Exploring the Boundaries of Behavioral Robotics: Understanding the Limitations of Psychokinesis

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1 Abstract

Advancements in behavioral robotics have enabled remarkable emulation of human abilities within artificial intelligence (AI) systems. However, amidst these technological achievements, the question of whether some human capacities lie beyond the reach of robots remains unanswered. This paper delves into the enigmatic realm of psychokinesis, exploring the purported ability of the human mind to directly influence physical objects and processes. Inspired by our previous book, "An Excursion into the Paranormal," we present the paper as a call for submissions and discussions on the limits of robotics and AI.

Psychokinesis, one of the three branches of paranormal phenomena, challenges conventional scientific explanations and is often considered a domain of delusions or fraud. To address this skepticism, we propose employing statistical verification methods used for extrasensory perception to explore the existence of psychokinetic phenomena.

Through coin tossing and dice throwing experiments, we illustrate the potential for statistical validation of psychokinetic influence. The results indicate that statistically significant outcomes might suggest psychokinetic abilities beyond conventional human capacities.

By inviting researchers, scientists, and enthusiasts to contribute to this journal, we seek to foster an academic discourse on the boundaries of behavioral robotics and the interface between consciousness and AI. Our paper endeavors to prompt an exploration of the extraordinary, shedding light on uncharted frontiers, and unraveling the mysteries that lie at the crossroads of science and the human mind.

2 Introduction

The field of behavioral robotics has made tremendous strides in replicating human abilities and cognition within artificial intelligence systems [1]. However, amidst these groundbreaking advancements, a question lingers: Are there human abilities, such as psychokinesis, that robots may never be able to emulate? [2]. This paper aims to initiate a discussion and call for paper submissions on the limits of robotics and AI, inspired by our previous book, "An Excursion into the Paranormal," now out of press.

We invite researchers, scientists, and enthusiasts to contribute their papers to this journal, where we aim to broaden our understanding of human abilities, the limits of technology, and the interface between consciousness and artificial intelligence. By exploring the paranormal, we hope to shed light on the extraordinary and unravel the mysteries that lie at the crossroads of science and the human mind [3].

The term "psychokinesis" derives from the two words "psyche" and "kinesis", which are both of Greek origin, the first meaning the mind or soul, while the second refers to the study of movement or motion. Psychokinesis, in a narrow sense, denotes the ability of the mind to directly influence the motion of physical objects, but more generally it encompasses the ability of the mind to exert direct influence on physical processes of any kind [4]. Orthodox science in its current state cannot explain such abilities of the mind, and consequently denies the existence of such abilities. It considers psychokinetic manifestations to be delusions, hallucinations, or outright fraud.

Psychokinesis is one of the three main branches of paranormal phenomena, the others being extrasensory perception and survival related phenomena [5]. Psychokinetic phenomena include setting stationary physical objects into motion, influencing the motion of objects already moving, floatation of objects, deformation of the shape of physical objects, production of light and sound without reliance on physical causation, spontaneous ignition, interference with the functioning of mechanical, electrical, or electronic apparatus, unaccountable images on photographs, and more rarely dematerialisation and re-materialisation of physical objects and even of living organisms, all in contradiction to the currently known laws of physics.

3 Methods

The question automatically arises whether the reality of psychokinesis can be scientifically verified. The answer is that statistical verification can be obtained, and definitely exists. The statistical verification of extrasensory perception was described in some detail, via tossing coins and dice, cutting shuffled packs of cards, and electronic means.

Coin tossing methods can also be applied to obtain statistical verification for psychokinesis. Let a coin be tossed 200 times, preferably by a push button operated mechanical catapult, causing it to spin in the air before landing on a horizontal surface. If the coin has uniform density and near perfect even edges, so that the coin, and also the rest of the procedure, is free of "bias", then the most likely outcome, in 200 tosses, is 100 heads and 100 tails.

In practice, it is likely that a departure from this result will be observed, in fact, calculations, show that the probability for obtaining a number of heads lying in the range of 95 to 105 , and including both these figures, is 56%. If one keeps obtaining a number of heads within this range in successive batches of 200 tosses, it can be reasonably assumed that the coin, and the tossing procedure, is free of bias.

Now let a subject with suspected psychokinetic abilities be present, but so situated that any physical interference with the coin tossing procedure is totally excluded, and ask the subject to try influencing the motion of the coin mentally, while spinning in the air, so as to produce heads in preference to tails. Of course, it is most unlikely that anyone could produce 200 heads in 200 tosses, but it could happen that a subject would come up with 120 heads in 200 tosses. Probability calculations, show that the probability of getting 120 heads or more, in 200 tosses by chance, is 0.0029 or 0.29%. If in any orthodox scientific test, the probability for a result having come about by chance is 0.05, namely 5%, or less, that result is considered "significant", chance is called into question, and a causative factor is suspected. Also, if the probability for a result having occurred by chance is 0.01, namely 1%, or less, the result is labelled "highly significant", chance is rejected, and some causative factor is assumed. The result of the above coin tossing test, with a probability factor of 0.0029 or 0.29%, is thus highly significant, the suspected causative factor being the subject's psychokinetic ability, which should be considered as statistically indicated.

In practice one might arrange 10 test runs, typically one week apart, each with 200 tosses or more. One might then find that the psychokinetic ability of the subject varies from test run to test run, but if the overall result is highly significant, the psychokinetic ability should be considered as verified, doing otherwise would be inconsistent, and even dishonest.

Tests for psychokinetic abilities may also be based on throwing dice. A die, or a number of dice, would be enclosed in a transparent rectangular box, which upon pressing a push button would be turned over by a mechanism a number of times, and then stop with its bottom side horizontal, and the die or dice resting on it. The box being transparent, the number of spots uppermost could easily be read. Of course, all physical interference with the box would have to be totally excluded, other than pushing the button to initiate each throw.

However, before a die may be used for a psychokinesis test, control runs would need to be performed, to verify the absence of bias in both the die and the throwing procedure. In the absence of bias, a single throw of a die may result in one of six equally probable outcomes, corresponding to any one of the six sides of the die facing upward, that is, any number of spots between 1 and 6 coming topmost. In a single throw, the probability of a particular number of spots landing topmost is 1 in 6 , or $1/6 = 0.1667$, or 16.67%. Thus if a die is thrown 180 times, then in the absence of bias, one would expect each number of spots to come uppermost in 1/6 of the 180 throws, that is in 30 throws.

In practice, some departures from this expected result are likely, but a statistical calculation will indicate if the observed departures are attributable to chance, and consequently the die and the throwing technique may be regarded unbiased. For instance, let it be supposed that the outcome of a control run of 180 throws of a single die is as shown in Table 1.

Number of spots	1	2	3	4	5	6
Number of times uppermost:	28	31	27	32	29	33

Table 1: Control run of 180 throws of a single die

The number of six spots	$X = 33$ or more
The number of throws	$N = 180$
The probability of a six spot in one throw	$p = 1/6$
The probability of any other than a six spot in one throw	$q = 5/6$
The mean	$M = (N) \times (p) = (180) \times (1/6) = 30$
The standard deviation	$S = \sqrt{(N) \times (p) \times (q)} = \sqrt{(180) \times (1/6) \times (5/6)} = \sqrt{25} = 5$
The normalised deviation	$Z = (X - 0.5 - M)/S = (33 - 0.5 - 30)/5 = 2.5/5 = 0.5$

Table 2: Probability of obtaining 33 six spots or more, in 180 throws

The largest departures from the chance expectation of each number of spots coming topmost 30 times, are 33 six spots and 27 three spots. Using the normal probability curve, and find the probability of obtaining 33 six spots or more, in 180 throws, as is done in Table 2, leading to a normalised deviation $Z = 0.5$.

Calculating, gives the corresponding probability as $0.30845 \approx 0.31$. Since this figure is well above the significance level of 0.05 , the result is attributable to chance. It is obvious that similar calculations for the other number of spots in Table 1 would also yield chance results, and so the absence of bias may be considered as confirmed.

The calculation of probability from the normal probability curve, is only one of a number of possible ways of evaluating probability. In cases where a single action may result in more than two different outcomes, and where individual probabilities of these outcomes may be equal or unequal, another method of statistical calculation, known as the "chi-square" method, may be more useful. The throwing of dice is a specific example within the category of such cases, where a single throw of a die may result in 1 of 6 equally probable outcomes, namely any one of the six possible numbers of spots coming uppermost, the probabilities of these 6 outcomes in this case being equal to 1/6 each.

In what follows, the numbers in Table 1 are used to illustrate how one may employ the chi-square method, to show that the results in Table 1 have come about by chance. The procedure is laid out in Table 3, which applies to 180 throws, and where the meaning of the various terms is as follows: "Number of spots" stands for the faces of the die and the number of spots on them. "Actual frequency" means the number of times each face came uppermost in the given number of throws, that is, in 180 throws in this case. "Expected frequency" is the number of times each face would be expected to come uppermost from probability considerations in the given number of throws, namely $180/6 = 30$ in this case. "Deviation" is the difference between the actual and expected fre-

Number of Spots	1	2	3	4	5	6
Actual frequency	28	31	27	32	29	33
Expected frequency	30	30	30	30	30	30
Deviation = Actual -Expected	-2	+1	-3	+2	-1	+3
Deviation squared	4	1	9	4	1	9
Ratio = $\frac{\text{(Deviation squared)}}{\text{(Expected frequency)}}$	$\frac{4}{30}$	$\frac{1}{30}$	$\frac{9}{30}$	$\frac{4}{30}$	$\frac{1}{30}$	$\frac{9}{30}$

Table 3: (Number of throws = 180)

quencies, and may be positive or negative. "Deviation squared" is the deviation multiplied by itself, and is always positive. "Ratio" is the deviation squared divided by the expected frequency.

The chi-square is the sum of the ratios, and is denoted X^2. Rounded to three figures it is: $X^2 = \frac{4}{30} + \frac{1}{30} + \frac{9}{30} + \frac{4}{30} + \frac{1}{30} + \frac{9}{30} = \frac{28}{30} = 0.933$

Clearly, if all numbers of spots came up 30 times as expected, then all the deviations would be zero, and one would also have the chi-square $X^2 = 0$, which would indicate an ideal chance result. Before one can ascertain whether the figures in Table 1 are chance results, one needs to determine the so called "degrees of freedom", which means the number of values in a set of values that can be freely chosen before the rest is determined. In the case of Table 1, one may choose any five numbers in the bottom line, which then determines the sixth number, because the six numbers must add up to 180. Thus taking the first five numbers, and adding them yields $28 + 31 + 27 + 32 + 29 = 147$, and so the sixth number must be $180 - 147 = 33$. This then means that there are five degrees of freedom. Often the degrees of freedom equal the number of possible outcomes of a single action less one, in this case $6 - 1 = 5$. The term degrees of freedom is often denoted by the short: DF.

One must enter the line starting with the number 5 in the DF column. It is seen that $\mathrm{X}^2 = 0.933$ is less than the first entry in that line, namely 1.15 , which in turn corresponds to a probability of 0.95 in the top line. So, the probability corresponding to $X^2 = 0.933$ must be larger than 0.95 . Thus, the probability of the outcome in Table 1 having occurred by chance is larger than 0.95 , which is far above the significance level of 0.05 . Consequently, the result in Table 1 is a chance result, and the absence of bias may be safely assumed.

In general, the larger the chi-square figure is for a given number of degrees of freedom, the smaller is the probability of the result having come about by chance. It will also be noted, that the two methods of probability calculations dealt with in the foregoing, lead to different results. This is so because different questions are being asked. The first figure, namely 0.30854 or 0.31 approximately, is the probability of 33 six spots or more, in 180 throws, which indicates a chance outcome. The second figure, namely 0.95 approximately, is the probability of the sum total of all deviations from the expected frequencies, and is also indicative of a chance outcome. When considering the large difference between the two figures, it must be borne in mind that the upper limit to the first figure is 0.5 corresponding to 30 six spots or more, out of 180 throws, whereas

Number of Spots	1	2	3	4	5	6
Number of times Uppermost	35	23	20	27	39	43

Table 4: 180 throws

The number of six spots	$X = 43$ or more
The number of throws	$N = 180$
The probability of a six spot in one throw	$p = 1/6$
The probability of any other than a six spot in one throw	$q = 5/6$
The mean	$M = (N) \times (p) = (180) \times (1/6) = 30$
The standard deviation	$S = \sqrt{(N) \times (p) \times (q)} = \sqrt{(180) \times (1/6) \times (5/6)} = \sqrt{25} = 5$
The normalised deviation	$Z = (X - 0.5 - M)/S = (43 - 0.5 - 30)/5 = 12.5/5 = 2.5$

Table 5: 180 throws

the upper limit to the second figure is 1.0 corresponding to all faces of the die coming up exactly 30 times in 180 throws, which would yield a chi-square figure equal to zero.

In the foregoing, the procedure for using the chi-square statistical method was illustrated. The underlying theory is not dealt with in these pages, interested readers may find that information in books dealing with probability and statistics.

Now let a subject be tested for psychokinetic abilities, by the die throwing technique, employing a single die. As described above, the die would be enclosed in a rectangular transparent box, which would be turned over by a mechanism a few times in response to the experimenter pushing a button, and then come to rest with the die resting on its horizontal bottom face. The subject, seated some distance from the box, or perhaps in a nearby room, would be invited to try to influence the fall of the die, aiming for six spots uppermost each time. Let it be supposed that the outcome of 180 throws is as given in Table 4.

Proceeding as before, the normal curve can be used to find the probability of obtaining 43 six spots or more, in 180 throws, as done in Table 5. The normalised deviation is found to be $Z = 2.5$, which gives the probability as $P \approx 0.0062$.

Since this figure is less than 0.01 or 1%, the result is statistically highly significant, and would suggest psychokinetic ability being responsible.

Alternatively, one may rely on the chi-square statistical method, which leads to Table 6.

Hence, the chi-square, rounded to three figures, is:

$X^2 = \frac{25}{30} + \frac{49}{30} + \frac{100}{30} + \frac{9}{30} + \frac{81}{30} + \frac{169}{30} = \frac{433}{30} = 14.4$

For the same reason as for Table 3, the number of degrees of freedom is 5. The line applicable to five degrees of freedom ($DF = 5$) shows that $X^2 = 14.4$ comes between 12.8 and 15.1 .

Number of spots	1	2	3	4	5	6
Actual frequency	35	23	20	27	39	43
Expected frequency	30	30	30	30	30	30
Deviation = Actual - Expected	+5	-7	-10	-3	+9	+13
Deviation squared	25	49	100	9	81	169
Ratio = $\frac{\text{(Deviation squared)}}{\text{(Expected frequency)}}$	$\frac{25}{30}$	$\frac{49}{30}$	$\frac{100}{30}$	$\frac{9}{30}$	$\frac{81}{30}$	$\frac{169}{30}$

Table 6: (Number of throws = 180)

Thus, the probability lies between 0.025 and 0.01 . One may work out the probability corresponding to $X^2 = 14.4$ by proportion, leading to $P \approx 0.015$. However, it may be sufficient to state that the probability of the above result having come about by chance is smaller than 0.025 or 2.5%, which is a statistically significant result.

Once more it will be noted, that the two methods of probability calculations lead to different results, namely 0.0062 and 0.015 respectively. This is because, as explained earlier, different questions are being asked. The first figure is the probability of 43 six spots or more, in 180 throws. The second figure is the probability of the sum total of all the deviations from the expected frequencies. Thus, both results are statistically significant, and so the likelihood of psychokinesis being responsible is indicated.

Many tests aiming at verifying the reality of psychokinesis by means of coin tossing and die throwing have been carried out during the 20th century. In particular, Joseph and Louisa Rhine, who pioneered extrasensory perception tests by means of coins, dice and cards, also reported significant psychokinesis test results relying on coin and die throwing techniques in the 1930s, and their work has been replicated by many other investigators since.

Results were obtained by many other means, which is not surprising, since the variety of physical processes that may be subject to psychokinetic influence is nearly limitless. A few examples are: influencing balls rolling down an incline, bubbles rising in a liquid, rotation of sensitive wheels, and reliance on piezoelectric crystals which when physically deformed, or compressed, produce electrical voltage differences between points on their surfaces.

The author's own work in the late 1990s involved experimental setups built around a sensitive rotating wheel, called the "Egely Wheel", and also a piezoelectric crystal, both of which eventually yielded statistically significant results.

The Egely wheel is a very light, thin, metallic disk, having a diameter of 6.5 centimetres, with 72 cogs around its perimeter, and so pivoted that it can rotate in a horizontal plane around its centre. It is found in general, that it is much easier to psychokinetically influence the motion of an object which is already moving, than to set a stationary object into motion. Consequently, an experimental procedure was devised, whereby the wheel was set into motion by the experimenter using an impulse start mechanism, and then the task was to ascertain if, under the psychokinetic influence of a test subject, the wheel could be made to rotate longer and further before stopping, than it would otherwise

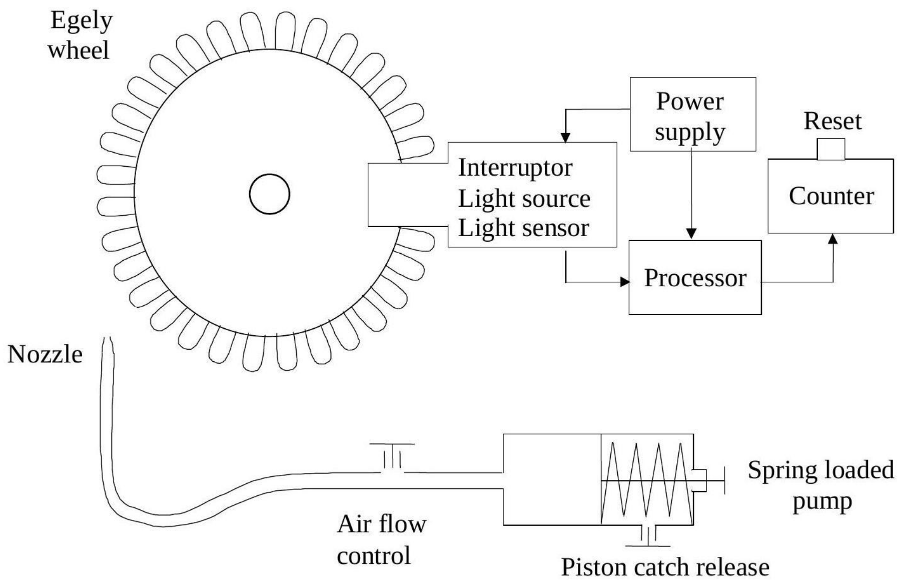

Figure 1: Egely Wheel

do by itself.

This required an impulse start mechanism, and also facilities for measuring the total wheel movement before coming to rest after having been impulse started.

4 Results

The overall experimental setup is depicted in Figure 1.

Figure 1 shows the top view of the wheel. An air pump served as the impulse start mechanism. The piston of the pump could be pushed to the right against the force exerted by a compressed spiral spring, to a position where the piston would be held by a catch mechanism. Upon releasing the catch by actuating the push button of the catch mechanism, the piston would be pushed to the left by the spring, completing its motion within a fraction of a second. The pump would thus deliver a puff of air, via a flexible hose and a nozzle, in a direction tangential to the edge of the wheel, but perpendicular to the cogs of the wheel. This would set the wheel in a rotary motion. The speed of the rotation of the wheel would be highest just after the application of the air-puff, subsequent to which the speed of the wheel would gradually diminish. The volume and the speed of the air delivered to the edge of the wheel, and so the applied impulse, could be controlled by means of an airflow control valve. This was set so that the wheel, after having been impulse started, would typically come to a stop in less than 50 seconds, after making close to one revolution. Furthermore, the shape of the nozzle, its position relative to the wheel, and the volume and speed of the air delivered, all had to be carefully adjusted so as to ensure a smooth start of the wheel, free of any wobble. This was found to be essential for achieving good results.

The cogs of the rotating wheel were arranged to pass between the jaws of an "interruptor", with its bottom and top jaws being located below and above the cogs of the wheel. A power supply activated a light source in the bottom jaw of the interruptor, which produced a light beam that was directed toward a light sensor mounted in the top jaw. Depending on the position of the wheel as it revolved, the light beam could either pass between two adjacent cogs and reach the light sensor, or alternatively, it could be blocked by an intervening cog from reaching the sensor. Whenever the light beam passing between two adjacent cogs could reach the sensor, a voltage generated by the sensor was delivered to an electronic processor, and whenever a cog between the light source and the sensor blocked light from reaching the sensor, the voltage delivered to the processor would be nearly zero.

Subsequent to the passage of each cog between the jaws of the interruptor, the light reaching the sensor caused the processor to produce a fixed magnitude, fixed duration output voltage pulse, typically 10 volts in magnitude and of 0.01 second duration. These pulses were counted by an electronic counter. The counter would need to be reset to zero, prior to each impulse start of the wheel.

Whenever the wheel came to a stop, or nearly so, it was possible for a cog to hover in a position where it only partly blocked the light from reaching the sensor. This could have resulted in sending many consecutive on and off voltage signals to the processor, each producing a pulse and a count, without the wheel actually moving by 1 cog. To prevent such false counts, the processor had to be so designed that once it had produced a pulse, and sent it to the counter, it could not produce another pulse until after the sensor voltage had fallen back to near zero, indicating that a cog has definitely passed between the light source and the light sensor.

When using the wheel in psychokinesis tests, it had to be free of any extraneous mechanical influences. As even the smallest air current could affect the wheel's motion, it was found necessary to enclose the wheel, together with the air delivery nozzle and the interruptor, into a transparent plastic box, with small holes just large enough for passing into the box the air delivery hose to the nozzle, and the electrical leads to the interruptor. Also, in order to exclude any other possible mechanical interference, the box with the wheel in it was placed on a shelf bolted to the solid brick wall of the laboratory, the wall itself resting on concrete foundations. All other parts of the experimental setup, namely the pump, the processor, and the counter were placed on an adjacent bench, at which the experimenter would be seated.

A control run involved impulse starting the wheel at exactly 1 minute intervals, with the counter having been reset to zero just before each impulse start. The counter readings were then recorded at 10 second intervals after starting, that is at 10, 20, 30, 40, and 50 seconds after the start. The counter would again be reset to zero just before the next start, which would take place 60 seconds after the previous start.

An active run would be conducted exactly the same way as a control run, except that the subject to be tested for psychokinetic ability would be seated in the laboratory, at a distance of 1 to 4 metres from the wheel, in a position enabling the subject to see the wheel, but not physically interfere with it, as confirmed by continual observation by the experimenter.

An experimental test run would consist of 2 active runs and 2 control runs. Each active run, and each control run, involved 10 impulse starts of the wheel at 1 minute intervals, and 5 counter readings at 10 second intervals, after each impulse start. Each such run would thus take 10 minutes to complete, and yield 50 counter readings. Normally, a rest period of 5 minutes would be allowed between the 2 active runs. The control runs were conducted usually 1 hour before to the subject's arrival at the laboratory, and 1 hour after the subject had left. This had been done, because experience indicated that the subject's psychokinetic influence on the wheel could not be turned off at will, in fact, such influence tended to prevail while the subject was on the premises, even though she or he consciously may have wished to terminate that influence. It was also found that the subject's influence on the wheel can operate while she or he was either under way to the laboratory before the active runs, or on the way from the laboratory after the active runs. Placing the control runs about 1 hour before, and 1 hour after, the active runs minimised this problem.

It was also observed, that the mental state of the experimenter conducting the experiment occasionally had a noticeable influence on the wheel's motion. Disturbing or worrying thoughts entering the experimenter's mind tended to cause the counter readings to rise. So, the experimenter had to learn to suppress such thoughts, and replace them with thoughts of a neutral nature, such as contemplating aspects of the furniture in the laboratory.

It was found that, through appropriate impulse control, the wheel could almost always be arranged to stop moving close to but within 50 seconds after the impulse start. Thus, the counter reading at 50 seconds normally represented the total number of cogs the wheel had moved following an impulse start. A complete test run would yield 40 such "total readings", 20 from the 2 active runs, and another 20 from the 2 control runs.

It was also surmised, that the psychokinetic agency would tend to prolong the motion, rather than speed the wheel up, and so its effect was more likely to show up toward the end of the wheel's movement, rather than shortly after the start of the motion. It was therefore decided to take "incremental readings" as well, which were the number cogs moved either between the 20 and 50 second marks, or the 10 and 50 second marks. Thus, an overall test run yielded 80 readings in all, namely: The question was then, if the 20 total active readings were significantly higher than the 20 total control readings, and also if the 20 incremental active readings were significantly higher than the 20 incremental control readings.

Thus, the task was to decide statistically, if one set of readings was significantly higher than another set of readings. In such cases, another statistical method, called the "student's t" method, is particularly useful. This involves calculating a quantity called the student's t parameter, that is denoted by the letter t. In general the larger is the calculated t value, the smaller is the probability of any difference between the two sets of readings having come about by chance, or putting it differently, the more likely it is that the two sets of readings differ owing to some underlying causative factor. Thus, in the rotating wheel tests for psychokinesis, one would expect the active readings to be significantly higher than the control readings, if the psychokinetic ability of the subject has successfully made the wheel move considerably further than it otherwise would.

The essential quantities involved in the student's t statistical calculations are:

1. The number of readings in each active run and each control run, (denoted N)
2. The mean of the readings in each active run and each control run, (denoted M)
3. The variance of the readings in each active run and each control run, (denoted S^2)

If two sets of readings were significantly different, one would expect the difference between their means to be large, and at the same time the variances of the sets to be small, so as to reduce any overlap between the sets. Also, the larger the number of readings is in the sets, the more certain one could feel that the difference between their means is not due to chance.

The necessary calculations are simpler if the number of readings in the two sets are equal, which has been deliberately arranged by making the number of active readings equal the number of control readings. In view of the foregoing, it is perhaps not surprising to find that the student's t parameter is given by:

$t =$ (mean of set 1 -mean of set 2) $\times \sqrt{\frac{(\text{ number of readings in one set })-(1)}{(\text{variance of set 1})+(\text{ variance of set 2})}}$

Here again, as in the case of the chi-square statistics, the probability corresponding to any given t value depends on the number of degrees of freedom, which in this case is given by:

Degrees of Freedom: $DF =$ (total number of readings in the two sets) - (2)

Knowing the student's t value, and the degrees of freedom DF, one may find the corresponding probability from the student's t tables.

Now let an artificial example of two sets of readings be considered as shown in Table 7.

With reference to Table 7, the student's t parameter from the above expression, and the values in Table 7, rounded to three figures, is:

$t = (5 - 4) \times \sqrt{\frac{(4-1)}{(5)+(5)}} = (1) \times \sqrt{\frac{3}{10}} = 0.548$

The number of degrees of freedom is: $DF = (4 + 4) - (2) = 6$.

Consulting the student's t tables, one finds in the line for $DF = 6$, that $t = 0.27$ corresponds to a probability of 0.4 , while $t = 0.72$ corresponds to a probability of 0.25 . The required probability for $t = 0.548$ above, lies between these two values, and could be worked out by proportion. However, it is obvious

Quantities involved	Set 1	Set 2
Actual readings	$2, 4, 6, 8$	$1, 3, 5, 7$
Number of readings	4	4
Mean of readings	$(2+4+6+8)/4 = 5$	$(1+3+5+7)/4 = 4$
Deviations from mean	$-3, -1, +1, +3$	$-3, -1, +1, +3$
Squares of deviations	$9, 1, 1, 9$	$9, 1, 1, 9$
Variance of readings	$(9+1+1+9)/4 = 5$	$(9+1+1+9)/4 = 5$

Table 7: Artificial Example

Quantities involved	Set 1	Set 2
Actual readings	$5, 6, 7, 8$	$1, 2, 3, 4$
Number of readings	4	4
Mean of readings	$(5+6+7+8)/4 = 6.5$	$(1+2+3+4)/4 = 2.5$
Deviations from mean	$-1.5, -0.5, +0.5, +1.5$	$-1.5, -0.5, +0.5, +1.5$
Squares of deviations	$2.25, 0.25, 0.25, 2.25$	$2.25, 0.25, 0.25, 2.25$
Variance of readings	$(2.25 + 025 + 0.25 + 2.25)/4$ $= 1.25$	$(2.25 + 0.25 + 0.25 + 2.25)/4$ $= 1.25$

Table 8: Second Example

by inspection, that the probability is larger than 0.25 , and so it is well above the significance level of 0.05. Consequently, the two sets of readings are sufficiently similar to have come from two tests that were not influenced by different causative factors.

Now let a second example be considered as shown in Table 8.

The student's t from the above expression, and the values in Table 8, to four figures, is:

$t = (6.5 - 2.5) \times \sqrt{\frac{(4-1)}{(1.25)+(1.25)}} = (4) \times \sqrt{\frac{3}{2.5}} = 4.382$

Here also the degrees of freedom $DF = 6$. With $DF = 6$ one finds that $t = 4.32$ corresponds to a probability of 0.0025 , while $t = 5.21$ corresponds to a probability of 0.001 . Since $t = 4.382$ is between above two t values, the probability corresponding to $t = 4.382$ lies between 0.0025 and 0.001 . The figures suggest that it is only slightly below 0.0025 . The probability is thus smaller than 0.01 , below which results are normally regarded highly significant. Consequently, there is a highly significant difference between the two sets of readings, and so they are likely to have come from experiments, the results of which were brought about by different causative factors.

In the foregoing, the application of the student's t statistical method for finding if one set of values was higher than another set of values by a statistically significant amount was illustrated by means of two artificial examples. The underlying theory is not treated in these pages, interested readers are referred to books on probability and statistics.

In 1998, subject A.D. had undertaken a rotating wheel psychokinesis test series of 10 test runs. The tests were conducted as described in the foregoing,

$M\&S^2$	= Mean and variance of 10 total readings
$\Delta M\&\Delta S^2$	= Mean and variance of 10 incremental readings
$M_{\mathrm{A}}\&S^2$ A	= Mean and variance of 20 total active readings
$M_{\mathrm{C}}\&S^2_{\mathrm{C}}$	= Mean and variance of 20 total control readings
$\Delta M_{\mathrm{A}}\&\Delta S^2_{\mathrm{A}}$	= Mean and variance of 20 incremental active readings
$\Delta M_{\mathrm{C}}\&\Delta S^2_{\mathrm{C}}$	= Mean and variance of 20 incremental control readings
$t\&P$	= student's t and probability for total readings
$\Delta t\&\Delta P$	= student's t and probability for incremental readings
$N_{\mathrm{A}}\&N_{\mathrm{C}}$	= Number of total active and total control readings
$\Delta N_{\mathrm{A}}\&\Delta N_{\mathrm{C}}$	= Number of incremental active and incremental control readings

Table 9: Symbols

with the subject seated approximately 1 metre from the wheel, on a high stool, so that she could see the wheel by looking down at it obliquely. During the active runs A.D. was kept under observation, she sat quite motionless, and any physical interference with the wheel during all test runs, be it active or control runs, was totally excluded.

The test run undertaken on 26/10/98 was the most significant, and its results are given in Table 10. The first column lists the instants at which readings were taken, namely 10, 20, 30, 40, and 50 seconds after the wheel was impulse started. The second and subsequent columns of numbers, list the number of cogs the wheel had moved during the minute designated at the top of those columns, as read from the counter at the instants listed in the first column. The readings at 50 seconds are the total readings, while the bottom figures in the columns are the number of cogs moved between the 20 and 50 second marks, and equal the differences of the counter readings at 50 and 20 seconds. These differences are termed the incremental readings. The meaning of the various symbols appearing in Table 10 are listed in Table 9.

With reference to Table 10, using the formula established in the foregoing for calculating the student's t parameter, one gets the rounded figures:

$t = (73.55 - 60.00) \times \sqrt{\frac{20-1}{26.85+16.50}} = 8.97$

$\Delta t = (8.75 - 2.85) \times \sqrt{\frac{20-1}{1.59+0.43}} = 18.09$

The corresponding degrees of freedom are: the total number of active readings plus the total number of control readings less two, that is, $DF = 20 + 20 - 2 = 38$. One needs to rely on the nearest value, $DF = 40$. However, it is found that the probabilities corresponding to the above $t, \Delta t$, and DF values are so small, that they fall outside the range. When meeting student's t values falling outside the range one can estimate the corresponding probabilities P from the normal probability curve. This is feasible because for any given probability value, and large enough number of degrees of freedom, the student's t value, approaches the normalised deviation, or Z value. For $Z = 1.96$, gives $P = 0.025$, for infinite degrees of freedom, $DF = \infty$, and $t = 1.96$, also gives $P = 0.025$. The two figures for t and Z are not equal in general, and may differ considerably when the degrees of freedom are small, or the values of t are large. The normal curve yields only approximations to the probabilities obtainable from Pascal's triangle, or the binomial theorem. Nevertheless, taking $t \approx Z$ may yield a close enough estimate for the probability P.

Subject to these approximations, the above calculated values of t and Δt yield: $t \approx Z = 8.97 \approx 9, P \approx 10^{-19}$, and $\Delta t \approx Z = 18.09 \approx 18, \Delta P \approx 10^{-72}$.

In view of these very low probability figures, and the uncertainties in deducing them, probabilities in the rest of this chapter will be presented as follows. Probabilities ascertainable from the student's t table, will be given to the nearest single figure. Probabilities not ascertainable from the student's t table will be estimated from the normal probability curve, based on the assumption that $t \approx Z$, and given either to the nearest single figure, or the nearest order of magnitude. But for $t \approx Z = 6$ or higher, the probability is $P \approx 10^{-9}$, or 1 in 1000 million, or smaller, in which case the probability will be given as $P \approx 0$ (nearly zero).

Tables 14 and 15 summarise the results of 10 test runs undertaken by A.D. in 1998. The first column in the tables lists the dates of the test runs, and the meaning of the symbols at the heads of the remaining columns have been listed in Table 9. The symbol Σ in the bottom lines of the two tables, stands for the combined result of the 10 test runs. While the overall result of the 10 test runs could be worked out the same way as the results of the individual test runs, formulae exist which enable the overall result to be deduced from the individual test run results in a less laborious way.

As seen from Table 14, the total motion results of 2 test runs (17/8 and 31/8) were not significant, those of 2 further test runs (24/8 and 28/9) were significant at a probability $P = 0.03$, while the results of the remaining 6 test runs $(7/9, 12/10, 19/10, 26/10, 9/11$, and $16/11)$ were highly significant. The combined result of the 10 total motion test runs was also highly significant with $t = 9.63, DF = 398$, and $P \approx 0$.

As was anticipated, the incremental motion results as given in Table 15 were better. Only 1 test run (17/8) was not significant, while the result of another test run (24/8) was significant at a probability $\Delta P = 0.02$. The results of the remaining 8 test runs (31/8, 7/9, 28/9, 12/10, 19/10, 26/10, 9/11 and 16/11) were highly significant, as was the combined result of the 10 incremental motion test runs at $\Delta t = 16.36, DF = 398, \Delta P \approx 0$.

When the rotating wheel test setup was being developed, prior to the first test run with subject A.D., it was noted that the experimenter's mental state occasionally appeared to cause anomalous wheel movement. It was also noted that such anomalous behaviour could be minimised, or avoided, most of the time, by the experimenter trying to maintain a calm and peaceful mental disposition.

$N_{\mathrm{A}} = 20 \quad M_{\mathrm{A}} = 73.55 \quad S_{\mathrm{A}}^2 = 26.85 \quad \Delta N_{\mathrm{A}} = 20 \quad \Delta M_{\mathrm{A}} = 8.75 \quad \Delta S_{\mathrm{A}}^2 = 1.59$

$N_{\mathrm{C}} = 20 \quad M_{\mathrm{C}} = 60.00 \quad S_{\mathrm{C}}^2 = 16.50 \quad \Delta N_{\mathrm{C}} = 20 \quad \Delta M_{\mathrm{C}} = 2.85 \quad \Delta S_{\mathrm{C}}^2 = 0.43$

$t = 8.97 \quad P \approx 0 \quad \Delta t = 18.09 \quad \Delta P \approx 0$

Sec	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	43	43	44	43	39	51	46	45	47	42	$M = 59.60$
20	56	54	57	55	51	65	59	59	61	53	$S^2 = 19.44$
30	58	57	59	58	52	69	62	62	63	56	
40	58	57	59	58	52	69	62	62	63	56	$\Delta M = 2.60$
50	58	57	59	58	52	69	62	62	63	56	$\Delta S^2 = 0.64$
$50 - 20$	2	3	2	3	1	4	3	3	2	3	

Table 10: Psychokinesis Test Run by Rotating Wheel, Subject: A.D., 26/10/98, Pre-Control Run, 1.00 p.m. to 1.10 p.m.

Mec	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	51	42	48	51	42	50	49	57	47	50	$M = 73.70$
20	68	55	64	68	57	65	65	76	61	66	$S^2 = 39.61$
30	74	59	69	74	62	71	71	82	67	72	
40	77	61	71	76	65	73	73	85	69	74	$\Delta M = 9.20$
50	79	63	71	77	66	74	74	86	70	77	$\Delta S^2 = 1.36$
$50 - 20$	11	8	7	9	9	9	9	10	9	11	

Table 11: Active Run, 2.10 p.m. to 2.20 p.m.

Sec	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	47	47	47	48	49	48	48	52	51	54	$M = 73.40$
20	60	61	63	65	66	63	64	69	69	71	$S^2 = 14.04$
30	66	67	69	70	71	68	70	75	75	77	
40	68	69	70	71	73	70	72	78	78	79	$\Delta M = 8.30$
50	69	70	70	72	73	70	74	78	79	79	$\Delta S^2 = 1.41$
$50 - 20$	9	9	7	7	7	7	10	9	10	8	

Table 12: Active Run, 2.25 p.m. to 2.35 p.m.

Sec	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	42	50	44	41	46	47	41	48	47	43	$M = 60.40$
20	54	64	56	53	58	60	52	61	59	56	$S^2 = 13.24$
30	57	67	59	56	62	63	55	64	62	59	
40	57	67	59	56	62	63	55	64	62	59	$\Delta M = 3.10$
50	57	67	59	56	62	63	55	64	62	59	$\Delta S^2 = 0.09$
$50 - 20$	3	3	3	3	4	3	3	3	3	3	

Table 13: Post-Control Run, 3.35 p.m. to 3.45 p.m.

	ACTIVE			CONTROL			PROBABILITY	
Date	$\boldsymbol{N_{\mathbf{A}}}$	$\boldsymbol{M_{\mathbf{A}}}$	$\boldsymbol{S^2_{\mathrm{A}}}$	$\boldsymbol{N_{\mathbf{C}}}$	$\boldsymbol{M_{\mathbf{C}}}$	$\boldsymbol{S^2_{\mathrm{C}}}$	$\boldsymbol{t}$	$\boldsymbol{P}$
17/8	20	61.95	73.75	20	62.45	39.05	-0.21	> 0.1
24/8	20	63.40	35.94	20	60.20	18.86	1.88	0.03
31/8	20	60.95	26.25	20	58.80	39.76	1.15	> 0.1
7/9	20	68.55	48.85	20	61.65	29.13	3.41	0.0008
28/9	20	65.25	35.39	20	62.30	9.81	1.91	0.03
12/10	20	73.80	53.96	20	60.60	32.94	6.17	≈ 0
19/10	20	65.55	44.35	20	59.80	13.86	3.29	0.001
26/10	20	73.55	26.85	20	60.00	16.50	8.97	≈ 0
9/11	20	67.90	39.39	20	60.75	23.49	3.93	0.0002
16/11	20	71.30	20.01	20	62.60	17.84	6.16	≈ 0
Σ	200	67.22	59.53	200	60.92	25.61	9.63	≈ 0

Table 14: Psychokinesis Test Runs by Rotating Wheel, 1998, Subject: A.D., 1 metre from wheel, Total motion

	ACTIVE			CONTROL			PROBABILITY	
Date	$\Delta\boldsymbol{N_{\mathbf{A}}}$	$\Delta\boldsymbol{M_{\mathbf{A}}}$	$\Delta\boldsymbol{S^2_{\mathrm{A}}}$	$\Delta\boldsymbol{N_{\mathbf{C}}}$	$\Delta\boldsymbol{M_{\mathbf{C}}}$	$\Delta\boldsymbol{S^2_{\mathrm{C}}}$	$\Delta\boldsymbol{t}$	$\Delta\boldsymbol{P}$
17/8	20	4.10	0.69	20	3.90	0.89	0.69	> 0.1
24/8	20	4.85	8.53	20	3.35	1.83	2.03	0.02
31/8	20	4.15	0.43	20	3.15	1.33	2.30	0.01
7/9	20	4.80	1.66	20	2.15	0.63	7.63	≈ 0
28/9	20	5.55	0.95	20	3.45	0.45	7.74	≈ 0
12/10	20	10.10	1.39	20	3.15	0.53	21.86	≈ 0
19/10	20	6.80	1.26	20	3.50	0.45	11.00	≈ 0
26/10	20	8.75	1.59	20	2.85	0.43	18.09	≈ 0
9/11	20	5.45	1.35	20	3.10	0.99	6.70	≈ 0
16/11	20	7.00	1.00	20	3.20	1.56	10.35	≈ 0
Σ	200	6.16	5.50	200	3.18	1.10	16.36	≈ 0

Table 15: Psychokinesis Test Runs by Rotating Wheel, 1998, Subject: A.D., 1 metre from wheel, Incremental motion

	ACTIVE			CONTROL			PROBABILITY	
Date	$N_{\mathbf{A}}$	M_{A}	S^2_{A}	$N_{\mathbf{C}}$	$M_{\mathbf{C}}$	S^2_{C}	t	P
18/8	20	61.95	18.05	20	62.05	44.25	-0.06	> 0.1
25/8	20	60.05	5.65	20	61.00	17.10	-0.87	> 0.1
1/9	20	62.30	23.11	20	60.25	16.09	1.25	0.1
8/9	20	59.50	12.85	20	61.50	17.95	-1.65	0.05
29/9	20	61.40	28.94	20	61.95	13.45	-0.37	> 0.1
13/10	20	61.85	19.13	20	61.15	39.13	0.40	> 0.1
20/10	20	60.05	18.25	20	60.30	63.91	-0.12	> 0.1
27/10	20	61.60	16.94	20	60.35	17.33	0.93	> 0.1
10/11	20	62.50	28.75	20	61.25	41.49	0.65	> 0.1
17/11	20	62.65	30.03	20	62.30	18.21	0.22	> 0.1
Σ	200	61.39	21.31	200	61.21	29.40	0.36	> 0.1

Table 16: Psychokinesis Control Runs by Rotating Wheel, 1998, No subject, Experimenter only, Total motion

	ACTIVE			CONTROL			PROBABILITY	
Date	$\Delta N_{\mathbf{A}}$	ΔM_{A}	ΔS^2_{A}	$\Delta N_{\mathbf{C}}$	$\Delta M_{\mathbf{C}}$	ΔS^2_{C}	Δt	ΔP
18/8	20	3.20	0.46	20	3.10	0.59	0.43	> 0.1
25/8	20	3.65	0.53	20	3.95	0.55	-1.26	0.1
1/9	20	4.20	0.96	20	3.40	0.74	2.67	0.006
8/9	20	3.65	1.03	20	3.70	0.51	-0.18	> 0.1
29/9	20	3.60	0.64	20	3.80	0.36	-0.87	> 0.1
13/10	20	4.15	0.33	20	3.35	0.93	2.91	0.003
20/10	20	3.80	0.46	20	3.95	0.95	-0.55	> 0.1
27/10	20	3.25	0.69	20	3.30	0.71	-0.18	> 0.1
10/11	20	3.95	0.65	20	3.20	0.56	3.04	0.002
17/11	20	3.50	0.45	20	3.60	0.54	-0.22	> 0.1
Σ	200	3.70	0.72	200	3.54	0.73	1.87	0.03

Table 17: Psychokinesis Control Runs by Rotating Wheel, 1988, No Subject, Experimenter only, Incremental motion

Nevertheless, when carrying out test runs with subjects, the possibility could not be ignored that the experimenter's own mental states could have contributed to the results obtained.

Because of this, it was decided to repeat each test run conducted with subject A.D., the next day, at the same time, and exactly the same way, as was done with A.D., but with A.D. absent and, not having been informed, consciously unaware of the repeat test run being done. The 10 "no-subject" control runs led to the results summarised in Tables 16 and 17. It will be noted that only 1 total motion test run (8/9) produced significant results, while the remaining 9 total motion test runs, and also the combined total of the 10 test runs, led to chance results. In comparison, 3 incremental motion test runs ($1/9, 13/10$, and $10/11$) yielded highly significant results, the remaining 7 incremental motion test runs led to chance results, and the combined incremental result of the 10 test runs at $\Delta t = 1.87$, $DF = 398$, and probability $\Delta P = 0.03$ or 3% was only moderately significant.

This implies that the experimenter's mind, at times, may exhibit unconscious psychokinetic activity. However, there is a very great difference in the level of significance between the results obtained with the subject A.D. present, and with A.D. absent, as indicated by comparison of Tables 9.11 and 9.12 on the one hand, with Tables 16 and 17 on the other hand. This suggests that the experimenter's contribution to the results achieved by subject A.D. was very small, if any.

The results achieved by A.D. indicate that her psychokinetic abilities are hardly disputable. The student's t values, and associated probabilities, imply that psychokinesis having taken place is very close to certainty.

In 1999, subject D.M. had undertaken two rotating wheel psychokinesis test series, each consisting of 10 test runs. The first test series was conducted the same way as described in the foregoing, and implemented with subject A.D. in 1998. Subject D.M. was seated 1 metre from the wheel, and was able to view the wheel by looking obliquely down at it.

The second test series differed from the first in one important respect, the difference being that D.M. was seated at a distance of 4 metres from the wheel. During the first test run of the second series, subject D.M. could not see the wheel itself, but was able to monitor the wheel's motion by being able to observe the counter displaying the number of cogs moved by the wheel at any given point in time. Subject D.M. found this frustrating, and felt that seeing the wheel was essential for her. So, for the remaining 9 test runs in the second series, a mirror was fixed above the wheel at an angle of 45 degrees, so that D.M. seated 4 metres away could observe the wheel, and its motion, in the mirror. This arrangement was found to be acceptable to D.M.

Also, there was another difference between the tests undertaken by A.D. and D.M., as in the case of D.M. the incremental motion was taken from 10 to 50 seconds after each impulse start, and not from 20 to 50 seconds as was the case with A.D. This change was made so as to explore if it had a substantial effect on the incremental motion test results.

The most highly significant test run in the first series was the last run on

26/4/99. The results of this test run are given in Table 18. The meaning of the various symbols in Table 18 is as listed in Table 9, and the layouts of Table 18 and Table 10 are the same, so that columns and rows fulfil the same role in both. With reference to Table 18, the formula for calculating the student's t parameter, when applied to the values in Table 18, yields the following rounded figures:

$t = (70.95 - 61.70) \times \sqrt{\frac{20-1}{12.85+15.01}} = 7.64$

$\Delta t = (21.90 - 16.70) \times \sqrt{\frac{20-1}{2.09+1.81}} = 11.48$

The relevant degrees of freedom equal the total number of active readings plus the total number of control readings less two, that is, $DF = 20+20-2 = 38$. One needs to rely on the nearest listed value, namely $DF = 40$. One finds that for the above values of t, Δt, and DF, the corresponding probability figures fall outside the listed range of values. In view of the previous discussion on this matter, the associated probabilities were estimated from the normal probability curve, Table A6.4, assuming that $t \approx Z$, which leads to: $t \approx Z = 7.64, P \approx 10^{-14} \approx 0$, and $\Delta t \approx Z = 11.48, \Delta P \approx 10^{-28} \approx 0$.

Tables 22 to 25 summarise the results achieved by D.M. in the two test series undertaken by her. The first column in each table lists the dates of the various test runs, while the meanings of the symbols at the heads of the remaining columns are as listed in Table 9.

Tables 19 and 23 give the total motion and incremental motion results respectively, of the 10 test runs, obtained by D.M. when seated 1 metre from the wheel. Inspection of these tables shows that except 3 total motion test runs $(8/2, 15/2$, and $22/2)$, all other total and incremental motion test runs yielded highly significant results. The combined result of the 10 test runs was also highly significant, for both the total motion and the incremental motion case, with $t = 8.58, DF = 398, P \approx 0$, and $\Delta t = 15.28, DF = 398, \Delta P \approx 0$.

Tables 21 and 25 give the total motion and incremental motion results of D.M., when seated 4 metres from the wheel. In this test series only 3 total motion test runs $(24/5, 1/7$, and $13/7)$ yielded highly significant results, 1 test run $(10/8)$ was significant at a probability $P = 0.05$, and the remaining 6 test runs $(19/4, 10/5, 31/5, 8/6, 6/7$, and $20/7)$ yielded chance results. However, the combined total motion result of the 10 test runs was still highly significant at $t = 3.30, DF = 398, P = 0.0005$. The incremental results were considerably better, 5 test runs $(24/5, 8/6, 1/7, 13/7$, and $10/8)$ yielded highly significant results, 2 test runs $(6/7$ and $20/7)$ were significant, and only 3 test runs $(19/4, 10/5$, and $31/5)$ led to chance results. The combined incremental motion result of the 10 test runs was also highly significant with $\Delta t = 9.98, DF = 398, \Delta P \approx 0$.

It may be well worthwhile to compare all the foregoing rotating wheel psychokinesis test series results, as listed in Table 9.20.

It is noted that with A.D. and D.M. seated 1 metre from the wheel, both results are very good, with A.D. ahead of D.M. by a small margin. The results achieved by D.M. at a distance of 1 metre are considerably better than the results obtained by D.M. at a distance of 4 metres. This, however, may or may

Sec	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	48	42	44	46	45	46	42	46	42	42	$M = 61.3$
20	62	55	57	60	59	60	55	60	55	55	$S^2 = 6.81$
30	65	57	60	63	63	63	58	64	59	59	
40	65	58	60	64	63	63	58	64	59	59	$\Delta M = 17.0$
50	65	58	60	64	63	63	58	64	59	59	$\Delta S^2 = 0.60$
$50 - 10$	17	16	16	18	18	17	16	18	17	17	

Table 18: Psychokinesis Test Run by Rotating Wheel, Subject: D.M., 26/4/99, Pre-Control Run, 8.00 p.m. to 8.10 p.m.

Sec	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	46	47	54	48	51	46	51	52	45	50	$M = 70.6$
20	59	60	71	63	67	61	68	69	61	65	$S^2 = 18.64$
30	64	66	77	68	72	66	73	74	66	70	
40	64	67	78	69	73	67	74	76	67	71	$\Delta M = 21.6$
50	64	67	78	69	73	67	74	76	67	71	$\Delta S^2 = 3.04$
$50 - 10$	18	20	24	21	22	21	23	24	22	21	

Table 19: Active Run, 9.10 p.m. to 9.20 p.m.

not be a distance related effect, as at times good results were obtained, with subjects separated from the wheel by several intervening rooms.

$$\begin{array}{llllll}
N_{\mathrm{A}} = 20 & M_{\mathrm{A}} = 70.95 & S_{\mathrm{A}}^2 = 12.85 & \Delta N_{\mathrm{A}} = 20 & \Delta M_{\mathrm{A}} = 21.90 & \Delta S_{\mathrm{A}}^2 = 2.09 \\
N_{\mathrm{C}} = 20 & M_{\mathrm{C}} = 61.70 & S_{\mathrm{C}}^2 = 15.01 & \Delta N_{\mathrm{C}} = 20 & \Delta M_{\mathrm{C}} = 16.70 & \Delta S_{\mathrm{C}}^2 = 1.81 \\
 & t = 7.64 & P \approx 0 & & \Delta t = 11.48 & \Delta P \approx 0
\end{array}$$

Further, at times high readings were obtained when a subject was on way to, or from, the laboratory at a distance of several kilometres. The better performance at 1 metre could perhaps be due to the subject feeling that a direct view of the wheel was essential to her.

The results obtained from experimenter G.K., in the absence of any subject, are attributable to chance for the total motion, and are barely significant for

Sec	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	47	52	47	51	49	48	50	48	48	51	$M = 71.3$
20	62	69	62	67	64	63	67	64	63	68	$S^2 = 6.81$
30	67	74	67	73	69	68	72	69	68	73	
40	68	76	68	74	71	69	73	70	69	74	$\Delta M = 22.2$
50	68	76	69	74	71	69	73	70	69	74	$\Delta S^2 = 0.96$
$50 - 10$	21	24	22	23	22	21	23	22	21	23	

Table 20: Active Run, 9.25 p.m. to 9.35 p.m.

Min	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
10	40	45	44	43	49	50	49	42	47	48	$M = 62.1$
20	51	57	56	55	64	65	61	54	60	62	$S^2 = 22.89$
30	54	61	59	58	68	69	65	57	64	66	
40	54	61	59	58	68	69	65	57	64	66	$\Delta M = 16.4$
50	54	61	59	58	68	69	65	57	64	66	$\Delta S^2 = 2.84$
$50 - 10$	14	16	15	15	19	19	16	15	17	18	

Table 21: Post-Control Run, 10.35 p.m. to 10.45 p.m.

	ACTIVE			CONTROL			PROBABILITY	
Date	$\boldsymbol{N}_{\mathbf{A}}$	$\boldsymbol{M}_{\mathbf{A}}$	$\boldsymbol{S}^2_{\mathrm{A}}$	$\boldsymbol{N}_{\mathbf{C}}$	$\boldsymbol{M}_{\mathbf{C}}$	$\boldsymbol{S}^2_{\mathrm{C}}$	$\boldsymbol{t}$	$\boldsymbol{P}$
25/1	20	66.10	10.79	20	62.05	20.85	3.14	0.002
1/2	20	65.80	22.06	20	62.35	12.43	2.56	0.008
8/2	20	62.35	13.13	20	61.40	16.04	0.77	> 0.1
15/2	20	63.35	17.03	20	61.55	6.15	1.63	0.06
22/2	20	61.50	9.75	20	61.25	6.99	0.27	> 0.1
1/3	20	64.35	11.83	20	61.45	8.85	2.78	0.004
8/3	20	66.45	23.65	20	62.00	10.70	3.31	0.001
29/3	20	65.30	15.21	20	61.95	20.15	2.46	0.01
12/4	20	68.15	22.43	20	61.95	14.85	4.43	0.00003
26/4	20	70.95	12.85	20	61.70	15.01	7.64	≈ 0
$\boldsymbol{\Sigma}$	200	65.43	22.87	200	61.77	13.31	8.58	≈ 0

Table 22: Psychokinesis Test Runs by Rotating Wheel, 1999 Subject: D.M., 1 metre from wheel, Total motion

	ACTIVE			CONTROL			PROBABILITY	
Date	$\Delta\boldsymbol{N}_{\mathbf{A}}$	$\Delta\boldsymbol{M}_{\mathrm{A}}$	$\Delta\boldsymbol{S}^2_{\mathrm{A}}$	$\Delta\boldsymbol{N}_{\mathbf{C}}$	$\Delta\boldsymbol{M}_{\mathbf{C}}$	$\Delta\boldsymbol{S}^2_{\mathrm{C}}$	$\Delta\boldsymbol{t}$	$\Delta\boldsymbol{P}$
25/1	20	17.30	1.31	20	15.25	3.19	4.21	0.00005
1/2	20	18.60	3.54	20	15.90	1.79	5.10	$\approx 10^{-7}$
8/2	20	17.05	1.35	20	15.45	2.45	3.58	0.0005
15/2	20	18.15	2.13	20	16.10	0.79	5.23	$\approx 10^{-6}$
22/2	20	17.55	1.35	20	16.40	0.84	3.39	0.0008
1/3	20	19.10	2.09	20	16.05	1.05	7.50	≈ 0
8/3	20	19.20	2.86	20	16.25	1.99	5.84	$\approx 10^{-8}$
29/3	20	20.15	2.73	20	17.05	2.05	6.18	≈ 0
12/4	20	21.20	3.36	20	16.70	2.41	8.17	≈ 0
26/4	20	21.90	2.09	20	16.70	1.81	11.48	≈ 0
Σ	200	19.02	4.71	200	16.19	2.12	15.28	≈ 0

Table 23: Psychokinesis Test Runs by Rotating Wheel, 1999, Subject: D.M., 1 metre from wheel, Incremental motion

	ACTIVE			CONTROL			PROBABILITY	
Date	$\boldsymbol{N}_{\mathbf{A}}$	$\boldsymbol{M}_{\mathrm{A}}$	$\boldsymbol{S}^2_{\mathrm{A}}$	$\boldsymbol{N}_{\mathbf{C}}$	$\boldsymbol{M}_{\mathbf{C}}$	$\boldsymbol{S}^2_{\mathrm{C}}$	$\boldsymbol{t}$	$\boldsymbol{P}$
19/4	20	59.7	8.01	20	61.15	12.23	-1.40	0.1
10/5	20	61.10	18.29	20	60.70	15.21	0.30	> 0.1
24/5	20	63.90	10.59	20	61.00	15.60	2.47	0.009
31/5	20	60.95	27.75	20	62.15	18.13	-0.77	> 0.1
8/6	20	62.85	22.93	20	60.75	22.19	1.36	0.1
1/7	20	65.95	20.35	20	61.35	14.03	3.42	0.0008
6/7	20	59.90	26.59	20	60.65	20.83	-0.47	> 0.1
13/7	20	66.15	27.73	20	61.30	12.91	3.32	0.001
20/7	20	62.40	20.64	20	61.05	16.55	0.96	> 0.1
10/8	20	64.00	25.30	20	61.55	16.45	1.65	0.05
Σ	200	62.69	25.63	200	61.17	16.60	3.30	0.0005

Table 24: Psychokinesis Test Runs by Rotating Wheel, 1999, Subject: D.M., 4 metres from wheel, Total motion

	ACTIVE			CONTROL			PROBABILITY	
Date	$\Delta\boldsymbol{N}_{\mathrm{A}}$	$\Delta\boldsymbol{M}_{\mathbf{A}}$	$\Delta\boldsymbol{S}^2_{\mathrm{A}}$	$\Delta N_{\mathbf{C}}$	$\Delta\boldsymbol{M}_{\mathbf{C}}$	$\Delta\boldsymbol{S}^2_{\mathrm{C}}$	$\Delta\boldsymbol{t}$	$\Delta\boldsymbol{P}$
19/4	20	16.10	1.39	20	16.25	1.39	-0.39	> 0.1
10/5	20	16.35	2.33	20	15.90	1.29	1.03	> 0.1
24/5	20	19.60	1.94	20	16.50	1.85	6.94	≈ 0
31/5	20	17.35	3.83	20	16.50	2.35	1.49	0.07
8/6	20	18.95	3.15	20	16.60	2.54	4.29	0.00004
1/7	20	19.55	3.65	20	15.50	1.35	7.89	≈ 0
6/7	20	17.65	4.63	20	16.50	2.35	1.90	0.03
13/7	20	19.90	4.29	20	16.20	1.76	6.56	≈ 0
20/7	20	17.10	3.79	20	15.95	1.55	2.17	0.02
10/8	20	18.65	3.93	20	16.60	1.74	3.75	0.0003
Σ	200	18.12	5.04	200	16.25	1.94	9.98	≈ 0

Table 25: Psychokinesis Test Runs by Rotating Wheel, 1999, Subject: D.M., 4 metres from wheel, Incremental motion

Test Run	$\boldsymbol{DF}$	$\boldsymbol{t}$	$\boldsymbol{P}$	$\boldsymbol{\Delta t}$	$\boldsymbol{\Delta P}$
A.D. 1 metre from wheel	398	9.63	≈ 0	16.36	≈ 0
D.M. 1 metre from wheel	398	8.58	≈ 0	15.28	≈ 0
D.M. 4 metres from wheel	398	3.30	0.0005	9.98	≈ 0
Experimenter G.K. only	398	0.36	> 0.1	1.87	0.03

Table 26: Experimental Summary

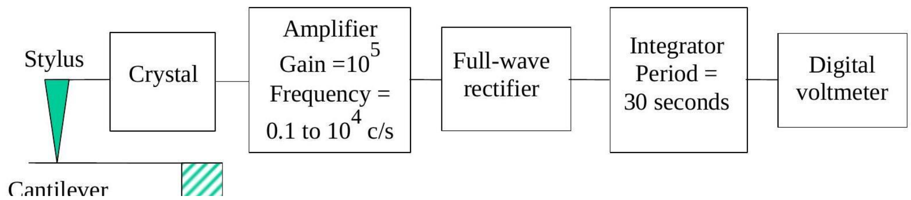

Figure 2: Sensor consisting of a piezoelectric crystal, primarily designed to serve as a pickup for a record player

the incremental motion. These results with only G.K. present, are very valuable in confirming that the highly significant results obtained by subjects A.D. and D.M. were indeed achieved by the subjects, and are not attributable to some overlooked extraneous factors.

A number of unsuccessful attempts were made during the 1980s to obtain significant psychokinesis test results, that involved subjects aiming to influence a piezoelectric crystal psychokinetically. The apparatus used in these tests was redesigned in the late 1990s, mainly by including integration into the setup, that led to good results in the year 2000.

The experimental setup is depicted in Figure 2. The sensor consisted of a piezoelectric crystal, primarily designed to serve as a pickup for a record player. A stylus, originally serving to transfer vibrations from a rotating phonographic disk to the crystal, was arranged to be in light contact with the free end of a thin, highly flexible metallic cantilever strip, which was mechanically fixed at its other end. Any slight mechanical interference with the cantilever would thus be transferred to the crystal via the stylus. The crystal in turn would produce a minute voltage between its output terminals.

This voltage was then amplified by means of an electronic amplifier, having a gain close to $100,000 = 10^5$, and a frequency ranging from 0.1 to $10,000 = 10^4$ cycles per second (c/s). This meant that a voltage produced by the crystal at any instant of time would cause a voltage to appear at the amplifier output terminals, which was 100,000 times as large as the voltage produced by the crystal. However, this would only work for voltages alternating between positive and negative values a number of times per second within the above frequency range, extending from 0.1 to 10,000 cycles per second. Moving outside this frequency range at either end would cause the amplifier output voltage to fall gradually to zero. The amplifier was powered from a direct voltage source, in the form of a battery consisting of four 1.5 volt dry cells. The output voltage from the amplifier served as input voltage to a "full-wave rectifier", which is an electronic circuit that changes negative voltages to positive voltages of the same magnitude, while leaving positive voltages unchanged. Thus the output voltage of the rectifier was a voltage varying with time, but which could have positive values only.

With the help of suitable electronic circuitry, one could measure the rectifier output voltage at short time intervals, and for each time interval obtain a rectangular area with a base equal to the length of the time interval, and a height equal to the corresponding rectifier output voltage. If the time intervals were short enough, so that the rectifier output voltage could change very little within any one time interval, then the sum of all such areas over a given time period would be designated the "voltage-time area", or the "integral", of the rectifier output voltage over that time period. Furthermore, the average rectifier output voltage over that period would equal the above integral divided by the length of the time period.

An electronic integrator circuit carries out the above summation process automatically, and also precisely, since it works on the principle that the time intervals are infinitesimally short and correspondingly many. The integrator in Figure 2 was designed to produce a short audible beep every 30 seconds, and following the onset of each beep, to produce a steady output voltage, that equalled the integral of the rectifier output voltage over the previous 30 second integration period preceding the onset of the beep. So, the integrator output voltage, as displayed on the voltmeter in Figure 2 between any two beeps, equalled the integral of the rectifier output voltage between the former two beeps. Consecutive integrator output voltages were thus measures of the very small voltages produced by the crystal due to either mechanical interference with the crystal, or due to internally generated noise voltages within the crystal and associated electronic circuitry. In view of the above, the integrator output voltage displayed on the digital voltmeter was updated at the onset of each beep.

The experimental setup was found to be very sensitive to extraneous influences, in particular any magnetic fields originating from electrical appliances and associated electrical wiring. Consequently, it was necessary to place the crystal and the amplifier in a totally enclosed and earthed metallic box, which in turn was placed inside a shielded cage. The amplifier output voltage was then conveyed from inside the box and the cage by a shielded cable to the rectifier, the integrator, and the voltmeter situated in the laboratory, which was separated from the room accommodating the cage by a 10 centimetre thick brick wall.

Experimental test runs were conducted the same way as was the case with the rotating wheel psychokinesis tests. A test run consisted of 1 pre-control run, 2 active runs, and 1 postcontrol run, each such run involving 20 consecutive integrator readings at 30 second intervals, over a 10 minute period. The 2 active runs had a few minutes break between them. During the active runs, the subject was seated in the laboratory in an armchair facing the brick wall, with the cage and the box containing the crystal and the amplifier beyond that wall, and attempted to mentally influence the setup so as to increase the readings. The experimenter also seated in the laboratory, recorded the integrator output readings from the voltmeter, and was thus in a position to keep the subject under observation.

The pre-control run was conducted approximately 1 hour before the subject's arrival, and the post-control run about 1 hour after the subject's departure. As with the rotating wheel tests, this was found to be a good compromise, in view of the fact that the readings could be affected once the subject was on the premises, or on the way to, or from, the laboratory.

Subject A.D. had undertaken 10 crystal psychokinesis test runs, as described above, the results of which are summarised in Table 9.21. As before, the first column lists the dates of the test runs, and the symbols at the heads of the remaining columns have meanings as listed in Table 9.9. The symbol Σ indicates the combined result of the 10 test runs.

As an example, one of the experimental test runs was conducted on 3/5/2000. For this test run, from Table 27, the average of the 40 active integrator output voltage readings was: $M_\mathrm{A} = 5.40969$ volts, with a variance $S^2{}_\mathrm{A} = 0.00020$, while the average of the 40 control integrator output voltage readings was: $M_\mathrm{C} = 5.39972$ volts, with variance $S^2{}_\mathrm{C} = 0.00024$. The amplifier gain was not exactly 10^5, but was so set as to yield integrator output voltages of the order of 5 volts, about half way within the integrator working voltage range.

As in previous tests, here too it was arranged that: $N_\mathrm{A} = N_\mathrm{C} = N$, but with $N = 40$.

Hence the corresponding rounded student's t parameter is:

$$t = (M_\mathrm{A} - M_\mathrm{C}) \times \sqrt{\frac{N-1}{S_\mathrm{A}^2+S_\mathrm{C}^2}} = (5.40969 - 5.39972) \times \sqrt{\frac{40-1}{0.00020+0.00024}} = 2.97$$

The associated degrees of freedom are 40 active readings plus 40 control readings less 2, that is, $DF = 40+40-2 = 78$. However, $DF = 40$ and $t = 2.97$ correspond to a probability $P = 0.0025$, and so the probability corresponding to $DF = 78$ and $t = 2.97$ must be smaller than 0.0025 . Thus, the above is a highly significant result. It will be noted that the above calculations involve 5 decimal places. This had been done to secure sufficient non-zero figures for all variances. Consulting Table 27, it is seen that 3 test runs (16/2, 8/3 and 10/5) with probabilities $P > 0.05$ were not statistically significant, 1 test run (22/3) with probability $P = 0.04$ was significant, while the remaining 6 test runs (9/2, 1/3, 15/3, 12/4, 3/5, and 23/5) with probabilities $P < 0.01$ were highly significant. Of these, 2 test runs (9/2 and 12/4) yielded probabilities $P < 10^{-6}$, that is smaller than 1 in 1,000,000 or less than one in a million. The overall result of the 10 test runs was also highly significant with a probability $P < 10^{-6}$, namely smaller than 1 in 1,000,000 or one in a million.

Each experimental run listed in Table 27 was repeated the following day, at the same time, exactly the same way, the only difference being that A.D. was absent, and not having been informed, was consciously unaware of the proceedings. The results of this control test series are presented in Table 28. It is seen that only 1 test run (17/2) was significant, with probability $P = 0.03$, another test run (10/2) narrowly missed being significant at $P = 0.06$, while the remaining 8 test runs with probabilities $P > 0.1$ must all be regarded as having yielded chance results. The overall result of the 10 control test runs, at a probability $P = 0.32$, was also a chance result.

The results of the control test series in Table 28 thus help to confirm that the results obtained by A.D., as listed in Table 27, were not the outcome of some overlooked normal causative factors, but that they were in all probability the outcome of purely mental activity, that is psychokinetic activity, on the part

	ACTIVE			CONTROL			PROBABILITY	
Date	$\boldsymbol{N_{\mathbf{A}}}$	$\boldsymbol{M_{\mathbf{A}}}$	$\boldsymbol{S^2_{\mathrm{A}}}$	$\boldsymbol{N_{\mathbf{C}}}$	$\boldsymbol{M_{\mathbf{C}}}$	$\boldsymbol{S^2_{\mathrm{C}}}$	$\boldsymbol{t}$	$\boldsymbol{P}$
9/2	40	5.42926	0.00207	40	5.35119	0.00265	7.10	≈ 0
16/2	40	5.34581	0.00099	40	5.33533	0.00159	1.29	≈ 0.1
1/3	40	5.37414	0.00191	40	5.35022	0.00104	2.75	0.004
8/3	40	5.41650	0.01318	40	5.39314	0.00237	1.17	> 0.1
15/3	40	5.36826	0.00047	40	5.34138	0.00113	4.20	$\approx 10^{-5}$
22/3	40	5.35217	0.00240	40	5.33774	0.00011	1.80	0.04
12/4	40	5.40612	0.00101	40	5.37279	0.00071	5.02	$< 10^{-6}$
3/5	40	5.40969	0.00020	40	5.39972	0.00024	2.97	0.002
10/5	40	5.30105	0.01611	40	5.31014	0.01742	-0.31	> 0.1
23/5	40	5.36645	0.00053	40	5.34586	0.00111	3.18	0.001
Σ	400	5.37695	0.00526	400	5.35375	0.00351	4.94	$< 10^{-6}$

Table 27: Crystal Psychokinesis Test Runs, Subject: A.D., 2000

of subject A.D.

This conclusion is further strengthened by the fact that both A.D. and D.M. have achieved highly significant results, suggestive of psychokinesis, also by a very different procedure, namely the previously described rotating wheel test.

The psychokinesis test results achieved by the subjects A.D. and D.M., as presented in the foregoing, are the best results, but not the only significant results obtained by the author. A number of other subjects have undertaken the rotating wheel test. Unfortunately, most of these subjects volunteered for one test run only, even though in some cases the results suggested an extension to a test series worthwhile. The results of three subjects, who achieved statistically significant results, are given in Table 29. All three were single test runs with 20 active readings, 20 control readings, and 38 degrees of freedom.

It was stated earlier, that the rotating wheel setup was so adjusted that the wheel would usually come to rest within 50 seconds, after having been impulse started. While this was almost always the case, in a few exceptional instances, subject A.D., and also some others, were able to keep the wheel moving, following an impulse start, for 3 minutes or longer. However, as such prolonged wheel motions occurred rarely and unexpectedly, they did not lend themselves to statistical evaluation. Nevertheless, such prolonged wheel movements are also highly suggestive of psychokinesis taking place.

It may also be informative to compare the rotating wheel psychokinesis test results achieved by subjects A.D. and D.M., with the precognition test results obtained by the same two subjects as presented in Chapter 8.

It will be noted that the rotating wheel psychokinetic test results are considerably better than the precognition test results, as indicated by much lower probability figures. The tests conducted with subjects A.D. and D.M., and a number of other subjects, indicate that, in general, obtaining significant psychokinesis results by means of the rotating wheel test is easier, than obtaining significant extrasensory perception results. In fact, there are subjects who can

	ACTIVE			CONTROL			PROBABILITY	
Date	$N_{\mathbf{A}}$	$M_{\mathbf{A}}$	S^2_{A}	$N_{\mathbf{C}}$	$M_{\mathbf{C}}$	S^2_{C}	t	P
10/2	40	5.36141	0.00068	40	5.35102	0.00103	1.57	0.06
17/2	40	5.37455	0.00025	40	5.38179	0.00033	-1.88	0.03
2/3	40	5.38276	0.00567	40	5.37941	0.00405	0.21	> 0.1
9/3	40	5.40111	0.01298	40	5.37067	0.01558	1.12	> 0.1
16/3	40	5.37233	0.00044	40	5.36986	0.00137	0.36	> 0.1
23/3	40	5.36362	0.00147	40	5.37631	0.00206	-1.33	0.1
13/4	40	5.32252	0.00305	40	5.32866	0.00311	-0.49	> 0.1
4/5	40	5.34800	0.00018	40	5.34946	0.00022	-0.46	> 0.1
11/5	40	5.34214	0.00734	40	5.34254	0.00862	-0.02	> 0.1
24/5	40	5.35418	0.00022	40	5.35264	0.00018	0.48	> 0.1
Σ	400	5.36226	0.00367	400	5.36024	0.00394	0.46	0.32

Table 28: Crystal Psychokinesis Control Runs, No Subject-Experimenter only, 2000

Subject	Total t	Incremental Δt	Total P	Incrementa ΔP
C.M.	2.52	5.36	≈ 0.01	$\approx 10^{-5}$
I.G.	1.2	2.74	≈ 0.1	≈ 0.005
V.D.	0.23	2.53	≈ 0.4	≈ 0.01

Table 29: Single test runs with 20 active readings, 20 control readings, and 38 degrees of freedom

achieve moderately significant results in rotating wheel psychokinesis tests, and yet are unable to reach significance, at the $P = 0.05$ probability level, in extrasensory perception tests. This does not seem to apply to piezoelectric crystal psychokinesis tests. The results achieved by A.D. in extrasensory perception tests, and crystal psychokinesis tests, yielded approximately the same level of significance.

Whether the psychokinesis test procedure involved the rotating wheel, or the piezoelectric crystal, one would expect higher variances during active runs than during control runs. Inspection of the overall results in Tables 14, 15, 19, 20, 21, 25, and 27 shows this to be the case. However, inspection of Table 28, containing piezoelectric crystal test results obtained in the absence of a test subject, indicates very large fluctuations in variance, ranging from 0.0018 to 0.01558 , differing by a factor of $0.01558/0.00018 \approx 86$. This indicates that the crystal test is subject to highly variable extraneous influences. Such influences may be due to magnetic storms interfering with the earth's magnetic field, or perhaps cosmic ray showers reaching the earth from outer space. Such fluctuations may lead to lower significance levels in test results than what would otherwise be obtained, but do not invalidate the results actually obtained.

The above described laboratory tests for psychokinesis were designed for detecting minute psychokinetic effects. In some real life situations, involving psychics who may be described as physical mediums, or in the case of claimed haunted locations and poltergeist outbreaks, psychokinetic effects may take place on a massive scale. Such macro-psychokinetic effects are also considered to originate from the unconscious minds of agents, who are not consciously aware of their involvement. However, such macro-manifestations do not easily lend themselves to scientific investigations, and are readily dismissed as the products of fertile imaginations.

Also, in view of the above test results, cases of outstanding performance in such activities as ball games and sports shooting may to some extent involve the unconscious psychokinetic guidance of balls and bullets, while such are in motion.

As for the nature of the modus operandi, measurable physical force fields, such as electric and magnetic fields, have not been found to play a role in psychokinesis. In fact, test procedures are normally designed to exclude the possibility of the involvement of such fields. However, in the known physical universe, both energy and information are often transmitted by means of waves, such as sound waves in air, or electromagnetic waves in electric and magnetic fields. Analogously, in psychokinesis the involvement of as yet unknown hypothetical fields, at times referred to as "psi" fields, is often suspected. The interaction between such fields and matter, if such fields exist, may occur at, or possibly below, the subatomic level.

5 Conclusion

In conclusion, the paper "Exploring the Boundaries of Behavioral Robotics: Understanding the Limitations of Psychokinesis" has delved into the intriguing realm of psychokinesis and its potential implications for artificial intelligence (AI) and robotics. Our examination of this enigmatic concept, inspired by our previous work in the paranormal field, has prompted thought-provoking discussions on the limits of human abilities and their emulation in machines.

The notion of psychokinesis challenges conventional scientific explanations, yet we propose that statistical verification methods can be applied to explore its potential existence. Through coin tossing and dice throwing experiments, we have demonstrated the feasibility of statistically significant outcomes that suggest psychokinetic influence beyond conventional human capacities.

While our investigation focuses on the specific phenomenon of psychokinesis, its implications transcend this particular realm. The quest to understand the limitations of robotics and AI in replicating human abilities is of paramount importance. It calls for an interdisciplinary approach that encompasses psychology, neuroscience, ethics, and AI research.

We extend an invitation to researchers, scientists, and enthusiasts to contribute their expertise to this topic, aiming to broaden our collective understanding of behavioral robotics and the boundaries of artificial intelligence. By fostering open dialogue and collaboration, we hope to bridge the gap between the extraordinary and the known, sparking innovative ideas and research directions.

Our journey into the paranormal has not only challenged preconceived notions but also emphasized the need to approach the unknown with curiosity and intellectual rigor. As we navigate the uncharted territories of science, it is imperative to remain open to possibilities, encouraging the exploration of unconventional phenomena with a critical and unbiased lens.

In embracing this spirit of inquiry, we aspire to unlock new avenues of research, pushing the boundaries of behavioral robotics and AI to unprecedented heights. By understanding the limitations of our creations, we can shape a future where artificial intelligence coexists harmoniously with humanity, complementing and enriching our understanding of the world.

As we embark on this collective journey of discovery, we remain committed to fostering a community of scholars dedicated to unveiling the mysteries that lie at the crossroads of science and the human mind. Through collaborative efforts and interdisciplinary exploration, we aspire to unravel the intricacies of human cognition and pave the way for a future where behavioral robotics stands as a testament to the boundless potential of both the human intellect and artificial intelligence.

With this paper, we extend our gratitude to all contributors, reviewers, and readers who have joined us on this thought-provoking odyssey. May our collective efforts lead us to new horizons in behavioral robotics and AI, forging a brighter and more informed future for humanity and its creations.

"Exploring the Boundaries of Behavioral Robotics: Understanding the Limitations of Psychokinesis" is an invitation to embark on a transformative journey of inquiry, discovery, and collaboration—an exploration of the extraordinary that challenges us to redefine the possible.

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