelson's (1976) telepathy experiment, one group of subjects was given more control by allowing them to choose a symbol deck and to hold discussions with their partners. The other group of subjects had less control, for they could neither choose a deck nor discuss issues with their partners. It was found that subjects given more control felt they performed better than those with less control (only illusory control). The amount of control given to the subjects was actually independent of actual

performance. Results indicated that telepathic hit rates for both groups were not significantly different from chance-level. In the Benassi et al. (1979) study, subjects were asked to estimate their success on a psychokinetic task. Believers thought they exerted greater control than disbelievers even though their performance was the same. Furthermore, in a computer stimulated coin-tossing task, Blackmore and Troscianko (1985) demonstrated that in both the control-determined and chance-determined conditions, believers felt that they had exerted more control than skeptics. Scores of both groups under both conditions were the same. Apparently, the illusion of control can lead those subjected to it to misinterpret chance outcomes as if these outcomes were due to their own skill (perhaps involving psychokinesis). Similar bias, such as illusory correlation (i. e., perceiving events as co-occurring much more often than they actually do) (Chapman, 1967) may also lead to misinterpretations of everyday events. For example, getting an obscene phone call on Friday the 13th.

Previous research has shown that people in general, are poor in making judgments relating to probabilistic concepts (Falk, 1986; Marks & Kammann, 1980; Nisbett & Ross, 1980; Singer & Benassi, 1981; Tversky & Kahneman, 1974). Errors involving probability estimates are apparent when people are dealing with rare events such as coincidences. Coincidence refers to the situation in which two events happen together by chance in such a way that the combination carries high personal meaning to someone. Jung (1960) developed the term synchronicity to depict the acausal but meaningful coincidence of two or more events. Although Hasher and Zacks (1984) reported that (a) frequency of occurrence information is automatically encoded and (b) people are generally accurate in their frequency estimations, other researchers suggest that people tend

to underestimate the frequency of rare events such as coincidences (Alvarez, 1982; Falk, 1986; Hines, 1988; Marks & Kammann, 1980; Singer & Benassi, 1981; Zusne & Jones, 1982). In a true coincidence (rarity combined with personal meaningfulness), there is no causal connection between the two events. It is the observer who sees meaning in the happenings. When coincidences occur to people, they often get feelings of drama, surprise, strangeness and puzzlement.

Assume that John is lying in bed one day and happens to think of an old friend whom he has not seen in years. The very next day, when he looks in the newspaper, he finds out that his friend was killed the previous night in a car accident. Such coincidences may have convinced many people to believe that they possess some type of ESP, since the first event (made meaningful by the second event) could not have occurred through normal sensory (causal) channels. One may even search out examples of such coincidences (Koestler, 1972). However, one can calculate the probability of coincidental events, and often these calculated probabilities come out rather high (Alvarez, 1982).

> The probability of a coincidental recollection of a known person in a 5-minute period just before learning of that person's death can easily be calculated to within a factor of 10. Let us take a 30-year period, and assume that an average person would recognize the names of 3,000 different people who might die in that period of time (3,000 is taken as a geometrical mean of 10^3 and 10^4, the probable extremes of a population of "known persons"). We assume that our subject will learn of the death of each of these persons at some time in the 30 years. If we restrict our attention to the time when our subject learns of the death of a particular person, we can then ask how probable it is that, in the 5 minutes just preceding that exact time of learning of the

> death, an unrelated recollection that is unique to the 30-year period will occur. This probability, to within a factor of 2, is the ratio of a 5-minute interval to a 30-year interval, or 3×10^{-7}. (It is clear that if one thinks of the particular person once a year rather than once every 30 years, the probability will rise by a factor of 30, to about 10^{-5}.) The probability that one will have such an experience when learning of the death of any one of 3,000 recognizable persons is clearly 10^{-3} in a 30-year period, or approximately 3×10^{-5} per year. If we take the sample of 10^{8} adults in the United States, 3×10^{3} experiences of the sort related above should occur per year, or about 10 per day. (For the average person 3,000 recognizable names is probably an overestimate, but the postulated single recollection in 30 years is certainly much too low. These two departures from realistic assumptions have opposite effects on the computed area, so 10 per day is still a reasonable estimate.) With such a large sample to draw from, it is not surprising that some exceedingly astonishing coincidences are reported in the parapsychological literature as proof of extrasensory perception in one form or another. (p. 73)

Some researchers have examined a multitude of rare events only to draw the conclusion that at least some of them show unexpected but personal meaningfulness and so are evidence of synchronicity (Koestler, 1972). However, conclusions based on such procedures involve faulty reasoning. "Instead of starting by drawing a random sample and then testing for the occurrence of a rare event, we select rare events that happened and find ourselves marveling at their randomness. This is like the archer who first shoots an arrow and then draws the target circle around it" (Falk, 1986, p. 49). From an objective point of view, we should be impressed only if events occur with predictable regularity. Hence, underestimating

coincidences or rare events may be an important factor contributing to the acquisition of anomalistic beliefs.

One mechanism which may underlie biased judgments (such as illusion of control, selective learning and remembering, and the underestimation of rare events) may be people's misjudgments of the likelihood of chance events. Blackmore and Troscianko (1985) asked subjects to estimate what they should get by chance on a computer coin-tossing task. They found that believers in paranormal forces were unable to correctly estimate the number of hits to be expected by chance when an unbiased coin is flipped 20 times. They gave a mean estimate of 7.9 hits showing considerable underestimation of chance baseline (which in this case is 10). Disbelievers, on the other hand, were able to judge correctly with a 9.6 hits mean estimate. According to Blackmore and Troscianko, if people consistently underestimate the number of successes expected for a chance event, then they will probably view chance performance as indicating that the event is occurring above chance level (so they may search for unseen forces to explain what caused this non-random event to occur). People may attribute the effect to a psychic cause such as psi, to a supernatural force such as God, or to themselves as in cases of illusory control. Blackmore and Troscianko (1985) have labelled this misjudgment of chance level as the chance baseline shift.

Jones and Russell (1980) asked subjects to witness an attempt to demonstrate telepathy by two confederates (a sender and a receiver) using ESP cards. The cards were marked in a way only detectable to the confederates so that the receiver could easily manipulate success rate. In the chance level condition, performance of telepathy was controlled at 20 per cent (which is exactly at chance level). In the success condition, the receiver deliberately performed at a 60% accuracy. Subjects were then

asked if they thought ESP had occurred. Results indicated that both believers in the paranormal and skeptics thought ESP had occurred in the success condition. However, only the believers attributed success of ESP in the chance condition. Jones and Russell interpret these findings as due to selective learning, where believers selectively appraise and respond to belief-related information in terms of their preexisting biases. It is possible, though, that selective learning may have been confounded with the chance baseline shift effect, where believers may simply have misjudged the level of chance in the first place.

Cognitive Impatience

As discussed above, difficulties in estimating the probabilities of everyday events may have led to serious flaws in the human judgmental process. However, merely misunderstanding the probability of events would not necessarily lead to a belief in the paranormal. Rather, a person would still have to attribute the cause of an observed event to some paranormal agent or force. According to one theory (Nickels, 1987), this misattribution may be a result of an over-readiness of some people to jump to causal conclusions (when they could wait for more substantial evidence and thereby avoid judgment errors based on incomplete data). When individuals overattribute without sufficient objective evidence, they are showing "cognitive impatience" (Nickels, 1987). These persons are impulsive and intolerant of ambiguity. They desire and demand quick closure even when the necessary facts are not yet in. In fact, they tend not to "withhold judgment" even when confronted with a problem and insufficient information with which to solve it (Nickels, 1987). This theory may support the view that believers in the paranormal may prematurely believe because of cognitive impatience, whereas skeptics may staunchly refuse to believe until conclusive evidence is in because of their

"fact-tied stubbornness" (Nickels, 1987).

Hypotheses

Previous scientific research has questioned the capabilities of believers in the paranormal to make appropriate intuitive judgments about their world. However, most of the research has emphasized complex problems, memory for details, belief-bias, and valid reasoning on issues related to the paranormal. The present study, however, attempts to get at a more basic level of intuitive judgment by stressing simple assessments which do not rely upon personal meanings, recollections and beliefs. The focus in the present study is on the most elementary judgments one can make.

Blackmore and Troscianko (1985) have shown that when both believers and disbelievers in the paranormal are asked to estimate how they would perform on a coin-tossing task, believers tend to underestimate the chance baseline, while disbelievers tend to be accurate in their estimations. If errors in basic chance level estimates are based on an inherent judgmental bias of believers (rather than on the beliefs they have acquired), then this misjudgment of chance level should also occur outside a paranormal context. However, two types of chance baseline estimates can be studied. The first set involves the likelihood of an event occurring on one trial. For example, "What is the likelihood of getting a head on one flip of an unbiased coin?" Since this task involves only one trial and is relatively obvious and easy to do, it is anticipated that all subjects will do better on it than on questions involving more trials. The second type of estimate involves an extension of the first problem to more than one trial. Here the difficulty of estimation is increased by increasing the number of trials on which estimations are based, e. g., "How many heads would you expect to get on 42 flips of an unbiased coin?" Because believers have been found to be less accurate than skeptics in judging an extended chance

baseline (Blackmore & Troscianko, 1985), it is hypothesized that **(1)** believers will underestimate the expected frequency of a specific outcome over several trials more than skeptics.

If believers in the paranormal are more subject to biased perceptions and judgments, they may also be more subject to reaching logically invalid conclusions. Rotton and Kelly (1985) found that believers were less accurate than disbelievers in identifying valid and invalid hypothetical syllogisms. Accordingly, it is hypothesized that **(2)** believers will make more logical errors in syllogistic reasoning than skeptics.

Based on the assumption that believers in the paranormal may be subject to cognitive impatience (Nickels, 1987), it is more likely that they -- rather than skeptics -- will jump to premature conclusions. Therefore, it is hypothesized that **(3)** believers will be less likely to withhold judgment during problem solving than skeptics.

It has been reported (Alvarez, 1982; Falk, 1986; Hines, 1988; Marks & Kammann, 1980; Singer & Benassi, 1981; Zusne & Jones, 1982) that people have a general tendency to underestimate rare events such as meaningful coincidences. The questions is whether believers and disbelievers differ in their estimates of frequently and infrequently occurring events which are not personally meaningful. Hasher and Zacks (1984) state that frequency judgment is important to decision making in everyday life, for probability judgments are derived from basic knowledge of frequency. Tversky and Kahneman (1974) suggest that people in general are highly susceptible to the availability heuristic. That is, people tend to overestimate frequently occurring events and underestimate infrequently occurring events. Therefore, if believers in the paranormal make more illogical judgments than skeptics, they may even accentuate an already common bias among people in general. Accordingly, it is

hypothesized that (**4**) believers will underestimate the frequency of personally meaningless rare events more than skeptics. Similarly, it is hypothesized that (**5**) believers will overestimate the frequency of personally meaningless common events more than skeptics.

Method

Subjects

Subjects were 230 undergraduate students (94 males and 136 females) from one intact introductory psychology class at the University of Manitoba. Subjects received experimental credit towards fulfillment of the course research requirement. Each subject was tested in two different class periods.

Materials

Two different sets of assessment instruments were used in this study: the Revised Paranormal Belief Scale and the Judgment Questionnaire.

The Revised Paranormal Belief Scale. The Revised Paranormal Belief Scale (Tobacyk, 1988) consists of twenty-six items which measure the intensity of paranormal belief. This scale can be broken down into seven subscales containing Traditional Religious Belief, Psi Belief, Witchcraft, Superstition, Spiritualism, Extraordinary Life Forms, and Precognition. The strength of belief is measured using a 7-point scale. A score of "1" represents "strongly disagree," a score of "4" represents "uncertain," and a score of "7" represents "strongly agree" to a particular phenomenon. Subjects were divided into skeptics, agnostics, and believers on the basis of total scores. The two cutpoints used in the tripartite classification of subjects were 91 (26 x 3.5 on the 7-point belief scale) and 117 (26 x 4.5) on the paranormal belief score. Therefore, those subjects whose total belief scores fell between 26 and 90 inclusively were classified as skeptics, those whose scores fell within 91 and 116 inclusively were classified as agnostics, and those whose scores fell within 117 and 182 inclusively were classified as believers. Test-retest reliability for the Revised Paranormal Belief Full Scale is reported to be .92. Intercorrelations among paranormal subscales are found to be moderately low (.39 - .49) showing

discriminant validity. (See Appendix A.)

The Judgment Questionnaire. The second instrument was the Judgment Questionnaire. (See Appendix B.) The first page of the Judgment Questionnaire consisted of a personal information sheet. Participants were asked to give information on their age, sex, major, and number of statistics, math, and logic courses taken. They were also asked to indicate their familiarity with playing cards and their proficiency in the English language.

The Judgment Questionnaire inquired about three different kinds of intuitive judgments. The first group of questions was designed to measure how accurately people estimate the frequency of rare, moderately frequent, and commonly occurring events. Subjects were shown nine different letter diagrams, each to be looked at for five seconds. Each diagram differed in its ratio of rare to total items (1:100, 1:200, and 1:400), and each consisted of three letters (S, T, U) randomly distributed throughout the diagram but varying in frequency of occurrence. For the 1:100 ratio diagrams, the number (frequency) of rare, moderate, and common items was 15, 150, and 1335, respectively. For the 1:200 ratio diagrams, these numbers were 15, 300, and 2685; for the 1:400 ratio diagrams, these numbers were 15, 600, and 5385. The S was the rare item on three diagrams (one for each ratio), the moderate item on three diagrams (one for each ratio), and the common item on three diagrams (one for each ratio). On each successive trial, subjects were asked the same question ("Examine the diagram; and when I say 'stop,' please turn the page and estimate as best you can how many Ss there were in the diagram."). Subjects were asked to write their estimates on the following page. Then the next diagram was shown. Scores were calculated as deviations from the correct answer, so minus scores represented

underestimates, zero scores accurate estimates, and plus scores overestimates.

The second group of questions on the Judgment Questionnaire involved probabilities and were patterned after Blackmore and Troscianko's (1985) study. Six questions were asked on simple 1-trial probability. These questions served as a measure of the subjects' basic understanding of chance. For example, "What is the likelihood of getting a Club on one draw from a normal deck of 52 playing cards?" Subjects were asked to indicate their answers according to the number of chance(s) out of 52 possibilities. Another twelve questions varying in the number of trials (104 and 504) were used to examine subjects' abilities to extend their knowledge on probability. An example was, "On the basis of probability, how many Black Sevens would you expect to get on 104 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?" Scores were calculated as deviations from the correct answer, so minus scores represented underestimates, zero scores accurate estimates, and plus scores overestimates.

The third group of questions on the Judgment Questionnaire dealt with logical reasoning on 16 different hypothetical syllogisms. The procedure differed from that of Rotton and Kelly's (1985) through the use of three conclusions rather than two with no mention of the paranormal. Respondents picked the most logically sound conclusion. Four questions had correct answers which were positive ("something occurs"), four which were negative ("something does NOT occur"), and eight which were withhold ("there is insufficient information to reach either of the other two conclusions"). In order to avoid possible response biases of subjects as well as possible weighting biases due to more questions with "withhold" as

the correct answer, syllogistic accuracy scores were calculated using the d' measure (McNicol, 1972). According to this measure, d' accuracy equals the false alarm rate (expressed in Z scores) minus its corresponding hit rate (expressed in Z scores). The hit rate for questions whose correct answer is withhold would be the number of withhold answers given to withhold questions divided by the number of withhold questions; the corresponding false alarm rate would be the number of withhold answers given to non-withhold questions divided by the number of non-withhold questions. A minus Z hit rate as well as a plus Z false alarm rate represent accuracy (with the reverse representing inaccuracy). Therefore, minus d' scores indicate a hit rate below the false alarm rate (i. e., inaccuracy), zero d' scores indicate a hit rate equal to the false alarm rate, and plus d' scores indicate a hit rate above the false alarm rate (i. e., accuracy). (Answers to the Judgment Questionnaire are provided in Appendix C.)

Procedure

Data were collected from one intact psychology class during two different sessions. A week prior to major testing, subjects were asked to complete the Revised Paranormal Belief Scale. They were informed that the scale assesses students' beliefs. Major testing was conducted one week later. By giving the two questionnaires at different times the experimenter tried to reduce subjects' attempts to identify the hypotheses and thereby alter their responses accordingly.

Before the Judgment Questionnaire was distributed, subjects were told that the purpose of the experiment was to examine students' judgmental performance. Respondents were asked to answer all questions in the test booklet, and should make a guess if they do not know the answer. Instructions were provided in the Judgment Questionnaire booklet. They were asked to fill out the information sheet and await further instructions.

All subjects turned to the diagrams and gave frequency estimates of the number of Ss on each of the nine diagrams in the following order: 1:100 rare, 1:100 moderate, 1:100 common, 1:200 rare, 1:200 moderate, 1:200 common, 1:400 rare, 1:400 moderate, and 1:400 common. They were told when they should open their test booklets and turn from one page to another. Subjects were asked to estimate how often the letter S occurred in a diagram and were then asked to turn to the next page of the Judgment Questionnaire and examine the diagram for five seconds. After five seconds, subjects were asked to turn to the next page to write down their best estimates as to the number of Ss appearing in the last diagram. Subjects continued this procedure until estimates were obtained on all nine diagrams.

Subjects then moved on to the probability questions followed by the hypothetical syllogisms. Questions were arranged on both instruments so that subjects would answer similar questions in succession rather than skipping from one type of problem or frame of reference to another.

A whole class period was provided for the subjects to complete the Judgment Questionnaire. Participants were informed as to when and how they could obtain feedback regarding the results of the experiment. Subjects were thanked for their participation, and experimental credits were given.

Results

Establishment of the Basic Sample

A total of 313 subjects completed the Judgment Questionnaire and the Paranormal Questionnaire. Forty five participants wrote only one of the two questionnaires and therefore could not be used. Thirty one subjects most proficient in a language other than English were excluded to avoid possible misinterpretations of questions and instructions. In fact, the Levene's test of equality of variances indicated that those subjects whose first language was not English were quite different from those whose first language was English. The two groups were found to be significantly different in terms of means and variances on two out of five major dependent variables (diagram and probability estimates) at the .01 level. One subject who had no experience in playing cards was excluded to avoid possible difficulties involving probability estimates. Six additional subjects were omitted for they did not provide legitimate answers to one or more of the questions. The Levene's test of equality of variances revealed no significant differences (.01 level) between subjects who had taken statistics or logic and those who had not. Therefore, these subjects were not excluded from any analyses. The remaining 230 students (94 males and 136 females) served as subjects in the study.

Findings on Hypotheses

Tests of hypotheses one through five were made through the use of planned comparison F tests contrasting the score means of believers and skeptics at the .05 level. Results on hypothesis 1 showed no significant probability differences either for 104-trials, (F (1,127)=0.96, p=.328) or for 520-trials (F (1,127)=0.33, p=.567). Results on hypothesis 2 showed no significant difference for d' syllogistic accuracy, F(1,127)=2.36, p=.127. Results on hypothesis 3 showed a significant difference for the

number of times subjects withheld judgment on all syllogisms, F (1,127)=6.04, p=.015. Inspection of means indicates that hypothesis 3 was confirmed, since skeptics withheld more than believers. (See Table 1 for the means and standard deviations of all subgroups used in the present study.) Results on hypothesis 4 showed a significant difference in the accuracy of frequency estimates on rare diagrams, F(1,127)=4.67, p=.033. Inspection of means indicates that hypothesis 4 was disconfirmed, since believers gave higher rather than lower frequency estimates than skeptics, and both groups overestimated rather than underestimated rare frequencies (as determined by a confidence interval analysis which gave a lower limit at the .05 level for the skeptics equal to 16.27 and for the believers equal to 7.48). Results on hypothesis 5 showed no significant difference in the accuracy of frequency estimates on common diagrams, F(1,127)=2.23, p=.137.

Insert Table 1 about here

Additional Findings on Sex and Belief Differences

Further analyses (tested at the .05 level) were undertaken to examine possible but unhypothesized relationships among major variables. Differences among believers, agnostics, and skeptics (rather than merely believers and skeptics) were analyzed using the Hotellings' multivariate analysis of variance (MANOVA) which accounts for unequal number of subjects per cell. A separate 2 x 3 MANOVA using Sex (male, female) and Belief (believers, agnostics, skeptics) as the two between-group variables was run on five different dependent variable packages. The first package analyzed three probability estimates (1-trial, 104-trials, 520-trials) and gave an overall MANOVA which was not significant for sex, for

belief, or for the sex by belief interaction. (See Table 2 for MANOVA results on all five dependent variable packages.) The second dependent variable package analyzed three syllogistic accuracy estimates (d' accuracy on questions with correct answers being positive, negative, withhold) and gave an overall MANOVA which was not significant for belief or for the sex by belief interaction but was significant for sex. Followup ANOVAs show that there was a significant sex difference on positive questions, $F(1,224)=4.59$, $p=.033$, and on withhold questions, $F(1,224)=8.27$, $p=.004$, but not on negative questions, $F(1,224)=2.62$, $p=.107$. Inspection of means indicates that males were more accurate on positive and withholding questions than females. A third dependent variable package analyzed the Z hit rates for the three types of syllogism questions (positive, negative, withhold) and gave an overall MANOVA which approached significance for belief, was significant for sex, and was not significant for the sex by belief interaction. Followup ANOVAs show that there was a significant belief difference in the Z hit rate for positive questions, $F(2,224)=5.47$, $p=.005$, and in the Z hit rate for negative questions, $F(2,224)=3.93$, $p=.021$. The Z hit rate for withhold questions approached significance, $F(2,224)=2.14$, $p=.073$. Inspection of means indicates that believers had a higher Z hit rate for positive and negative questions than skeptics, but in the marginal finding a lower Z hit rate for withhold questions than skeptics. Additional ANOVAs show that there was no significant sex difference in the Z hit rate for positive questions, $F(1,224)=0.80$, $p=.371$, or for the Z hit rate for negative questions, $F(1,224)=0.17$, $p=.677$. The Z hit rate for withhold questions approached significance, $F(1,224)=2.99$, $p=.085$. Inspection of means indicates that in the marginal finding females had a higher Z hit rate for withhold questions than males. A fourth dependent variable package analyzed the three types

of syllogism responses (number of positive answers given, negative answers given, withhold answers given) with an overall MANOVA which was not significant for belief, for sex, or for the sex by belief interaction. A fifth dependent variable package analyzed frequency of diagram accuracy estimates (rare, moderate, common) with an overall MANOVA which was not significant for belief, for sex, or for the sex by belief interaction.

Insert Table 2 about here

Another analysis consisting of a 2 x 3 ANOVA using Sex (male, female) and Belief (believers, agnostics, skeptics) as the two between group variables was run on total d' syllogistic accuracy estimates. Results showed a sex difference, $F(1,224)=7.99$, $p=.005$, but no belief difference, $F(2,224)=1.39$, $p=.251$, and no sex by belief interaction, $F(2,224)=1.06$, $p=.349$. Inspection of means shows that males were more accurate on the syllogisms than females.

Because previous analyses used sex and belief as between group variables, they were unable to examine the possibility that there maybe sex differences in paranormal belief. Therefore, a one-way ANOVA using sex as the between group variable was run on total paranormal belief scores. Results showed a sex difference, $F(1,228)=5.71$, $p=.018$, with females having higher paranormal belief than males. A followup analysis examined the relationship between sex and the seven paranormal subscales. A one-way MANOVA using Sex as the between group variable showed significant sex differences on the Spiritualism subscale, $F(1,227)=7.02$, $p=.009$, and on the Precognition subscale, $F(1,227)=6.41$, $p=.012$. Inspection of means indicates that females have higher paranormal beliefs

on these two paranormal subscales than males.

Additional Findings on the Overall Sample

Several additional analyses were undertaken to investigate the judgment and belief characteristics of the entire sample of subjects.

Probability estimates. The MANOVA with probability estimates for 1-trial, 104-trials, and 520-trials as dependent variables indicated that the accuracy of the overall sample differed significantly from zero (the point of perfect accuracy), F (3,222)=3.57, p=.015. Followup ANOVAs showed that all subjects did well on questions involving 1-trial estimates (F (1,224)=3.49, p=.063). However, overestimations occurred on probability questions which involved 104-trials (F (1,224)=7.29, p=.008) and 520-trials (F (1,224=7.21, p=.008). (See Table 3 for a summary of means, standard deviations, and the direction of the bias for the overall sample.)

Insert Table 3 about here

Syllogistic accuracy and response types. A MANOVA on the d' accuracy scores of all subjects for the positive, negative,and withhold syllogism questions indicated that the syllogistic accuracy of the overall sample differed significantly from zero (point of hit rate / false alarm rate equality), F (3,222)=160.99, p=.001. Results indicate that subjects' performance on syllogism estimates were significantly above zero on positive questions (F (1,224)=294.89, p=.001), on negative questions (F (1,224)=335.72, p=.001), and on withhold questions (F (1,224)=37.04, p=.001). The total d' syllogistic accuracy scores were above zero as well (F (1,224)=331.95, p=.001). In addition, on all 16 syllogisms subjects gave an average of 4.5 positive responses (SD=2.06), 5.45 negative responses (SD=2.12), and 5.98 withholding responses (SD=3.83).

Frequency estimates. A MANOVA was run on Frequency (diagram) judgments to test whether the estimates of all subjects for rare, moderate, and common events differed significantly from zero (the point of perfect accuracy). The overall MANOVA was significant, $F(3,222)=452.77$ $p=.001$. Follow-up ANOVAs showed that subjects overestimated rare events ($F(1,224)=32.59$ $p=.001$) and underestimated moderate ($F(1,224)=892.22$, $p=.001$) and common events ($F(1,224)=761.02$ $p=.001$).

Total paranormal beliefs. The mean and median Paranormal Belief scores for all subjects were 93.24 and 95.0, respectively, within a possible range of 26 (skeptical) and 182 (believing). Of the 230 subjects studied, 99 were classified as skeptics, 101 as agnostics, and 30 as believers.

Belief subscale endorsement. In order to examine which of the seven paranormal belief subscales were popular and which were not, a "per item mean score" was computed for each of the seven scales. This score was obtained by dividing the total mean score for each individual subscale by the number of items the subscale contains. This yields a subscale mean score with a range from 1 to 7. Prevalence of belief for all subjects appeared to be highest for Religion, followed by Extraordinary Life Forms, Psi, Precognition, Witchcraft, Spiritualism, and Superstition. Table 4 summarizes the paranormal subscales according to the endorsement rate from high to low and also provides information on the number of items for each subscales, total means, standard deviations, and the per item means.

Insert Table 4 about here

Intercorrelations

Intercorrelations were run among major dependent variables and paranormal beliefs. No significant relationships were found between probability estimates and total paranormal belief. (See Table 5.)

Insert Table 5 about here

Although correlations were high for syllogistic accuracy on positive, negative, withhold, and total accuracy scores, correlations of these scores with total paranormal belief were not significant with the exception of a weak but significant direct relationship present between belief and positive syllogism questions (r=.15, p=.03). (See Table 6.) Correlations among the positive, negative, and withhold hit rate scores were rather high, and significant but weak relationships were found between these hit rates and total paranormal belief. (See Table 7.)

Insert Table 6 and 7 about here

Interestingly, very high correlations were found among syllogism response types (i. e., the number of positive, negative, and withhold responses given by subjects to all syllogisms regardless of their correct answers) indicating that those subjects who gave a greater number of positive responses also gave a greater number of negative responses but a lower number of withholding responses. A significant (but weak) direct relationship was found between total paranormal belief and positive response type (r=.14, p=.03), while an inverse relationship was found between total belief and withhold response type (r=-.14, p=.03). (See Table 8.) Correlations among frequency estimates and belief were not

significant. (See Table 9.) Intercorrelations among Paranormal Belief subscales were typically significant but not very high. All paranormal subscales correlated significantly with the full scale. (See Table 10.)

Insert Table 8 to 10 about here

Discussion

Results of the present study confirm hypothesis 3 in that skeptics withheld judgment on syllogisms more than believers. However, results disconfirmed hypothesis 4 for rare diagrams in that believers as compared to skeptics gave higher rather than lower frequency estimates, and both groups overestimated rather than underestimated rare frequencies. Results failed to support hypothesis 1 on probability estimates, hypothesis 2 on syllogism accuracy, and hypothesis 5 on frequency estimates for common diagrams.

Paranormal Belief and Probability Estimates

Probabilistic accuracy. Contrary to hypothesis 1, believers in the paranormal did not show any chance baseline shift effect in probability estimation (i. e., underestimating the expected frequency of a specific outcome over several trials). This result failed to confirm the findings of Blackmore and Troscianko's (1985) study. However, several procedural differences between their study and the present study may help to explain the failure to obtain comparable results.

Instead of using a direct involvement, computer-stimulated coin-tossing task, the present study asked questions regarding playing cards in which only imagery may have been involved. Direct involvement may facilitate a chance baseline underestimation because of the illusion of control (Langer, 1975). For example, through direct involvement in a task, believers may acquire a higher illusion of control (thinking they have exerted control when they have not) as compared to skeptics (Ayeroff & Abelson, 1976; Benassi et al., 1979). This illusion may then lead believers to misinterpret chance outcomes as due to their own skills and thereby underestimate the basic chance level (Blackmore & Troscianko, 1985). Perhaps believers and skeptics reason differently only when tasks

encourage an illusion of control established through direct involvement.

The probability estimation task was different in another way from the previous study. Blackmore and Troscianko used an exceedingly simply coin-tossing task which involved a maximum of 20 trials. The present study used playing card problems involving a larger number of trials (104 and 520). Unexpectedly, all subjects seemed to have difficulties answering the 104-trial and 520-trial questions, although all were accurate on the 1-trial questions. Since subjects in general were unable to extend their knowledge to more complex probabilities, a common lack in generalization of probabilities across all people may account for the failure to distinguish any belief differences.

Also, Blackmore and Troscianko used only three paranormal questions to determine subject allocation rather than 26 questions as in the present study. The earlier study allocated subjects based on questions on the existence of ESP and psychokinesis, and whether or not those phenomena can be demonstrated in the laboratory, so other types of occult beliefs were totally ignored. The present study utilized a more complete and well-developed scale and therefore had a more representative base from which to examine paranormal beliefs in general.

Overall probabilistic accuracy. As anticipated, subjects in general did well on the 1-trial probability questions. This was not surprising because the questions were relatively straight forward. However, it does imply that subjects not only are familiar with playing cards, but they also possess basic concepts of probability theory.

When subjects were asked to make judgments on 104-trial and 520-trial questions, subjects overestimated the probability of occurrence. It is noteworthy that most participants in this experiment were statistically naive. As a number of researchers point out, people do operate using

simple statistical rules (Fong et al., 1986; Jepson, Krantz, & Nisbett, 1983; Peterson & Beach, 1967). However, the ability to solve more complex problems depends on whether the problems are well defined in terms of the sample size and the role of chance (Jepson, Krantz, & Nisbett, 1983; Nisbett et al., 1983); objective versus subjective problems (Jepson, Krantz, & Nisbett, 1983; Nisbett et al., 1983); and the subjects' statistical knowledge (Fong et al., 1986; Jepson, Krantz, & Nisbett, 1983; Nisbett et al., 1983). For the present sample, the inability to accurately solve extensional probabilities may due to limited statistical knowledge.

Paranormal Belief and Syllogistic Reasoning

Syllogistic accuracy. Although it was predicted that believers in the paranormal would be less accurate in syllogistic reasoning than skeptics (hypothesis 2), no difference was found. Believers as compared to skeptics may not differ in their reasoning ability when they are assessed using basic (elementary) tasks. The aim of the present study was to examine intuitive judgments at a basic level using simple tests which are not confounded by personal meanings or emotional content. When reasoning tasks are themselves pure measures of judgmental ability, the belief-bias effects may be less dramatic. In fact, this explanation is supported by Wierzbicki (1985), who gave subjects sixteen hypothetical syllogisms, half related to paranormal content and half to neutral content. The correlation between extraordinary belief scores and the number of reasoning errors was .39 for paranormal questions and only .14 for neutral questions.

A second explanation for insignificant results involves the difference in syllogistic format used. Other researchers who examined occult beliefs and logical reasoning have tended to use syllogisms with either neutral and/or paranormal content (Rotton & Kelly, 1985; Wierzbicki, 1985). The present study utilized a much more content-free format, for abstract

syllogisms were used. Other studies have suggested that responses on abstract syllogisms are different from those on content-filled syllogisms (Evans, 1984; Janis & Frick, 1943). For content-filled syllogisms, subjects are more likely to base their judgments on the believability of the conclusions, so their deductive reasoning ability becomes confounded with personal belief bias. The present study does not have this problem.

Withholding judgment. Consistent with hypothesis 3, skeptics withheld judgment on syllogisms more than believers in the paranormal. Combining the findings of accuracy and response type, it seems that skeptics withhold judgment more than believers, but they do not withold more correctly. This result appears to confirm the view that believers in the paranormal are susceptible to cognitive impatience (Nickels, 1987), i. e., they tend to jump to premature conclusions rather than withhold judgment. However, cognitive impatience is defined as a tendency to reach premature conclusions when faced with insufficient evidence. Therefore, although believers gave a lower number of withhold responses to the syllogisms than skeptics, the more appropriate measure of cognitive impatience is a measure known as miss rate or false negative rate. This measure is defined as 1-hit rate (McNicol, 1972) and indicates how often subjects give positive and negative responses (coming to conclusions) to questions whose correct answers were withhold (insufficient evidence) as compared to how many withhold questions there are in the syllogism questionnaire. Analysis of the hit rate shows that the difference between believers and skeptics approached significance with believers having a lower hit rate and thus a higher miss rate than skeptics. Therefore, there is a marginal finding in the present study supporting the view of cognitive impatience.

Overall syllogistic accuracy. Considering all subjects in the present sample, performance on total d' syllogistic accuracy was significantly above zero level. Further analyses showed that subjects scored significantly above zero on positive, negative, and withhold syllogism questions.

Intercorrelations within syllogism question types were as expected. Basically, subjects who were accurate on positive questions were also accurate on negative questions and withholding questions as well. However, a more interesting finding is the fact that subjects tended to give either a large proportion of withholding responses or a large proportion of positive and/or negative responses to the 16 syllogisms but not both. This result seems to suggest that people are either withholders or non-withholders.

Paranormal Belief and Frequency Estimations

Estimations of rare events. People tend to underestimate the frequency of rare events such as meaningful coincidences (Alvarez, 1982; Singer & Benassi, 1981; Zusne & Jones, 1982). Believers were, therefore, expected (hypothesis 4) to extend this already occurring bias to underestimating rare events that are not personally meaningful more than skeptics. The results showed the opposite.

As stated by Jung (1960), synchronicity refers to acausal but meaningful coincidence of two or more events. Others also define a true coincidence as having no causal relationship between events but involving a combination of the events which are rare and highly meaningful to the observer (Falk, 1986; Hines, 1988; Zusne & Jones, 1982). Quite often, when people encounter a coincidence, they experience a feeling of strangeness, for they do not expect coincidences to occur. Such attitudes may suggest that whether or not one underestimates rare events depends

upon whether the event is meaningful or salient to the observer. Maybe it is this essential component which leads to an underestimation of events, and it was by design absent in the present study.

Estimations of common events. As proposed by Tversky and Kahneman (1974), a popular way for assessing frequencies is the availability heuristic. This heuristic is likely to cause an overestimation of frequently occurring events. Although believers were expected to be more susceptible to this bias than skeptics, no such difference was found. Believers did not overestimate the frequency of commonly occurring events any more than skeptics, so hypothesis 5 was not confirmed. According to Tversky and Kahneman (1974), the use of the availability heuristic may also depend upon factors other than frequency. Familiarity, salience, and imaginability of the content may also affect the degree to which the availability heuristic is employed. As indicated earlier, the present task tested a rather pure and abstract form of frequency estimate. Content may be an important element which leads to erroneous judgments.

Overall frequency-estimation accuracy. Considering performance of the whole sample, misjudgment of frequency (diagrams) was sizable. Subjects overestimated rare events and severely underestimated occurrences of moderate and common events. Hasher and Zacks (1984) report that people are generally able to make accurate frequency estimates. Tversky and Kahneman (1974) suggest that people tend to underestimate low frequencies and overestimate high frequencies when subjected to the availability heuristic (the basis for hypotheses 4 and 5). However, more in line with present results are a third group of researchers who in studying pure frequency estimations have reported the opposite (Attneave, 1953; Hintzman, 1969; Rowe & Rose, 1977; Teigen, 1973). The latter researchers found that judged frequency was often a logarithmic function

of the actual frequency, so that subjects tended to overestimate low frequencies and underestimate high frequencies.

The marked inaccuracy in judgments among participants in this study may have been due to several factors. First, the exposure time may have been too short. Research done by Erlick (1964) and Howell (1973) has demonstrated that high rate of presentation would lead to a decline in performance. A five second time interval for viewing the diagrams may not have been sufficient as the level of difficulty increased. Perhaps time interval should be lengthened as diagrams become more complex. Furthermore, the frequency estimation task may have been too difficult for the subjects to handle. As shown in Table 3 standard deviations obtained from the diagram estimates were large. Obviously, subjects were not used to dealing with large numbers (leading to a large variance in performance).

Some researchers have tried to account for erroneous frequency judgments by suggesting that subjects may avoid using extremely high or low responses when making estimates (Begg, 1974; Lichtenstein, Slovic, Fischhoff, Layman & Combs, 1978), or they may develop a concept of average frequency (Rowe & Rose, 1977; Underwood, Zimmerman, & Freund, 1971). The average frequency concept tends to develop when judgment is delayed (Begg, 1974; Underwood, et al., 1971) or when the content to be judged is abstract (Begg, 1974). The present results may illustrate this last point.

Sex Differences

Although no formal hypotheses were advanced regarding sex differences, some interesting differences were obtained.

Syllogistic accuracy. Although males and females failed to differ in the number of times they gave positive, negative, and withhold responses,

males were more accurate than females on overall syllogistic reasoning and specifically on positive and withhold questions. This result may not be too surprising, since males may perform better than females on the average due to their spatial/cognitive skills (Maccoby & Jacklin, 1974).

Paranormal beliefs. Most recent studies have not reported sex differences in psychic beliefs (Benassi, Sweeney, & Dreno, 1979; Blackmore & Troscianko, 1985; Jones et al., 1977; Rotton & Kelly, 1985; Tobacyk et al., 1984; Wierzbicki, 1985). McGarry and NewBerry (1981) found marginal sex differences with females having a higher endorsement rate than males. Although Tobacyk and Milford (1983) found no significant sex differences in total paranormal scores, some sex differences were revealed when analyzing the seven subscales. They found that females scored higher than males in traditional religious beliefs and precognition. Yet, interestingly and surprisingly to these researchers, males scored higher on extraordinary life forms, a result which appears to reverse the pre-60s findings that females were usually greater believers than males (Tobacyk & Milford, 1983; Zusne & Jones, 1982). The present study found that females scored higher on total paranormal belief than males. More specifically, females showed significantly higher beliefs on two out of the seven subscales, namely, spiritualism and precognition, although all but one of the means were in the direction of female belief (except for the same deviant in the earlier study -- extraordinary life forms). Perhaps, as Nickels (1989) hypothesized about similar results, "females may have once more climbed 'out on a limb' with a revitalized interest in . . . the New Age and Shirley Maclaine" (p. 15).

Suggestions for Future Research

The present study failed to show that belief in anomalistic phenomena is related to people's basic intuitive judgments. Believers and skeptics

may operate rather similarly in their everyday life when beliefs are not in conflict with their judgments. They may make the same mistakes in their probability, syllogistic accuracy, and frequency (diagrams) judgments. The results of the present study call to question the claim often made by scientific researchers that skeptics are far superior to believers in their capabilities for making intuitive judgments. Therefore, it is suggested that future researchers should extend the present study to the general population in order to test how generalizable these findings are.

Since the cognitive impatience hypothesis was marginally confirmed, future studies might well investigate this concept further. Subjects' response styles on syllogism questions deserve further exploration as well. In the present study, subjects tended to be either withholders or non-withholders. What may have contributed to this response style is not obvious. A large group of factors such as the type, the content, and familiarity of the task, or personality variables may work independently or interactively to bring about such response styles. Future research is needed to shed light on this finding.

Despite the fact that no repeatable experiment in anomalistic psychology is presently available (Marks, 1986), considerable evidence suggests that the prevalence of paranormal beliefs among the general public is very high and persistent. Since the human belief system is seemingly very complex and cannot be accounted for by any single factor, much is yet to be understood as we investigate further into the realm of anomalistic beliefs.

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Appendix A
Revised Paranormal Belief Scale

BELIEF QUESTIONNAIRE

Please enter a number for each item to indicate how much you agree or disagree with that item. Use the numbers as indicated below. There are no right or wrong answers. This is just a sample of your own beliefs and attitudes. Thank you.

1 = Strongly Disagree
2 = Moderately Disagree
3 = Slightly Disagree
4 = Uncertain
5 = Slightly Agree
6 = Moderately Agree
7 = Strongly Agree

1. The soul continues to exist though the body may die.
2. Some individuals are able to levitate (lift) objects through mental forces.
3. Black magic really exists.
4. Black cats can bring bad luck.
5. Your mind or soul can leave your body and travel (astral projection).
6. The abominable snowman of Tibet exists.
7. Astrology is a way to accurately predict the future.
8. There is a devil.
9. Psychokinesis, the movement of objects through psychic powers, does exist.
10. Witches do exist.
11. If you break a mirror, you will have bad luck.
12. During altered states, such as sleep or trances, the spirit can leave the body.
13. The Loch Ness monster of Scotland exists.
14. The horoscope accurately tells a person's future.
15. I believe in God.
16. A person's thoughts can influence the movement of a physical object.
17. Through the use of formulas and incantations, it is possible to cast spells on persons.
18. The number "13" is unlucky.
19. Reincarnation does occur.
20. There is life on other planets.
21. Some psychics can accurately predict the future.
22. There is a Heaven and a Hell.
23. Mind reading is not possible.
24. There are actual cases of witchcraft.
25. It is possible to communicate with the dead.
26. Some people have an unexplained ability to accurately predict the future.

Student #: _____

Sex: _____

Age: _____

Appendix B
Judgment Questionnaire

JUDGMENT QUESTIONNAIRE

Department of Psychology
University of Manitoba

1988

INFORMATION SHEET

Please do NOT write your name anywhere on this questionnaire. However, we do need the following information:

Student # _____

Age _____ Sex _____

# of older brothers _____ # of older sisters _____

# of younger brothers ____ # of younger sisters ____

Your major (if any) _____

Do you frequently play games which use a normal deck of 52 playing cards? yes no

Have you ever played a card game? yes no

Have you ever taken a statistics course in university? yes no
If yes, how many? _____

Have you ever taken a mathematics course in university? yes no
If yes, how many? _____

Have you ever taken a logic course in university? yes no
If yes, how many? _____

Is English your first language? yes no
If not, what is? _____

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How many "S's" were there in the diagram? _____

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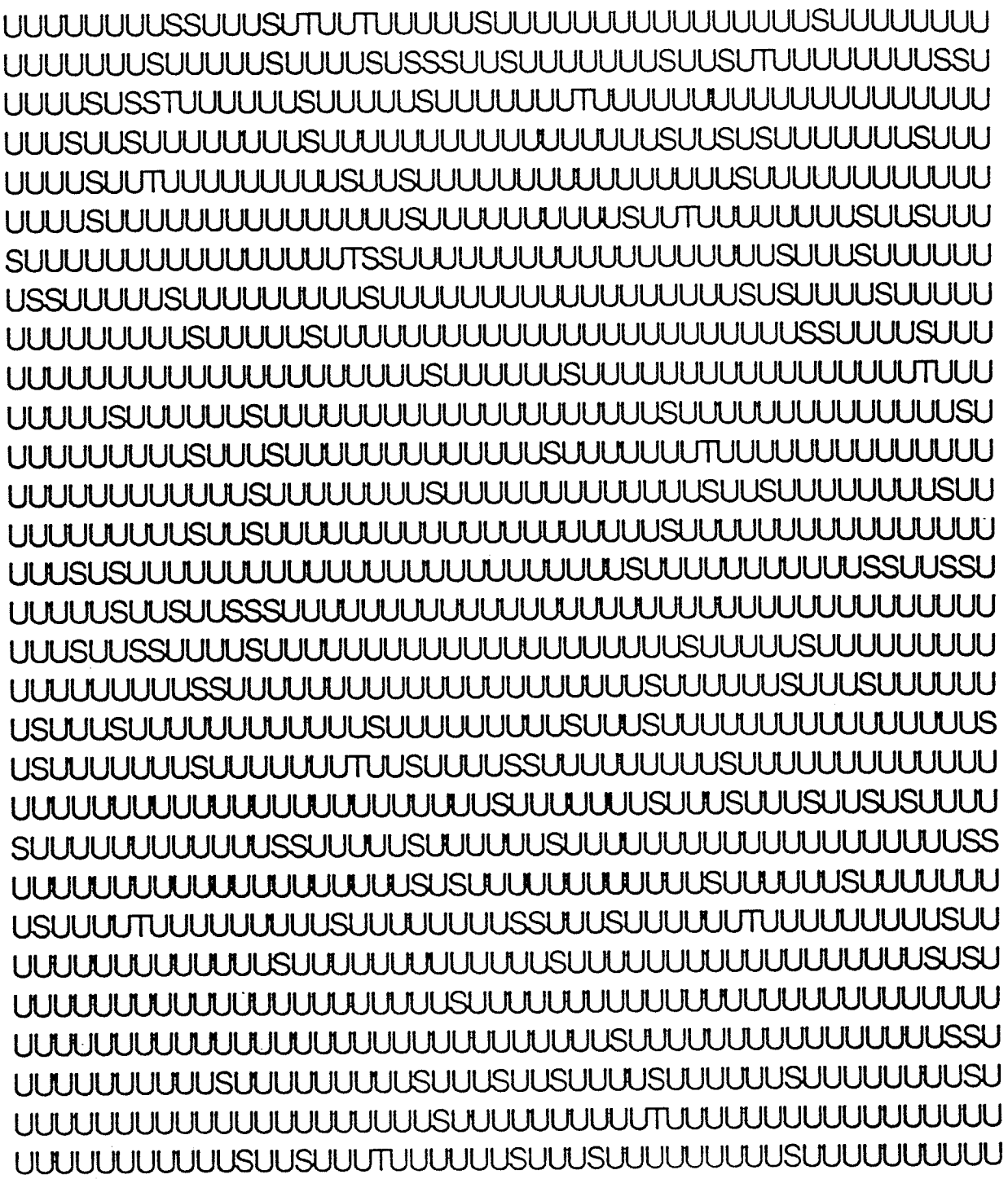

How many "S's" were there in the diagram? _____

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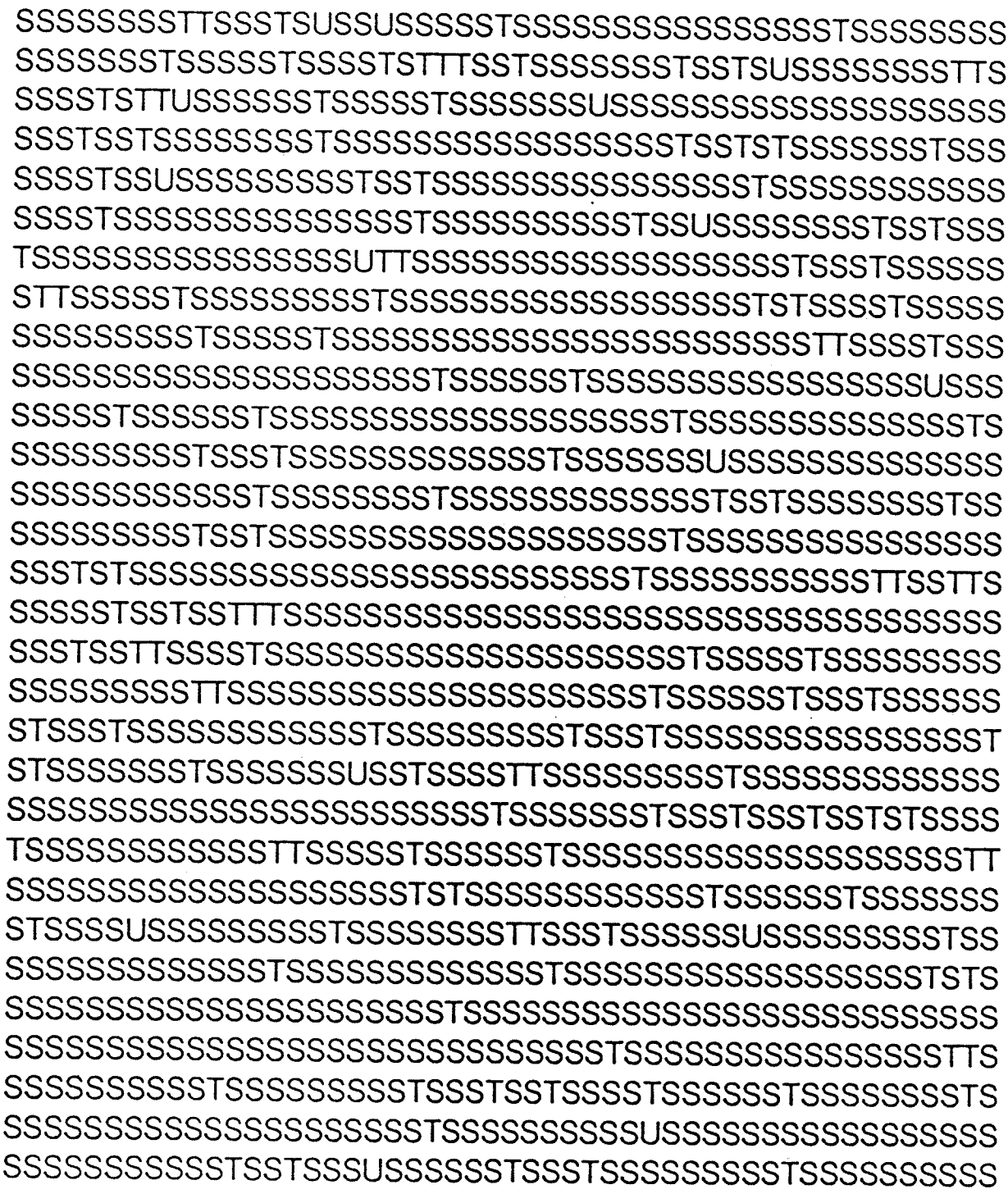

How many "S's" were there in the diagram? _____

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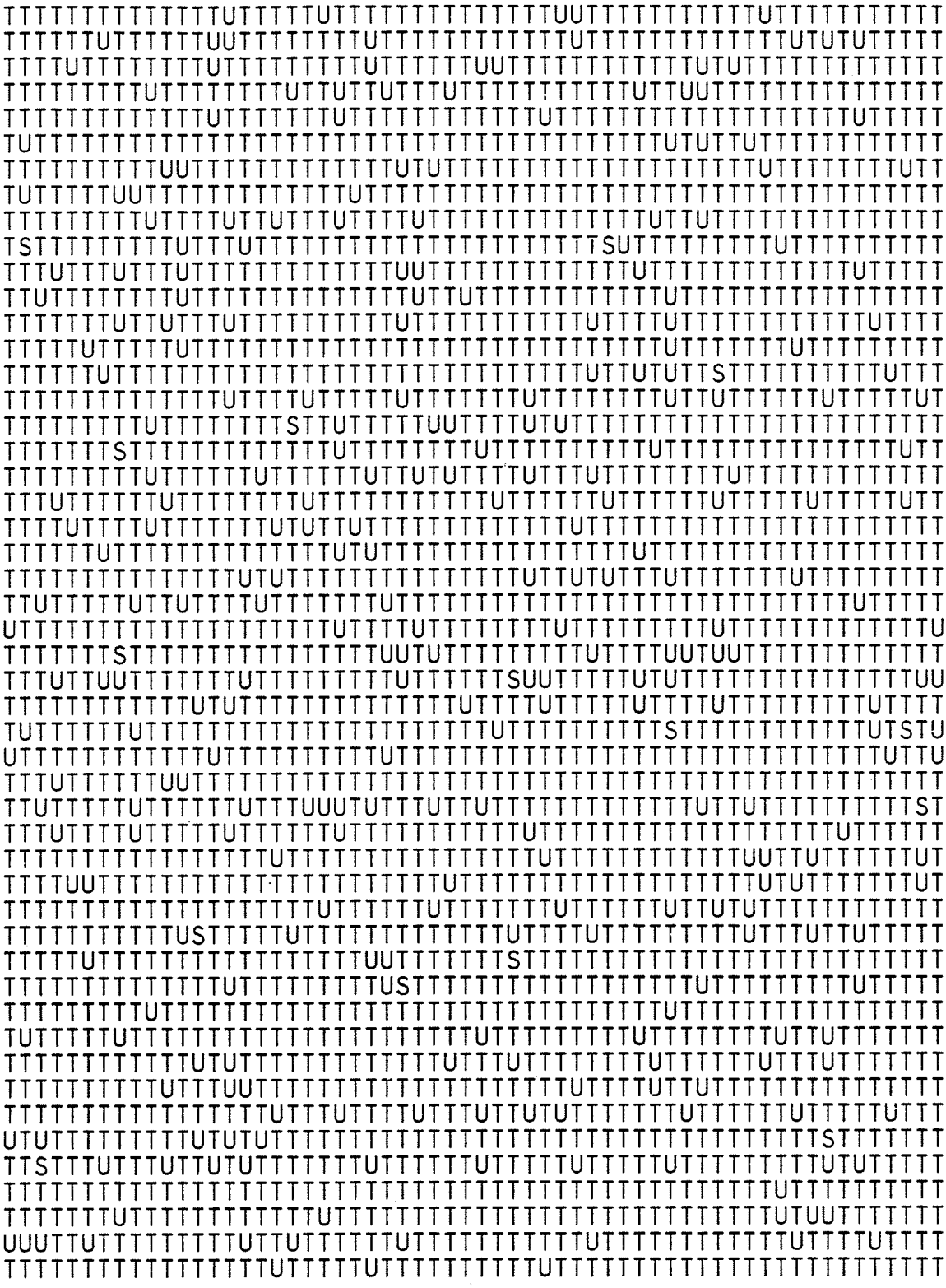

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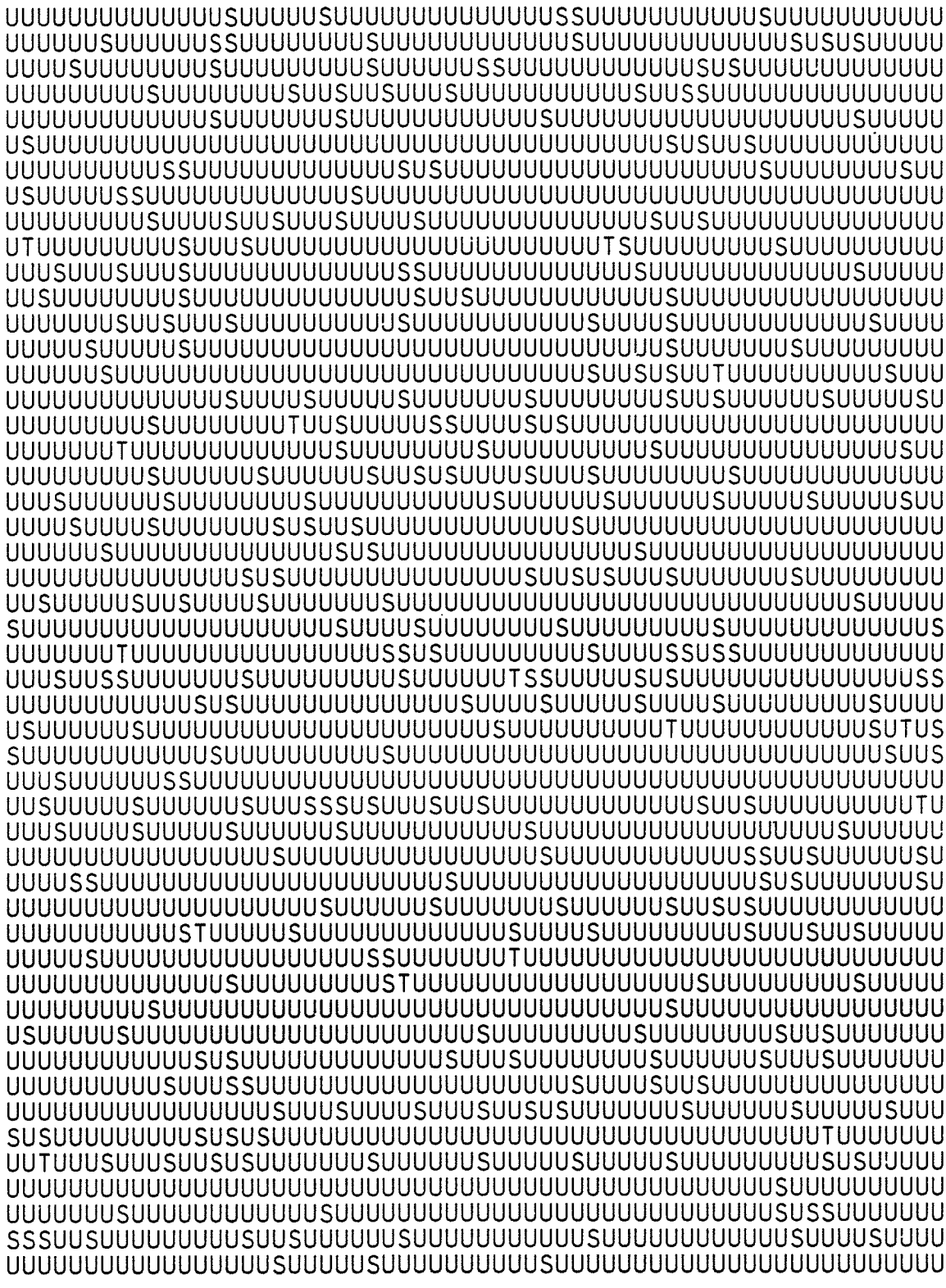

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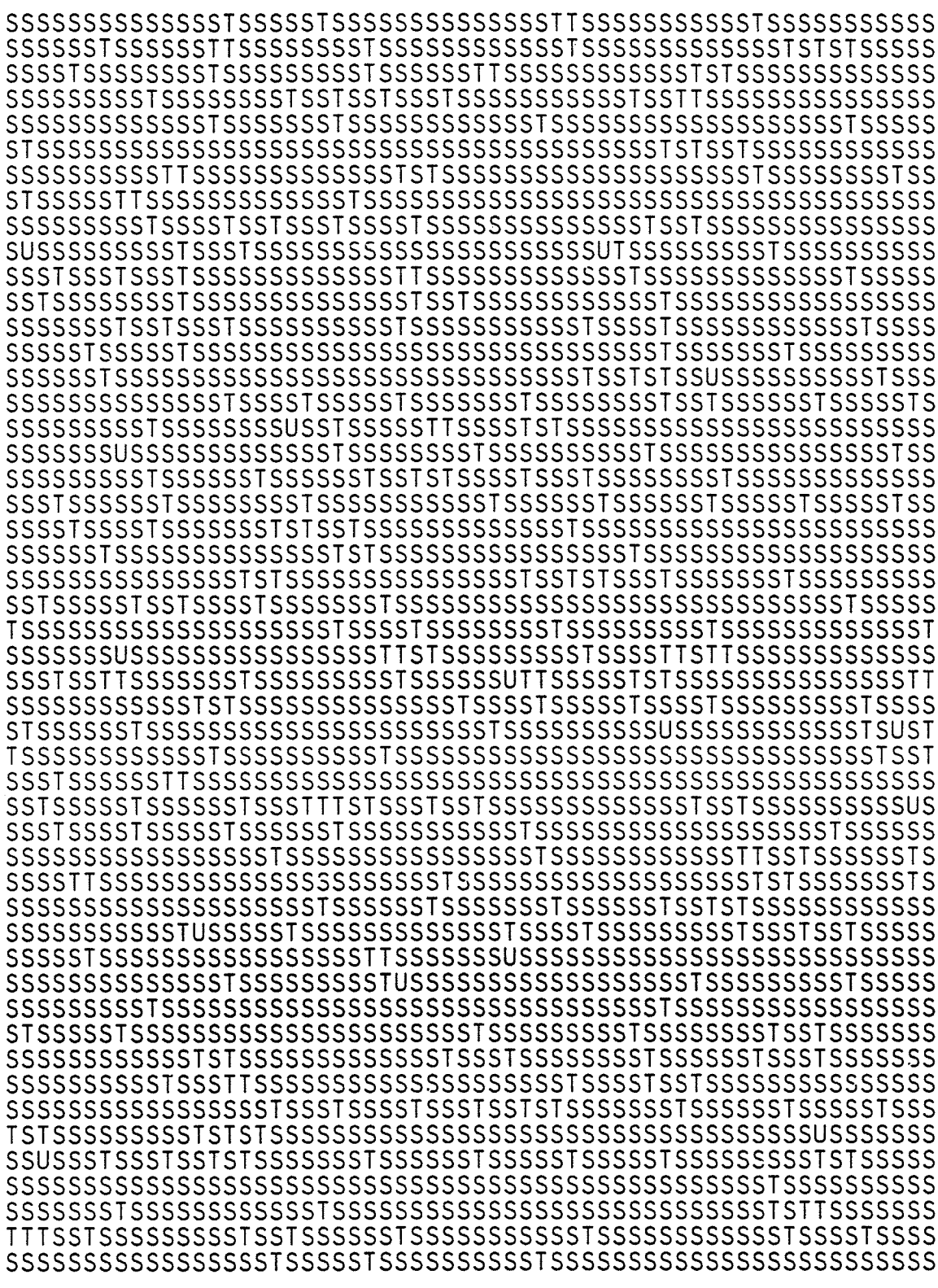

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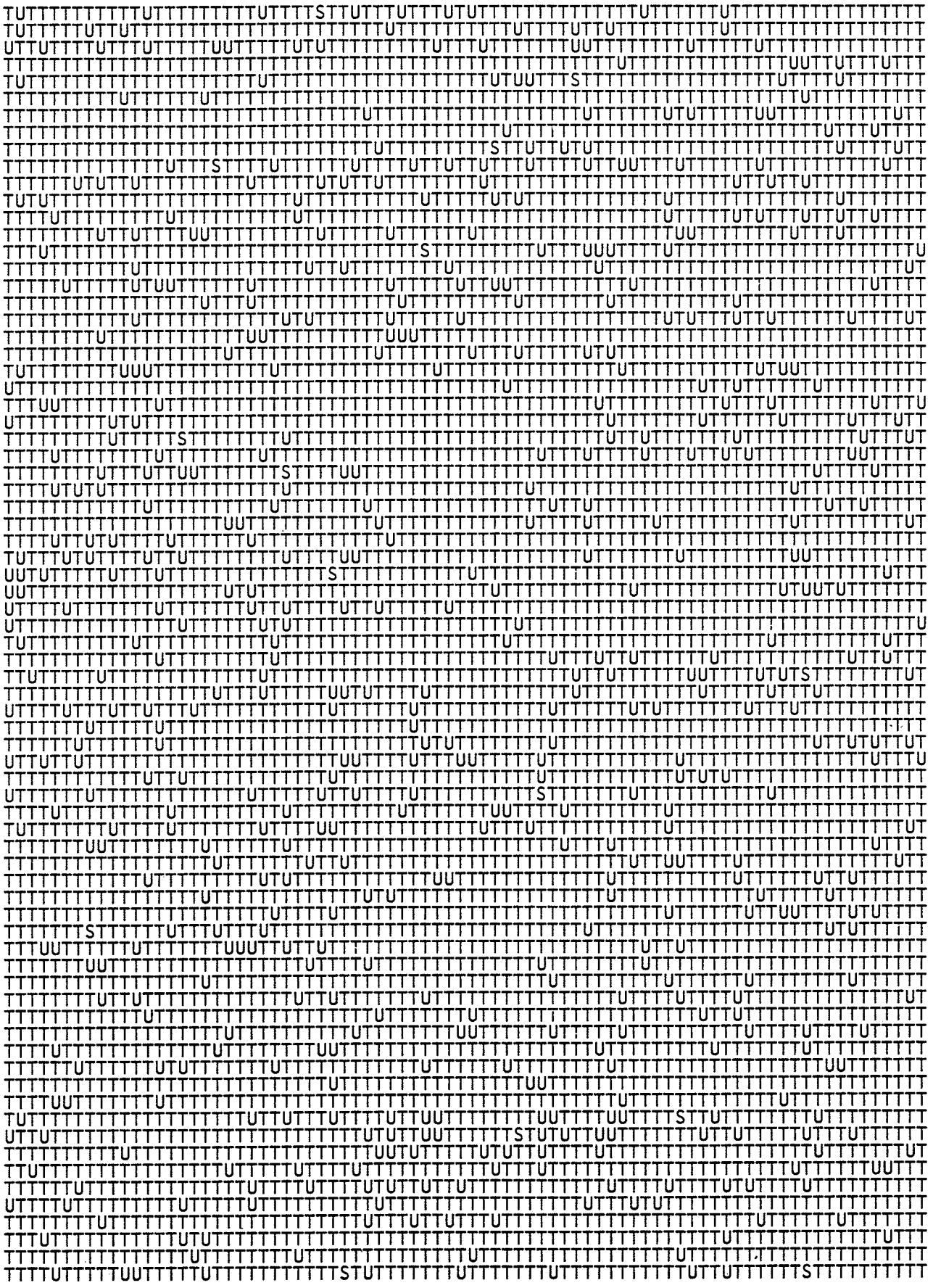

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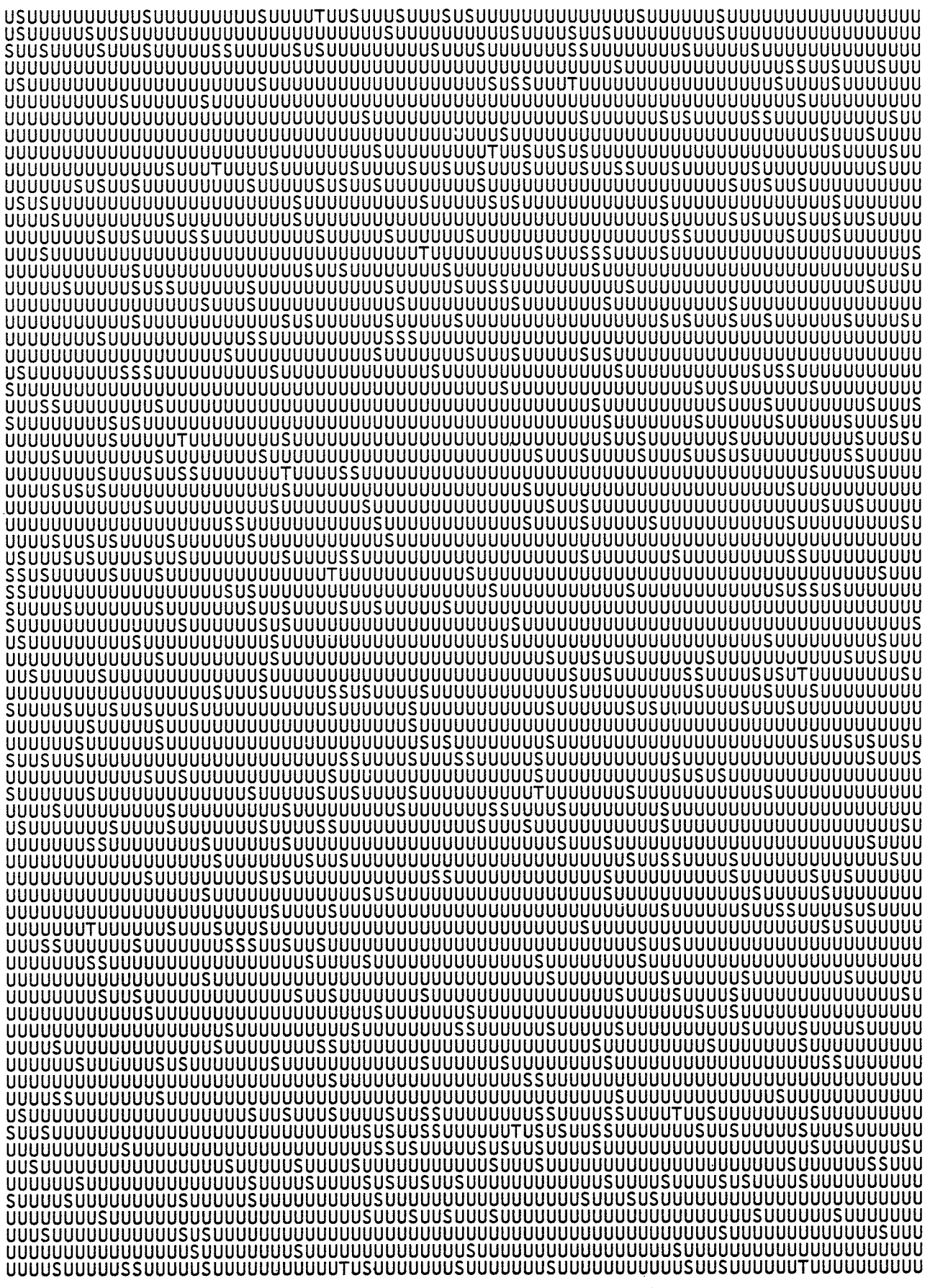

How many "S's" were there in the diagram? _____

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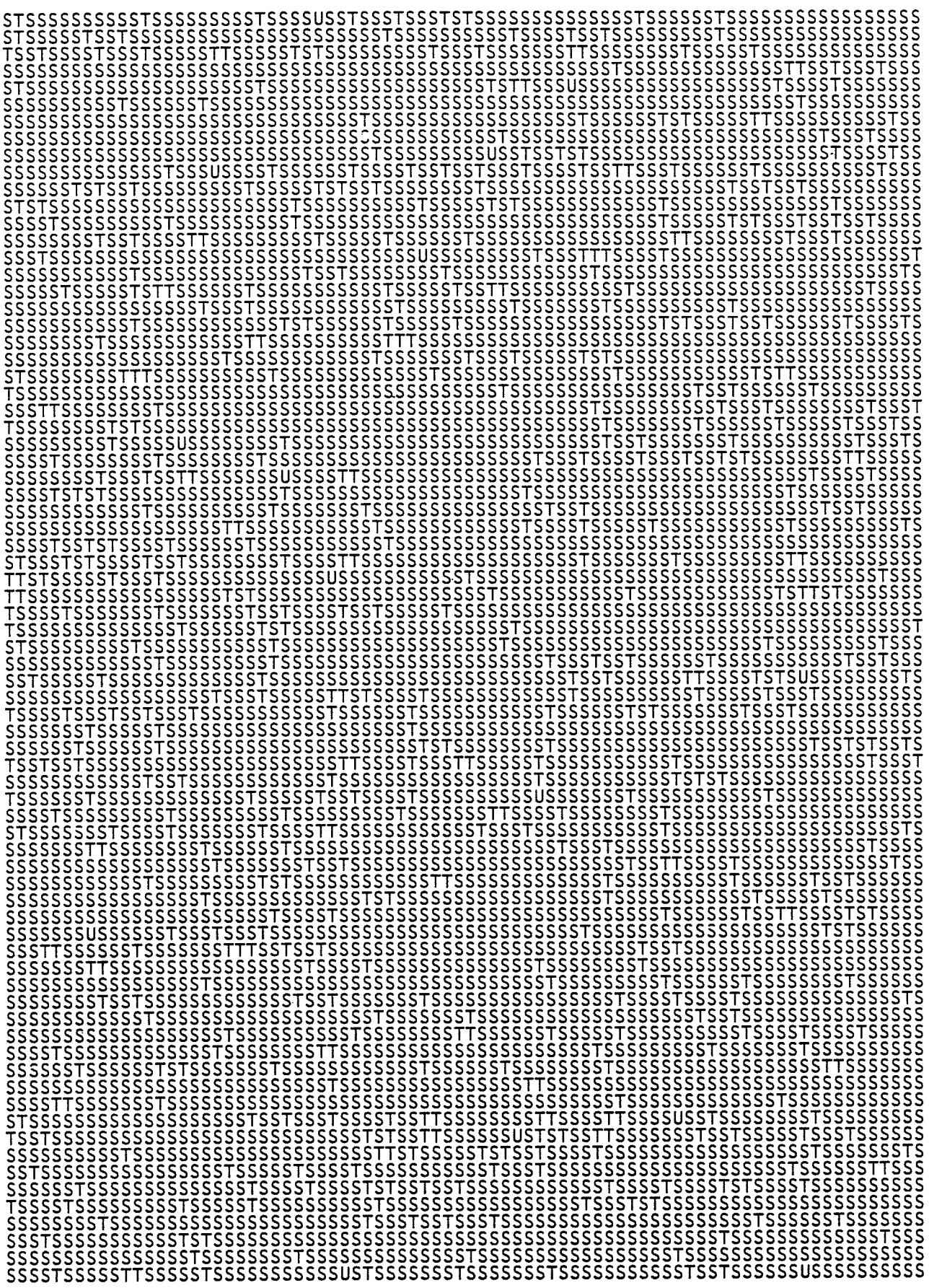

How many "S's" were there in the diagram? _____

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ESTABLISHING A 1-TRIAL LIKELIHOOD

Please estimate the likelihood of getting each of the following playing cards on one draw. For example, the likelihood of getting a **Facecard** on one draw from a normal deck of 52 playing cards is 12 chances out of 52 (i.e., the King, Queen, and Jack of clubs and the same for diamonds, hearts, and spades).

1. What is the likelihood of getting an **Ace** on one draw from a normal deck of 52 playing cards?

answer:_____ chance(s) out of 52 possibilities

2. What is the likelihood of getting a **Red Card** on one draw from a normal deck of 52 playing cards?

answer:_____ chance(s) out of 52 possibilities

3. What is the likelihood of getting a **Black Seven** on one draw from a normal deck of 52 playing cards?

answer:_____ chance(s) out of 52 possibilities

4. What is the likelihood of getting a **Club** on one draw from a normal deck of 52 playing cards?

answer:_____ chance(s) out of 52 possibilities

5. What is the likelihood of getting a **Red Facecard** on one draw from a normal deck of 52 playing cards?

answer:_____ chance(s) out of 52 possibilities

6. What is the likelihood of getting a **King of Hearts** on one draw from a normal deck of 52 playing cards?

answer:_____ chance(s) out of 52 possibilities

ESTABLISHING A 104-TRIAL LIKELIHOOD

Please estimate the likelihood of getting each of the following playing cards on 104 draws.

1. On the basis of probability, how many **Aces** would you expect to get on 104 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

2. On the basis of probability, how many **Red Cards** would you expect to get on 104 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

3. On the basis of probability, how many **Black Sevens** would you expect to get on 104 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

4. On the basis of probability, how many **Clubs** would you expect to get on 104 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

5. On the basis of probability, how many **Red Facecards** would you expect to get on 104 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

6. On the basis of probability, how many **Kings of Hearts** would you expect to get on 104 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

ESTABLISHING A 520-TRIAL LIKELIHOOD

Please estimate the likelihood of getting each of the following playing cards on 520 draws.

1. On the basis of probability, how many **Aces** would you expect to get on 520 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

2. On the basis of probability, how many **Red Cards** would you expect to get on 520 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

3. On the basis of probability, how many **Black Sevens** would you expect to get on 520 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

4. On the basis of probability, how many **Clubs** would you expect to get on 520 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

5. On the basis of probability, how many **Red Facecards** would you expect to get on 520 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

6. On the basis of probability, how many **Kings of Hearts** would you expect to get on 520 draws from a normal deck of 52 playing cards (when each drawn card is returned to the deck and the deck is then reshuffled)?

answer:_____

COMING TO CONCLUSIONS

Please indicate which of the three answers to each problem is logically sound (i.e., follows from the given premises) by entering (1), (2) or (3).

SECTION A: COMING TO CONCLUSIONS ABOUT "Y"

1. Science finds that: If X occurs then Y occurs
   You now observe that: X occurs
   Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

2. Science finds that: If X occurs then Y does NOT occur
   You now observe that: X occurs
   Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

3. Science finds that: If X occurs then Y occurs
   You now observe that: X does NOT occur
   Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

4. Science finds that: If X occurs then Y does NOT occur
   You now observe that: X does NOT occur
   Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

5. Science finds that: If X does NOT occur then Y occurs
   You now observe that: X occurs
   Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

6. Science finds that: If X does NOT occur then Y does NOT occur
You now observe that: X occurs
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

7. Science finds that: If X does NOT occur then Y occurs
You now observe that: X does NOT occur
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

8. Science finds that: If X does NOT occur then Y does NOT occur
You now observe that: X does NOT occur
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) Y occurs (2) Y does NOT occur (3) There is insufficient information available to reach either conclusion

SECTION B: COMING TO CONCLUSIONS ABOUT "P"

9. Science finds that: If P occurs then Q occurs
You now observe that: Q occurs
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

10. Science finds that: If P occurs then Q does NOT occur
You now observe that: Q occurs
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

11. Science finds that: If P occurs then Q occurs
You now observe that: Q does NOT occur
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

12. Science finds that: If P occurs then Q does NOT occur
You now observe that: Q does NOT occur
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

13. Science finds that: If P does NOT occur then Q occurs
You now observe that: Q occurs
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

14. Science finds that: If P does NOT occur then Q does NOT occur
You now observe that: Q occurs
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

15. Science finds that: If P does NOT occur then Q occurs
You now observe that: Q does NOT occur
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

16. Science finds that: If P does NOT occur then Q does NOT occur
You now observe that: Q does NOT occur
Therefore, under the assumption that events repeat themselves, you should expect which of the following?

(1) P occurs (2) P does NOT occur (3) There is insufficient information available to reach either conclusion

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Appendix C
Answers to the Judgment Questionnaire

Probability Estimates:

	1-trial	104-trials	520-trials
Ace	4	8	40
Red Card	26	52	260
Black Seven	2	4	20
Club	13	26	130
Red Facecard	6	12	60
King of Hearts	1	2	10

Diagram Estimates:

Diagram	#1 -- 15	#4 -- 15	#7 -- 15
	#2 -- 150	#5 -- 300	#8 -- 600
	#3 -- 1335	#6 -- 2685	#9 -- 5385

Syllogism Estimates:

Section A :	Question	#1 -- 1	#5 -- 3
		#2 -- 2	#6 -- 3
		#3 -- 3	#7 -- 1
		#4 -- 3	#8 -- 2
Section B :	Question	# 9 -- 3	#13 -- 3
		#10 -- 2	#14 -- 1
		#11 -- 2	#15 -- 1
		#12 -- 3	#16 -- 3

Table 1
Means and Standard Deviations for All Subgroups

Estimates	Belief			Sex	
	Skeptics (N=30)	Agnostics (N=101)	Believers (N=99)	Males (N=94)	Females (N=136)
Prob. Estimates					
1-Trial					
M	1.69	1.57	6.57	1.80	2.61
S D	20.12	16.35	19.56	13.99	21.06
104-Trials					
M	122.05	75.72	12.27	52.54	111.47
SD	610.19	421.18	45.79	327.63	573.58
520-Trials					
M	124.43	210.76	30.13	78.29	199.64
S D	883.55	915.86	295.46	557.23	996.63
Syllog. Accuracy					
d' Total					
M	2.11	2.31	2.76	2.70	1.99
S D	2.16	1.77	1.61	2.05	1.80
d' Positive					
M	2.63	2.95	3.80	3.36	2.62
S D	2.78	2.38	2.70	2.67	2.55

(table continues)

Estimates	Belief			Sex	
	Skeptics (N=30)	Agnostics (N=101)	Believers (N=99)	Males (N=94)	Females (N=136)
d' Negative					
M	2.71	3.07	3.75	3.32	2.79
S D	2.56	2.48	2.49	2.70	2.39
d' Withhold					
M	0.98	0.90	0.73	1.43	0.55
S D	2.40	2.31	1.88	2.41	2.15
Hit Rate					
Z Positive					
M	-0.78	-1.11	-2.36	-1.29	-1.02
SD	2.17	2.28	2.63	2.29	2.35
Z Negative					
M	-1.28	-1.75	-2.72	-1.76	-1.62
SD	2.43	2.53	2.66	2.54	2.54
Z Withhold					
M	0.09	0.51	1.45	0.06	0.72
SD	2.72	2.97	2.93	2.91	2.84

(table continues)

Estimates	Belief			Sex	
	Skeptics (N=30)	Agnostics (N=101)	Believers (N=99)	Males (N=94)	Females (N=136)
Response Types					
# Positive					
M	4.20	4.54	5.37	4.36	4.60
SD	1.88	2.13	2.20	2.16	1.99
# Negative					
M	5.13	5.60	5.97	5.21	5.61
SD	2.12	2.14	1.92	2.03	2.16
# Withhold					
M	6.58	5.79	4.67	6.33	5.74
SD	3.70	3.88	3.84	3.85	3.81
Frequency					
Rare					
M	25.65	21.05	65.10	31.81	26.68
S D	47.58	58.91	161.03	95.12	62.33
Moderate					
M	-688.14	-668.62	-560.90	-687.78	-645.83
S D	312.30	356.65	338.91	306.42	356.50
Common					
M	-6074.70	-5742.56	-5144.87	-5855.32	-5774.56
S D	2945.62	3398.42	3112.56	2627.83	3511.04

(table continues)

Estimates	Belief			Sex	
	Skeptics (N=30)	Agnostics (N=101)	Believers (N=99)	Males (N=94)	Females (N=136)
Paranormal Belief					
Total Belief					
M	---	---	---	89.22	96.01
S D	---	---	---	23.04	19.81
Religion					
M	---	---	---	20.47	21.69
S D	---	---	---	5.89	6.01
Extraordinary Life Forms					
M	---	---	---	11.71	10.73
S D	---	---	---	4.10	3.70
Psi					
M	---	---	---	13.44	14.91
S D	---	---	---	6.20	5.68
Precognition					
M	---	---	---	13.15	14.96
S D	---	---	---	5.39	5.27
Witchcraft					
M	---	---	---	12.86	13.97
S D	---	---	---	5.33	5.81

(table continues)

Estimates	Belief			Sex	
	Skeptics (N=30)	Agnostics (N=101)	Believers (N=99)	Males (N=94)	Females (N=136)
Spiritualism					
M	---	---	---	12.34	14.27
S D	---	---	---	5.53	5.32
Superstition					
M	---	---	---	5.14	5.48
S D	---	---	---	3.19	3.19

Table 2

MANOVA Results on the Five Dependent Variable Packages

	d. f.	F	p
Probability Estimates			
Sex	3, 222	0.39	.761
Belief	6, 444	1.53	.165
Sex x Belief	6, 444	1.13	.343
Syllogistic d' Accuracy			
Sex	3, 222	3.12	.027
Belief	6, 444	1.78	.102
Sex x Belief	6, 444	1.43	.203
Syllogistic Z Hit Rate			
Sex	3, 222	2.74	.044
Belief	6, 444	2.10	.052
Sex x Belief	6, 444	0.74	.618
Syllogistic Response Type			
Sex	3, 222	0.82	.486
Belief	6, 444	1.54	.164
Sex x Belief	6, 444	0.23	.966

(table continues)

	d. f.	F	p
Frequency Estimates			
Sex	3, 222	0.72	.539
Belief	6, 444	1.61	.142
Sex x Belief	6, 444	0.62	.716

Table 3

Means and Standard Deviations on Judgment for All Subjects

Estimates	M	S D	p	Estimate Accuracy
Probability				
Trial 1	2.27	18.47	.063	accurate
Trial 104	87.39	488.20	.008	overest
Trial 520	150.00	845.70	.008	overest
Syllogistic Accuracy				
d' Total	2.28	1.93	<.001	accurate
d' Positive	2.92	2.62	<.001	accurate
d' Negative	3.00	2.53	<.001	accurate
d' Withhold	0.91	2.29	<.001	accurate
Syllogistic Hit Rate				
Z Positive	-1.13	2.33	---	---
Z Negative	-1.68	2.54	---	---
Z Withhold	0.45	2.88	---	---
Syllog. Response Type				
# Positive	4.50	2.06	---	---
# Negative	5.45	2.12	---	---
# Withhold	5.98	3.83	---	---

(table continues)

Estimates	M	S D	p	Estimate Accuracy
Diagrams				
Rare	28.77	77.27	<.001	overest
Moderate	-663.00	336.90	<.001	underest
Common	-5808.00	3174.00	<.001	underest

Note. N=230.

Table 4

Means and Standard Deviations on Belief for All Subjects

Paranormal Scales	Number of Items	Total M	S D	Per Item M
Total Para. Belief	26	93.24	21.41	3.59
Religion	4	21.20	5.98	5.31
Extraordinary Life Forms	3	11.13	3.89	3.70
Psi	4	14.31	5.93	3.58
Precognition	4	14.23	5.38	3.56
Witchcraft	4	13.52	5.64	3.39
Spiritualism	4	13.49	5.48	3.37
Superstitution	3	5.34	3.19	1.78

Note. N=230.

Table 5

Intercorrelations For Probability Estimates and Paranormal Belief

Variable	1	2	3
1. Prob. 1-trial	--		
2. Prob. 104-trials	.01	--	
3. Prob. 520-trials	.13*	.84**	--
4. Tot. Para. Belief	.07	-.06	-.01

Note. N= 230.

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

Table 6

Intercorrelations For Syllogistic Accuracy and Paranormal Belief

Variable	1	2	3	4
1. d' Total	--			
2. d' Positive	.79**	--		
3. d' Negative	.78**	.41**	--	
4. d' Withhold	.76**	.41**	.42**	
5. Tot. Para. Belief	.09	.15*	.10	-.05

Note. N= 230.

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

Table 7

Intercorrelations For Syllogistic Hit Rate and Paranormal Belief

Variable	1	2	3
1. Z Positive	--		
2. Z Negative	.54**	--	
3. Z Withhold	-.53**	-.54**	--
4. Tot. Para. Belief	.17*	-.13*	.13*

Note. N= 230.

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

Table 8

Intercorrelations For Syllogistic Response Types and Paranormal Belief

Variable	1	2	3
1. # Positive	--		
2. # Negative	.71**	--	
3. # Withhold	-.92**	-.92**	--
4. Tot. Para. Belief	.14*	.12	-.14*

Note. N= 230.

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

Table 9

Intercorrelations For Frequency Estimates and Paranormal Belief

Variables	1	2	3
1. Freq. rare	--		
2. Freq. moderate	.42 **	--	
3. Freq. common	.06	.54**	--
4. Tot. Para. Belief	.10	.07	.07

Note. N= 230.

* p < .05, ** p < .001

Table 10

Intercorrelations Among Paranormal Belief Scales

Beliefs	1	2	3	4	5	6	7
1. Religion	—						
2. Extraordinary Life Forms	-.06	—					
3. Psi	.07	.41**	—				
4. Precognition	.09	.17*	.44**	—			
5. Witchcraft	.20*	.27**	.49**	.23**	—		
6. Spiritualism	.08	.41**	.66**	.48**	.39**	—	
7. Superstitution	.00	.07	.09	.33**	.06	.11	—
8. Tot. Para. Belief	.38**	.51**	.79**	.66**	.67**	.77**	.31**

Note. N=230.

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