A LIFE LESS ORBINARY? Accounts of Experimentation into the Natural Causes of 'Orbs'

by Dave Wood

ABSTRACT

Previous research into 'orb phenomena' has been either theory-based or conducted without a rigorous scientific methodology; the aim of this study was to provide scientific evidence as to whether orbs are, or are not, caused by non-paranormal factors. Paranormal theories and two rational theories – the 'orb zone' and 'blooming' – were presented. The paper presents the results of five experiments that examine whether orb capture is associated with 1) increased depth of field, 2) camera flash operation, 3) the distance between the flash and the lens, 4) the use of digital cameras and 5) the megapixel count of a camera. Each experiment was conducted in a conditions-matched experimental (haunted) and control (non-haunted) environment. The Chi-Square statistical test was applied to the results (>.05) and found that orb capture was not dependent on whether the location was 'haunted'; that increased depth of field, flash distance, flash use and use of digital cameras did contribute towards orb capture. However it was established that the effective count of megapixels made no difference to orb capture. The need for future research and explanation was highlighted, in particular the need for a dedicated website to present the evidence and theories in an accessible way, understandable by all.

INTRODUCTION

It is ten years since the USA's International Ghost Hunters Society (2002) claims to have coined the term 'orb'; in the UK these anomalies were termed 'lightballs' (Parascience, 2007). Now known ubiquitously as orbs, these anomalies are typically white (though colours can vary), typically pale (though can be bright), typically spherical (though can be other shapes) and typically caught on compact digital camera. There are uncommon instances of orbs seen by the naked eye, by 35mm camera, by SLR (single lens reflex) camera and, arguably less frequently, on video camera.

Various descriptions of 'anomalous lights' have been linked to experience of ghosts, UFOs, religious experiences etc., over time, and

are too voluminous to reference here. The focus of this research has been 'orbs' caught on stills camera; research into 'naked eye' experiences are beyond the scope of the present study, however the linking of eye witnessed orbs with photographed orbs shall be touched upon.

Orbs appear to be associated with 'haunting cases' where orb photos seem to be exclusively caught in allegedly haunted locations, at night and in the dark, by paranormal investigators.

Accounts like those of the IGHS and Parascience claim that the anomalies were not a subject of wide interest before the twenty-first century; there is little evidence to counter this claim. Orbs, however, were photographed prior to their widespread notice, and very occasionally identified in a paranormal context. One reliable source is Photographs of the Unknown (1980) which shows four orb photos, the earliest from 1907; the authors does, however, describe them as an unusual but natural phenomena.

Orbs appeared to breach the (interested) public consciousness in 2002 when LivingTV's show 'Most Haunted' first aired. Lee (2007) asserts that, at the time, Most Haunted claimed there was 'no scientific explanation' for orbs. In the following years orbs appeared to capture the imagination of paranormal investigators and the public alike. Whilst any survey of paranormal investigators in 2007 would probably reveal that the majority largely discount orbs as 'evidence', the subject still seems to cause some excitement amongst the public. The author has been contacted in several cases where clients label their house as haunted where the trigger of the belief was the capture of orbs on camera.

Whilst many researchers believe orbs have a normal explanation, no scientific research appears to have taken place to justify this opinion, beyond a (non-paranormal related) explanatory note on the website of camera manufacturer Fuji (2007). Views held about the orb phenomenon appear to be many and varied, but several distinct categories can be observed.

DIFFERING VIEWS ON THE ORB PHENOMENA

Categories of researcher belief in orbs appear to fall into the rationalist, minority belief and rejection of rationalism.

The rationalist view contends that all orbs are naturally explicable as airborne particles or similar. This wholesale rejection takes place in spite of no scientific evidence and often a poor or incomplete understanding of the rational theory (respective examples – Juliano, 2007, The Society for Paranormal Investigation, 2007). Such theorists can hold onto their beliefs despite any ostensible evidence provided to the contrary and often rely on well-intentioned but wholly unscientific experiments to justify their viewpoints (for example Midnite Walkers, 2007).

The minority-belief theorists assert that 'most' orb photographs are non-paranormal, but that small percentages of them are paranormal. Often the theory goes that the 'standard' white, spherical and pale orbs are normal but orbs photos that occur with less frequency are paranormal; these latter orbs tend to be defined by observable differences to the norm. Examples include moving orbs, of a different colour (Wilson, 2004), multiple orbs (IGHS, 2002), non-transparent orbs (Taylor, 2003) or orbs that are not perfectly round (Eaton, 2004). In some cases theorists assign the label 'paranormal' to orbs if they feel the variables associated with orb rationalism (e.g. use of flash or 35mm camera) are not present (Kimura, 2006).

Rejection-of-rationalism theorists argue that all orbs are paranormal events. Such theorists seem to be fewer in number at the time of writing. Reasons presented for these beliefs include: the belief in orbs as part of a paranormal cycle (Ghosts, 2007); an instinctive disbelief in the credibility of any natural explanation (Paranormal Ghost Society, 2007; Melrose, 2007); orbs providing support following tragedies (Sipos, 2006); the conviction that orbs have been captured where ghosts have been 'identified' (Whitedove, 2006) and the capturing of orb photographs following the sighting of a naked-eye orb.

When considering the arguments presented supporting orbs-as-paranormal phenomena, one flaw emerges; specifically that few have presented an argument for the causes of orbs. Some such theories have been developed, however.

PARANORMAL ORB THEORIES

Previously presented evidence suggests that there was no starting theory connecting orbs with the paranormal. The origins of the

connection were sudden; resulting from photographs of orbs being taken frequently in allegedly haunted locations. This also coincided with the proliferation of digital cameras.

The rationalist explanation states that conditions for prolific orb capture are similar to those of typical investigations of the paranormal; specifically, taking photos in old houses, in the dark with cheap digital cameras. Since these conditions matched 'ghost hunts' more frequently than other spheres of life, the orbs were linked with paranormal events. It should be noted, however, that this researcher has observed that orb photos do occur regularly in 'everyday situations'. As such knowledge was transferred from researcher to researcher the theory was backed up, by way of superstition, as orb 'evidence' appeared consistent with the assertion of paranormal connection.

Whilst most belief in orbs as paranormal phenomena seems to rest with unsubstantiated paranormal or religious belief or a rejection of the rational theory, various theories have developed to attempt to explain the phenomena.

One such theory states that orbs are balls of energy being passed from natural, living or man-made sources to 'spirits' to aid their manifestation (Juliano, 2007). This theory would appear to be a justification for the phenomena by integrating with existing 'ghost theory'; this theory, however, would appear to have no scientific justification, either empirical or theoretical.

Another, somewhat related, theory states that orbs are balls of energy "existing in the semi infrared range of light" (Juliano, 2007; MPRS, 2007) and are captured by digital cameras, as these cameras are capable of capturing light in that spectrum. Again this would be appear to be a case of forcing the paranormal evidence into a related scientific theory. Similarly there is no evidence presented to substantiate this theory, despite the relative ease with which evidence could be gathered.

RATIONAL ORB THEORIES

Two primary rational theories of orbs can be found. First the connection between orbs and digital camera megapixel ratings and secondly the explanation of orbs as out of focus dust – the 'Orb Zone' theory.

The theory relating to effective megapixel rates relates to the technical function of 'blooming' (Hannemyr, 2007), "the overflow of charge from [one] pixel to another, caused by extreme lighting conditions such as a bright white light next to dark edge" (UKParanormal, 2007). This theory has been rationally dismissed as a 'rectangular' rather than spherical aberration that effects a small number of pixels only; an effect too small to produce orbs of the size that are captured (Townsend, 2007). Empirical observation by paranormal researchers, however, seems to add weight to the theory that higher megapixel rate cameras do capture fewer orbs compared to their lower quality counterparts (Wood, 2005).

A number of theorists in recent years have made compelling cases for orbs as out of focus dust (Townsend, 2006; Van Walree, 2007; Wood, 2006). This is a complicated theory that will be handled as briefly as possible.

The starting point of the theory is the generally recognised fact that orbs are common using digital cameras, but uncommon when using 35mm cameras (Wood, 2005). One of the key differences between digital and 35mm cameras is the 'plate' onto which the photographed image is projected. 35mm cameras use reels of film, photos are projected onto physical film. Digital cameras use CCD (charged couple device) chips as a digital replacement; CCD chips vary in size but are almost always much smaller than the old style film (with the exception of some Digital SLRs). To maintain the image resolution, the lens of digital cameras was required to be far sharper; thus resulting in an increased depth of field (DOF). When a camera focuses on a subject, the subject is the only point that is entirely in focus. However in front of, and behind, the subject other objects are gradually less in focus. This whole field of focus is known as the depth of field.

As the DOF of digital cameras were greater, the nearest point where an object could be in focus was brought close to the camera. Thus, the point just before this area of focus – where objects are seen as out of focus – was brought closer to the camera itself. The area just before this nearest point of being 'out of focus' is an area where nothing can be seen or, technically, the area where objects are so 'out of focus' as to be so big they appear invisible. What is actually seen where an object is out of focus is the 'blowing up' of the object into small circles; out of focus objects can also be semi-transparent (try placing a finger close to

your eyes, you can see through it). These small diffuse circles are made up of 'circles of confusion' – the smallest area that can be seen as sharp (typically 0.05mm).

In summary, the resulting area in front of a camera can be split up into three 'fields'. In the nearest field nothing is visible, in the middle field objects appear out of focus and in the far field objects are in focus. Each of these fields is further defined by what the camera can physically view. Therefore the only field in which dust can be seen is the middle – out of focus, and therefore much larger – field. This is because in the near field it is not visible, and in the far field it is too small to see. The reason the dust is represented as circular is because the previously mentioned 'circles of confusion' define it. The circular aperture of the camera in turn defines the circles of confusion. This helps to explain orbs of different shapes, particular orbs of a triangular and hexagonal shape; some makes of camera design the aperture in a geometric, non-spherical, shape.

Various factors, beyond the type of camera, contribute to the size of the DOF. The first is the distance of the subject. If the subject is further away a sharper focus is required, which in turn increases the depth of field. The other two are technical features of the camera – focal length and aperture used. These help to explain why some cameras capture more orbs than others, and why photos of distant objects capture more orbs.

A further factor that makes this out of focus dust visible, as orbs, is the amount of light needed to be illuminated. A high intensity of light is needed for these orbs to be visible. The common source of light is a flash. The amount of light immediately in front of the camera is intense, but in line with Newton's Inverse Square Law the further something is from the flash the intensity is much lower. Therefore compact cameras capture orbs more frequently as the flash is closer to the lens. SLR cameras – with the flash mounted further away – capture orbs less frequently. Similarly, when no flash is used orb capture is possible but only where there is an intense light source (sometimes daylight) within the area of the camera.

To return to 35mm cameras, there is nothing about 35mm camera technology that precludes orb capture. However, because the depth of field is much smaller it is very rarely close enough to the camera to allow orb capture. The result is that orbs captured using 35mm are

your eyes, you can see through it). These small diffuse circles are made up of 'circles of confusion' – the smallest area that can be seen as sharp (typically 0.05mm).

In summary, the resulting area in front of a camera can be split up into three 'fields'. In the nearest field nothing is visible, in the middle field objects appear out of focus and in the far field objects are in focus. Each of these fields is further defined by what the camera can physically view. Therefore the only field in which dust can be seen is the middle – out of focus, and therefore much larger – field. This is because in the near field it is not visible, and in the far field it is too small to see. The reason the dust is represented as circular is because the previously mentioned 'circles captured using 35mm are infrequent infrequent, but entirely possible.

To summarise, the combined circumstances needed to capture orbs are shown below. This very small area has been termed the 'orb zone'. The 'orb zone' has to satisfy the following characteristics:

1. Within the field of view of the camera – what it can 'see' within its environment;

2. An area with sufficient light intensity to illuminate particles – usually the flash of a compact camera, but other light conditions (including daylight) can occasionally provide enough intensity;

3. Behind the camera's point of nearest focus – any particles beyond this will appear 'in focus' and thus too small to be discernable;

In front of the camera's point of visibility – anything behind this will be too out-of-focus to be visible.

These characteristics and the resulting 'orb zone' are shown in figure 1, overleaf.

AIMS OF THE PRESENT STUDY

This study aims to address the needs of the research community, in terms of scientific evidence of the origins of orbs. The primary aim of the study, thus, is to test the rational explanations of orbs to assess whether they are significant contributors to the existence of orbs. This has been achieved by planning a procedure to test five hypotheses:

1. It is hypothesised that the label of 'haunted' or 'not haunted' will make no significant difference to the number of orbs photos captured;

2. It is hypothesised that increasing the depth of field should

increase the number of orbs;

3. It is hypothesised that operating a flash in low light will capture more orbs than not operating the flash;

4. It is hypothesised that increasing the distance of the flash from the lens will capture fewer orbs;

5. It is hypothesised that using a 35mm camera in the place of a digital camera will capture fewer orbs;

6. It is hypothesised that varying the effective rate of digital camera megapixel count will affect the number of orbs captured.

Providing evidence that orbs can be naturally effected should provide evidence for those who dismiss orbs as natural. Similarly those who dismiss natural explanations entirely may be educated by the study. Whilst minority theorists – who believe most orbs are natural, but a few are not – may be provided with evidence of the natural

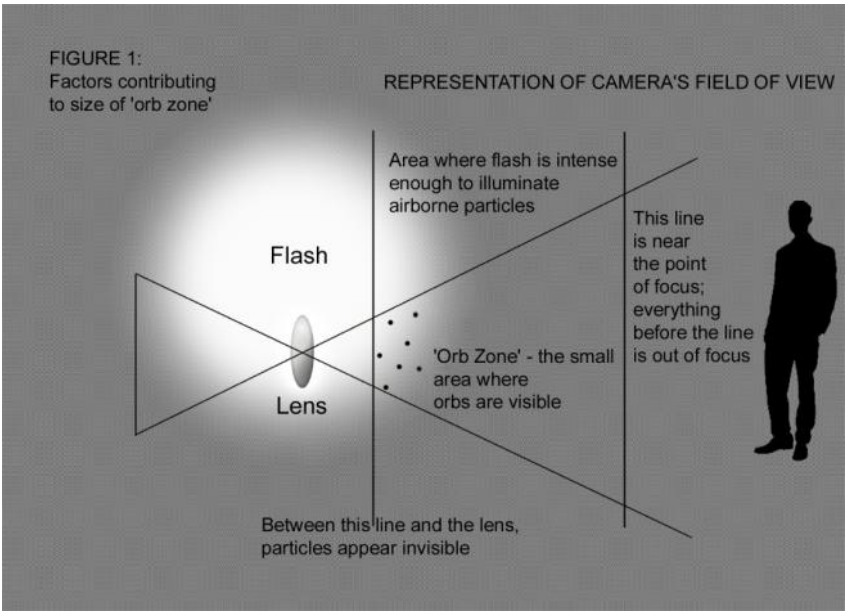

Fig.1—These circumstances needed to capture orbs and the resulting 'orb zone'.

explanations of orbs, the current methodology will not address the 'exceptions' directly.

The discussion will note a bank of possible exceptions for further study and explanation. These exceptions are all adequately explained within the 'orb zone' theory, so it may be that these explanations for exceptions are sufficient for researchers.

METHOD

PARTICIPANTS

Five research assistants were used in the first round of five experiments. Each assistant was assigned to an experiment to make consistent any effects associated with the individual. The same two participants were used in subsequent rounds and each was assigned to an experiment. Three disinterested members of the public who had no knowledge of the orb phenomena, or the experiment or its conditions, were selected to judge which photos contained 'orbs' and which did not. Each judge was presented with a typical photograph of an orb on which to base his or her judgements.

MATERIALS

In each condition cameras were placed on a telescopic tripod and tape was used to mark the resting and 'shooting' locations of assistants.

The following types of cameras were used in each experiment:

- First experiment – Panasonic DMC-FZ10-K and Samsung Digimax 401.
- Second experiment – Kodak Easyshare DX6440.
- Third experiment – Samsung Digimax 502.
- Fourth experiment – Samsung Digimax 401.
- Fifth experiment – Samsung Digimax 401 and Kodak Colour disposable 35mm cameras.

A brief and debrief sheet was provided for all assistants and participants.

LOCATION

Location was a key consideration for the study. A controlled field environment was selected to aid ecological validity; the environment had to be controlled but had to be as similar as possible to field

conditions. A haunted building was selected that was known to be associated with orb photos that have been theorised to be both paranormal and non-paranormal by past researchers. A location with high instances of orb photos was deemed important in order to generate enough data to be analysed.

The events manager of the location, herself a paranormal researcher, was asked to select two rooms. One room with an ongoing history of paranormal phenomena was chosen for the experimental conditions. One room with no known history of paranormal activity was selected for the control conditions. As the location was able to provide several such rooms two were selected that were as similar as possible to one another. It was ensured the rooms had the correct amount of space to host identical experiments and that the structure of the rooms and the level of dust – defined by the same flooring material – was similar.

DESIGN AND PROCEDURE

In each location assistants were positioned at a line a set distance from a tripod. The tripod was of a set height, which was a set distance from the subject. The subject was a wall in the first round of experiments. The camera manual was used in each experiment to ensure the subject distance was sufficient for maximum flash activation, therefore holding this variable constant. The experimenter timed each assistant to move the same distance to the tripod and take a photograph of the subject in the same direction. Movements by individuals were held constant in all conditions so the level of dust flow was kept as constant as possible. The same assistant was used for each experiment so any potentially compounding variables related to individual assistants – such as method of movement or levels of breathing – were kept constant. A sample of this procedure using two assistants is shown in figure 2, opposite.

After each of the assistants had taken one photograph the process was repeated. Twenty repetitions comprised each phase for each of the five experiments; there were four phases overall.

Twenty photos per person per phase, over four phases, were deemed appropriate. Whilst a greater numbers of trials would have allowed more validity in the results, this number was deemed valid

especially in the light of fatigue and other human factors associated with conducting experiments for a longer period of time.

The first phase took place in the experimental condition (i.e. the 'haunted' location). The first experiment varied the distance of the lens from the flash, so an SLR camera was used. The second experiment varied the use of flash, which was activated or not. The third experiment varied the effective megapixel count, which was set at maximum. The fourth experiment varied the depth of field, and the 'normal' zoom mode was selected. The fifth experiment varied the type of camera used, and a 35mm camera was selected.

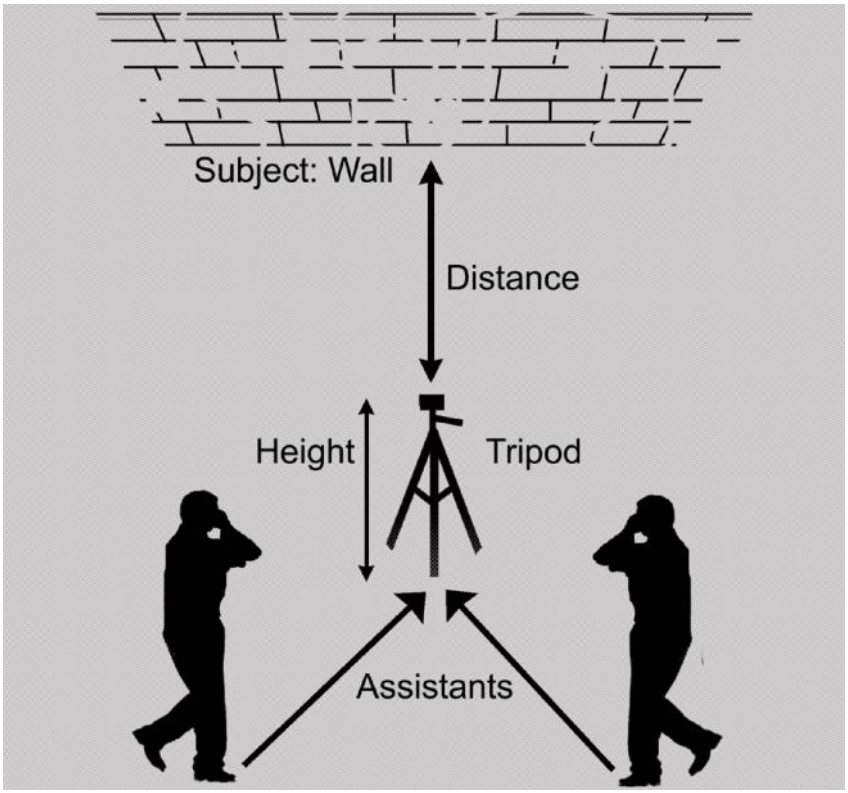

Fig.2—Procedure with two assistants.

especially in the light of fatigue and other human factors associated with conducting experiments for a longer period of time.

The first phase took place in the experimental condition (i.e. the 'haunted' location). The first experiment varied the distance of the lens from the flash, so an SLR camera was used. The second experiment varied the use of flash, which was activated or not. The third experiment varied the effective megapixel count, which was set at maximum. The fourth experiment varied the depth of field, and the 'normal' zoom mode was selected. The fifth experiment varied the type of camera used, and a 35mm camera was selected.

The second phase took place in the control condition and replicated exactly the above phase (i.e. the 'non-haunted' location).

The third phase took place in the experimental condition (i.e. in the 'haunted' location). The first experiment used a compact camera in place of the SLR, where the flash was closer to the lens. The second experiment activated the flash of the same camera used in the first two phases. The third experiment varied the effective megapixel count to approximately one sixth of the count during the first two conditions; the rate was set internally using the same camera. The fourth experiment used the same camera as the first two phases but activated the zoom function to increase the depth of field. The fifth experiment used a compact digital camera in place of the 35mm camera.

The fourth phase took place in the control condition and replicated exactly the above experiment (i.e. the 'non-haunted' location).

The experiments and phases are represented in Table 1:

	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
Phase 1 - experimental/ haunted' location	SLR vs Compact	Compact flash vs non-flash	Low vs high megapixel	Normal vs enhanced DOF	35mm vs compact
Phase 2 - control/ non-haunted' location	SLR vs Compact	Compact flash vs non-flash	Low vs high megapixel	Normal vs enhanced DOF	35mm vs compact
Phase 3 - experimental/ haunted' location	SLR vs Compact	Compact flash vs non-flash	Low vs high megapixel	Normal vs enhanced DOF	35mm vs compact
Phase 4 - control/ non-haunted' location	SLR vs Compact	Compact flash vs non-flash	Low vs high megapixel	Normal vs enhanced DOF	35mm vs compact

DESIGN AND PROCEDURE OF REPEAT EXPERIMENTS

Following the experimental procedures each photographic unit was examined to ensure that all camera variables were held constant during the experiment. The EXIF information for each image was examined to ensure variables – which are controlled automatically in most compact cameras – such as shutter speed, lens aperture, focal length, F -number, exposure time and ISO rating were constant throughout the experiment. Where variables were identified from the EXIF data after the experiment the experiments were considered flawed and compounded, therefore repeat experiments were needed, where the compounding variables had been identified and eliminated.

Flaws were identified in the third and fourth experiments (see discussion). These two experiments were repeated in the same location using the same set up and circumstances as the first procedure. The exception was the use of a subject at varying distances from the camera, to alter the depth of field.

It was deemed acceptable to repeat the two experiments in isolation, as there were no plans to compare each experiment to any of the other four.

Flaws were found in the repetitions of the two experiments. A final experiment was conducted in exactly the same way as above, except that in the third experiment the ISO rating was on forced 'hold' and in the fourth experiment no subject was used, but the micro focus setting was used to reduce the depth of field.

RESULTS

All photographs were presented to independent judges in a random order. Photos were deemed a 'hit' – that is, to contain at least one orb – if two or three of the judges had flagged up the photo as such.

Each experiment was subjected to the Chi-Square inferential statistical web test (Georgetown Linguistics, 2007). Summary results follow in Table 2. These relate to the final results following repeats.

Test	Chi-Square	>p	Significant?	Orbs (a)	Orbs (b)
Experimental (a) vs control overall (b)	1.51	.05	No—supports hypothesis	75 of 160	86 of 160
SLR camera (a) vs compact (b) overall	15.25	.001	Yes – supports hypothesis	0 of 40	13 of 40
SLR camera (a) vs compact (b) - experimental locations	8.49	.01	Yes – supports hypothesis	0 of 20	7 of 20
SLR camera (a) versus compact (b) - control locations	7.06	.01	Yes – supports hypothesis	0 of 20	6 of 20
Compact flash (a) vs compact non-flash (b) overall	4.21	.05	Yes – supports hypothesis	4 of 20	0 of 20
Compact flash (a) vs compact non-flash (b) - experi-mental locations	4.44	.05	Yes – supports hypothesis	4 of 20	0 of 20
Compact flash (a) vs compact non-flash (b) control locations	-	-	No—does not support hypothesis	0 of 20	0 of 20
Low megapixel (a) vs. High megapixel (b) camera - over-all	2.88	-	No—does not support hypothesis	39 of 40	35 of 40

Low megapixel (a) vs. High megapixel (b) - experimental locations	3.24	-	No – does not support hypothesis	20 of 20	17 of 20
Low megapixel (a) vs. High megapixel (b) - control locations	0.36	-	No – does not support hypothesis	19 of 20	18 of 20
Normal (a) vs. enhanced (b) depth of field - overall	11.42	.001	Yes – supports hypothesis	30 of 40	40 of 40
Normal (a) vs. enhanced (b) depth of field - experimental locations	7.06	.01	Yes – supports hypothesis	14 of 20	20 of 20
Normal (a) vs. enhanced (b) depth of field - control locations	4.44	.05	Yes – supports hypothesis	16 of 20	20 of 20
35mm (a) vs. compact (b) camera - overall	7.44	0.1	Yes – supports hypothesis	2 of 40	11 of 40
35mm (a) vs. compact camera (b) - experimental locations	3.14	0.5	No – does not support hypothesis	1 of 20	5 of 20
35mm (a) vs. compact camera (b) - control locations	4.33	0.5	Yes – supports hypothesis	1 of 20	6 of 20

Note: Degrees of freedom in each test = 1

Table 2 shows that, overall, there was no significant differences in the number of orbs captured between experimental and control locations; in other words there was no difference between haunted and non-haunted locations.

It is shown that, overall and in experiment and non-experimental locations, there is a significant link between greater number of orb photos and the reduced distance of the flash from the lens ($\chi 2 = 15.25$, df = 1, p = 0.001) and an enhanced depth of field ($\chi 2 = 11.42$, df = 1, p = 0.001). These findings were consistent with their hypotheses.

In the case of flash activation there was a significant link ($\chi 2 = 4.21$, df = 1, p = 0.05), overall and in the experimental location, between the flash being activated and greater orb capture. The link was not statistically significant in the control location simply because no orbs were caught in either condition.

In the case of the types of camera there was a significant link ($\chi 2 = 7.44$, df = 1, p = 0.05), overall and in the control location, between a digital camera being used and greater orb capture. Whilst the experimental condition was not significant, the results in this condition still supported the hypothesis.

Table 2 also shows that in all conditions there was no significant link between megapixel count and greater orb capture.

DISCUSSION

The most striking statistic to emerge from the results is the number of orbs captured, in the same circumstances, in the experimental (haunted) control (non-haunted). These statistics were very similar; certainly not significantly different. This would suggest that orbs have no correlation with 'haunted places', where all other circumstances are held constant (supporting Hypothesis 1).

All tests applied to depth of field and flash distance returned a significant relationship. This suggests a correlation between orbs captured and, respectively, a) the distance of the flash from the lens (supporting Hypothesis 3) and b) the enhancement of depth of field (supporting Hypothesis 4).

In the case of use of flash and type of camera two of the three tests, in each case, indicated a significant relationship (supporting Hypotheses 2 and 5, respectively). The cases where the tests failed were

adequately justified in the results section. These results would suggest that the use of flash and the use of digital cameras have a positive and significant relationship with the number of photos containing orbs.

The results of the megapixel count conditions did not support the hypothesis (Hypothesis 6). The study suggests no direct relationship between megapixel count and the number of orb photos captured.

DISCUSSION OF FLAWED AND REPEATED EXPERIMENTS

Flaws were discovered in the third and fourth experiments. In the case of the fourth experiment: whilst the results supported the hypothesis it was found that the 'zoom function' altered the 'field of view' in a compounding way, as a result of the change of the depth of field.

In the third experiment the results were consistent with the hypothesis, but it was established that the alteration of the megapixel count had also reduced the ISO rating (the film speed or sensitivity). In the case of the fourth experiment it was found that whilst the results supported the hypothesis, the use of a subject subtly changed the lighting of the room to a compounding degree.

LIMITATIONS OF THE RESEARCH

The primary limitation of the research was its relatively limited scope. The study sought to establish that certain technical factors related to cameras have significant influence on orbs. The more rational 'minority theorists' contend that whilst dust accounts for the vast majority of orbs, that certain orbs that differ in appearance from the typical description of an orb may be paranormal.

The 'orb zone' account of orbs does offer explanations for these less common orbs as technical aberrations. Being less common, such exceptional cases are more difficult to study under experimental conditions.

Further limitations of the research include the first and fifth experimental condition. Orb zone theory suggests that different makes of camera – in particularly of lens and CCD chips – produce different effects. Thus, comparing different cameras – SLR and compact, 35mm and digital – were less than ideal, but there was no viable alternative.

Another limitation concerned potentially compounding factors. Whilst all due care was taken to ensure all conditions were identical, including any factors relating to the individual, the precise quantities of dust and 'ghosts' were necessarily unknown. However these limitations detract very little from the main thrust of the research.

Further, this research relates only to orbs captured on 'stills' cameras and takes no account for orbs captured on video camera. However, the theory that seeks to explain 'stills' orbs can just as adequately explain video orbs.

Finally it should be noted that the nature of science does not provide absolute proof, however strong evidence should only be superceded by even stronger research, properly conducted.

AREAS FOR FURTHER STUDY

Whilst this study provides significant evidence that 'common' orbs are related to non-paranormal factors related to digital cameras, there is scope for further research.

In the first instance future experimental research could explore the 'proof', or theories presented, for theories suggesting that orbs are a paranormal phenomenon. This would include the possible poor probabilistic reasoning related to interaction with orbs and the infrared spectrum. Research into both these theories would not be complicated and may, therefore, be justifiable to conduct.

The second area of future research relates to so-called exceptional cases. This study provides significant evidence for the 'orb zone' theory, which in turn can offer explanations for exceptional cases. However further research into specific exceptional cases may add value to the theory.

The author will construct a website to provide explanations for exceptional cases, including:

- Orbs of different colours;
- Multiple orbs and orbs that appear to be moving;
- Orbs of different compositions and structures;
- Orbs of different shapes and sizes;
- Incomplete orbs;
- 'Fuzzy' orbs.

Further explanation is also warranted as to why orbs appear when components of the orb zone theory are not present, including:

- Orbs captured without flash or in daylight condition;
- Orbs captured using 35mm cameras;
- Orbs that appear to be hidden behind a solid object further away from the lens than the orb zone;
- Orbs caught with an SLR camera;
- Orbs caught in a 'dust free' or 'moisture free' environment, with a camera hood or with a 'clean' lens.

IMPLICATIONS OF THE RESEARCH

For those who accept the scientific method it would be reasonable to accept that the study provides strong evidence that orbs are 'caused' by normal factors relating to digital cameras and the circumstances surrounding orb capture.

This study should also lay the groundwork for an accessible, web-based explanation of every aspect of orb theory. The author has observed that numerous researchers have believed in the paranormal nature of orbs as a default position because information on the subject was either a) not available, b) inaccessible to a layperson or c) addressed the theory rather than the everyday concerns of lay investigators.

Finally, in the context of lay paranormal research this study substantiates and justifies the stance of rationalists and minority theorists as to the nature of orbs on photographs. In particular it finally justifies the stance that, unless there is a specific research objective in mind, orb photos are rarely worth the time it takes to analyse them.

REFERENCES

Eaton, J. W. (2004) *I think we have a true orb, folks!* URL http://www.ghoststudy.com/monthly/may04/trueorb.htm Date accessed: 20 January 2007.

Fuji (2007) *Flash reflections from floating dust particles* URL http://www.fujifilm.com/products/digital/tips/reflect/index.html Date accessed: 20 January 2007.

Georgetown Linguistics. (2007) *Web Chi Square Calculator* URL http://schnoodles.com/cgi-bin/web_chi_form.cgi Date accessed: 20 January 2007.
Ghosts (2007) *Orbs Energy Vortex!* URL http://www.ghosts.org.uk/index182.html Date accessed: 20 January 2007.
Hannemyr, G. (2007) *Image Defects: Blooming* URL http://hannemyr.com/photo/defects.html#bloom Date accessed: 20 January 2007.
International Ghost Hunters Society (2007) *Natural Orbs versus Spirit or Ghost Orbs* URL http://www.ghostweb.com/orb_theory.html Date accessed: 20 January 2007.
Juliano, D. (2007) *Digital Cameras are Good Tools and the Infrared Connection* URL http://theshadowlands.net/ghost/digitalcameras.htm Date accessed: 20 January 2007.
Juliano, D. (2007) *What are Orbs?* URL http://theshadowlands.net/ghost/orbs.htm Date accessed: 20 January 2007.
Kimura, M. (2004) *Science of Orb Photos* URL http://www.learninglight.net/index.php? option=com_content&task=view&id=674&Itemid=109 Date accessed: 20 January 2007.
Lee, P. (2007) *Where have all the ghosts gone?* URL http://www.btinternet.com/~dr_paul_lee/ghostresearch.htm Date accessed: 20 January 2007.
Melrose, D. (2007) *The Sceptics View* URL http://www.joe15.fsnet.co.uk/sceptic.htm Date accessed: 20 January 2007.
Midnite Walkers (2007) *False Orb Experiment* URL http://midnite-walkers.com/joomla/content/view/30/50/ Date accessed: 20 January 2007.
MPRS (2007) *Photographic Evidence: Analysis & Research* URL http://www.missouriparanormal.com/photos.html Date accessed: 20 January 2007.
Paranormal Ghost Society (2007) *Truth!* URL http://www.paranormalghostsociety.org/truth.htm Date accessed: 20 January 2007.
Parascience (2007) *Orbs, or a load of balls?* URL http://www.parascience.org.uk/articles/orbs.htm Date accessed: 20 January 2007.
Rickard, R. & Kelly, R. (1980) *Photographs of the Unknown* London:

English Library Ltd.
Sipos, T. M. (2006) *Guardian Angel Orbs* URL http://www.weeklyuniverse.com/2006/angelorb.htm Date accessed: 20 January 2007.
Taylor, T. (2003) *Spirit Photographs: Orbs and Globes of Light* URL http://www.prairieghosts.com/orbs.html Date accessed: 20 January 2007.
The Society for Paranormal Investigation (2007) *Ghost Orbs* URL http://www.paranormalghost.com/ghost_orbs.htm Date accessed: 20 January 2007.
Townsend, M. (2006) 'How to ... take Anomalous Photos' *Anomaly: Journal of the Association for the Scientific Study of Anomalous Phenomena* 38, 2-15
Townsend, M. (2007) *Orbs: Alternative Theories* URL http://www.assap.org/newsite/htmlfiles/Orb%20mythology.html Date accessed: 20 January 2007.
UKParanormal (2007) *Orbs, what the hell are they?* URL http://www.ukparanormal.co.uk/Orbs.html Date accessed: 20 January 2007.
Whitedove, M. (2007) *Books* URL http://www.michellewhitedove.com/gs_samplech.php Date accessed: 20 January 2007.
Wilson, G. (2004) *Photographic Analysis: Orbs* URL http://www.the-atlantic-paranormal-society.com/arthunters/photo-orbs.html Date accessed: 20 January 2007.
Wood, D (2005) 'Orb Theory and the Correlation Between Orb Anomalies and Digital Camera Megapixelage' *Journal of Investigative Psychical Research.* 1(1), 10-15
Wood, D. (2006) 'The Truth About Orbs' *Journal of Investigative Psychical Research.* 2(1), 3