Research Article

DOI: http://dx.doi.org/10.53043/2347-3894.acam12004

Use of a Torsion Pendulum to Study Aspects of Psychokinesis, Inertia, and Momentum

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Asian Journal of Complementary and Alternative Medicine. Volume 12 Issue 02

Published on: 25/07/2024

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Cite this article as: Hansen JN. *Use of a Torsion Pendulum to Study Aspects of Psychokinesis, Inertia, and Momentum.* Asian Journal of Complementary and Alternative Medicine, Vol 12(1), 20-44:2024.

ABSTRACT

These experiments are a continuation of studies begun 20 years ago. They were inspired by a philosophical journey undertaken 30 years ago. Many novel conjectures emerged during this journey, some of which seemed suitable as hypotheses that could be subjected to experimental tests. One of them was that thoughts exert physical forces. Torsion pendulums are exquisitely sensitive to physical forces, serving both to detect and quantify them. A pendulum consisting of a steel mesh hemisphere suspended by a short nylon fiber was used to detect and measure forces surrounding the crania of subjects. Subject effects on the pendulum were observed using a camera that documented the motions of the pendulum, which could be subjected to analysis and interpretation. Hundreds of experiments were performed on dozens of subjects, none having known unusual characteristics; so were normal subjects. These subjects affected the pendulum in characteristic ways. Among them were pendulum oscillations that departed significantly from the natural center of oscillation of the pendulum. Another was many new frequencies of oscillation in addition to the natural frequency of the pendulum. Unexpectedly, these effects persisted, in diminished form, for as long as 15-30 min after departing from the pendulum.

More recently, subjects of a more exotic nature were recruited. One had practiced a specific form of meditation for 40 years. Results showed differences from normal subjects, especially in that the pendulum responded differently when the subject meditated compared to when not meditating. The displacements from the natural center of oscillation, the number and strength of oscillation frequencies, and the persistence of effects after departure were all different between the meditation experiment and the non-meditation experiment.

A more exotic subject was one who had participated in many studies of psychokinesis. A dozen experiments over 3 days were conducted with this subject. As with the meditation subject, deviations from normal subjects were substantial; some being even greater than the meditation subject. These differences were more in quantity than in kind. It was then that the usual method of analyzing the data was changed in favor of another, which was to slowly and carefully go through the data just a few seconds at a time. What was found was astonishing, and seemingly unexplainable by known scientific principles.

Explanations were sought among the conjectures encountered in the philosophical journey. One was that translocation resembles a chemical reaction. F = ma was reformulated to include terms for inertia and momentum. The conjecture that translocation could be catalyzed was explored, so that translocation could proceed in the absence of inertia and momentum.

These conjectures led to the idea that the forces exerted by thoughts can catalyze translocations among brain components to initiate a cascade of events that result in muscle contractions and consequent body movements. This implies that we employ psychokinesis to initiate and carry out the movements that enable us to survive within our environment. This capability was achieved by the processes of biological evolution and natural selection, which can exploit any principle of nature; including those that we have no knowledge of nor understanding.

Keywords: Translocation as a chemical reaction; Catalysis of translocation; Translocation without inertia and momentum; Psychokinesis drives body movements; Thoughts exert forces

INTRODUCTION

These pendulum experiments, which began 20 years ago, involved many subjects that were ordinary in that there was no selection based personal qualities or characteristics, so were normal subjects. Hundreds of experiments were performed on dozens of subjects. The subject effects on the pendulum were substantial and readily measured and analyzed. A consistent pattern emerged, in that the presence of a subject induced many new frequencies of oscillation in addition to the natural frequency of the pendulum. The center of oscillation of the pendulum would consistently drift away from the natural center of oscillation and oscillate around this new center for most of the run. This displacement was usually clockwise, but sometimes counterclockwise, and would occasionally change from clockwise to counterclockwise during the run, indicating the force driving the displacement was a spiral force. It was also consistently observed that after a subject departed from the pendulum, it would not immediately return to native oscillation, but continue to show non-native frequencies nor would it return to the natural center of oscillation. This implied that whatever energetic effect had been exerted against the pendulum by the subject, a substantial portion remained and was not completely dissipated even 30 *min* after departure. It is noted the pendulum hemisphere is an open steel mesh, which would be expected to allow thermal air currents to rapidly disperse. These results have been reported in several publications [1-4].

After using normal subjects exclusively, it was decided to try subjects who might differ from controls. One subject was Benn Kobb, who had practiced Sound Current Meditation for 40 years. Runs while not meditating showed differences from runs while meditating. The differences included more abundant extra frequencies, larger displacements from the natural center of oscillation, and stronger persistence of effects after departure from the pendulum. These results are described in [3].

To explore effects exerted by a more exotic subject; Cherylee Black, who has participated in many studies of psychokinesis, was recruited. A dozen pendulum experiments over three days with her as the subject were performed.

FFT analysis showed many frequencies in addition to the natural frequency of the pendulum. Substantial displacements from the natural center of oscillation were observed and there was significant retention of these frequencies and displacements after departure from the pendulum. It could be said that all of those effects seemed stronger than normal subjects, in some ways surpassing those in the Benn Kobb meditation experiments. The disappointment was there was no dramatic departure from these previously observed effects. Therefore, convincing evidence of a psychokinesis effect could not be claimed.

It was then decided that it may be possible to discern a psychokinesis effect by looking more closely at the data. Until then, all of the data output was plotted as simple lines, mainly because at a data rate of 10 per sec, to include all the data points on the lines would just make a thicker line to no clear benefit. It was decided to include all of the data points superimposed on the lines, and then step through the experiment a few seconds at a time. Since an entire experiment encompasses nearly 40,000 data points, an analysis of just a few at a time was an arduous task. What was discovered was astonishing and it is that discovery that will be presented here. After this discovery, data from previous experiments with normal subjects were analyzed in the same way and showed the same effects. What was discovered is therefore not unique to a psychokinesis adept but is common to everyone.

MATERIALS AND METHODS

The pendulum used here and in our earlier experiments to detect and measure subject effects is depicted in Figure 1, and its design and use have been described in detail [1,2,5]. Briefly, it is a 220 g 15 x 35 cm steel mesh hemisphere (a food cover) suspended by a short length (1.75 cm length x 0.7 mm diameter) of nylon filament. A photo of the fiber attached to the pendulum is shown in Figure 2.

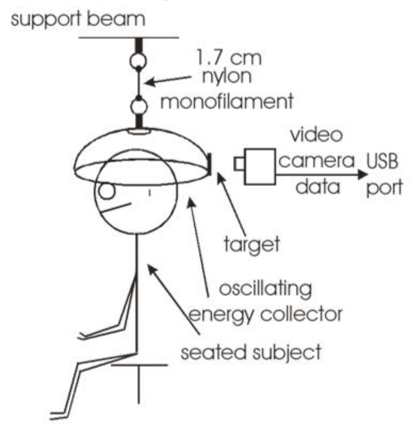


Figure 1. Method of data collection from rotationally oscillating pendulum. A video camera records pendulum positions and saves the data for analysis

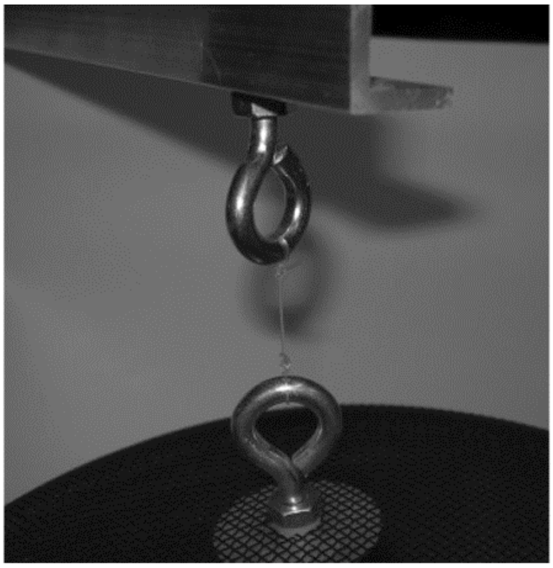
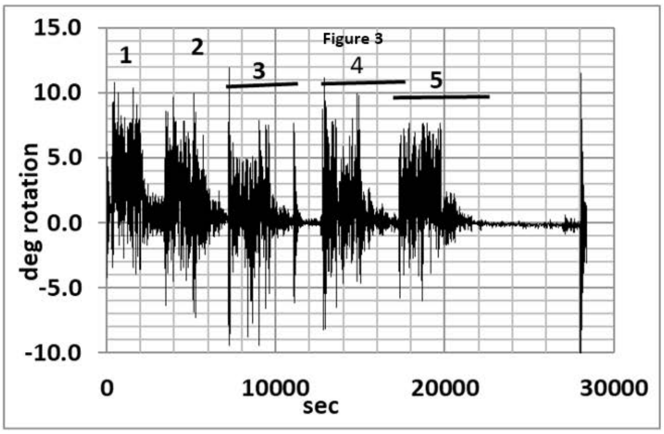


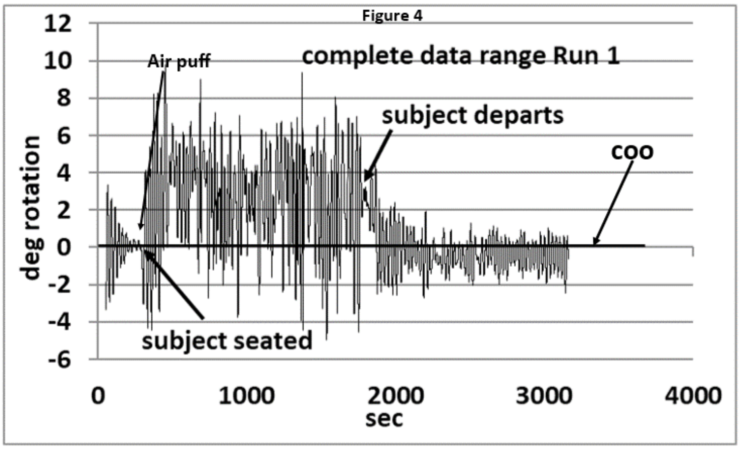
Figure 2. A photo of the 1.7 cm x 0.7 mm nylon filament used in the pendulum experiments.

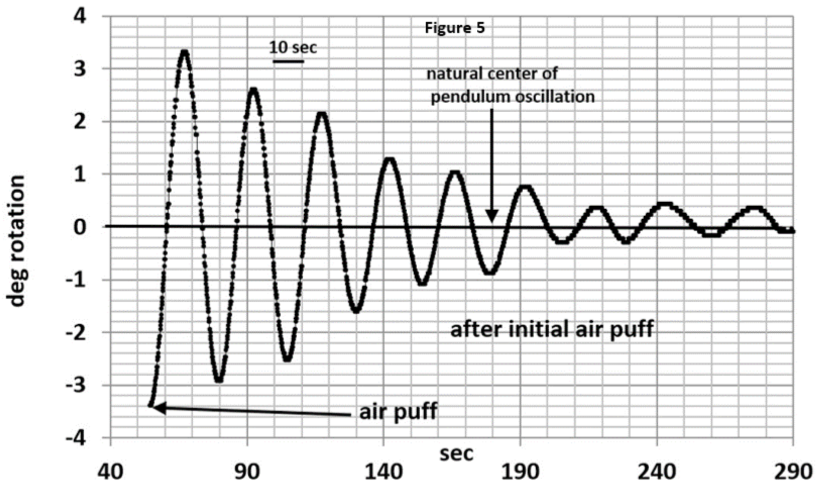
This fiber and hemisphere combination results in a 30 sec period of oscillation, or 2 *cpm*. This period of oscillation gives good sensitivity to the effects exerted by subjects with minimal ambient influences. Rotational motions of the pendulum are recorded using a video camera focused on a 1 cm white dot on the side of the hemisphere. A computer program determines the center of the dot 10 times per sec, displays the data during the experiment and stores the data for later analysis. The program was written in LabVIEW by Irene He and was obtained from her. These measurements are precise, and the rotational position of the pendulum at any time during an experiment is known at a resolution of about 0.1 mm. Whereas the pendulum used here is a steel mesh hemisphere, hemispheres of PET plastics and vegetable fiber produced similar results. Frequencies of the oscillating pendulum were determined by Fast Fourier Transformation analysis (FFT) using the Sigview signal analysis program.

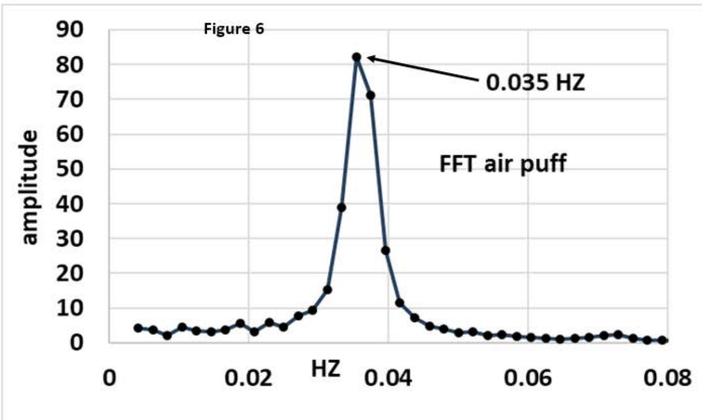
RESULTS

The programed camera that records the motions of the pendulum was used to document the experiments that were performed with Cherylee Black. Figure 3 shows the series of 5 experiments run back-to-back on the first day. Figure 4 shows the complete data range of the first experiment. The run begins with an air puff from a can of compressed air to establish the performance of the pendulum. The time segment including the puff in Figure 5 shows classic torsion pendulum behavior. It is largely damped within 5 min. FFT analysis in Figure 6 shows a frequency of 0.035 *Hz*, or a period of 28.5 sec. Despite the pendulum configuration being always the same, this check of pendulum characteristics is always performed in every experiment.



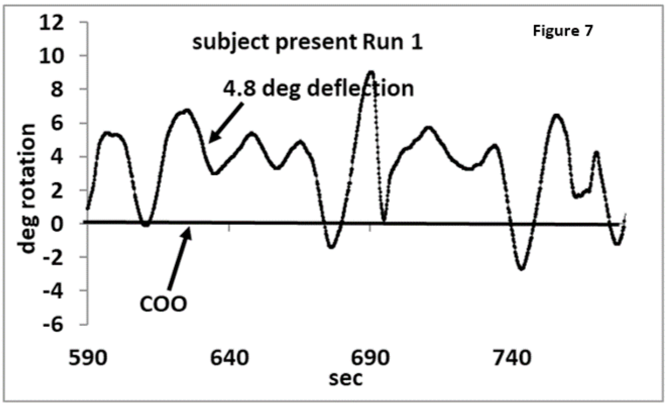


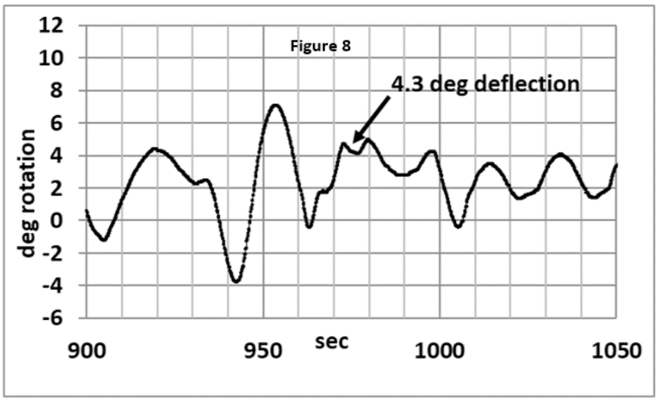




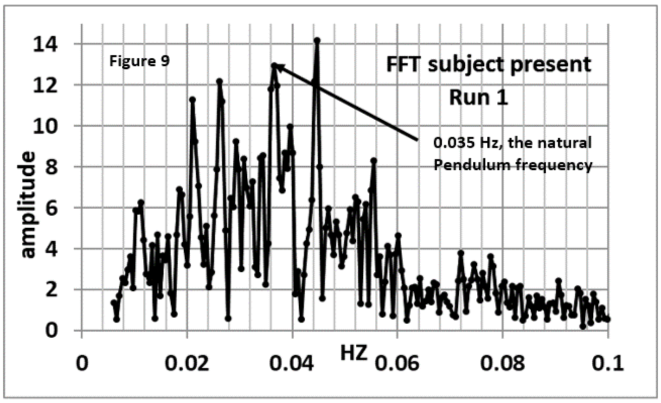
As shown in Figure 4, soon after the subject is seated, the pendulum begins to oscillate increasingly displaced from the natural center of oscillation. The displacement is in the clockwise direction which shows that the force driving the displacement is a clockwise spiral force. The displacement increases quickly and rises toward a maximum and levels off to remain highly displaced until the subject departed. When the subject departs, the oscillations rapidly approach the natural center of oscillation; but goes beyond that to oscillate below the natural center, indicating it has become a counterclockwise spiral force. This implies that when the subject energy is imparted to the pendulum it is a clockwise spiral, and after the subject departs, the energy departs as a counterclockwise spiral.

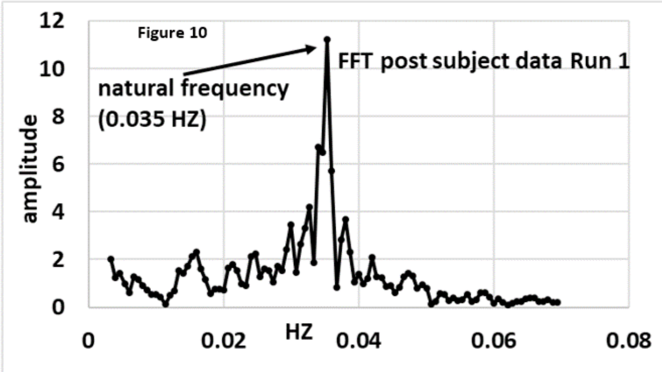
During the run when the subject is present, the departure of the center of oscillation from the natural center of oscillation is substantial. Figure 7 shows a segment of time during which the center of oscillation is deflected by 4.8 deg. Another segment in Figure 8 shows a deflection of 4.3 deg. Although these are the extremes of deflection, the entire subject data range shows substantial deflections from the natural center of oscillation. These deflections are somewhat greater than is typically observed, but not dramatically so. It suggests that whatever energy field surrounds the subject, it is a little stronger here than usual.



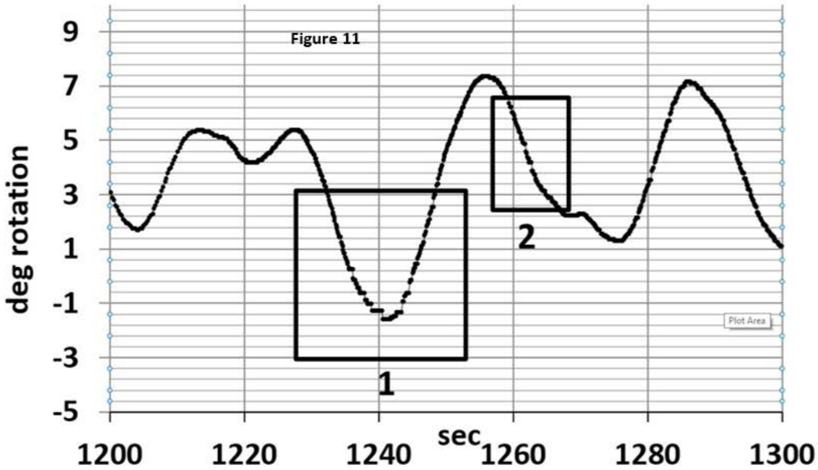


The frequencies of oscillations of the pendulum were determined by FFT analysis. Figure 9 shows the FFT analysis when the subject is under the pendulum. It shows many frequencies, substantially more than typically observed among other subjects. Figure 10 is the FFT analysis after the subject has left the pendulum. The extraneous frequencies, diminished in amplitude, continue after the subject has left.





Then began the task of going through the time course of the experiment a few seconds at a time. Anomalies (boxed) were encountered in the 1200-1300 sec region in Figure 11. The 1234-1250 *sec* seg is in Figure 12. It shows more than 15 pauses of 0.2-1.6 sec duration, with most being more than 0.4 sec. The jumps between pauses are of various lengths, and there are very few data points during these jumps, which means that the duration of the jump is less than the 0.1 sec duration between data points.



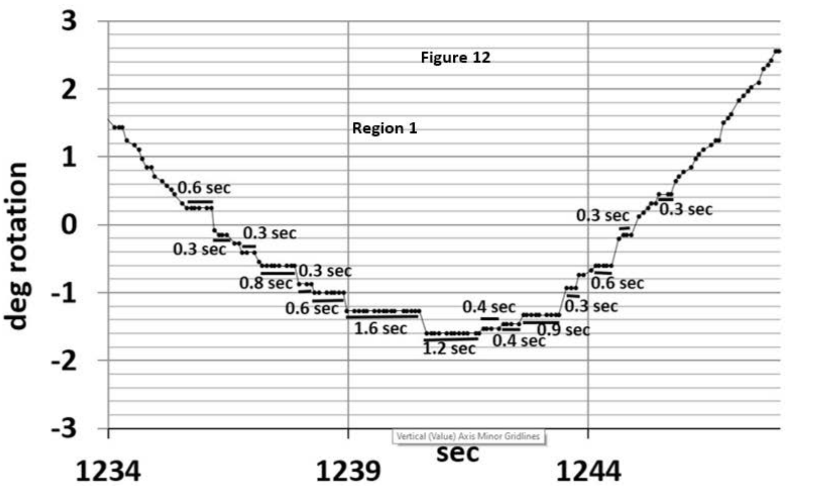
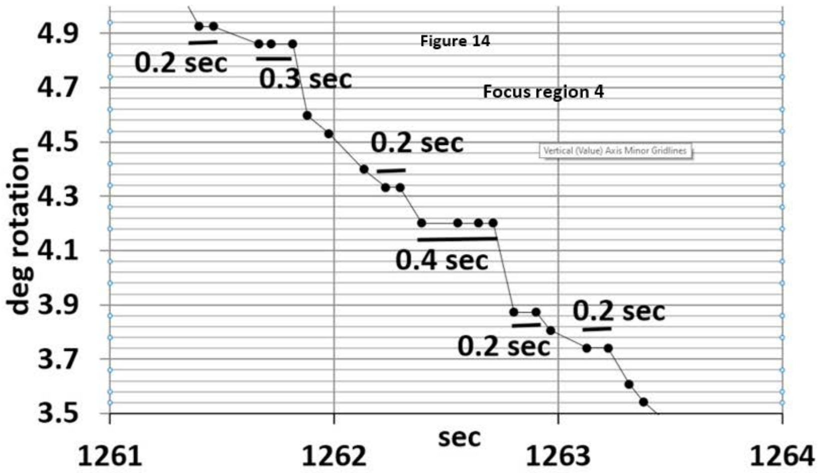
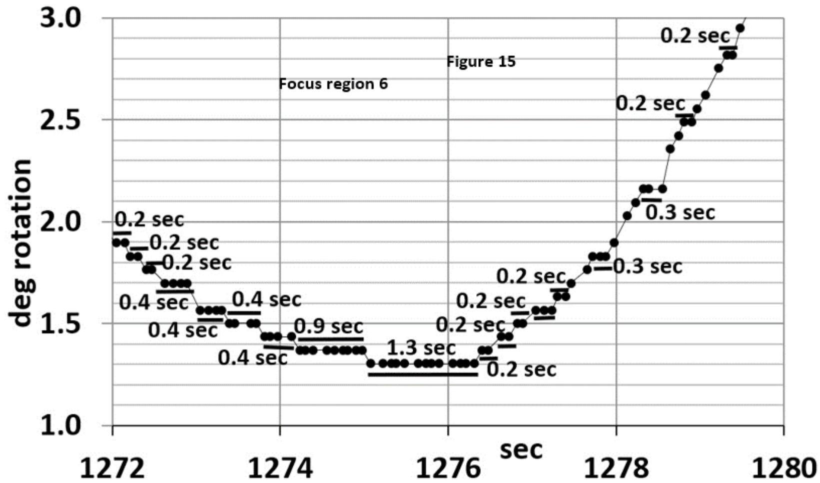
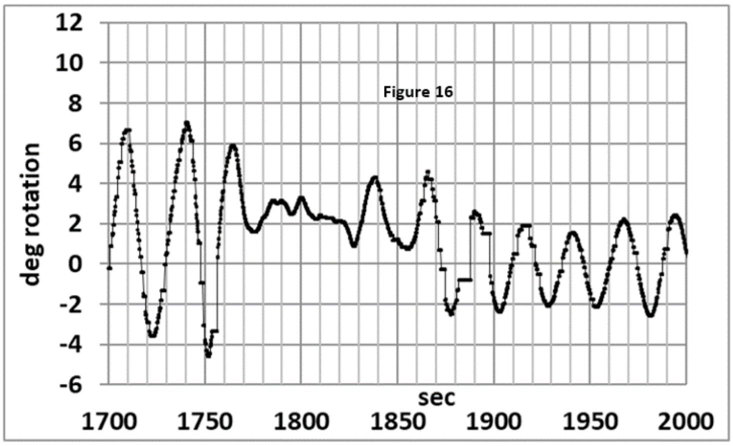


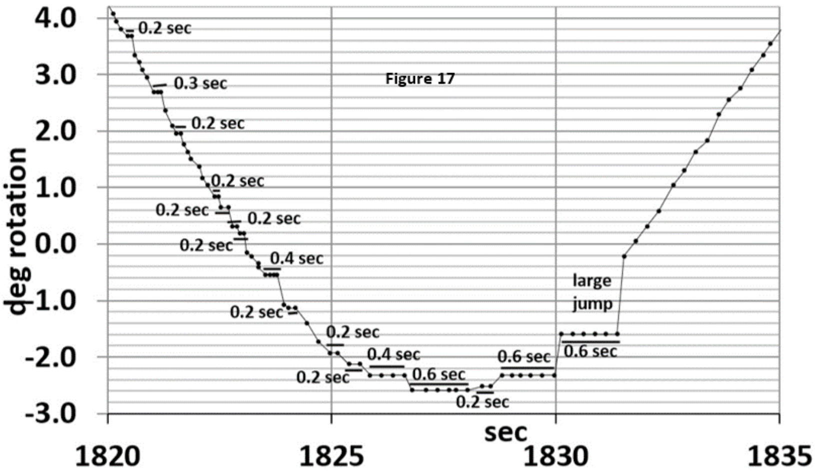
Figure 13 shows the 1260-1280 sec region, with three boxed segments. Focus region 4 of 1261-1264 sec is in Figure 14. It shows six 0.2-0.4 sec pauses during the 3 sec segment. Focus region 5 of 1263-1272 sec in Figure 15 shows 17 0.2-2.0 sec pauses within the 9 sec segment. Focus region 6 of 1272-1280 sec shows 18 0.2-1.3 sec pauses during the 8 sec segment is in Figure 16. All of the pauses are separated by rapid jumps.



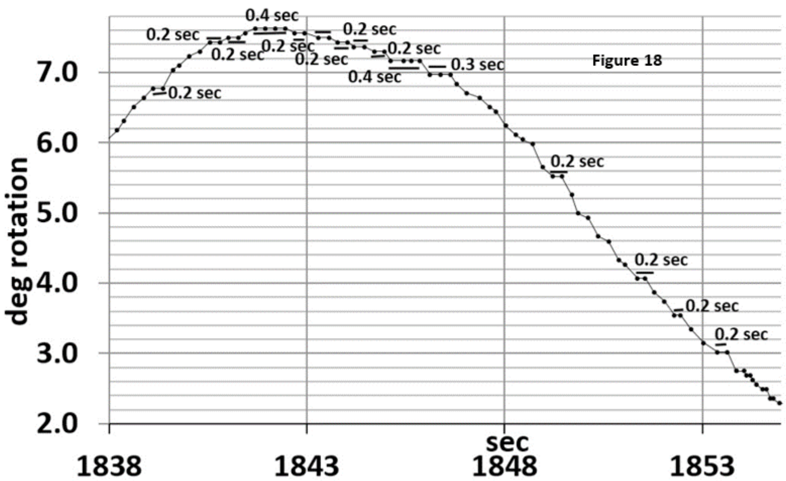


Going on to the 1700-2000 sec region in Figure 16, which includes the time the subject departs the pendulum at about 1980 sec. The 1820-1835 sec segment is in Figure 17. It shows 14 0.2-0.6 sec pauses, including a jump that is larger than so far seen, also of less than 0.1 sec duration. It has one jump much larger than the others, also with a less than 0.1 sec duration.





The 1838-1854 sec region is Figure 18. It shows 15 mostly 0.2 sec pauses surrounded by jumps of various sizes. The 1853-1871 sec region is in Figure 19. This 8 sec region contains more than 33 pauses ranging from 0.2-2.3 sec. Figure 20 is the 1870-1882 sec region with 25 pauses in this 12 sec segment, ranging from 0.2-2.7 sec. Each of these pauses is separated by a jump of less than 0.1 sec duration. Figure 21 is the 1890-1900 sec region with 16 pauses of 0.2-1.6 sec, all separated by jumps of less than 0.1 sec. Figure 22 is the 1899-1910 sec region with 8 pauses of 0.4-3, 2 sec, along with pauses of 3.0 and 1.3 sec. The jumps of various sizes are all less than 0.1 sec duration, except for the long jump that has a data point at the very end of its flight.



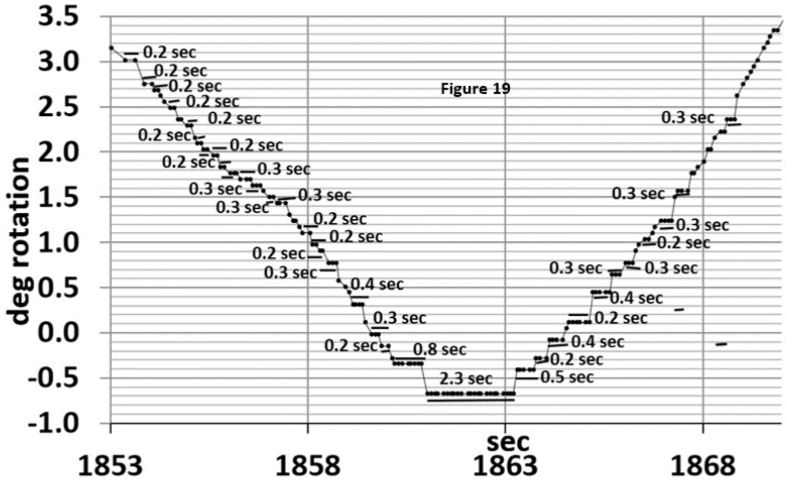


Figure 19
deg rotation
sec
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
1853
1858
1863
1868
0.2 sec
0.3 sec
0.4 sec
0.8 sec
2.3 sec
0.5 sec

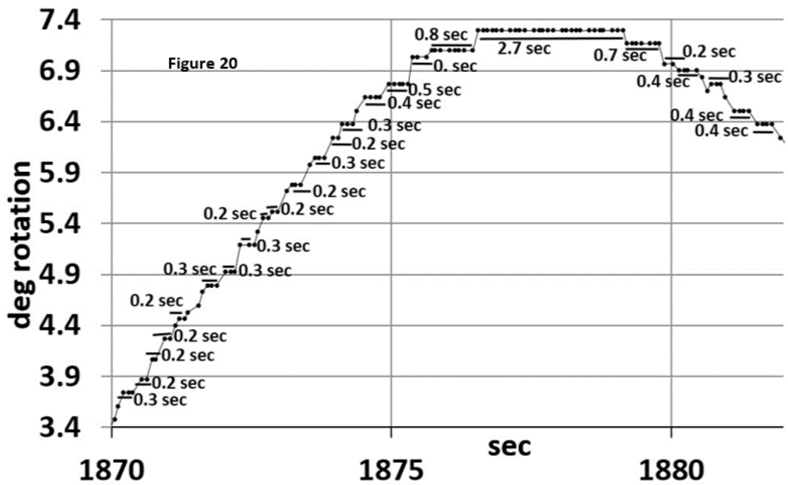


Figure 20
deg rotation
sec
7.4
6.9
6.4
5.9
5.4
4.9
4.4
3.9
3.4
1870
1875
1880
0.2 sec
0.3 sec
0.4 sec
0.5 sec
0.8 sec
0. sec
2.7 sec
0.7 sec

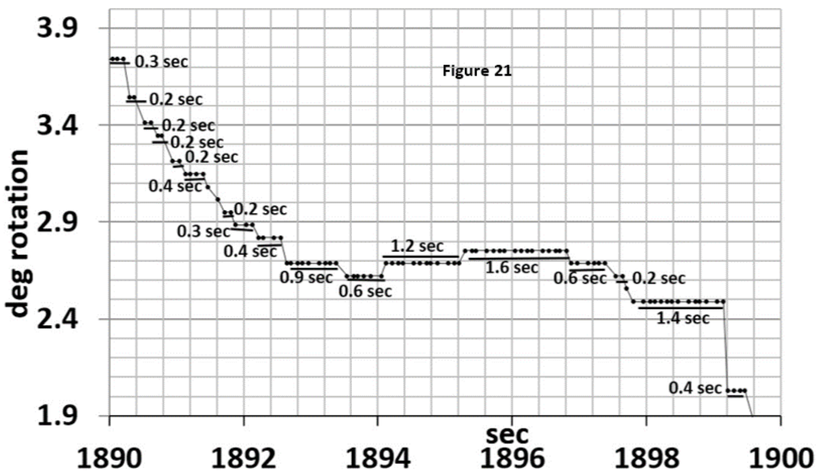


Figure 21
deg rotation
sec
3.9
3.4
2.9
2.4
1.9
1890
1892
1894
1896
1898
1900
0.3 sec
0.2 sec
0.4 sec
0.9 sec
0.6 sec
1.2 sec
1.6 sec
1.4 sec

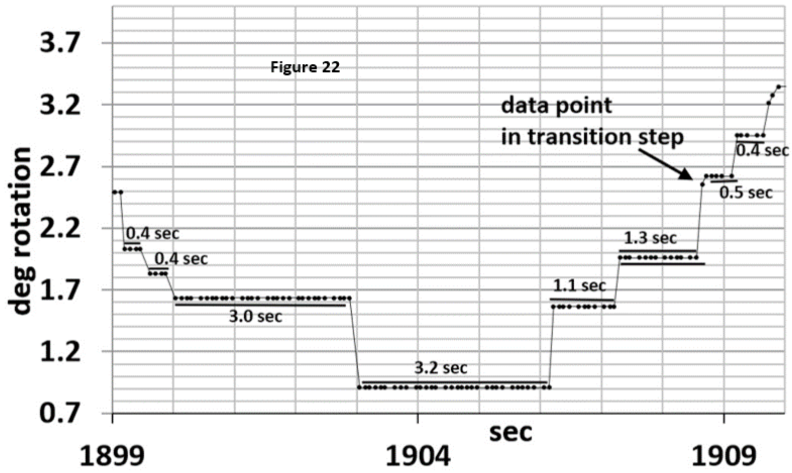
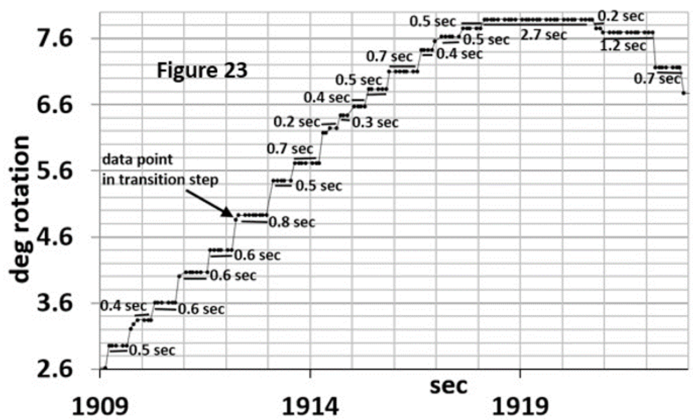


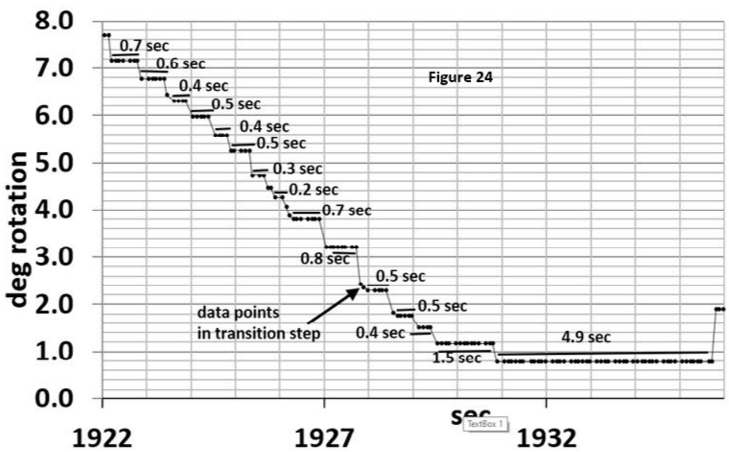
Figure 23 is the 1909-1923 sec region with 18 pauses ranging from 0.3-2.7 sec. The jumps of various sizes are all less than 0.1 sec except for at least two, both having a data point at the very end of the jump segment.

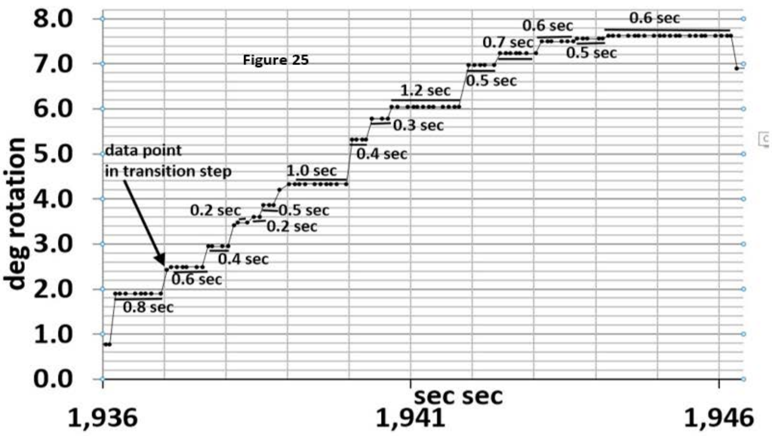
Figure 24 is the 1922-1932 sec region, with more than 15 pauses of 0.2-4.9 sec, with most of them greater than 0.5 sec. The jumps are of various sizes, and a group of data points at the end of one of the larger jumps.

Figure 25 is the 1936-1946 sec region with at least 14 pauses of 0.2-1.2 sec, with most of them being greater than 0.5 sec. There are various jump sizes with less than 0.1 sec duration with at least two jumps having a data point at very end of the jump.

Figure 26 is the 1947-1953 sec region with 13 pauses of 0.2-1.0 sec, with most of them being 0.3 sec or longer. All of the jumps are less than 0.1 sec duration.







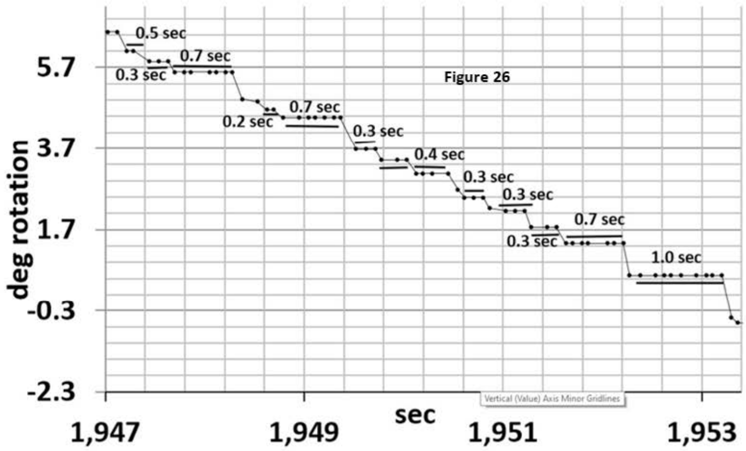
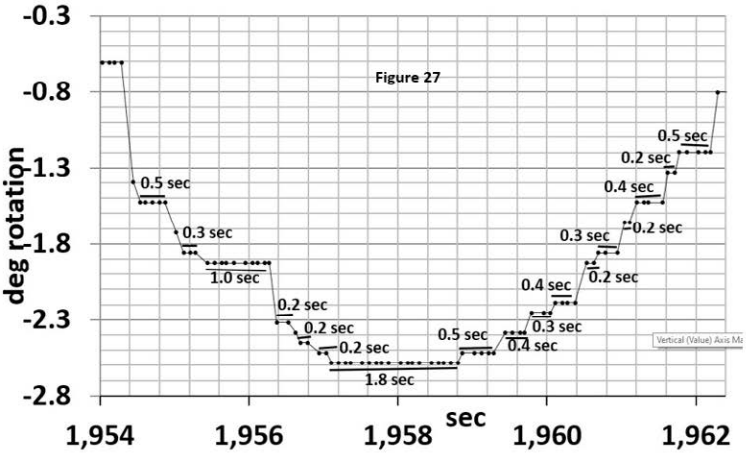


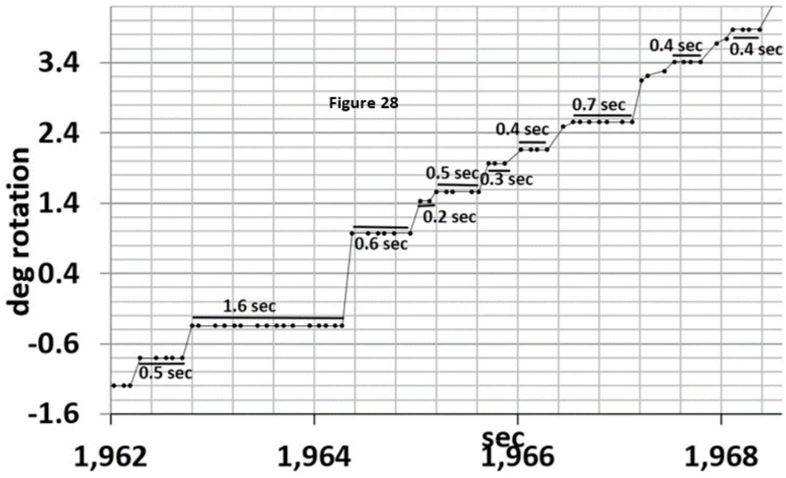
Figure 27 is the 1954-1962 sec region with at least 17 pauses of 0.2-1.8 sec, with most being longer than 0.4 sec. Two of the longer jumps may have a data point, but it could be that the single data point was a pause shorter than the commonly seen 0.2 sec.

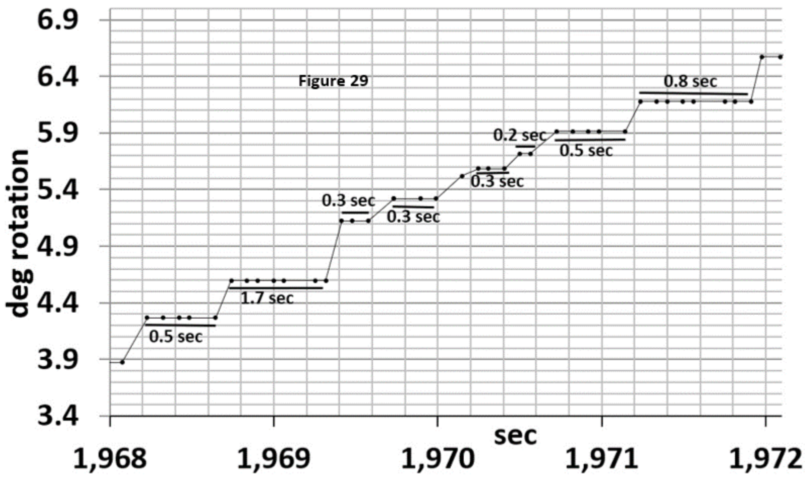
Figure 28 is the 1962-1968 sec data region, with 10 clearly defined pauses of 0.2-1.6 sec. There are jumps of various sizes, which has become a general pattern. The longest jump has no data point, so is less than 0.1 sec.

Figure 29 is the 1968-1972 sec data region, with 8 pauses of 0.2-1.7 sec duration, with all but one being greater than 0.2 sec. The pattern of jumps of various sizes of less than 0.1 sec duration is continued.

Figure 30 is the 1972-1976 sec data region, with 7 pauses of 0.2-0.9 sec duration. Compared to earlier regions, the jumps seem to be getting longer, nearly all less than 0.1 sec duration.







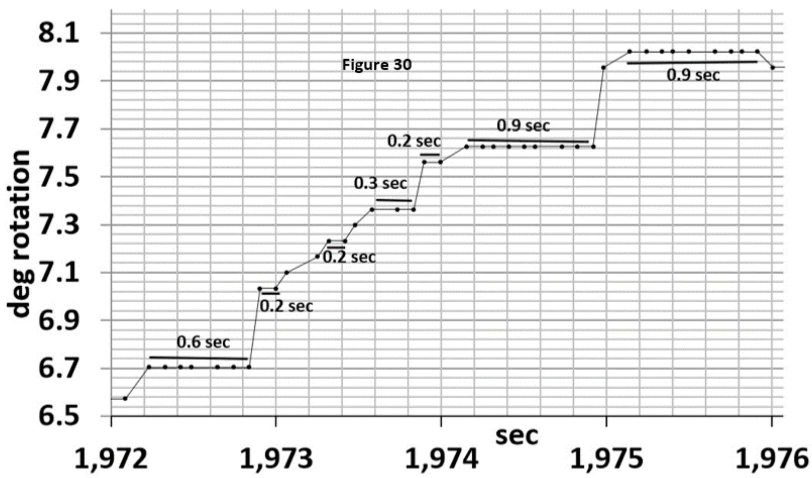
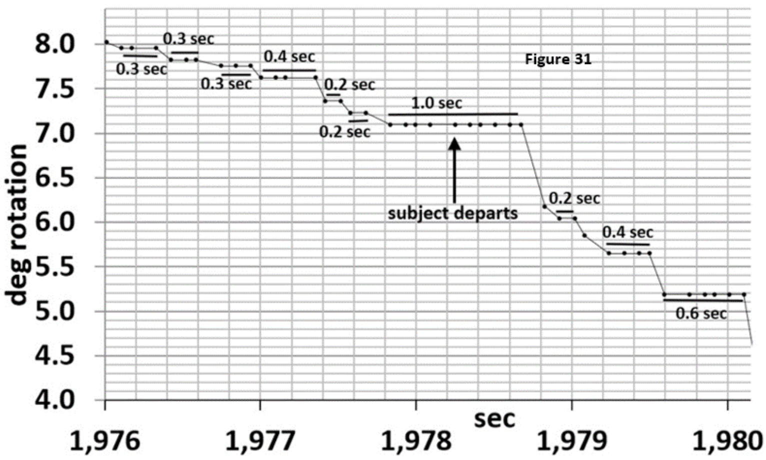


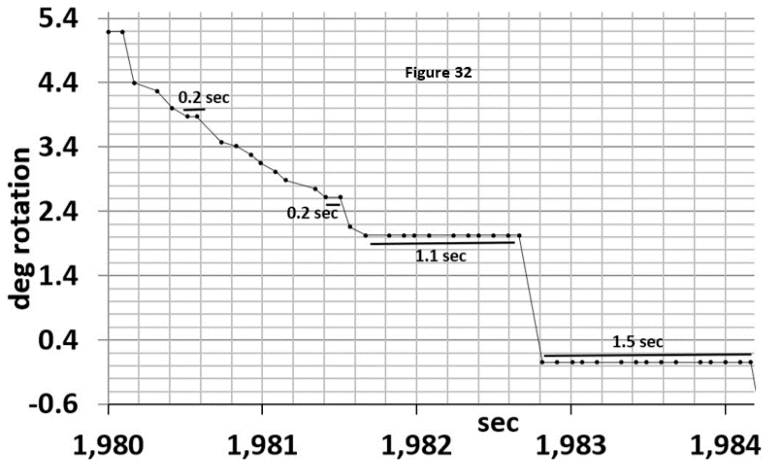
Figure 31 is the 1976-1980 sec data region, which encompasses when the subject departs the pendulum. It has 10 pauses, from 0.2-1.0 sec duration.

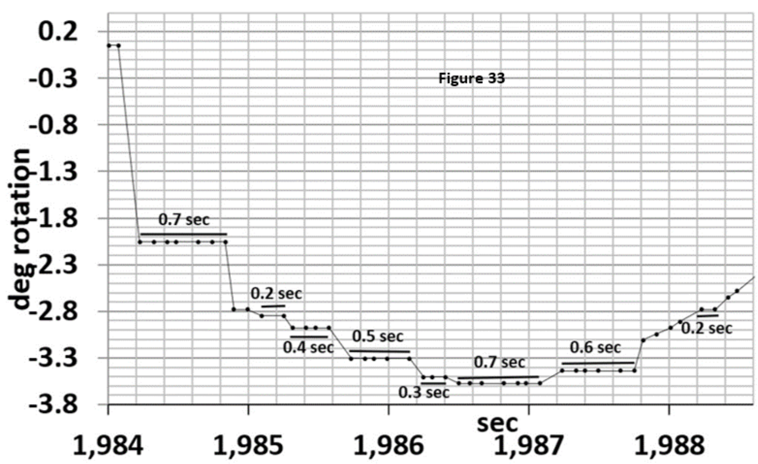
Figure 32 is the 1980-1984 sec region immediately after the subject has departed. Since this would remove the source of the energy driving the pendulum in a clockwise direction, the pendulum would be expected to fairly rapidly return to the natural center of oscillation, which is 0 deg of rotation. During this time region, the displacement of the pendulum drops from 5.4 deg clockwise to -0.6 deg in less counterclockwise. This is a shift of 6 deg that occurs over a time period of 4 sec, so is moving at an average rate of 1.5 deg/sec. Despite this rapid descent, the pendulum shows 2 pauses of 1.1 and 1.5 sec, respectively. Since the subject has departed, it is reasonable to assume that these effects are caused by residual energy in the hemisphere of the pendulum.

Figure 33 is the 1984-1988 sec region after the subject has departed. It contains 8 pauses of 0.2-0.7 sec duration, separated by jumps of various sizes, all less than 0.1 sec duration.

Figure 34 is the 1988-1992 sec region after the subject has departed. It contains 7 pauses of 0.2-2.7 sec duration, and a very long jump of more than 4.1 deg against the torsion force of the pendulum, with a duration of less than 0.1 sec. During that jump, the pendulum would have been moving at a rate of 41 deg/sec.







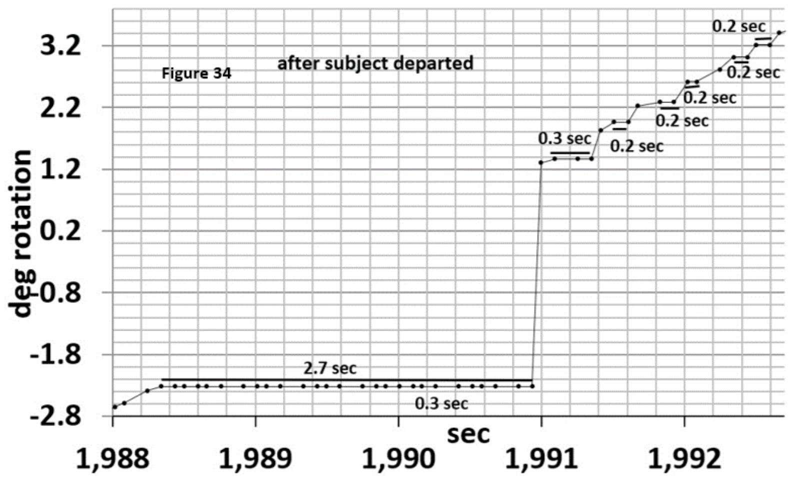
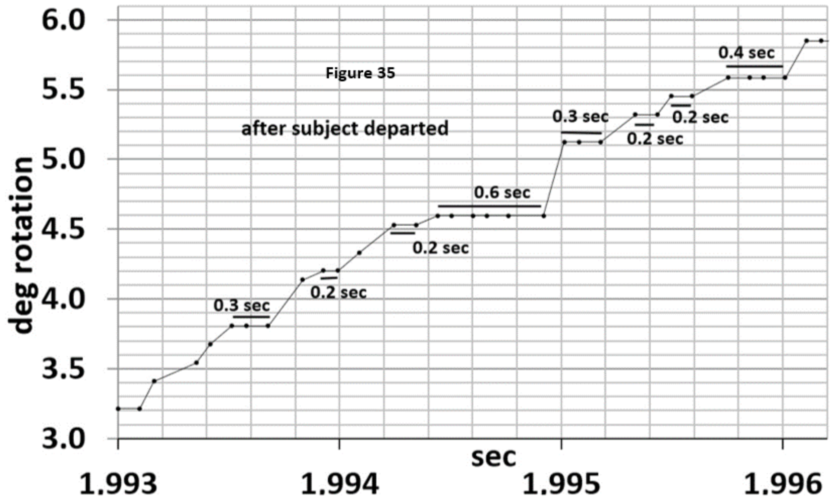


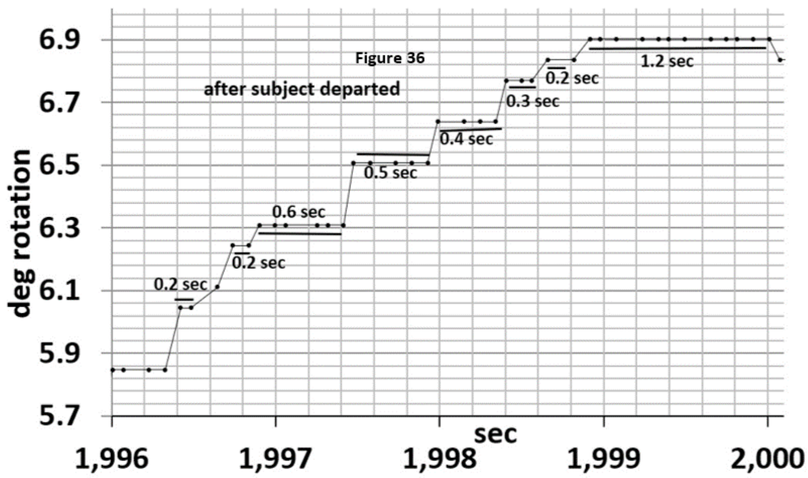
Figure 35 is the 1993-1996 sec region after the subject has departed. It shows 8 pauses of 0.2-0.4 sec duration, with jumps of variable length, all of less than 0.1 sec except possibly one.

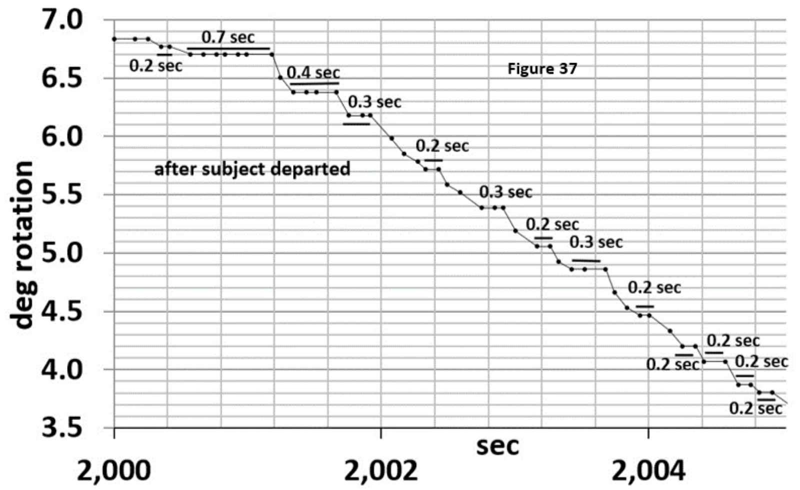
Figure 36 is the 1996-2000 sec region after the subject has departed. It shows 8 pauses 0f 0.2-0.6 sec duration.

Figure 37 is the 2000-2004 sec region after the subject has departed. It shows 13 pauses of 0.2-0.7 sec duration.

Figure 38 is the 2005-2013 sec region after the subject has departed. It shows more than 11 pauses of 0.2-2.7 sec.







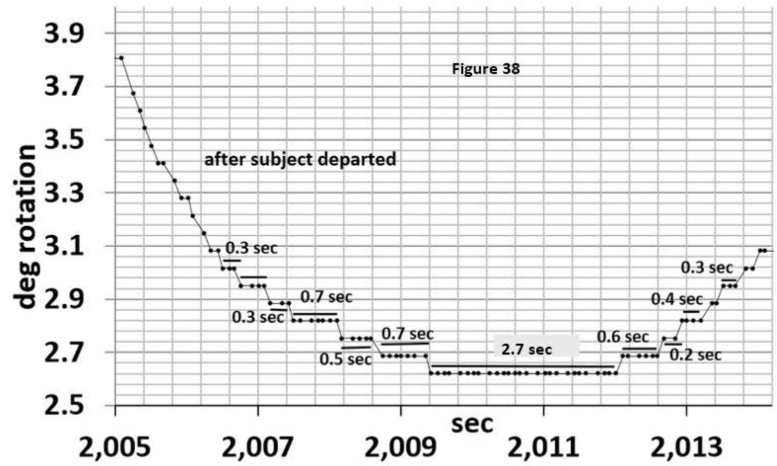
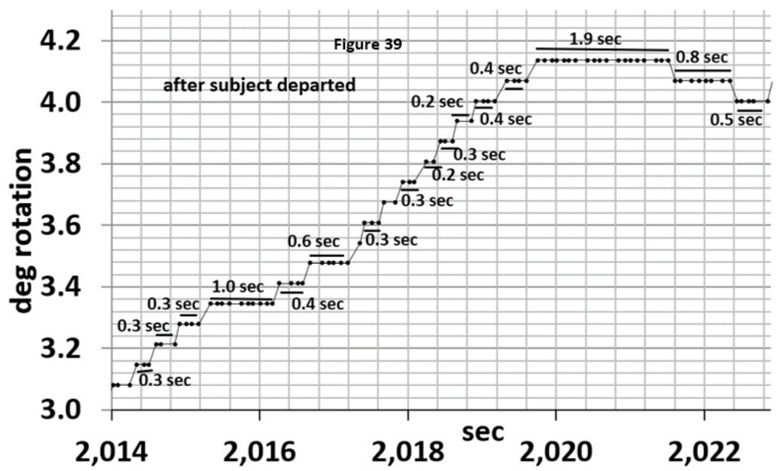


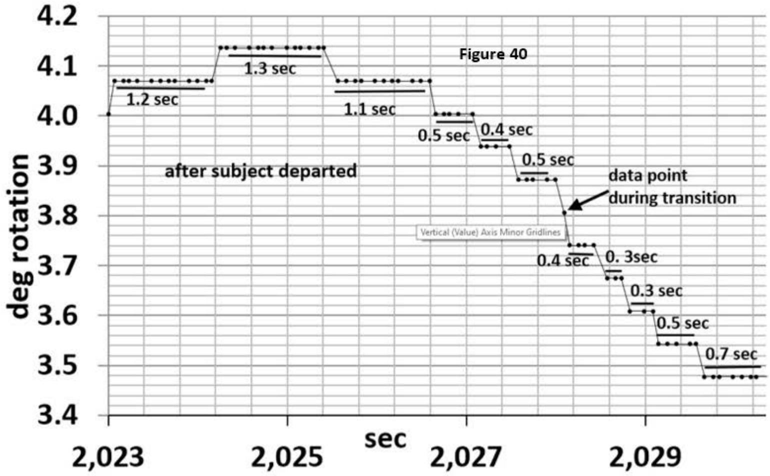
Figure 39 is the 2014-2022 sec region after the subject has departed. It shows 16 pauses of 0.2-1.9 sec duration.

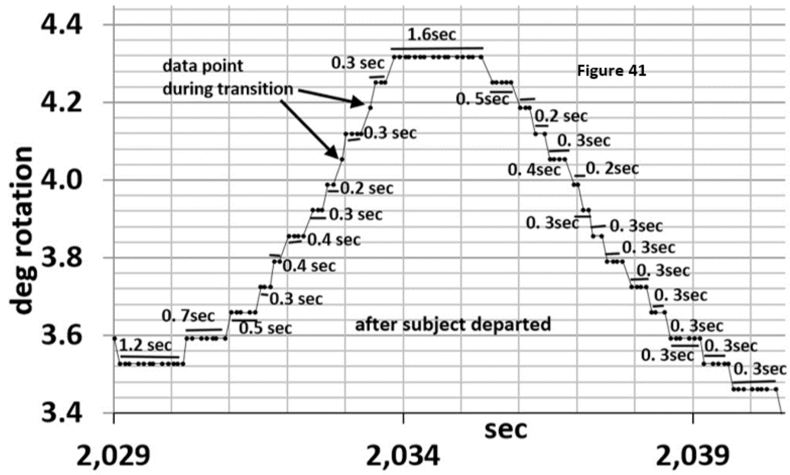
Figure 40 is the 2023-2030 sec region after the subject has departed. It shows 11 pauses of 0.3-1.3 sec duration. It shows one data point that is either an unusual 0.1 sec pause, or a data point in the transition step from one pause to the next.

Figure 41 is the 2029-2039 sec region after the subject has departed. It shows 24 pauses of 0.2-1.6 sec duration. There are 2 data points that are either 0.1 sec pauses or data points during a transition step.

Figure 42 shows the 2066-2076 sec region. It shows many 0.2 and 0.3 sec pauses followed by 12 pauses of 0.3-1.5 sec duration.







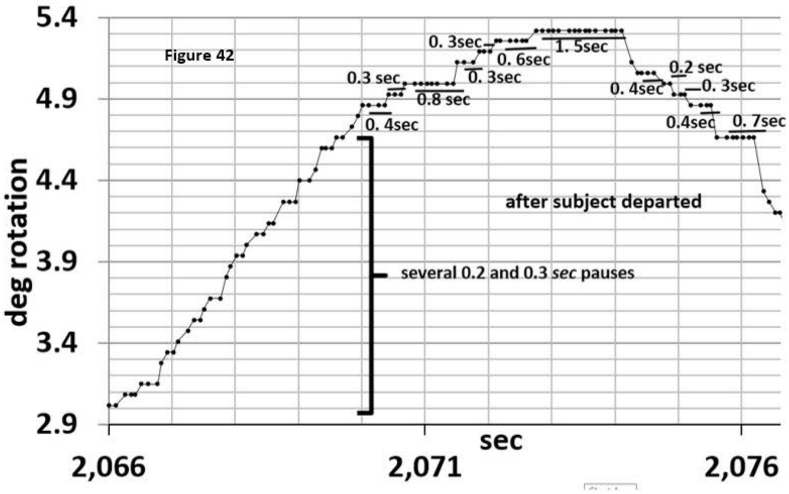
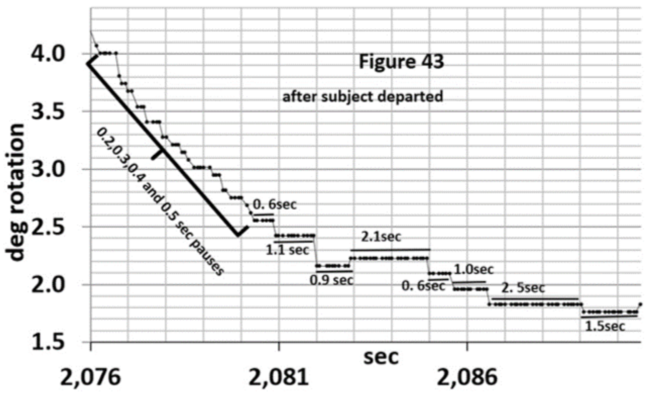
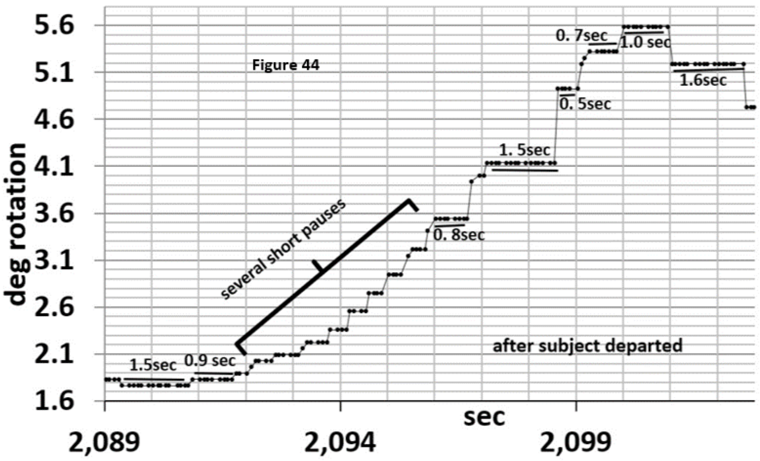


Figure 43 shows the 2076-2090 sec region. It shows many short pauses followed by 8 pauses of 0.6-2.1 sec duration.

Figure 44 shows the 2089-2103 sec region. There are several short pauses surrounded by pauses of 0.5-1.6 sec.

Figure 45 is the 2103-2123 sec region. There is a central region with several short pauses flanked by more than 5 pauses of 1-5.5 sec.





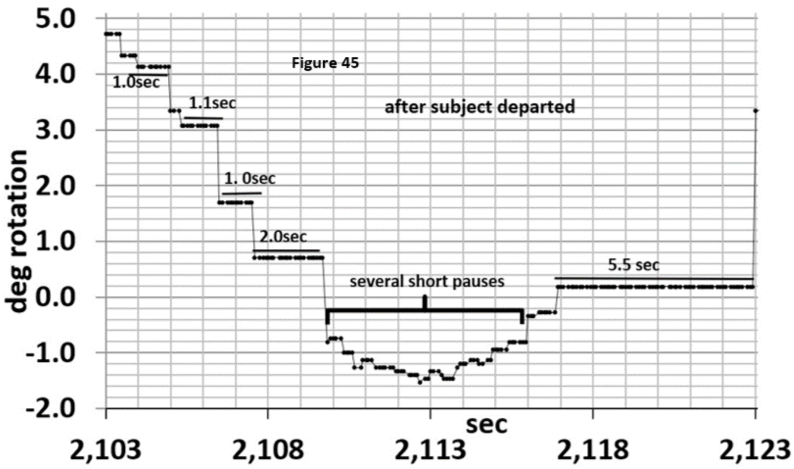
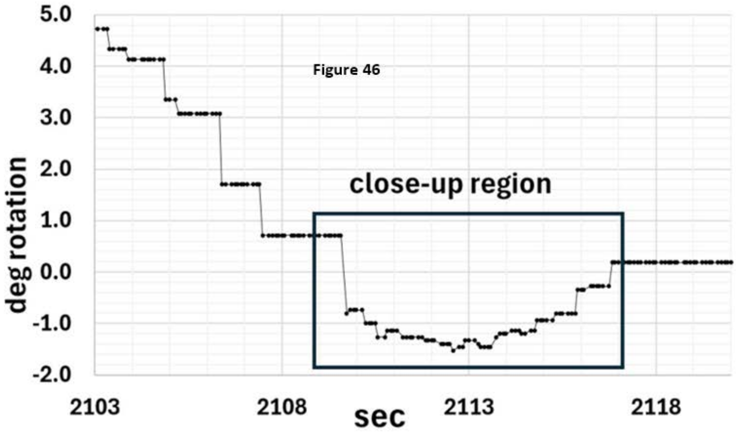
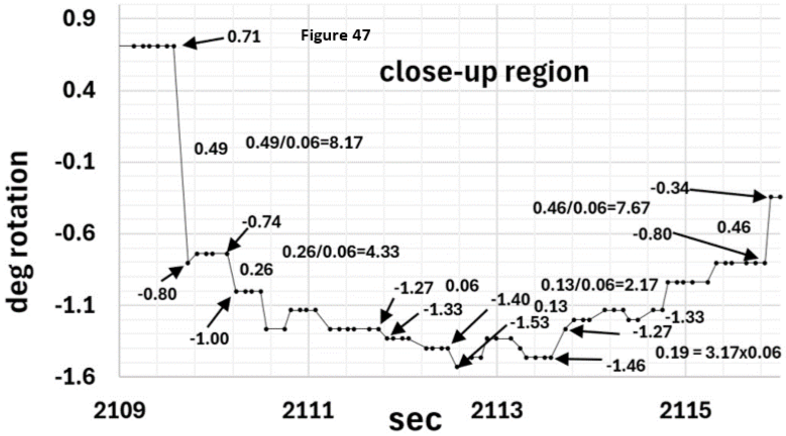
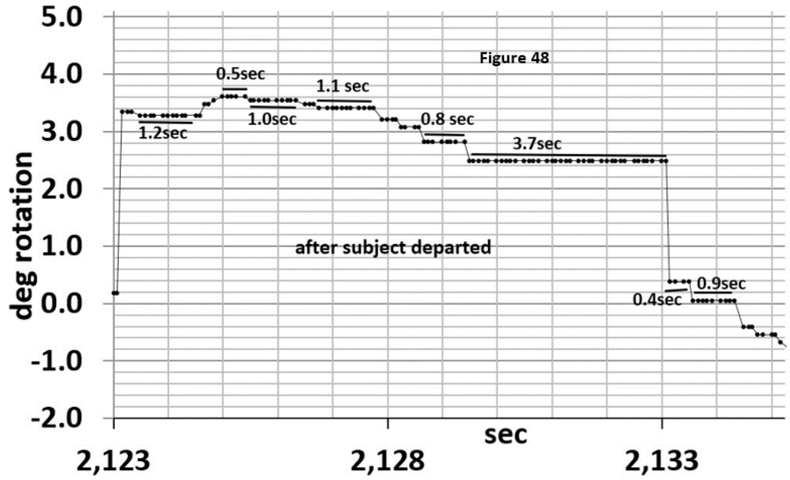


Figure 46 shows a region that is examined more closely in Figure 47 and is a 2109-2116 sec close up of the 2103-2223 sec region. There are 18 pauses of 0.2-0.6 sec duration. For the first time in this analysis, it is the jumps instead of the pauses that are analyzed. What is shown is the relative sizes of the jumps, which range from 0.06-0.49 deg. It is also shown that all of the jump lengths are near multiples of 0.06 deg. For example, 0.49 deg divided by 0.06 is 8.17. 0.26 deg divided by 0.06 is 4.33. 0.13 deg divided by 0.06 is 2.17, and so on. This is an artifact caused by the resolution of the camera which determines the position of the pendulum at a particular pixel position, and the smallest shift in position is one pixel. In this experiment, the shift of one pixel to the next is 0.06 deg. This accounts for the smallest 0.06 deg jump. Since data collection is pixelated in 0.06 deg steps, all steps are inevitably multiples of 0.06 deg. The significance of the length of the jumps being a multiple of a 0.06 deg will not be of interest.

Figure 48 is the 2123-2135 sec region. It shows more than 8 pauses, many longer than most with the longest being 3.7 sec. It also shows a jump of more than 2 deg. These departures from normal pendulum oscillation continue despite the subject having departed nearly 3 min prior.







There are hundreds of pauses shown in this data. During every one of those pauses, the pendulum remains in a fixed position, never moving by even a single pixel. Each one of these pauses is connected to the next pause by a jump whose duration is less than a tenth of a second, and that pause is connected to the next pause by another jump. This is repeated over and over throughout the entire experiment. The pendulum is therefore constantly jumping from one completely constrained position to another completely constrained position, and this pattern occurs throughout the entire experiment, both when the subject is present, and after the subject has departed.

When a grasshopper jumps from one leaf to another, the departed leaf will quiver, and the destination leaf will quiver. The departed leaf quivers because of the inertia that has to be overcome, and the destination leaf quivers because of absorbing the resulting momentum. During the hundreds of pauses separated by hundreds of jumps, there is not a single quiver among them. The pendulum has a mass of 220 g, and a torsion coefficient of 2,240 dyne-cm/radian, or 39 dyne-cm per deg of rotation [1,2]. The jumps range from a single pixel to over 4 deg. These jumps are of less duration than 0.1 sec, no matter how large. One would expect some quivering during transitions, but it never happens even once. During the 4.1 deg jump in Figure 34, the 220 g pendulum would be moving at a rate of 41 deg/sec when it reaches its destination, so should possess considerable momentum, but there is no sign of the effects expected from that momentum. At the end of the 4.1 deg jump at 41 deg/sec, the pendulum stops as abruptly as if hitting a brick wall. Since there was empty air instead of a brick wall, it was as if the pendulum possessed no momentum when it arrived at its destination. If you were watching the pendulum of a grandfather clock swinging back and forth, and you saw that it would pause for a few seconds, rapidly jump to another position and pause; and repeat this process of pausing and jumping for as long as you watched; you would be amazed at the impossibility of it. We should be equally amazed by what we are witnessing with this pendulum. It is as if, during the brief instant of a jump, both inertia and momentum vanish; and this occurs hundreds of times throughout the experiment. Not a single jump departs from this consistent pattern.

DISCUSSION

These results establish a pattern of pendulum behavior in which the pendulum will pause for durations as long as six seconds, then very rapidly jump to a new location and pause; then jump to a new location and pause; and repeat this over and over in a completely uninterrupted pattern throughout the entire experiment. This is unlikely to be an artifact of pendulum design or data collection. To intentionally force a pendulum to behave this way would be very difficult. It is a challenge to think of how known principles can account for this behavior.

While considering the possibility of identifying new principles, it is important that these pendulum experiments were performed to test a hypothesis that arose as a consequence of the philosophical journey taken 30 years ago described in Treefall [6]. It was an eventful journey, and along the way many strange conjectures were encountered; some of which seemed suitable as hypotheses that could be subjected to experimental tests. The hypothesis that thoughts exert physical forces was the one that inspired the pendulum. Another hypothesis inspired a thought experiment [7]. Other hypotheses were relevant to topics that have been discussed and debated for thousands of years. One of the prominent hypotheses in Treefall is that the translocation of objects occurs by a process that resembles a chemical reaction. In the analogy to a chemical reaction, an object at one position is the reactant and after translocation to an adjacent position is the product. In analogy to a chemical reaction, translocation requires the reactant to traverse an activation energy barrier, which corresponds to inertia, and after investing the energy it then possesses what we identify as momentum. A central aspect of this hypothesis is that empty space consists of a matrix and each matrix position can accommodate any object that is possible. Translocation therefore consists of objects translocating from one matrix position to another, and while doing so, must cross an activation energy barrier comprised of inertia and momentum. This concept was initially described in the Appendix of Treefall and expanded in a more comprehensive presentation [8].

By hypothesizing translocation as a chemical reaction, it was possible to derive an equation that embodies Newton's laws and contains terms for inertia and momentum. This equation improves on F = ma in that it is not a product of devising equations that fit empirical data, but an equation derived from first principles. This derived equation is,

$$I_o M_f \frac{d\Delta E_v}{dt} = m\frac{dv}{dt}$$

It is mathematically indistinguishable from F = ma, where F is seen to contain terms for inertia and momentum. The equation can be rearranged in a variety of ways to explore relationships among terms. Details of how the equation was derived and the definitions of the terms in the equation are in [6] and in the more comprehensive presentation [8].

The ability of enzymes to dramatically increase reaction rates is an important principle in all aspects of living systems. Acceleration rates can be astonishing, being as high as billions or trillions-fold. If translocation is like a chemical reaction, is it possible that it could be catalyzed? The possibility that translocation could be catalyzed, resulting in lowering the inertia-momentum energy barrier was considered [6,8]. The hypothesis that translocation is a chemical reaction and the hypothesis that it can be catalyzed would be a pair, with catalysis being relevant only if translocation is like a chemical reaction.

Treefall addresses the possibility that catalysis of the translocation reaction could be important to our survival. We survive because we can move our bodies to perform essential functions required to live. We are familiar with our body parts; arms, hands, fingers, doing exactly what we want them to do. These respond to our thoughts. Much is known about how nerve impulses trigger muscle contractions, which are ATP- driven reactions. I have never heard anyone wonder exactly how thoughts initiate these reactions. If a thought can initiate a change in a biological component, it must possess some kind of energy that is capable of triggering a change in that biological component. Put in these terms, the idea that thoughts can exert forces seems inescapable.

The force exerted by a thought is logically very small, possibly too small to significantly influence even a tiny object such as a biological molecule. Thoughts would be more effective if they were capable of catalyzing critical translocations of brain molecular components. This suggests that our ability to move is a consequence of thought-induced psychokinesis that orchestrates the motions of brain molecular components that are interfaced or integrated with motor neurons that control muscle contractions.

Whereas these pendulum experiments were inspired by the Treefall hypothesis that thoughts exert forces, the results embrace other Treefall hypotheses as well. Accordingly, the results conform not only to the hypothesis that thoughts exert forces, but to the hypothesis that translocation is analogous to a chemical reaction, and to the hypothesis that the translocation reaction can be catalyzed. Without intending to do so, the pendulum experiment tested all three hypotheses simultaneously. The best approach to the validity of a hypothesis is to try to prove it wrong; that is, to falsify it. If it cannot be falsified, the validity of the hypothesis is enhanced. Suppose the pendulum experiment had been knowingly designed to prove these hypotheses wrong. It has failed to do so, in that the hypotheses were not falsified. The validity of the hypotheses is enhanced, and they remain as suitable explanations of the experimental results until they can be falsified and replaced by new hypotheses that provide better explanations of these experimental results. Instead of the results falsifying these hypotheses, they fortify them.

Biological evolution as assisted by natural selection can exploit any principle of nature that is not forbidden by the fundamental laws of the universe. This includes principles that we neither know about nor understand. The principles revealed here were from observations of effects that occurred in close proximity to the cranium of a conscious human subject. These same principles must be in operation everywhere and could result in effects that are surprising and hard to explain. An example could be how observations influence the outcomes of double-slit experiments, and other conundrums of quantum mechanics. The advancement of scientific knowledge and understanding has always required the discarding of former principles in favor of new ones that invalidate the old ones. Whenever this occurs, adjustments have to be made to accommodate them. This is how we advance along the road to the discovery of the subtle rules that govern our existence.

CONCLUSIONS

The Preface of Treefall pays homage to Leonardo da Vinci for his ability to use his senses to perceive and to interpret his perceptions using his intellect free from prevailing opinions. He saw birds flying, and concluded they were immersed in some kind of fluid, so one's surrounding space was not ephemeral nothingness. Over 2,000 years ago, Zeno's philosophical arguments concluded that an arrow could not move if its flight were the uninterrupted continuous process dictated by prevailing opinions. Since arrows do move, the prevailing opinion was that Zeno's paradox was flawed. The fact that it was a very strong argument weakened faith in the ability of philosophical arguments to resolve anything. The opinion that Zeno's paradox is flawed prevails today.

Suppose instead, respected intellectuals were to have said; 'Zeno, your argument is very strong, seemingly unassailable. That means the process of arrow flight is not the uninterrupted continuous process that it seems to be. The process of translocation from one position to another must be something different from that.'

If that had been the prevailing attitude, life today could be very different; and interstellar space travel might have been achieved a thousand years ago. Isaac Newton was superb in establishing the relationships between forces and motion, but did he ever think about Zeno and consider the possibility that his paradox correctly pointed toward a process of translocation unlike the conventional paradigm? The apparent simplicity of the motion of objects does not evoke concerns that it may not be the simple process it seems to be. Until I encountered it in Treefall, I never had those concerns; and without Treefall I never would have.

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