



Obtaining Images During Paranormal Investigations

Part I - Film Cameras

Perhaps the most sought after evidence by all investigators of paranormal phenomena is the visual evidence. A picture speaks a thousand words as the saying goes. Images can take the form of still pictures from both film and more recently digital cameras and also video footage from both analogue and digital camcorders.

This article is not an in depth technical description of the various means of producing still and moving images there are many resources available to those interesting in such things. It is instead a discussion of the relative advantages and disadvantages the various methods offer to those who wish to make use of them in support of their own paranormal investigation requirements. Some technical information is necessary and will be provided when it is relevant to the general topic. In all cases where the paranormal investigator seeks to use image recording as a tool they are advised to fully explore all the various options, their relative advantages and disadvantages and decide for themselves what best suits their specific requirements. This article may help them with that task.

Over the past 150 years there have been many images that claim to show definitive proof of ghosts, anomalous moving objects and other such paranormal phenomena. Some have been quite compelling, whilst others have had many criticisms levelled against them. As a paranormal investigator it is important to make the most of every opportunity to capture useful evidence that may support the investigation findings or demonstrate the true nature of the phenomenon.

Choosing and using the right type of imaging device is an important first step. Selecting the best position for the camera will also maximise the chance of capturing something useful. Interpreting the subsequent images is the final stage of the process and is perhaps the one that is most likely to cause problems for the investigator.

Choosing the Right Camera

Many investigators use a camera of some type during an investigation - often the choice is made on the basis of whatever is available. Most people have access to a camera or perhaps a video camera-recorder (camcorder). In the majority of cases these will have been bought previously on the basis of the needs of the family for the recording of holidays and other family occasions. Sometimes an investigator may decide to purchase a camera or camcorder to support their investigations, although the choice is usually made with little regard to the features and abilities that the camera possesses and that may be helpful when conducting the investigation.

Usually, paranormal investigations are conducted after dark where the use of flash is needed to give sufficient light for a properly exposed and focussed image. It is for this set of conditions we will consider the key abilities of the various types of camera camcorder and media we'll be discussing.

In so many cases the instruction manual is briefly read then put away and forgotten - after all how difficult is it to take a photograph? Modern cameras have a wealth of additional features some of them such as manual control of exposure and focus can be a real help. In every case the user should dig out that

instruction manual and fully familiarise themselves with the capabilities of the camera or camcorder. Take some shots in all the different modes and test out the features. With camcorders and digital still cameras this is made even easier by the fact that the media is re-usable and therefore the only costs are in time. That time is a wise investment and this stage should not be overlooked even if you consider that you can take a pretty decent photograph.

Still Cameras

Without doubt the most likely item of equipment the paranormal investigator is likely to either own or have access to. They are available in two forms. The familiar film camera that takes either 35mm or one of the less common film formats. In recent years digital stills cameras have overtaken film models in sales and are increasingly found in the investigators kit bag. Within recent years we have seen an increase in mobile phones that provide a basic digital camera built-in to them.

Film Cameras

Choosing the Right Type of Film

Film cameras have been around for well over 150 years and the technology is mature and well understood. Film requires the exposure of Silver based chemicals within the film itself to light which in turn require to have further chemical processes carried out in order to produce the final picture we are all familiar with. In practise most people simply hand the film to a lab for the development and printing of the images.

Film is available in a range of speeds; this is an indication of its sensitivity to light. That speed or sensitivity is normally quoted in ISO ratings - the higher the number, the more sensitive the film is and the less light is required to produce an effective image.

Slow speed film, normally considered to be ISO 100 and below needs bright daylight or a powerful flash to produce the best quality images. Fast films, from ISO 400 and above need correspondingly less light for an effective image to be produced.

So, you may think that we just get the fastest film we can, as in all things there are some additional factors that need to be considered. The increased light sensitivity requires a different chemical ratio and the resulting images have an increased graininess and less definition, colours may also be less accurately defined.

Select a very high speed film with an ISO rating of 1600 or even 3200 and you may find that the image is a bit like looking through a fine mesh, very soft and with little definition in the objects. Fast films may also require specialist processing and developing that can cost a bit more money.

Film is also available in colour and monochrome (black & white) varieties, although realistically monochrome is rarely stocked by many stores and nowadays needs to be bought from a specialist camera store. Monochrome can offer some advantages such as it's ability to take pictures with a higher contrast ratio than colour but unless you are prepared to pay the extra costs for development it's perhaps best to stick to using easily obtainable colour film. Some investigators have experimented with film that is sensitive to Infrared light but this is a highly specialised type of film that cannot easily be used in many cameras, it needs careful storage and handling and is expensive to develop, at this stage we'll not consider it any further within this article.

Overall then, in most investigation situations colour film in the ISO range of 400 - 800 offer the perhaps best compromise between the need to capture low light images and reasonable definition in the subsequent images.

Before You Rush Out and Buy

Not all films are created equal and the various makers use slightly different chemical compositions in the products. This leads to subtle and some not so subtle differences between them. Generally, it is better to go with one of the big name brands. Kodak, Fuji, Konica and Agfa are perhaps the best known. They have invested heavily in developing film technology and this investment shows in the quality of the final image. There can be subtle but significant variations between brands, Kodak for example tend to have brighter, some might say 'over the top' colours. Fuji films tend to be slightly more subdued, more natural colours although favouring greens and also flesh tones. Another consideration is the development stage - if your local high street developer uses a Kodak or Fuji based processing system it may be that you will get the best final images by using the corresponding makers film although here we are getting into areas where the differences are almost too slight to be any concern.

It is at the development stage where a lot of problems can also occur that may lead to the production of anomalies. Poor temperature control at the processing stage, watermarks and mishandling all are well known causes of reported paranormal images.

You will also come across own brand film offered by various shops and supermarkets, this can be tempting as it often considerably cheaper than a big brand film. Generally, this should be avoided, as the economy can be false. Own brand film tends to use older film technology and the final images can be softer, less defined and of poorer colour rendition than the corresponding big brand version of the same ISO rated film.

If you need to take a lot of pictures perhaps for a record of the locations visited then own brand film may be worthy of consideration but shop around and experiment to ensure you are happy with the final image quality.

Film still retains one advantage over the digital cameras images - the negative.

For the purist this additional step can be used to show that the final image has not been tampered with after the picture has left the camera. Processing faults, which are a frequent cause of many photographic anomalies, are also easier to detect at the negative stage.

Choosing the Film Camera

Film cameras come in a wide variety of types. Here we will consider those that use 35mm film cassettes as these are the most likely to be already owned and the most readily available in the stores. 35mm cameras are available in two main varieties - the 'compact' and the SLR.

The 35mm Compact Camera is often designed to be simple and convenient to use. The controls are normally fairly basic although some models do offer a range of more advanced options. Normally the compact model has a small flash built in that is effective up to around 15ft from the camera. Many also offer the ability to automatically set the focus and the exposure - all the user has to do is aim and shoot and they are normally rewarded with a pretty decent image.

This ease of use is also one the chief drawbacks of this type of model. The maker has designed the camera to successfully take pictures of average subjects - people standing smiling at a distance of 6-10 ft in front of the camera or perhaps a nice holiday landscape.

Certainly 'auto-everything' allows the investigator to take a quick shot of anything that unexpectedly may take place or appear but at the increased risk of a poor defined or badly exposure image.

In low light, some auto focus systems may not work reliably or rapidly enough resulting in an image that is out of focus or in some models a picture cannot be taken at all as the camera prevents it being

taken until proper focus is achieved. The camera's in-built opto-electronics may also try to focus on something different to that which the investigator is trying to get a decent picture of. The subject will then be out of focus and difficult to see with any definition.

The shutter speed too, is also selected by the camera - often when the flash is used it will default to a shutter speed that may be too slow to capture some moving objects effectively resulting in blurred or out of focus objects that can often look extremely unusual and which can sometimes result in the picture being promoted as evidence of paranormal activity.

The viewfinder is another area of weakness in many compact 35mm cameras - the main problem is that the viewfinder does not 'see' exactly the same thing as appears on the film. This can lead to objects such as fingers, stray hairs and most frequently; the camera strap appearing in the final image, much to the surprise of the photographer. The slightly different viewpoint of the viewfinder also creates a parallax error and so even at a distance real world objects that are not seen at the time of taking the picture will appear in the final image, again frequently leading to the belief that some are perhaps paranormal. Finally, the lens on the compact models of 35mm camera is generally smaller to fit the body style. The lens aperture is also correspondingly smaller, less light passes to the film requiring the flash to be used in many more situations to compensate. Some compacts provide a zoom lens although this is rarely very powerful (3x is the most common). Zoom lenses have many more individual glass elements further reducing the amount of light passing through whilst increasing the chance of internal reflections and refractions that may cause false anomalies in the final image.

The 35mm compact can be a useful tool for the investigator and its ease of use means that it is quickly available for taking many satisfactory pictures. The image quality with even the cheapest 35mm compact camera will often be better than all but the most expensive digital models. With a little care and though this type of camera can provide the investigator with a useful investigative tool.

The 35mm Single Lens Reflex (SLR) Camera addresses many of the shortcomings of the compact models. The viewfinder uses a series of prisms and mirrors to allow the photographer to see exactly what will appear on the film. Although the majority of the available models have some degree of automation most also allow the user to make manual setting of shutter speed and the focus at the very least - in most cases the user can have total control of every function the camera offers.

Some SLRs have a small flash built-in but most models allow a more powerful flashgun to be attached. As the accessory flashgun is further from the lens axis this also has the advantage of reducing the amount of flash light that is reflected directly back toward the lens and reducing the amount of 'false anomalies' that this can create.

SLRs have traditionally formed part of a 'system' with many accessories being available - even for the budget models. Extra lenses, remote controls, data backs that print time and date information and many more gadgets are available for just about every make of 35mm SLR manufactured in the last 25 years. If you have a particular photographic experiment you wish to try then a 35mm SLR camera will almost provide everything you need to make it a reality.

Until quite recently 35mm SLRs were considered to be expensive and the preserve of the more dedicated enthusiast, with the coming of digital this has all changed. The camera shops and the auction websites are full of camera bargains - many almost at silly prices!

The lenses of 35mm SLRs are physically much larger and therefore allow very much more light to pass through them, flash is needed less. The optics are generally of a higher quality with more effective lens coatings to better control internal reflections and refractions.

As they are designed to be used by the more advanced amateur or also the professional, 35mm SLRs are generally built to take many thousands of pictures, the internal mechanisms such as the shutter and

the film drive are stronger and more reliable than with most compacts which are designed to be used less frequently and so do not need to be so resilient.

Although they address many of the basic problems with taking effective photographs the 35mm SLR still requires careful use. The majority of photographs that are taken of apparent paranormal or otherwise anomalous objects are the result of the photographer making some error when taking the picture. They can be quick to use with automation taking care of the picture taking processes when it is appropriate and manual control being used when necessary. Overall the quality of any pictures produced with a 35mm SLR will also be better than those taken with 35mm compact models.

The films themselves will be around for many years and the quality of film will still be generally better than anything but the very highest resolution digital camera. Although it is difficult to make a direct comparison the amount of information contained in a single 35mm film frame is around the same as would be found with a 40 Mega-pixel digital camera.

For the investigator seeking to take pictures of the highest quality possible. For the ability to take successful pictures in difficult lighting situations, for those wishing to carry out experimental techniques including Infrared photography and for the investigator seeking the best long term value and usefulness from their camera investment then the 35mm film camera may still be their No.1 choice.

Part II - Digital Cameras

Digital Photography

Digital cameras are a fairly recent innovation first appearing on the high street less than 10 years ago. The early models were horrendously expensive and produced images with low resolution and poor colour rendition. Battery life was also a serious issue as was the cost of the memory media needed to store the images. With the advent of improved technology, some of it developed originally for mobile phone uses digital cameras provide relatively low cost and reasonably decent quality images that have the extra advantage of being immediately viewable via the on-camera LCD screen, TV or a computer. Once the camera and sufficient memory is purchased then there are usually no further costs involved for the user. Printing may be done without even the need for a computer, high street stores allow the user to simply take along the memory card and the selected images can be printed just like a normal photograph. Printing can also be done at home or even at the investigation location using stand-alone portable printers costing less than £100.

Digital Film!

No, not a mistake as this is the description now commonly used by some memory card makers to describe the memory cards upon which the actual image data is stored after taking. Actually, this terminology is misleading as the memory card is perhaps better compared to a photo album. The best analogy for the film being the imaging chip as this is where the light is directed by the lens - exactly as light is directed onto the film in a 35mm camera.

Instead of film, the digital camera uses a silicon chip to turn the light into electronic information. There are two types of silicon chip in use - the CCD - Charge Coupled Device and the CMOS - Complimentary Metal Oxide Semiconductor. They both do the same job however and we do not need to worry too much about the differences here.

The ability of the imaging chip to resolve detail within the scene being photographed is a function of two variables; the number of individual light gathering points (pixels) on its surface and the physical dimensions of the chip. Generally however, most manufacturers simply quote the number of Mega-Pixels - Millions of individual pixels on the chip when promoting the specifications of a camera model. We will see later that chip dimension is also a factor that some may wish to consider when choosing a digital

camera to use on their paranormal investigations. It is important to note that even if one spends many thousands of pounds on a digital SLR the end result will still only contain less than 50% of the original information in the scene when compared to a similar film image. The fewer the number of Mega-pixels correspondingly even less information is available in the final image. Our eyes normally do not notice this lost information as we rarely enlarge a picture beyond a 7"x5" or perhaps a 10"x8" print size - blow up the image further and the fine detail will be missing, and this may be an issue in some situations where that information may hold vital clues and may mean the difference between an anomaly or an identified object.

The pixels on the chip cannot resolve colour so the light first needs to be passed through a filter that allows colours to be 'seen'. This filter has led to some comments that digital images have 'false colour information' to an extent this could be true but it is also the case that 35mm film also uses a filter within the structure of the film in order to resolve colour in a scene.

Digital Darkroom

Film cameras simply expose the film to the light - as already described the film is then taken out for developing and printing in order to reveal the final picture.

Within every digital camera there is a built-in developing lab that produces a finished image almost instantaneously.

The information about the light hitting the chip is transferred directly to a micro computer within the camera and it is this that then turns the raw data from the chip into a final image - just like a darkroom. This can cause some problems in itself as we are reliant upon the camera manufacturer to programme this computer to do an effective job of this process. Some digital models allow the user to store the image information in the form of a 'RAW' file. As the name implies this is the raw data from the image chip which can be worked on later using a computer in order for the image to be seen. Here again, we have to be aware that the final image will be the result of a subjective process by the user - they will produce a picture they consider is as they wish to see it. Of course many of these dilemma can be levelled at film photography too - the darkroom process or the settings of a commercial D&P machine are also largely subjective or at the discretion of the manufacturer.

Digital Camera Types

Broadly speaking there are two main camera types in this category although to try and properly reflect available technology we will actually divide the range of digital cameras into 3 groups; Compact, Bridge (Hybrid) and Digital SLRs (DSLR).

Compact

Entry level models can be bought very inexpensively these days - less than £50 for a 3 Mega-pixel model. The Lens is usually 'fixed focus' and will generally do a reasonable job of anything between about a 10cms to infinity. The aperture is also normally fixed and the exposure control is carried out electronically at the image chip.

Perhaps to be expected these cameras produce the least good images with the highest incidence of picture problems, unless one is on a really tight budget and is aware of the potential drawbacks then these cameras really ought to be avoided as they are simply not up to the task of gathering evidence. Perhaps their only use is as a visual sketchbook allowing the user to make a quick note of something such as the layout of a location for example.

In the mid range the user is almost spoilt for choice with a vast range of cameras having between 4 and 8 Mega-pixels supported by a wide range of settings and options that allow the user to tailor the

cameras abilities to their specific needs.

The same problems highlighted with film cameras also apply here too - perhaps even more so with the many facilities modern cameras can offer. Many users simply do not properly read the manual and take the trouble to learn how to best use these features, instead they turn the camera on and shoot away with the fully automated settings taking care of the picture settings. This will produce good pictures but often does not allow the best image to be obtained. Read the manual and experiment with the different settings. This is easy to do with a digital camera as it involves only time and time that will be very well spent.

The main thing to consider is the electronic 'apparent' sensitivity of the chip to light. Quoted for ease in ISO units the same as film the lower the number the better the final will normally be as the camera requires less electronic amplification (gain) to be needed. A faster setting (higher number) will allow pictures to be taken in situations of less available light but with a corresponding increase in amplification needed and a lowering of the image quality - experiment under investigation conditions to find the best image quality to suit your investigation needs.

There has been a recent trend amongst camera manufacturers to produce very small cameras - around the size of a credit card in some cases. This means a smaller lens and a small image chip and that will reduce overall quality however expensive the camera may be. The user may be prepared to accept a trade-off between an easily portable camera that fits neatly into their pocket and is always available and the slight loss of final image quality however.

Compact models also tend to have the flash closer to the lens axis, allowing the flash light to be reflected from objects onto the chip more readily. This is a known cause of many of the phenomena paranormal investigators refer to as 'Orbs'. The incidence of red-eye' effects is also higher in these type of cameras, great for making the other investigation team members look demonic!

Another setting that you should notice of with compact, indeed ALL digital cameras is the amount of image compression that is applied to the final image when it is 'written' to the memory card. Most camera makers allow the user to select this setting although some may label it as 'Image quality' instead. In order to fit the finished images onto the memory card the data needs to be compressed and this does mean more lost information when compared to the original scene. By choosing either a lower compression or a finer quality setting you will get less images onto the memory card but each will be of a higher quality. Most cameras store the final image as a jpg (jpeg) file, some allow the user to select storage as an uncompressed .tiff (TIFF) file instead - this means fewer images but a lot more original information is retained in the final image and that may be important for any subsequent analysis and determining what an anomaly actually is. One or two models even allow files to be stored as RAW file data which allows ALL the available information from the chip to be examined although this method will require the further use of a computer to write the final image.

Cameras are supplied with a memory card that is barely adequate in terms of storage abilities usually allowing only a few of the highest quality images to be stored on it - memory cards are nowadays inexpensive especially compared to their costs just a year or two ago, buy a large memory card - at least 512Mb or better a 1Gb card and you will be able to store all the images you'll need for any investigation. As a general rule of thumb go for a model by a well known camera maker with a lens of at least 25mm diameter and with a flash that 'pops-up' taking it further from the lens axis. A larger lens diameter is perhaps better than a couple of extra Mega-pixels too so don't just make your choices based solely upon the pixel count.

Bridge or Hybrid Cameras

This type of camera is a new development and has only really been around for about the past year or so. They are a mid-point between the DSLR and the compact taking some the best features of each

and would on the surface seem like the ideal camera for the investigator. They are a compromise and they do have a number of drawbacks although the makers are constantly evolving them to make them ever better.

This type of camera usually has a high pixel count - sometimes into double figures and often too a large zoom lens with a large diameter. The flash is also more powerful and pops up to a good height above the lens reducing some of the problems mentioned earlier. These models are heavy in added features and modes including full manual settings and this means they can be tailored for specific types of picture taking requirements which will suit the paranormal investigator well. One day it can be used on a site reconnaissance visit and later can take excellent images in a darkened room. The zoom lens allowing wide angle shots to take in whole scenes or close-ups of more distant features.

These cameras are normally quite large and chunky which for some people means that they are difficult to carry around all the time but the effort is usually well rewarded in terms of improved image quality over their compact brothers. The larger body often allows the maker to fit a larger LCD screen for setting-up and viewing final images and the screen may also be able to be rotated and tilted to allow better camera positioning whilst still being able to set-up the shot.

Best of all the image chip is normally physically larger too which means a further improvement in image quality - some recent models actually use the same image chips as the more expensive DSLR type of cameras. The fact that the lens is permanently attached to the body also is an extra bonus to the paranormal investigator. Looked at in more detail later dust on the image chip is a major cause of problems for DSLR users and in the Bridge design the sealed body / lens means dust cannot penetrate and create the problems of image anomalies that may be later interpreted as being of paranormal origin.

The viewfinder is normally in the form of an electronic viewfinder or EVF and not of the direct optical type such as is found on DSLRs, some of these EVFs are a little difficult to use with some subjects but most users tend to use the LCD screen so this is not a major drawback.

Bridge cameras may be amongst the best all round solution for the paranormal investigator and although they are a compromise they do on the whole represent an amalgam of the best from the easy to use compact models and also the top of the range DSLRs. Used with care and with the proper amount of time taken to learn and experiment with all the extra features these cameras have available then Bridge cameras should be high on the list of useful tools for the paranormal investigator.

Digital Single Lens Reflex - DSLR

Simply, these cameras are not unlike 35mm SLRs with the main difference being that instead of film, a large image chip is used instead. They use a mirror and prism arrangement to bounce the light coming through the lens up to a viewfinder, the mirror moving out of the way and a shutter opening to expose the image chip to the light at the time the picture is taken. There are two main advantages of DSLR cameras; they use a much larger image chip and they use lenses with a large diameter and thus a wider available aperture for lower light use. Another key advantage is that they allow the user to change the lens to suit their specific picture taking requirements. They are normally part of a 'system' with several lenses, flashguns and lots of specialist accessories, further allowing their use to be specifically tailored to the users needs.

It is this 'system' concept that may offer some users a further and important advantage - most DSLRs are also backwards compatible with 35mm SLR systems and this means that users with existing lenses and accessories have no need for further investment.

A major problem for many DSLR owners is dust gathering on the image chip itself. Every time a lens is changed dust inevitably gets inside the camera body and some of it will get onto the surface of the image chip. Dust also gets inside 35mm film SLRs too but as the film is wound through the camera the

amounts are not allowed to build up to excessive levels. Even small dust and pollen particles are larger than the individual pixels on the chip surface and so block the light falling onto any pixel that becomes obscured in this way. This results in dark patches on the final image and other anomalies.

The only method of dealing with this dust build up is to have the image chip surface cleaned a task that most people prefer to have a professional carry out as it is an extremely delicate operation and can permanently damage the chip if not done properly. One camera maker uses a special filter that vibrates 35,000 times per second to shake the dust onto a sticky collector pad and thus prevents the dust from getting onto the chip. So far this is the only effective in-camera solution that is available.

The Real Digital Film

The imaging chip - the actual 'film' within a digital camera was discussed earlier in this article however it is a good point to look again at the various chip options and consider some of them in more detail.

Rather than examine the technical differences we shall consider these differences in terms of the advantages or otherwise to the paranormal investigator, for those who seek more technical information then a search of Google will reveal many sites that will provide all the information they seek.

The imaging chips of both types, both CCD and CMOS are used by the camera manufacturers in a range of options but just two need be given any real thought when considering a cameras suitability for the needs of the paranormal investigator - they are the physical size of the chip and the number of individual light gathering sensors (pixels) on its surface. As stated previously most camera manufacturers quote the pixel count in the main specifications and advertising and it is usually true that the more pixels a chip has then the greater amount of information it is able to resolve within any scene. As with many things there is always a downside otherwise the makers would simply develop chips with increasing pixel counts and leave it at that.

For any given physical size of the chip, the more pixels inevitably they will be smaller - down to less than 3 microns in some compact and bridge models. The smaller pixels are correspondingly less sensitive to light than those of similar technical specification but larger size - in some DSLRs 5-7 microns is more common for example. In bright daylight scenes this may not be a serious issue as there is plenty of light available but indoors or at night these chips start to show their weakness. Correspondingly more amplification is then required to obtain useful data from the chip and the more amplification that is needed then the greater the amounts of electronic 'noise' will be present in the form of degradation in the final image. Electronic noise also produces anomalies in the image itself which may be interpreted as being paranormal by the unwary investigator. Manufacturers normally limit the range of sensitivities of these small chips - some only offering ISO equivalents of 100 to 400 and this may seriously limit the cameras usefulness in low light situations.

Larger chips allow the inherently better sensitivity to low light levels to be exploited and the manufacturer can offer the user a greater range of ISO equivalents - in some cases ISO numbers of 1600 or even 3200 are possible without excessive electronic noise being a problem. The larger pixels also allow for a greater tonal range to be captured from the scene and this will result in a more accurate scene rendition even at lower light levels.

Physically larger chips force the maker to provide a physically larger lens diameter too and such lenses normally have wider apertures and better optics so further improving the overall image.

Of course, as camera makers develop the electronics within the cameras over successive models they are able to better control the noise and low light weakness of the smaller chip so that they start to offer a very similar specification to the user. Some Bridge models offer double Mega-pixel chips that are barely larger than those in compact cameras. This is done with additional electronics and processing after the chip and improvements in the design of the pixel elements too - a microscopically small lens over each

pixel element improves light gathering for example. The limits of small form chip design may be being reached however, most recently some makers have actually reduced the number of pixel elements on these chips because they found that they were becoming 'too noisy' and image quality was suffering.

The large chips too are not without problems. These are essentially the same problems that apply to their smaller cousins. As makers vie with each other to cram ever more pixels onto the chip the pixels have to shrink in size. Because they have a larger form to start with however we are still some way from reaching the limits of image chip design just yet. As an example if the smaller pixel designs were used on a 35mm 'Full-size' chip as is used by both Canon and Nikon then the resolution of the chip would exceed that of 35mm film i.e. over 35 Mega-pixels!

When one is looking at the specifications of any digital camera both these factors need to be considered as they affect the overall size of the camera, the lens and the usability of the camera. Small cameras are portable and often easy to use but they have smaller image chips and so perform less well in lower light. Larger cameras perform better in low light but may be left behind when needed most.

Before leaving the subject of the image chip we need to look at some further issues that may affect the image quality. In the past CMOS chips were of low resolution and typically only ever used in webcams, mobile phone cameras and the cheapest digital camera models. This changed recently with the development of high resolution CMOS chip designs. The CMOS works slightly differently than the CCD design, this difference means it can transfer its data to the camera processor faster - not so important for the amateur but an important issue for some professionals such as sport photographers. We are now starting to see camera makers such as Canon and Sony using CMOS chips in their top end amateur models.

One of the most frequently stated reasons for using a digital imaging chip by paranormal investigators is perhaps the ability of chips to 'see' in the Infra-red part of the spectrum. It should be pointed out that all imaging chips have about the same degree of sensitivity to IR light but most makers choose to apply filters to remove it as it can affect the colour rendering of a scene in normal light conditions. Sony have made a feature out of this extra sensitivity to allow pictures to be taken in conditions where there is little or no visible light. Although it is mainly used in their video cameras, some of their still cameras also exploit this ability and permit Infra-red (IR) still photographs to be taken in locations where there is almost no ambient visible light. The ability of these cameras to 'see in the dark' is further enhanced by the fitting of Infra-red emitting LED lighting which illuminates the scene with light that the camera can see but we cannot.

Many paranormal investigators claim that paranormal manifestations are more visible under IR light or that they emit IR light which can be 'seen' by the chip, this is highly contentious and as yet unproven but it does mean that locations can be photographed under conditions of extremely low light which may aid the investigation process.

It also cannot be a bad thing if paranormal investigators have a tool that allows them to take pictures over a broader portion of the light spectrum.

Digital Conclusions

Digital photography offers the paranormal investigator a means of taking almost unlimited numbers of photographs without additional costs after the initial outlay on equipment and memory card/s. Once the card is full it can be downloaded to a laptop or one of many portable hard disk devices that are available for around £100 - £200 allowing more pictures to be taken. Pictures can be viewed immediately on the camera's LCD screen or on a computer or even a TV screen.

Digital images are of lower resolution than even similar pictures taken with any 35mm film camera, even the most basic models. The image also has less information within it which may be critical for some

situations.

Digital images are also prone to problems of electronic noise caused by the further electronic manipulation needed within the camera in order to produce an viewable image. Individual pixels may become faulty leading to anomalies within the image that may fool the unwary investigator. Dust may also cause problems in most DSLRs and may lead to anomalies appearing in the images produced if not dealt with.

One often overlooked problem with digital cameras is their need for power - all require batteries and many use them quickly, sometimes failing to last for a whole night's investigation. Rechargeable batteries are one solution to this, battery technology developed from mobile phone use providing some models with plenty of life. Using the flash, zoom and the LCD screen use up much of the battery life and temperature too, plays a important role in how long the battery lasts, the colder it is, the shorter it will last.

This temperature sensitivity of the batteries can result in the camera being apparently affected in some weird and some may claim paranormal way. 'My battery was fully charged but when I tried to take some pictures it refused to work - later, when I tried again it was working perfectly, it must be paranormal!' In reality, the batteries were too cold for the chemical reaction to take place properly and so there was insufficient power for the camera to operate, the camera is returned to the bag or pocket where it warms sufficiently to permit the battery to function and the camera starts to work again. Some types of Rechargeable batteries (notably the older NiCad types) may also have another trick to play on the unsuspecting investigator - they are designed to deliver their output voltage in a more stable way that Alkaline or other non-rechargeable batteries do. In a non-rechargeable cell, the chemical reaction steadily slows as the battery is used - the output voltage dropping steadily throughout until finally reaching a point when the 'Battery Low' warning flashes, at this point the user may still have almost 20% of the battery life still available and can keep on shooting for a bit longer before the battery must be changed. In a rechargeable battery the battery delivers a constant voltage throughout the period of use until the chemical reaction is exhausted, the battery will then fail quickly often without the low battery warning having time to alert the user.

It is therefore always a good idea to carry a 2nd set of batteries otherwise your expensive camera is just about useless and you can be sure that they will run out just when you need the camera most!

Perhaps the final issue with digital photography that applies to all camera types is that manipulation of image is a simple task and the sceptics will also say that with digital images fakes are easy to produce. There is also no negative to act as a further safeguard against 'created' images. This can be partially got around by developing good protocols for handling the data both in camera and afterwards in the computer. Modern cameras write secondary information - the EXIF data which contains information about the camera, the settings used at the time of taking along with date / time information too. Most photo software allows the user to show this information but unfortunately some software also allows it to be re-written too, reducing the effectiveness of this method of reducing fraud.

Many of the issues with digital photography can be accepted as a compromise against its immediacy and very low cost per image. Digital photography will soon become the dominant form of photography and paranormal investigators and also the sceptics need to accept that and work toward minimising some of the problems currently associated with this form of picture taking.

Part III - Video Photography

Video Photography

Video camera are amongst the most frequently used tools of the amateur paranormal investigator, many use one of the Sony models that offer the ability to record images in zero visible light conditions -

the 'NightShot' mode. This makes use of the inherent ability of an imaging chip's ability to see Infra Red (IR) light almost as well as the visible portion of the light spectrum.

First Steps

All camcorders made within the last 10 years use an imaging chip - most in the form of a CCD type device and so the first step for the reader should be to go back to the previous sections dealing with digital still cameras and re-read it. In effect, all camcorders, regardless of whether they use analogue or digital tape and DVD or even a hard disc are just a still camera that takes a continuous series of pictures. However, there are some subtle differences in the chips and the way the image information is dealt with that needs to be considered.

The Next Steps

Image chips in digital still cameras are used to produce a picture that may be viewed on a computer, a TV or printed in a range of sizes. An image chip in a camcorder only has to produce a high quality TV moving image. Actually, it is best to describe the final product as a series of still images as in the UK a television picture is actually a series of 25 still frames per second, so the similarities in the initial stage of the image making process are easy to see and indeed most camcorders also have the ability to act as digital still cameras too - recording the still images to either the main recording media (tape etc) or an additional memory card.

Camcorders do not need to have a lot of pixels, with some recent exceptions most still use less than 1 Mega-pixel. Some makers offer larger pixel numbers - although the specifications need to be carefully looked at prior to making any purchase, some Sony models have '3-Mega pixels' boldly displayed on the bodies of some camcorders, the figure refers to the total number of pixels that are available for use in taking digital stills. The number of used for the video images is 2 Mega-pixels.

The reasons that camcorders do not need so many pixels per chip is primarily because TV screens cannot display very high resolution pictures - even High Definition (HD) is still much lower than a printed picture requires. For a number of years Broadcast resolution video cameras have used 3 chips to improve maximise the quality. This allows each chip to be optimised for a single primary light colour i.e. Red, Green and Blue (RGB). This reduces colour smearing and makes the final pictures appear sharper and better defined. 3 chips are now a feature of many consumer camcorders although their advantage is largely lost at lower light levels and also it is rare to find 'Night vision' abilities on such models, designed mainly to optimise daylight use or use with powerful video lights.

Large image chips do have some advantages though in video photography. As with digital still cameras they usually perform better in low light situations as there is a larger available light gathering area. Unfortunately it's never that simple. Most camcorder manufacturers use developments in image chip design to squeeze more pixels into a physically small design. Some recent 1 mega-pixel designs - even ones with IR Night vision perform markedly worse than previous models under the same conditions - the smaller individual pixels mean less light sensitivity!

Another feature of many camcorders is some form of Image Stabilisation, in the top end models this is done optically by a moving lens or prism system, in most consumer models this is done electronically however. The image chip is made with more pixels than are needed to make-up the final picture. The extra pixels are used to reduce the effects of movement of the camera when hand holding. This is an effective system particularly when one is using the camcorder at higher zoom lengths. No stabilisation method will remove all camera motion but having this ability can make a big difference to the final picture quality.

A word of caution about these image stabilisation systems regardless of type. If you are using the camcorder mounted to a tripod or other form of solid support - even a table top then turn off the sta-

biliser. If left on, it can cause the image to appear to move - both sideways and also up and down, as the stabiliser 'hunts'. This can and has caused many unwary investigators to believe that either their camera was being 'played with' by some unseen force or that some other strange paranormal effect was happening. .

Analogue or Digital?

There are two main methods of turning the information from the image chip into the finished moving footage for display on a TV, Analogue and Digital.

All the early models of video camera and camcorder used analogue tape as the recording medium. In analogue systems the information from the chip is sent as a series of voltage signals to be written magnetically onto the tape - in exactly the same manner as a audio cassette recorder works. This methods allows a lot of electronic noise from the amplification circuits and the tape drive motors to be recorded too. A further drawback was that the tape surface could have imperfections within it and these would reduce the quality of the recorded signal. Such systems were termed 'Low-band' video and included VHS (Both full size and the compact VHS-C), and along with the 8mm format.

Later, the camcorder manufacturers used developments from commercial broadcast systems to offer the 'High-band' systems S-VHS / S-VHS-C and Hi8. Such formats separated the signal into two individual recorded information for the Chrominance (colour) and Luminance (brightness) components of the picture. This gave less colour smearing and a sharper overall picture although it did need to have a TV or computer fitted with a special socket and circuits to handle the picture information in this format. The tape normally had to be of improved quality too but surface imperfections could still degrade the picture.

Analogue has another drawback too - it is difficult for the user to make high quality copies as with each successive copy generation the voltage signal is reduced. If copies are ever needed then they should always be made using the original tape to ensure quality isn't reduced too much. Such 2nd or 3rd generation copies are usually easy to spot as the colours look washed out and the overall quality of the picture is fuzzy and ill-defined, these recordings are of little use to the paranormal investigator.

Hi-band systems however can produce excellent quality pictures and are nowadays camcorders using such systems are available often on the high street for less than £100 or £150 for models fitted with the IR Night vision technology. On internet auction sites some absolute bargains can be found from stores selling off old stock or users who have upgraded to digital camcorders. Provided one uses high quality tapes purpose made for High-band recording and is aware of the limiting factors then this is still a 1st class video tool for paranormal investigation work.

Digital camcorders have been around for about 10 years as consumer products - the 1st models to hit the stores had a massive price tag of well over £1000 but today digital camcorders can be found for less than £200 although IR night vision equipped models usually are a little more expensive.

In digital models the information from the image chip is sampled digitally thousands of times every second and output as a series of digital data to the recording media. To further reduce picture flaws the data from the chip is error checked by a microprocessor to ensure that the final data stream is error free before being written to the media.

The method also differs in another way too - it generates a vast amount of data and therefore some way of compressing the data is needed, to permit a decent amount of recording time per tape. Essentially, only one picture frame in every 25 (i.e. 1 per second) is fully written to the recording media - this is called a Key Frame. All subsequent images only have information about the changes to that Key Frame so areas that do not change are not recorded. The Key Frame compression technique also reduces tape flaw problems too, if the flaw falls on a Sub Frame data section then it may not affect the

final image excessively.

There are a number of tape formats, the most common being miniDV (sometimes wrongly called DV). MiniDV tapes are small and that means the camcorder can often be small and easily portable. The tapes are readily available in many shops and supermarkets and cost less than £5 per tape.

Other consumer formats are MicroMV which uses an absolutely minute tape size, although it still allows a full hour of recording to be made per tape. Digital 8 or D8 is a digital version of Hi8 and allows the user to playback previous Hi8 recordings on the same camcorder plus make digital recordings of new footage. In this format the tape speed is increased to allow greater quality, so the user can make 40 minute recordings on a 1 hour tape. There are some digital VHS-C (D-VHS-C) models still around but these should be generally avoided as they are now difficult to find tapes for and hard to interface with other items.

In the past 2 or 3 years we have seen the advent of DVD camcorders. These use smaller 8cm DVD discs and a slightly different form of compression technique to record the picture. They were originally promoted as 'Easy to use and View' - the disc simply being taken from the camcorder and placed into any DVD player to watch. These early models came in the inevitable variety of sub-formats such as DVD-R/RW, DVD+R/RW and DVD-RAM. All had compatibility problems and meant that these early models were not widely sold. However, DVD offers the investigator some distinct advantages too. The finished disc can be placed directly into a computer drive and the footage used without the often time-consuming step needed with tape systems to get the video data onto the computer. The discs, provided they are Re-Writable (RW) type can be used hundreds of times unlike tapes which are really only good for single use in evidential terms. A secondary advantage with these DVD camcorders is that the compression format (MPEG2) is not so easy to edit as yet by consumer software so computer assisted hoax video footage is also rarer at the moment with this system. The compression ratio is also usually selectable by the user so a disc can be last from around an hour to about 20 minutes depending on the picture quality required, obviously the higher quality / shorter times may be preferred by the investigator but even the lowest setting is still usually better than standard VHS tape footage. In the past couple of years many of the compatibility problems have been dealt with and any disc can usually be played in any home computer or fairly recent domestic DVD player - there are a few exceptions so one does still need to be aware.

Camcorders using solid state or internal hard discs are now becoming available too - these have some advantages for the paranormal investigator but also have some distinct problems of their own too. For the present those with Solid state memory either internally fitted or in the form of memory cards offer poor recording times and apart from their use in very small 'pocket' video cameras or in video-camera mobile phones their usefulness to the paranormal investigator is limited to perhaps making video 'sketches' of locations or short witness interviews.

Very recently, camcorders fitted with large internal hard drives have started to appear as consumer products. They allow very long continuous recordings to be made and remove the need to change tapes or discs - perhaps even for a whole investigation session. The compression technique is similar to that used for DVD and as with DVD this is variable allowing longer recording times to be made with a slight reduction in quality - again down to levels similar to standard VHS tape. At this sort of picture quality recording times up to 8 hours or more are possible.

The major downside of this system is that once the disc is full the user needs to download it to a computer before the disc can be re-used to make further recordings. If you do not have a computer to hand this may mean the camcorder is of no further use - a problem when away from base or on multi-night investigations unless one has a laptop available.

Evidentially, there may be other issues too - the footage from a tape or DVD camcorder can be retained on the original recording medium and so the investigator can show that no-post production techniques

have used to 'create' anomalies. Sceptics may never be fully convinced but having the original recording is always a good safeguard. With these 'write to memory' systems the footage must be transferred to either a computer or via a computer be burned to a DVD etc. This is now a copy of the original and it becomes more difficult to demonstrate that any additional steps have taken place.

Digital video as with digital still needs to be carefully considered in terms of it's potential evidential value. Software and in-camera editing means that images can be easily altered either unwittingly or deliberately leading to the creation of false anomalies that some may then consider to be paranormal.

Some Useful Features

Camcorders often have a wide range of 'features' built-in by the manufacturer to make the products more saleable to the consumer. Most are little more than gimmicks and of little use the paranormal investigator, but one or two are of real benefit and if used correctly can increase the usefulness of the potential video evidence. It is these that we will look at here.

Night Vision and Low Light Systems

Perhaps the best known and most sought after camcorder feature is the ability to take decent video footage in conditions of little or even no visible light. Pioneered by Sony who call it 'NightShot' this utilises the inherent ability of the sensitivity of all image chips to Infra red light. This if left unfiltered seriously affects the colour rendition of lit scenes and so the IR light is normally filtered out opto-electronically. Sony made the use of this filter selectable by the user and also fitted IR Light Emitting Diodes (LEDs) to the camera to provide some illumination at locations where there was no visible light available. This is a different technique from that used by so called 'Night vision' or 'Starlight' scopes which use a method of amplifying the amounts of light entering the device by means of a phosphor coated tube and photo-multiplier.

Originally meant for nature watching or video work in very low light situations Sony have incorporated 'NightShot' into most of their consumer camcorder models in the past 8 years. Use in paranormal investigations quickly followed the release of the early models. They quickly became one of the most used tools of the modern paranormal investigator and whilst they do permit footage to be obtained in very low light / no (visible) light situation they do not appear to have any special ability to 'see' ghosts or spirits. Inevitably, a lot of theories and ideas to explain their usefulness have sprung up over recent years - most of it nonsense and made by individuals who base their investigation ideas on some form of pseudo-science that they have picked up or made up.

In short IR Night vision cameras do allow the investigator to record a greater portion of the total light spectrum and allow pictures to be recorded in conditions of no visible light. This has obvious advantage to investigations - seeing fraud being performed for example that may otherwise go unnoticed in the dark being just one.

It is a fact that to date there is no evidence that ghosts or spirits (if they exist at all) emit IR light or are more visible under IR lighting conditions although as one might expect there are some who would no doubt challenge that statement.

We are dealing with something that is an true 'Unknown' and therefore it makes sense to look for evidence of it in as many different ways as we have available. Ghosts may only be visible to IR sensitive devices but they also may be just as likely to be viewable only with Ultra Violet (UV) light. Night vision is an excellent tool for the paranormal investigator but it's use confers no special advantage or magical ability to the user.

There are several camera manufacturers that appear to use this IR enhanced Night vision mode but in reality it is only available on Sony models of camcorder of all formats. Panasonic did offer the

same ability in some early models but after losing a patent infringement battle with Sony they have no longer dropped this IR enhanced technique and now use the same method as the rest of the camcorder makers - Colour or Mono Slow Shutter. This is also strangely now fitted to many Sony camcorders too in addition to their own IR system and works by leaving the 'shutter' open for longer allowing more light to be gathered at the image chip. The results of such 'slow shutter' techniques are of little benefit to paranormal investigators - it does increase by several orders of magnitude the amounts of light reaching the image chip but any movement is horribly blurred and has extremely low definition as a result. Even when the movement is of a known subject - such as a member of one's own team of investigators for example it is often impossible to identify them on the resulting video footage due to the motion blurring these modes create.

Interval Recording

This is simply the ability to use the camcorder to make recordings over an extended period of time. Images are recorded for a given period - normally around a second, then recorded to the media. After a pre-set interval (normally user selectable) a further recording period begins. In this way it is possible for time-lapse animation footage to be obtained. This may be useful when movement of objects within a scene is slow or subtle and may otherwise go unnoticed - filmmakers use this technique to show flowers opening for example. In some paranormal cases, objects such as furniture are described as moving or being moved. Normally video observation is difficult because of the need to change tapes etc.

Using this mode will reveal on playback of the recording the movement of any objects as if speeded up with most current models offering this ability it is possible to record for up to 12 hours onto a single 1 hour tape and provided mains power is used there is no further need to return to the camera.

An important point to note here is that this mode, whilst potentially very useful is open to relatively easy hoaxing - in the interval between recordings being made it is perfectly possible for someone to move objects without the camera recording their interference. As such this technique should be applied with additional safeguards such as ensuring the location is fully secured throughout the recording session.

Progressive Scan

Normal video recording systems rely on fooling the eye by providing a rapid series of still images in turn on the screen, this basic technique is further enhanced by actually shooting and showing two sequential images on the screen at the same time - a technique called interleaving, each alternate horizontal line of pixels showing one of the pair of images. By doing this the motion flicker is reduced and a more convincing smooth flow of motion is obtained.

The drawback is that if the footage contains potential evidence and it becomes necessary to 'grab' a still of the anomaly or freeze the TV picture there may be blurring or distortion of the picture which is in reality two pictures woven together electronically. Some image editing software packages allow the option to 'De-Interleave' the image but this is also a compromise option and results in often not very satisfactory stills being available for analysis and interpretation.

Most camcorders record their images using an interleaved technique - 1st all the odd numbered horizontal lines of pixels are sampled, followed by the even numbered horizontal lines thereby effectively recording two images simultaneously. This has the added disadvantage that only half the vertical resolution of the chip is used for any single image.

Another technique that is borrowed from high end video cameras is the ability to use the whole chip to make a single image scan then repeating the process 25 times per second. This has the advantage of better colour saturation and image definition as there are many more pixels being used for each separate image. The downside is that any movement can appear slightly jerky or a little awkward.

But for those who are using video cameras to attempt to capture some anomalous object and then analyse it afterwards using a computer Progressive Scan allows much better stills to be obtained - sharper and more defined. Such a feature can become a valuable tool to the paranormal investigator.

Still Pictures

Many models of modern digital camcorder provide some method of permitting the user to take still pictures too - these may be recorded to either the main media (tape or disc) or to a separate memory card. In some models this capability can also be combined with the low light ability giving the investigator a 'night vision' still camera.

To take a still image there is normally a dedicated 'Photo' button on the camcorder effectively meaning it can be used just like any other digital stills camera, in some this can be used even whilst taking video footage. This is great for the investigator who does not wish to carry around a camera and a camcorder. Even more usefully, it is possible on many models to even take stills from the previously recorded video footage as it is played back.

This still taking ability means that it is easy for the investigator who wishes to obtain some stills to import into a computer for further analysis or for use on websites and investigation reports. It not necessary to download the entire video footage which can be time consuming and uses a lot of hard drive space. There is of course a downside to all this - as mentioned earlier, the number of pixels on a video image chip does not need to very high and are often less than 1 mega pixel, this means that stills will be of low resolution even when compared to images taken on cheap dedicated digital still cameras which typically have at least 3 mega pixels or more. Some camcorders do offer larger image chips with up to 3 mega pixels, some even offer other photographic tools such as an in-built flash or the ability to add powerful flashguns to the camcorder but such abilities are not yet a proper substitute for using a proper digital camera.

Nonetheless this still taking ability should not be overlooked as a valuable tool for the paranormal investigator, providing one is aware of the limitations and works within them.

Overall Conclusions

Paranormal investigation is primarily all about gathering evidence. Visual evidence can be amongst the most compelling and useful we can provide. The sounds recorded on your audio cassette may be of ghostly footsteps along a deserted corridor BUT without the images to prove it was an empty corridor it is of poor evidential value.

Picture and video evidence is admittedly easy to fake and there are countless examples of such trickery around and have been almost since the invention of photography. With the ownership of digital cameras increasing it is of childlike simplicity to create your own ghost photographs in a couple of minutes on the home computer. This needs to be recognised and addressed by the serious investigator and with some thought it is possible to design methods and protocols to at least reduce such accusations. Photographs produced with film cameras also have similar weaknesses but to some extent the availability of the negative offers greater reassurance against fraud taking place.

Regardless of whatever method is used to obtain the images, be they moving or still the investigator needs to be fully aware of the abilities and weaknesses of their chosen tool. A thorough reading of the instruction manual, knowledge of all the controls and what they do is an essential 1st step. There are many books and websites that explain in detail the mechanisms and features of film, digital and video cameras and the wise investigator should use these to increase their knowledge.

The human eye has over 120 million light receptors - roughly equivalent to 120 mega pixels, film cameras have about half this amount and digital images contain less than 10% of the available information,

so it is easy to understand that a lot of potentially valuable information is missing when we view a photograph or video footage.

Both film and the image chip however, do have the ability to record information that cannot be seen by the unaided human eye. Both methods 'see' light differently than we can and the use of variable shutter speeds can allow motion to be frozen or blurred.

When used sensibly and with caution any camera can be a very valuable addition to the paranormal investigators tool kit. Select your camera carefully and use it even more carefully and you will be rewarded with photographs and footage that may greatly assist your investigation of the unknown. Fail to do this and the resulting images and footage will only serve to confuse and mislead you.