THE CAMERA OBSCURA AND THE PURSUIT OF THE UNCANNY

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ABSTRACT

This practice based research seeks to explore and extend the potential of camera obscura projections to perceptually transform objects and spaces by using their unique visual qualities. These pertain to immediacy and directness. Although apparently tangible, the projected images appear to reside in a void where there is an absence of surrounding visual reference. This causes the images to appear disconnected from any context, thereby prompting associations with Freud's notions of the uncanny and Proust's narrative of the transitional.

The research consists of a sequence of practice based studies. These commenced with an exploration into the perceptual ambiguities of reflection and shadow. Perceptual ambiguity was further explored through the distorting effects of curved pinhole cameras. The latter began to suggest using the camera itself as an object within which something could be viewed. With the incorporation of focusing lenses, this led to projections where the observer was situated within the camera obscura.

Throughout the research, the objects projected were always ordinary and familiar, commencing with a light bulb. The addition of lighting sequences thus enabled further exploration of various phases of ambiguity, as well as enhanced definition and recognition of the projected image. This was followed by projections of other objects, which sought to place them in a particular visual context; for example a mug projected into an actual microwave located within a kitchen. Although this produced surreal connotations, the surrounding visual material diluted the impact of the projected image. A decision was therefore made to concentrate entirely on the presentation of the projected images by refining projection techniques to enhance their quality and definition. The introduction of movement subsequently heightened perceptual ambiguity, as did the addition of the multiplication of images. This led to a rich variety of projected imagery which ranged from the perceptible to the imperceptible, involving synchronicity, transparency, juxtaposition, transposition from line to plane, and contrast between stasis and movement. The increasingly extraordinary images prompted a re-evaluation of the observer's visual assumptions.

These practical investigations, together with historical, literary, and philosophical issues, combine to extend the possibilities of the camera obscura in terms of contemporary artistic practice.

J Storey

AUTHOR'S DECLARATION

I declare that the work in this thesis is carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of this thesis has been submitted as part of any other academic award. The thesis has not been presented to any other educational institution in the UK or overseas.

Any views expressed in the thesis are those of the author and in no way represent those of the University.

Signed:

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INTRODUCTION

This studio-based research seeks to perceptually transform objects and spaces through optical projection using camera obscuras. This followed my MA work where 'the uncanny' had been a prominent theme that I explored through optical effects.[1] The objects used in this research were selected because they are ordinary, yet possess a strong gestalt which enables them to be easily recognised in their entirety. These seemingly tangible objects, when projected, appear mysterious and intangible. The images produced oscillate between the real and the illusory, provoking a disturbing visual ambiguity, which has associations with the 'uncanny' and the 'transitional'.

Central to the perceptual ambiguity of the practical work is Marcel Proust's *À La Recherche du Temps Perdu* (1913), which is discussed in more detail in the next section. This narrative explores the transitional state of the sub-conscious. Proust describes how, just as the diminishing firelight is able to perceptually alter and conceal objects and spaces, so the strengthening light of day can gradually, and ambiguously, reveal them. The overlap and dialogue between literary modernism, the transitional, and psychoanalysis, which emerged in the early 20th century are represented by the concerns of Proust and Freud. Freud's investigations into the sub-conscious had a significant influence on the Surrealist movement of the 1930s. The Surrealists deemed the sub-conscious to be a font of artistic inspiration, and celebrated and exploited the irrationality of dreams, where the distinction between reality and illusion becomes blurred. In René Magritte's painting *The Listening Room* (1958) for example, the artist sought to produce a disturbing and uncertain vision of reality through the juxtaposition of everyday objects. In his essay, *The Uncanny* (1925), Freud maintained that multiplication of the same thing was capable of invoking notions of the uncanny. In Proust's narrative, the double identities of author and narrator continually merge and separate, causing constant uncertainty for the reader. The history of the domestic and its discontents, modern anxiety and the terror of the bourgeois interior leading to dystopia have been explored by Anthony Vidler in *The Architectural Uncanny* (1992).

Inspired by these ideas I set out to discover whether the experience of the uncanny can be captured through the still imagery of the photographic, and then subsequently by creating an actual experience by means of the camera obscura. By setting the effect within the real and the domestic I set myself a considerable challenge spurred on by my

own fascination with the familiar in process of becoming unfamiliar. I was not certain whether the feeling of estrangement within the domestic could be conveyed, but in selecting the camera obscura I knew I was working with a device that had a history of recording the real and familiar, its ability to capture a moving image being strange in itself. However I wished to subvert this and to use the camera obscura as a means of tranforming the appearance of familiar objects in order to capture the uncanny.

The camera obscura is a device with the potential to create imagery that has direct parallels with the above. First recorded in the 4th century, it is a basic optical device that uses light to project images that appear inverted. Its projections, though merely the effect of light, can appear very real, perhaps surreal. Imagery can also be multiplied, invoking intriguing and compelling visions of the uncanny. The art historian Martin Kemp describes camera obscura imagery as follows:

> A camera obscura image of reasonable quality does possess a special visual 'feel'. It produces condensed enhancement of tone and colour, providing subtle intensification without harshness or glare. Nuances of light and shade, which seem too diffuse or slight to register in the original scene, are somehow clarified, and tonal effects gain a new degree of coherence. The shapes of forms, miniaturised in such a way that they seem to be condensed to their very essence, acquire a crystalline clarity.[2]

Whilst its projected images possess a strong sense of stasis, they are also capable of reproducing movement, and can appear both opaque and transparent. The ability of the camera obscura to project two dimensional images which so strongly suggest three dimensionality, is described by the scholar Philip Steadman as "collapsing three dimensional space onto a two dimensional plane",[3] which consequently undermines depth perception. The images are distinctly unlike those produced either by traditional or modern camera technology. An observer, separated from the world outside, in the darkened, silent space of a camera obscura, experiences its entrancing images, which are capable of slowing down the senses, and inducing contemplation and introspection. Despite their simplicity, the uniqueness of such images is still capable of captivating a 21st century observer.

Over past centuries, astronomers, scientists and magicians have used camera obscuras. Their use by artists such as Vermeer has long been debated, a debate recently given renewed vigour by David Hockney's theories on the early use of optics. Vermeer's keen sensitivity to the effects of light and colour and an interest in defining precise spatial relationships may have encouraged him to experiment with the camera obscura, not

merely as an optical aid, but as a means of exploring and exploiting particular qualities observed in its projected images. Vermeer's *Girl with a Red Hat* (1660), with its softly focused areas and glowing points of light, exemplifies the poetic qualities of camera obscura imagery.

Other 17th century artists such as Caravaggio and Kalf, who may also have used camera obscuras, display more dramatic lighting effects and considerable visual ambiguity as objects are revealed by light and concealed by intense dark shadows. In the tranquil still life paintings of Cotan, light is concentrated on ordinary objects in such a way that, by their isolation in space, they become elevated to almost iconic status, and transformed into something otherworldly.

By the 19th century, the fascination with camera obscuras began to move away from the specialisms of painting, draughtsmanship, and science, to that of public spectacle. Camera obscuras placed in tall or elevated buildings became popular entertainment devices, where live projections of the surrounding panorama might be observed. When the advent of photography could chemically fix a projected image, it did not detract from the compelling visual qualities of live projections, which, despite the latest developments in photography today, remain elusive to capture or reproduction. Likewise, the development of film could only reproduce moving imagery.

Whilst the camera obscura projects an image, contemporary artists such as James Turrell have been concerned with the presentation of actual environmental phenomena in real time, as for instance in a circle of sky. In his 'skyspace' installations, subtle modulations of light, which are both subject and object, produce experiences of pure sensation entirely devoid of literal content. These may bring about an introspective awareness, yet can also have a perceptually destabilising effect upon the observer. Likewise, Antony McCall's *Line describing a Cone* (1973), exemplifies the uniqueness of an event in real time. Whilst the video pioneer, Bill Viola, manipulates our sense of time by slowing down moving images, and consequently the senses of the observer, these are viewed through reproduction, as for example in *The Greeting* (1995).

Notwithstanding renewed interest by contemporary artists who have used light and projected imagery as an important component in their work, including Abelardo Morrell, Chris Drury and Richard Torchia, little has been done to explore the aesthetic

potential of the camera obscura by integrating historical, literary and philosophical issues. Instead, the camera obscura today is primarily employed in the traditional manner to observe the surrounding panorama from elevated vantage points or in similarly constructed versions.

This research seeks to address this deficiency by extending the use of the camera obscura as a visual stimulus, by subverting the familiar in order to make reality and illusion appear interchangeable. It intends to accentuate the uncanny as defined by Freud and the doubling that concerned both Freud and Proust, thereby revealing the projected object as a visual phenomenon that is both real yet transient. This is explored through a sequence of practical studies that commenced with pinhole cameras, actual and projected imagery, and narrative, through to high clarity camera obscura images. To the latter, movement and duplication of imagery was introduced, resulting in synchronicity, juxtaposition, transparency and transition. By undermining and subverting the everyday and familiar through perceptual transformation, I hope to bring about an effect of the uncanny which can actually be encountered, not second hand by means of a static image, but through a lived experience in real time.

The research concludes with a selection of exhibition installations, a dissertation and supporting documentation.

CHAPTER 1

Proust

Of central importance to this research has been Marcel Proust's (1871-1922) *À la Recherche du Temps Perdu*, published in 12 volumes between 1913 and 1927. Proust is generally regarded, on the basis of this literary work, as perhaps the greatest, and most pioneering French novelist of the 20th century. In Proust, things are never quite what they seem. He explores the shifts of the subconscious, where the sense of bodily displacement and perceptual disorientation may be similar to that experienced by an observer when first confronted with the immediacy of an image produced by a camera obscura. Proust had studied optics as part of a physics course, and developed a lifelong passion for photography. He viewed and depicted the world around him in literature primarily through the science and art of optics, and therefore gave primacy to the visual in experience, although he presented this as part of a panoply of senses triggered through memory[4]. His work is full of photographic metaphors, and he urged his readers to consider his work as a kind of optical instrument, suggesting that they try different lenses in order to see more clearly, so that one moment they could view a subject close up, and in the next from a distance, like a telescopic lens, and using different angles and perspectives to collage the whole picture. The narrator Marcel loses faith in the reliability of the appearance of the people in his life, and gradually comes to realise that there can never be a single truthful viewpoint.

As a keen night photographer during the blacked out Paris of the First World War, Proust was fascinated by objects illuminated in the darkness, plucking them from the shadows and isolating and illuminating them against the blackness of the night, to provide lasting impressions of their heightened sense of reality. The photographer Gyula Halàsz Brassaï (1899-1984), known particularly for his night time photography of Paris, commented:

> Proust remarks that each time the past and present telescope into each other, it is always the present site, which is the victor. 'And if the present site had not been the immediate victor, I believe I should have fainted [...] these resurrections of the past force our nostrils to breathe the air of remote places, [...] our whole person [...] totters between them and the present sites, in the vertigo of an uncertainty like the kind we sometimes experience before an ineffable vision, at the moment of falling asleep.'[5]

The narrator describes the images he sees when on the verge of sleep, as being in a constant state of flux as the light changes, and indistinct shadows are cast around the room. Between wakefulness and sleep, the mind enters a 'hypnogogic' phase, and between sleep and wakefulness, it enters a 'hypnopompic' phase. In these states one begins to lose touch with the world around, without showing physiological stages of sleep. Images form inside the head like still photographs. These images are referred to as dreams, visions or hallucinations, so that for example, hypnogogic visions are the images experienced while falling asleep – half dreaming, so to speak. The images may seem more real than real, almost surreal, and it is this imagery that so fascinated and influenced the Surrealist movement of the 1930s.

The modulating qualities of light can transform ordinary objects so as to be almost unrecognisable from one moment to another. Proust describes how the diminishing firelight is able to conceal objects and spaces, just as the emerging light of day gradually and ambiguously reveals them, evoking spatial uncertainty.[6]

The narrator also recalls that as a child, staying in an unfamiliar bedroom at the top of the house, isolated and detached, he is entranced by the images produced by a magic lantern,[7] but at the same time, he is anguished and disconcerted by them, recalling:

> When I lay awake at night and revived old memories of Combray, I saw no more of it than this sort of luminous panel, sharply defined against a vague and shadowy background, like the panels which a Bengal fire or some electric sign will illuminate and dissect from the front of a building the other parts of which remain plunged in darkness.[8]

Proust's ill health as an adult caused him to spend much of his life in bed, separated from the outside world, recalling and retrieving images of his youth, which he collaged into his literary masterpiece. Three hundred years earlier, René Descartes (1596-1650), philosopher, physicist, physiologist and mathematician, who sought to integrate philosophy with the 'new sciences', had positioned the self in the enclosed space of the camera obscura, where light rays were brought inside, through a single opening in a controlled and orderly manner, corresponding this to the light of reason, which likewise enters and penetrates the mind. He declared that, 'First it is the soul that sees, not the eye'.[9]

At times, Proust seemed to employ a kind of x-ray vision with which to look into and through his subjects. He commented that, 'As often as I dined out, I failed to see the

other guests, because, when I thought I was looking at them, I was x-raying them'.[10] Brassaï noted that, 'Proust was interested, along with Freud, in the lapses, mistakes and unconscious errors, which for him had the revealing value of x-rays.'[11]

As photography enabled the capture of a single image, the advent of film enabled the capture of continuous movement. Yet this could only be seen through reproduction and was unable to produce live imagery. Although Proust celebrates the present, it is through slowly building up and collaging snapshots and memories that he finally presents them to us. The chronophotographs of Marey and Muybridge, inventors of photographically decomposing movement, showed how time could be slowed or accelerated through a series of single images, capturing the successive stages of a particular movement. The development of the moving image clearly inspired the young Proust, and he compared the various positions of a galloping horse with the constantly shifting positions of objects in the room of the young narrator (Fig. P1).[12]

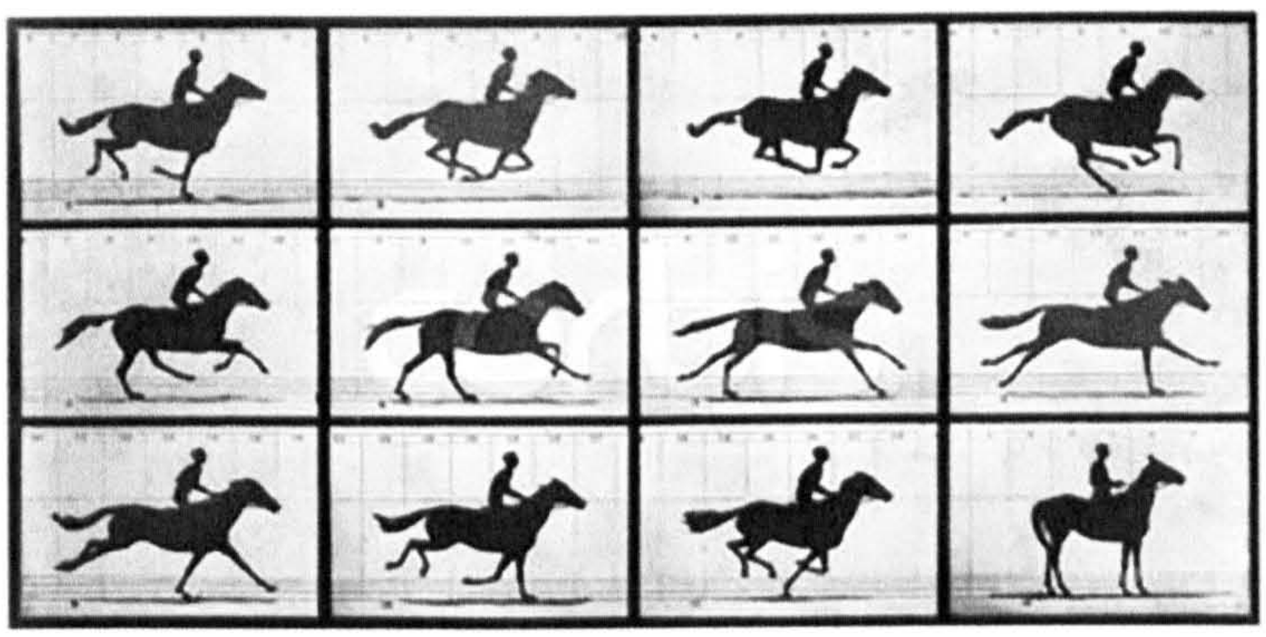


Fig. P1
The Horse in Motion 1878
Eadweard Muybridge

There is an unsettling kind of doubling evident in Proust. Sigmund Freud (1856-1939) maintained that duplication and doubling are capable of invoking notions of the uncanny, and although they shared similar concerns, it appears that neither Proust nor Freud was familiar with the work of the other. Just as optics can distort and create uncertainty, in Proust's narrative the constant merging of the two identities of author and narrator become indistinguishable.

Freud & the Uncanny

Sigmund Freud was a physiologist, medical doctor, psychologist, and father of psychoanalysis, whose investigations led to his fundamental discoveries of the unconscious forces that have a bearing on our everyday thoughts and actions. His ideas were to influence intellectual thought and many specialist disciplines in the 20th century, including the visual world. Freud recognised the power and importance of art, and in his studies of dream imagery opened up the study of the imagination and subconscious. Freud's *Interpretation of Dreams* (1900) was the result of his extensive investigations of dreams and the unconscious. He maintained that during sleep the sub-conscious is open to almost any internal or external stimuli, free from critical reason. In this state, anything is possible, and familiar images may be juxtaposed in such a way as to heighten their reality, rendering them surreal or uncanny.

In his essay *The Uncanny* (1925), Freud stated that the 'unheimlich' (uncanny) is something that is secretly familiar (heimlich), which has undergone repression and then returned from it[13]. The 'Uncanny' may be an overused word, but one which is still relevant today. It is not just a case of the strange or peculiar, but more specifically a disturbance of the familiar. The opposite of the German word '*unheimlich*' (uncanny, literally unhomely) is ambiguous in meaning, for '*heimlich*' (homely) signifies intimacy and domestic comfort, yet also the hidden or withheld'. Freud wrote:

> On the one hand it means what is familiar and agreeable and on the other, what is concealed and kept out of sight. [...] The notion of something hidden and dangerous, where 'heimlich' comes to have the meaning usually ascribed to 'unheimlich' is demonstrated thus, 'At times I feel like a man who walks in the night and believes in ghosts: every corner is Heimlich and full of terrors for him'. Thus 'heimlich' is a word the meaning of which develops in the direction of ambivalence, until it finally coincides with its opposite, 'unheimlich'.[14]

He maintained that recurrence of the same thing could also be a source of the uncanny, bringing to mind feelings of powerlessness sometimes experienced in dreams. He recounted the story of a young couple that moved into a rented house containing a curiously shaped table covered with carvings of crocodiles. As evening fell, an extraordinary smell pervaded the house; they stumbled over something in the dark, and seemed to see a vague form gliding over the stairs, as if the crocodiles on the table had suddenly come to life to haunt the house. Freud suggested that silence had greater potential for evoking the uncanny, since silence is frequently associated with the

darkness of night, where the rationality of day may be replaced by excessive flights of the imagination.

The uncanny may work through direct experience or through visual or fictional representations. Leonardo's *Mona Lisa*, with her softly blurred features and ambiguous smile, provides a visual example of something static which looks uncannily as if it is on the verge of animation. The uncanny relies on the uncertainty between the real and the imaginary, fact and fiction. It can be found where that which is dead seemingly comes unnervingly, to life, and where inanimate objects become strangely animated. Freud's work had a strong influence on the Surrealist movement of the 1930s, which although initially essentially a literary movement, also came to embrace the visual world. By 1936 Surrealism was a fully-fledged international art movement, which celebrated the irrational and spontaneous, and judged the unconscious to be a mainspring of artistic inspiration, exemplified in the work of artists such as René Magritte.

Freud cited *The Fall of the House of Usher* by Edgar Allen Poe and *The Sand-Man* by E T A Hoffmann as perfect literary examples of the uncanny in all its variations. In these narratives the uncanny is allowed to flourish in an imaginary and escapist world with clearly defined limits, and whose effects rely upon presenting a world that is like reality yet removed from it. An elemental belief in the magical power of objects is exploited within the safety of these stories. Everyday objects are removed from the norm thus acquiring a deviant, aberrant life and therefore different meanings.

Freud described an experience of perception manifested through literature and art, and Proust's narratives recreate sensations from his past through his fascination with optics. Both deal with the subversion of the familiar, which can produce a heightened and unique vision of reality. My absorption with the work of Proust and Freud, together with my fascination with the camera obscura's ability to reproduce imagery in real time but at the same time to subvert it, therefore provided the starting point in my quest to challenge the perception of the observer and thereby evoke a unique experience of the uncanny.

Historical Background

An historical review of the camera obscura is obviously beyond the scope of this dissertation. Nevertheless, what this section sets out to do is to focus on how it has been used to aid traditional drawing and painting, and as an inspirational tool, giving the artist the potential to exploit the inherent aesthetic qualities of its images. It also analyses the differences between photographic images and those of the camera obscura, and the consequences of the invention of photography on the camera obscura. Although film later enabled the recording of moving images, these could still only be viewed through reproduction. The popularity of the camera obscura as an entertainment device for projecting images in real time endures to this day, and despite the most advanced camera technology, its images defy capture or reproduction. The way in which the camera obscura has been utilised in contemporary artistic practice, together with the implications of visual perception and the passage of time and its manipulation, is also discussed.

Antiquity to the 19th century

Aristotle described how projected images could be formed by means of a pinhole as far back as the 4th century B.C. A ray of light from the point of an object passing through a pinhole, results in the formation of an inverted and sideways reversed image of the object on a screen opposite the pinhole (Fig. 1). This image will be dim, and not very sharp. The larger the hole becomes, the more light enters, making the image brighter, but less well focused.

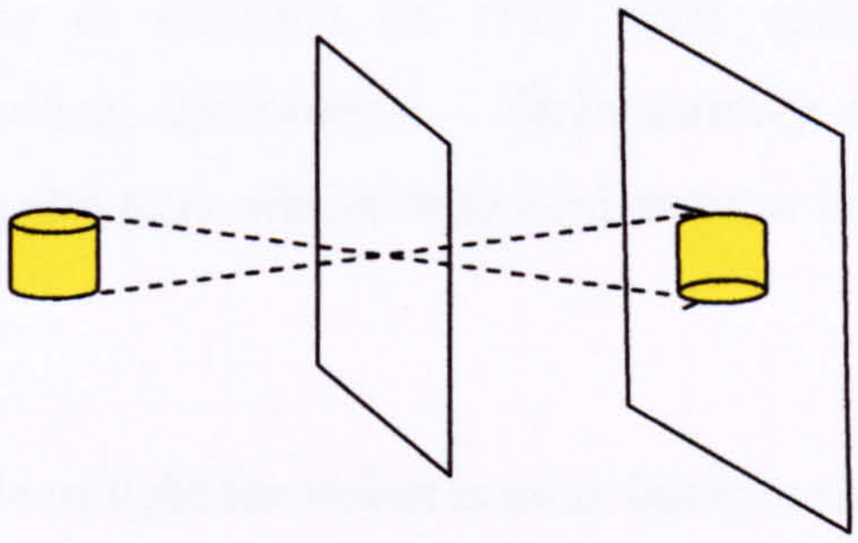


Fig. 1
Image formed by pinhole

When a lens replaces the pinhole, more light is allowed through and the lens can focus the image so that a much brighter, sharper image is produced (Fig. 2). If a focusing lens is thought of as comprising a pair of converging prisms (Fig. 2), it directs light from each point of the object through the lens and then to a corresponding point on the screen. However, some distortion will occur towards the outer edges and the extent of sharp focus will be limited. Lenses can only work properly when object, aperture and screen are adjusted to distances which produce focused images on the screen.

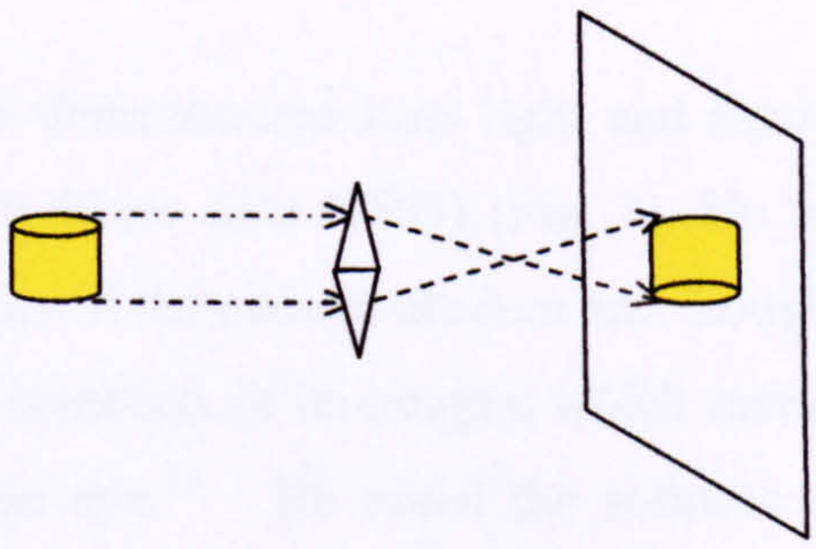


Fig. 2
Image formed with lens

The name 'camera obscura' comes from the Latin meaning a 'dark chamber'. The early illustration in Fig. 3 shows how an observer situated in a dark chamber sees an inverted image of an object illuminated outside, projected on the wall opposite the aperture where the light enters.

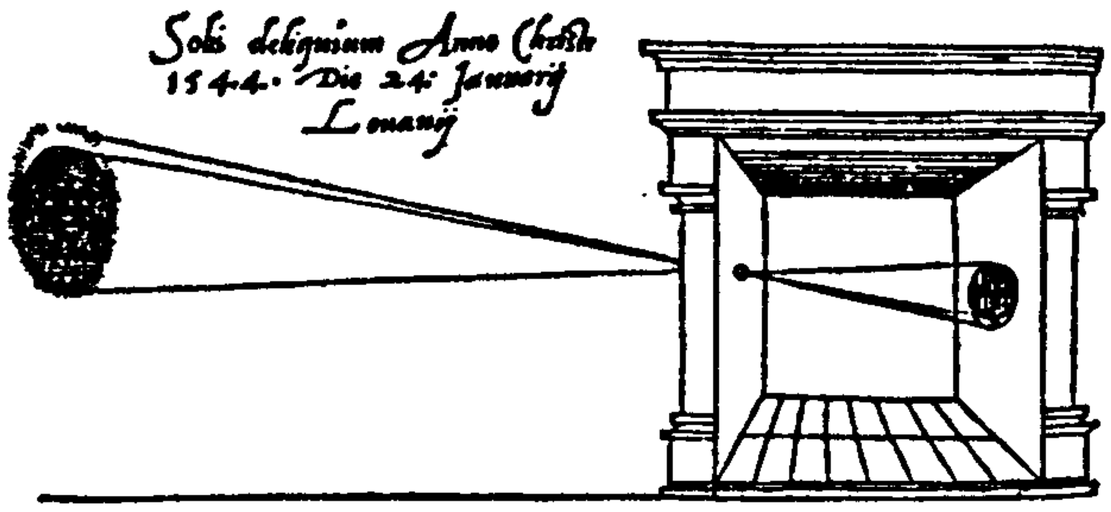


Fig. 3
Earliest known illustration of a camera obscura used to observe a solar eclipse 1544
Reinerus Gemma-Frisius.

During the 16th and 17th centuries, several churches in Italy such as the Church of St Petronio in Bologna in 1575 were specially constructed or adapted as giant astronomical instruments. Their suitably darkened spaces in effect became giant camera obscuras, which were used as solar timepieces by tracking the movement of the sun.

The role of light for vision is vital, but it is shadow which is necessary to describe form and gives us the ability to comprehend the three dimensional world. Leonardo da Vinci (1452-1519), artist and polymath, studied the effects of light and shadow, which he deemed to be necessary components in the description of an object, describing shadow as:

> The absence of light, merely the obstruction of the luminous rays by an opaque body. Shadow is of the nature of darkness. Light is of the nature of a luminous body; one conceals and the other reveals. They are always associated and inseparable from all objects. But shadow is a more powerful agent than light, for it can impede and entiely deprive bodies of their light, while light can never expel shadow from a body, that is from an opaque body.[15]

Da Vinci demonstrated how light and shadow could be used to reveal and conceal objects in *Mona Lisa* (1503) (Fig. 4). He was also fascinated by the image making capabilities of the camera obscura and thought of it as a kind of artifical eye, puzzling over the inversion of its images, which seemed to suggest that this also must occur in the human eye.[16] He noted the softness and blurring of sharp outlines typical of camera obscura images, referring to these effects as 'sfumato', from the Italian 'fumo' meaning 'smoke'.[17] This smokelike haziness tends to lend an image the illusion of movement, so that rather than considering the blurring of edges a shortcoming, da Vinci appears to have considered it an effect to be exploited. This effect is particularly noticeable around the eyes of *Mona Lisa* (Fig. 5), where it gives the painting a certain ambiguity and an increased sense of animation.

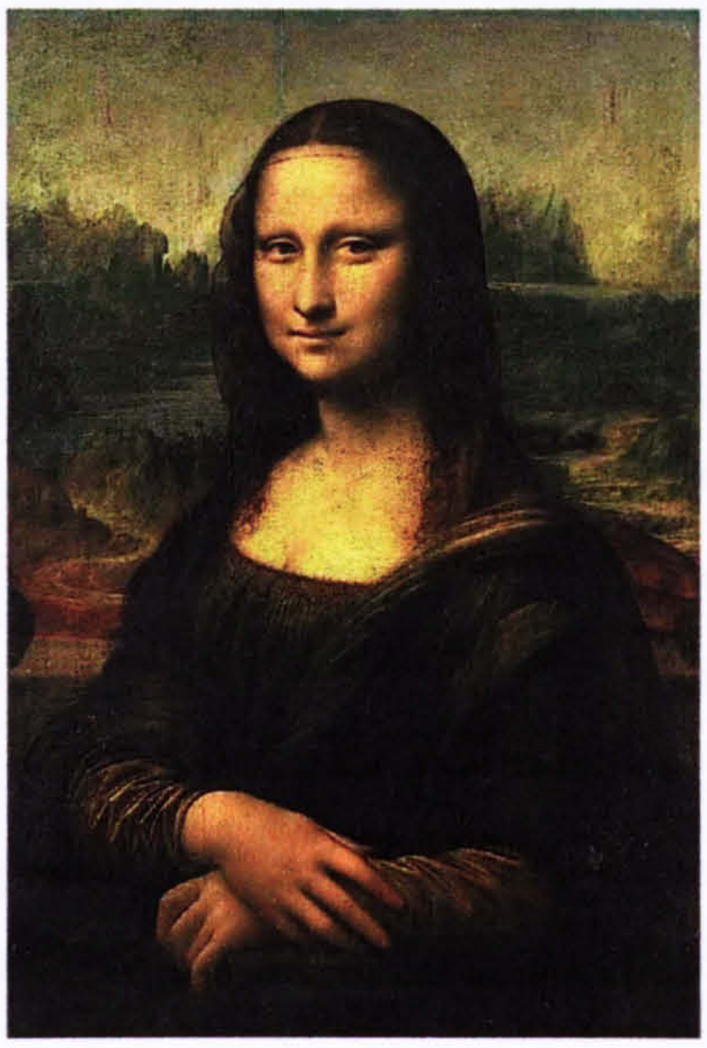


Fig. 4
Mona Lisa 1503-6
Leonardo da Vinci
Musée du Louvre, Paris

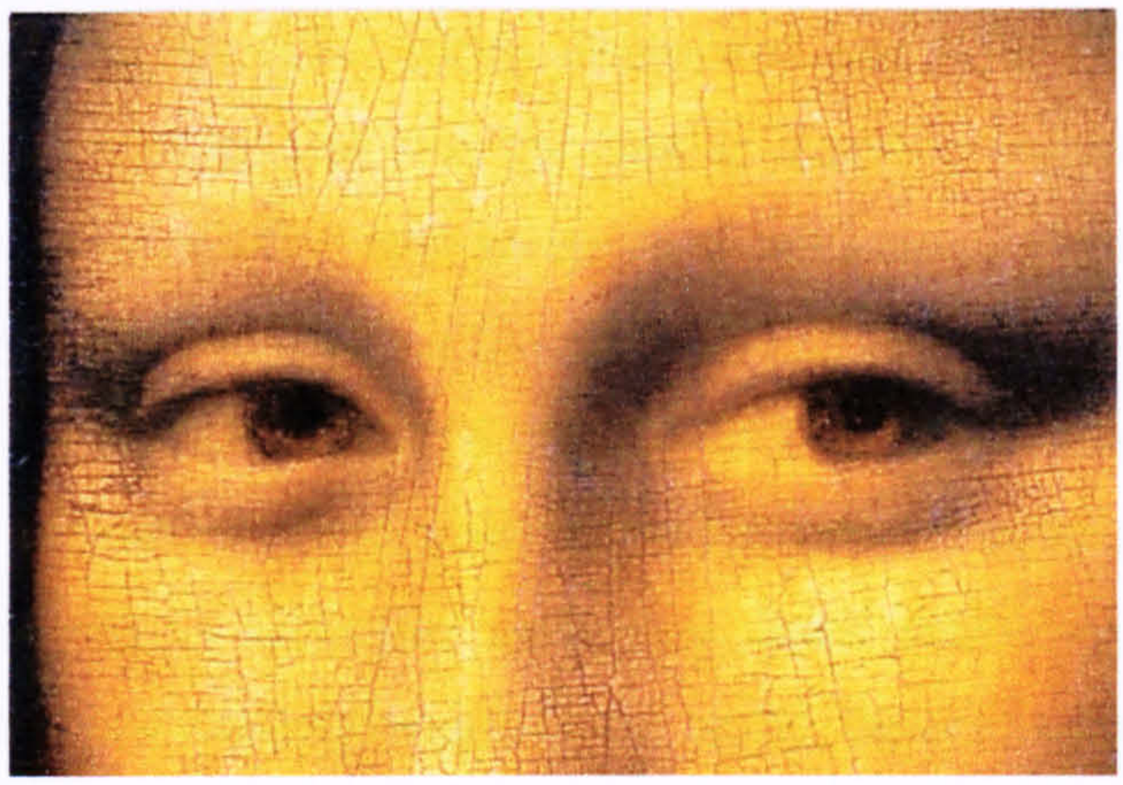


Fig. 5
Mona Lisa 1503-6 (Detail)
Leonardo da Vinci
Musée du Louvre, Paris

Before the 17th century, there was much suspicion surrounding those who experimented with optical devices such as camera obscuras, mirrors and lenses. Fear of excommunication from the church for what was then seen as commerce with the Devil, was a frightening possibility. Secrecy therefore surrounded scientific experimentation. Early observers of camera obscura projections, ignorant of how the images materialised so strangely out of the darkness, were often spellbound and even frightened by what they perceived as 'magic'. Marina Warner recently observed that:

> Running through the history of magic and its attendant anxieties runs a parallel history of optics: if the Devil was able to conjure appearances whereas God truly performed prodigies, it was imperative to establish the truth status of vision.[18]

The Italian scientist and writer Giovanni Battista della Porta (1535-1615), gathered together all available information on the camera obscura in his book *Magica Naturalis* (*Natural Magic*), published in 1558, which was a mixture of science, secrets and mysticism. Although a popular and widely read book, suspicion and prejudice persisted. He was even arrested and charged by the Inquisition for frightening audiences with his 'magical' upside down projections. Gradually however, lenses and optics acquired a greater scientific understanding. Daniel Barbaro's (1514-1570) book, *Practica della Perspettiva* (1568), helped to demystify the camera obscura, so that it lost some of its associations with magic. In his book for instance, he described how to create camera obscura projections[19].

Lenses had historically been mistrusted as misleading and distorting true vision. In early 17th century Holland, Johannes Kepler (1571-1630) discovered just how the human eye, the 'ultimate optical tool' worked, and was the first to describe retinal images as 'pictures'. So too came the recognition and acceptance that human sight could also be unreliable. Fellow countrymen such as Constantijn Huygens (1596-1687), and Samuel van Hoogstraeten (1627-1678) shared a fascination with the camera obscura's ability to render images of the natural world faithfully and directly. Yet, like the eye, the very instrument considered to represent truth, was itself falsifying. Although the camera obscura cast direct and moving images of the world, these images appeared upside down and their size modified. The Dutch interest in the camera obscura however was purely pictorial, based upon observation, experimental procedures and practical outcomes rather than upon mathematics or scientific theory, so that whilst being a direct challenge to artists, it also served as a model for their art. Although the camera obscura was an old device, its use for picture making was new.

Portable camera obscuras had evolved by the 17th century, including tents, sedan chairs and pocket models, largely promoted and popularised by Della Porta's book. Portable versions where an image projected onto translucent paper could be traced became increasingly popular with artists and draughtsmen as a drawing aid (Fig. 6). With a portable type, ambient light tends to dim the image (although black cloths attached to them which cover the head can overcome this problem). Apart from replacing a pinhole with focusing lenses, the camera obscura has essentially remained unchanged to this day.

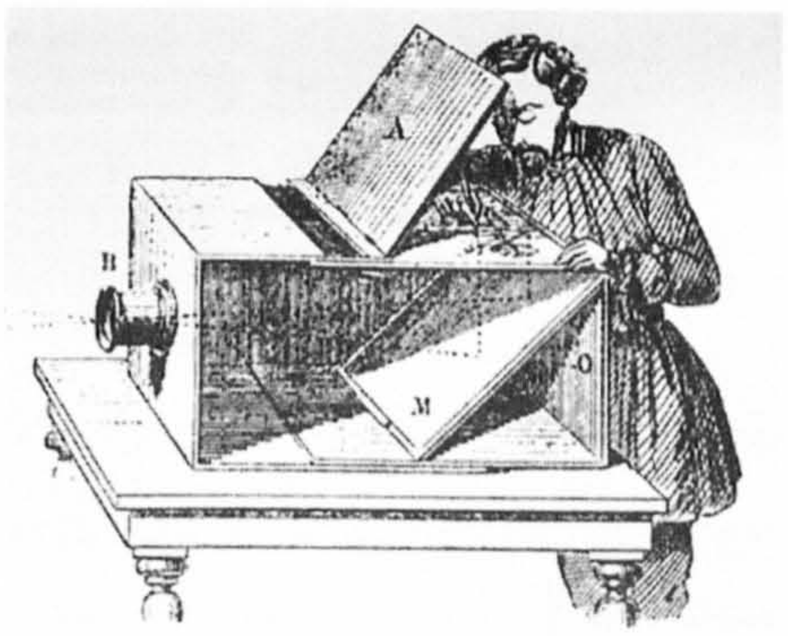


Fig. 6
Example of a large box camera obscura 1855
D. Lardner

A portable tent type, with a lens and mirror at the apex, is like a miniaturised version of the large walk in versions, except that only the head can be placed inside, and this type was useful for tracing images formed on the horizontal desk inside (Fig. 7).

Fig. 7
Portable tent type camera obscura 1825
Vincent Chevalier

Large walk in versions had become popular public attractions by the early 19th century. Because ambient light can be totally excluded, they produce the most successful images. A lens and mirror in the roof reflect an image at a 45° angle down onto a table within the room (Fig. 8). Since the area of focus of a camera obscura image projected onto a flat screen is relatively small (discussed in detail later), these table type screens, often as large as 1.52m in diameter, are usually concave, in order to extend the size of the focused image. The images appear horizontally, so that the viewer can move around the 'screen' to view the image the right way up (Fig. 9).

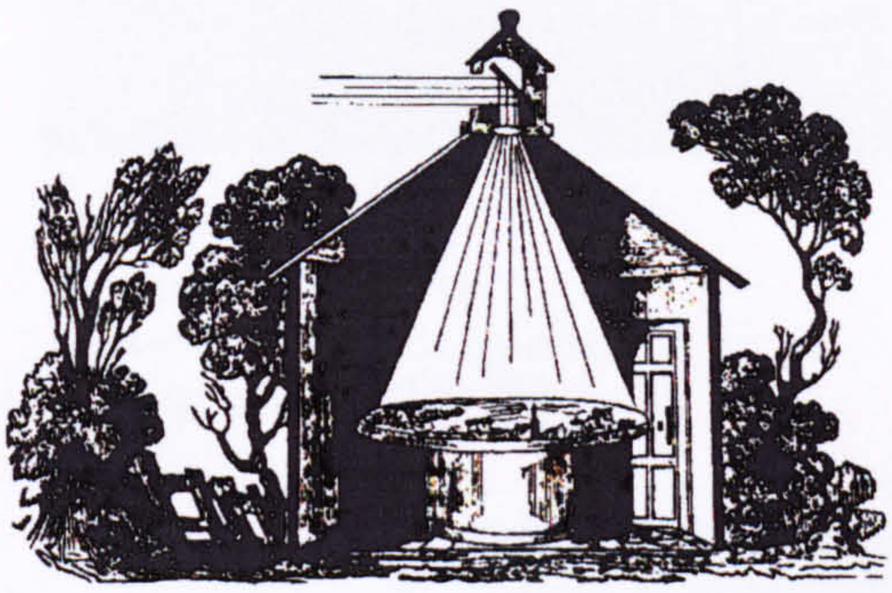


Fig. 8
Typical public camera obscura
Magazine of Science, April 1839

Fig. 9
Camera Obscura at Central Park,
Frank Leslie's *Popular Monthly* 1877

These popular tourist attractions proliferated in elevated positions in seaside resorts and pleasure parks, such as Aberystwyth (Fig.10), and Bristol (Fig.13), enabling them to gain the best views of the surrounding panorama (Figs.11 & 12). This type of camera obscura usually has a rod and handle or similar means of turning the mirror at the top to alter its direction and thus change the view to be projected. Although their outer appearances vary, their working mechanisms are similar.

Fig. 10
Aberystwyth camera obscura
Photograph by author 2003

Fig. 11
Projected image inside
Aberystwyth camera obscura
Photograph by author 2003

Fig. 12
View from outside
Aberystwyth camera obscura
Photograph by author 2003

Fig. 13
Bristol camera obscura
Photograph by author 2002

Room type camera obscuras served a practical role in both world wars, being used by the RAF to observe and record the accuracy of bomb aiming during pilot training.

As previously mentioned, in a camera obscura projection the area of sharp focus is limited, being sharpest in the centre. As the distance between the lens and the screen increases, light is spread over an increasingly larger area with a consequent light fall and diffusion and distortion towards the edges. This phenomenon is known as 'vignetting' (Fig. 14)[20], which is an effect of the inverse square law.

An artist wishing to trace an image produced by a camera obscura projection would only have a relatively small focused area at any one time. This necessitates repositioning the lens to focus on another area, so that a composite picture may be built up, as discussed by contemporary artist David Hockney, in his book *Secret Knowledge,* in which he claims that optics were used in the early 15th century, much earlier and more widely than previously supposed, by artists such as Jan van Eyck.

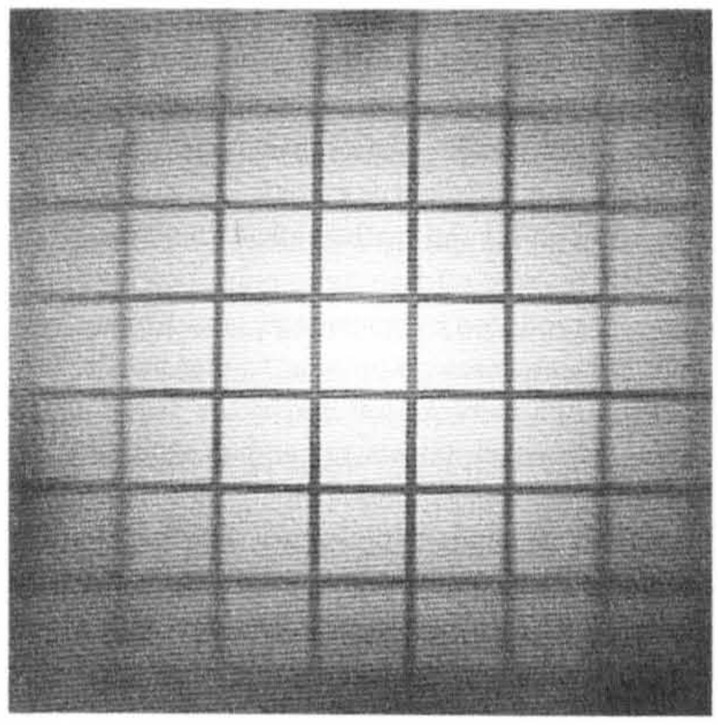


Fig. 14
'Vignetting' 2001
Mills

Pearblossom Highway (1986) (Fig. 15), by Hockney, which shows a composite picture of many photographic images, highlights the discrepancies which occur when pictures taken from slightly different viewpoints are collaged, which is what Hockney maintains many artists must have done when they used optics to help them construct paintings. Of course an artist can skilfully disguise these joins in a painting, although tell tale inconsistencies may remain, from which it is possible to speculate that optics have been used.[21]

Fig. 15
Pearblossom Highway 1986
David Hockney
J P Getty Museum, Los Angeles

Whilst camera obscura images naturally appear inverted, artists who traced over these inverted projections would have turned the finished work the right way up for viewing. There would have been little reason for them to be shown upside down. Therefore, deliberate inversions in art are rare. Nevertheless, inverted text appears in at least three paintings of the Annunciation painted in the early 15th century.

Fig. 16
Annunciation 1432 (Altarpiece)
Jan van Eyck,
St Bavo Cathedral, Ghent

Fig. 17
Detail of *Annunciation* 1432 (Alterpiece)
Jan van Eyck
St Bavo Cathedral, Ghent

Fig. 18
Detail of *Annunciation* 1432 (Alterpiece)
Jan van Eyck
St Bavo Cathedral, Ghent

In Jan van Eyck's (c1395-1441) *Annunciation* (1432) for example, (Figs.16, 17 & 18), there appear to be deliberately conceptual reasons for inversion. The angel Gabriel looks at and addresses Mary directly, but Mary does not look back at the messenger, whose words to Mary appear the right way up. Her reply appears upside down and back to front, suggesting that she does not reply to him aloud, but responds silently to the Holy Ghost, represented by the dove hovering above her head (Fig.18). The writing also seems to hover mysteriously, bearing no direct or physical relationship to the pictorial elements that form its background. The purpose of this may be to give it a divinity, a quality that is not of this world. This inversion of text seems to represent something that occurs internally, in the same way as an image is formed on the retina of the human eye, or through a camera obscura. However, as already noted, it was not until the 17th century that it was fully understood that images appear upside down upon the retina, but it seems reasonable to suppose that van Eyck was displaying his knowledge of mirrors and optics here, as he clearly does in *Arnolfini Marriage,* painted shortly afterwards in 1434, where he shows us his own small reflection in a mirror (Fig. 21).

Hockney argues that van Eyck must have used optics to paint the chandelier (Fig. 20) because this complicated object would have been difficult to paint by observation alone, but much more straightforward using some kind of lens. Van Eyck is known to have made separate drawings of various elements, which he could then assemble. Constant refocusing would be consistent with the use of optics. However, no conclusive evidence exists to prove whether the greater degree of naturalism, which seems to have suddenly occurred around 1420-1430, is due to the use of optics, as Hockney suggests. Indeed, it may also have been due to Filippo Brunelleschi's discovery of linear perspective around 1425, an artist who also used a camera obscura.

Fig. 19
Arnolfini Marriage 1434
Jan van Eyck
National Gallery, London

Fig 20
Arnolfini Marriage, 1434 (Detail of chandelier)
Jan van Eyck
National Gallery, London

Fig. 21
Arnolfini Marriage, 1434
(Detail of mirror reflection, including van Eyck's own tiny self-portrait)
Jan van Eyck
National Gallery, London

Although 18th century artists such as Joshua Reynolds and Canaletto (Giovanni Antonio Canal) are known to have used camera obscuras to aid drawing and painting, when a naturalistic appearance was the desired outcome, no documentary evidence actually exists to prove that either Johannes Vermeer (1632-1675) or Michelangelo Caravaggio (1571-1610) used camera obscuras or other optical aids such as mirror lenses in the 17th century. However, there is substantial evidence in the paintings themselves to suggest that they did. These artists did not 'cheat' by using optics because of any lack of ability, but actually exploited the characteristics of projected images. In fact, using optics to produce paintings could not be considered an easy option, since a great deal of skill and patience is required of the artist.

It is generally acknowledged that Caravaggio used optics, and in particular, mirrors. Artists traced projected images directly with paint if frontally projected, or back projected onto a translucent screen, eliminating the need for preliminary drawing. There is no evidence of preliminary drawings or preparatory studies by Caravaggio or Vermeer, and their paintings contain no under drawings. This is rare for artists painting complicated compositions, where at least some preliminary drawing might be expected, and this therefore implies the use of optics. This could also help to explain the lack of depth and flattening of the picture plane in paintings such as Caravaggio's *Boy with Basket of Fruit* (1593/4) (Fig 22), where the basket of fruit is depicted in sharp focus, but appears very 'flat'. It seems curiously detached from the boy, who is depicted in much softer focus, but equally 'flat'. It seems as if the images have been separately observed, then assembled.

Fig. 22
Boy with a Basket of Fruit 1593/4
Michelangelo Caravaggio
Villa Borghese, Rome

Although renowned for his mastery of foreshortening, in *Supper at Emmaus* (1661) (Fig. 23), Caravaggio creates huge discrepancies of size inconsistent with the conventions of perspective, most noticeably in Peter's hands, suggesting that different areas might have been studied separately and then assembled. All the heads are of similar size, which suggests repeated refocusing. The divergent perspectives in *Emmaus* could be due to problems of refocusing, a deliberate artistic decision, or a combination of both. For example, placing a white cloth over a heavily patterned one would eliminate the problem of matching complicated patterns. The basket of fruit in the foreground, like that in *Boy with a Basket of Fruit*, has an equally 'flat' appearance as if painted from a projection.

Fig. 23
Supper at Emmaus 1661
Michelangelo Caravaggio
National Gallery, London

Strong circumstantial evidence exists for Johannes Vermeer's use of optics, including a personal connection between Vermeer and the artist Samuel van Hoogstraeten (1627-1678), who both appeared to consider the camera obscura to be an inspirational device and visual stimulus rather than merely a mechanical drawing aid. Van Hoogstraeten promoted its use and commented, 'I am certain that the sight of these reflections in the darkness can be very illuminating to the young painter's vision'.[22] Like many of his contemporaries in the 17th century, van Hoogstraeten was particularly taken with the ability of the camera obscura to produce moving images:

> I saw countless people walking and turning about on a piece of paper in a small room, and [...] hundreds of little barges with passengers and the whole river, landscape and sky on a wall, and everything that was capable of motion was moving.[23]

The work of Vermeer has long been praised for the quality of his light, which he uses in a delicate manner to illuminate tranquil domestic scenes. However the areas of light and shadow have much starker contrast in Caravaggio's paintings, making them more dramatic. Whilst scholars generally agree that Vermeer used a camera obscura, Professor Philip Steadman has recently carried out detailed and extensive studies and reconstructions based on the actual paintings of Vermeer, in an attempt to prove that Vermeer also used a cubicle type camera obscura. He tantalisingly suggests that such a cubicle is visible in the reflection of the globe in *Allegory of Faith* (1666-7) (Fig. 25), so that even if Vermeer does not show himself in a reflection as van Eyck does in *The Arnolfini Marriage*, he may be more subtly hinting at where he is hiding. The detail in the reflection seems too precise to be overlooked. Fig. 26 shows Steadman's suggested possible arrangement of Vermeer's cubicle based on measurements taken from the painting and the probable configuration of windows.

A cubicle type could produce larger and clearer images, unspoilt by the ambient light of a box type device. However, constructing a special cubicle and repeatedly readjusting a lens would have been both time consuming and laborious. This is not to disagree with Steadman, but rather to emphasise the patience required and the lengths to which an artist might go, in order to use the visual stimulus of a camera obscura to produce inventive new work.

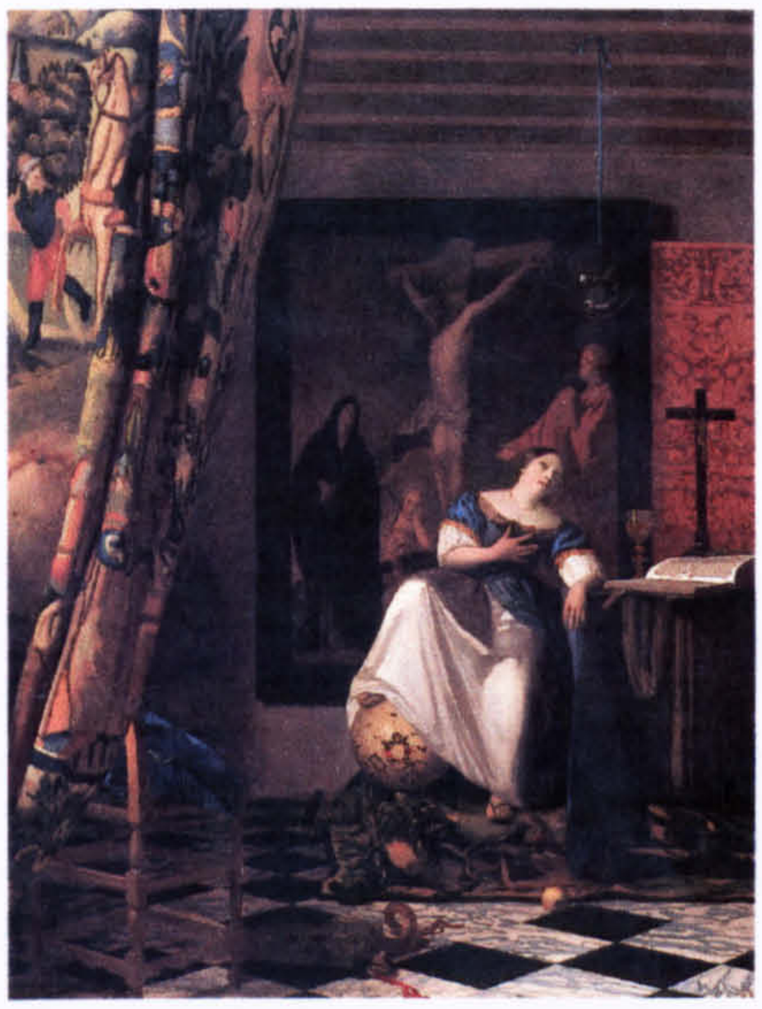


Fig. 24
Allegory of Faith 1666-7
Johannes Vermeer
Metropolitan Museum of Art, New York

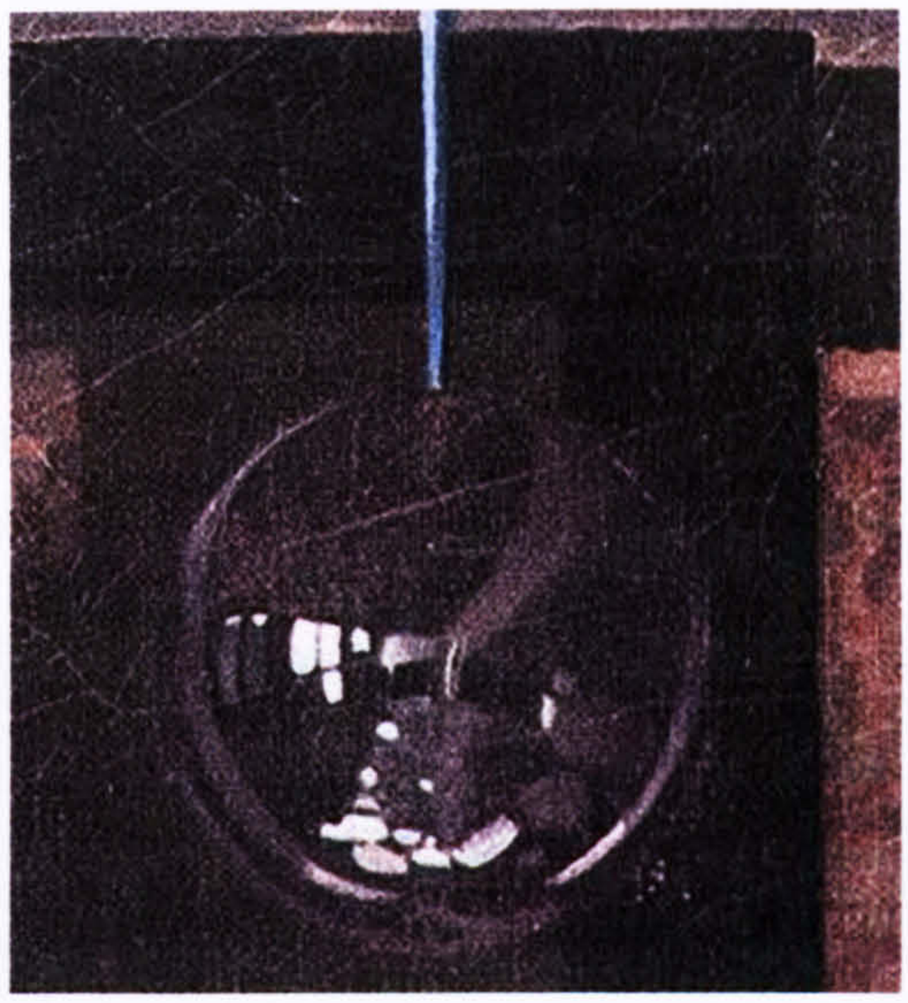


Fig. 25
Allegory of Faith 1666-7
(Detail of globe)
Johannes Vermeer
Metropolitan Museum of Art, New York

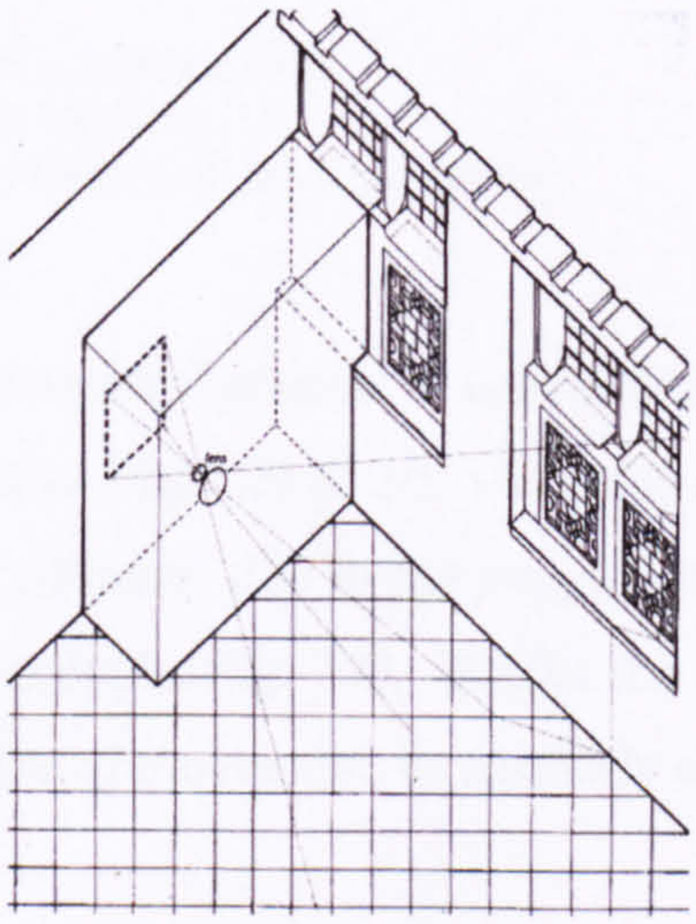


Fig. 26
Possible arrangement for Vermeer's
camera obscura cubicle, 2001
Philip Steadman

The invention of photography some 300 years later prompted comparisons with Vermeer's paintings. It was not the photographic detail that suggested comparisons, since his paintings often lack precise detail and focus when viewed close up, but rather how Vermeer seems to have translated and exploited the optical characteristics of projected images, including those that might be deemed deficiencies. At times what is in the distance is more sharply in focus than foreground objects. 'Circles of confusion', or softly focused areas, which occur when the image is slightly out of focus, are typical of camera obscura images, but not so easily observed by the naked eye. These effects are more pronounced in Vermeer's later paintings, such as *Girl with a Red Hat* (1665) (Figs. 27 & 28), where bright blobs of light, which might be inspired by optics, are exploited in their application. Vermeer's rendering of shadow obliterates, interrupts, and even denies distinct lines. This is similar to what we see in Leonardo's *Mona Lisa*, where areas of colour appear flattened or simplified and texture is obliterated.

Fig. 27
Girl with a Red Hat 1665
Johannes Vermeer
National Gallery of Art, Washington

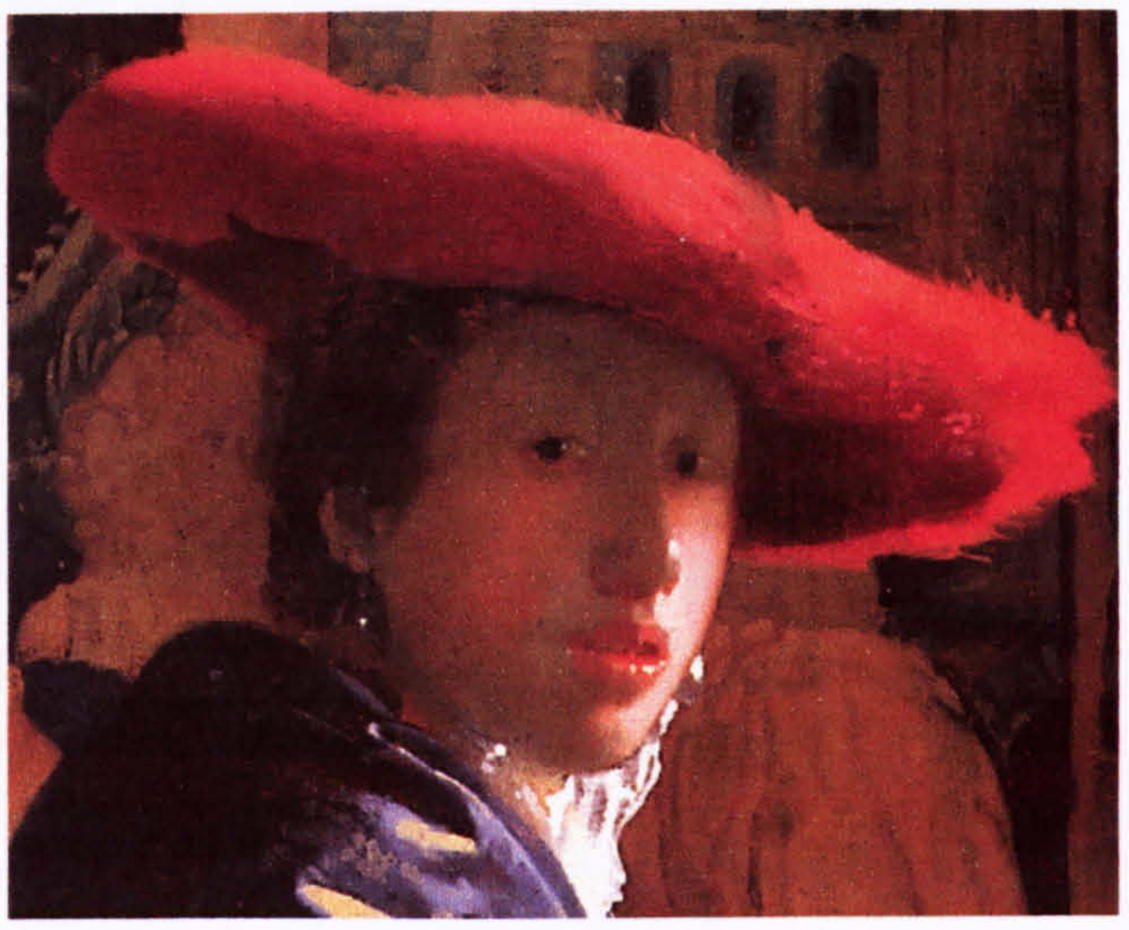


Fig. 28
Girl with a Red Hat 1665 (Detail)
Johannes Vermeer
National Gallery of Art, Washington

The difference between a conventional photograph and a projected image can be observed in Figs. 29 & 30. What is apparent in the projected image (Fig. 30) is the overall 'softness' due to the simplification of highlights and tones in comparison with the photograph (Fig. 29). Whilst the latter is fixed and static, the projected image is suggestive of movement, as similarly observed in da Vinci's *Mona Lisa*.

Fig. 29
Photograph of still life 2000
David Hockney

Fig. 30
Photograph of still life projection 2000
David Hockney

Working from a projected image is not instantaneous like a photograph, but a protracted exercise in patience. Viewing an upside down image is quite different to viewing one that appears the right way up. It becomes more abstract in terms of composition, thus forcing greater concentration by the observer. An inverted image can have a disorientating effect, as the observer can no longer take what they see for granted. Being forced to reassess such images causes previously overlooked characteristics to be observed afresh, giving renewed impetus to their artistic application. The sense of a 'captured' image is characteristic of Vermeer's paintings and of camera obscura projections. Although Vermeer's paintings portray intimate interiors, he depicts people in a detached way so that they cease to be individuals, and much more like still life objects. [24]

Proust also contemplates his subjects in a way that is detached, yet at the same time intimate. He retreats to his bedroom and Vermeer to his dark box, both in their way becoming voyeurs through a lens. Proust, influenced by his lifelong obsession with photography, considered Vermeer's *View of Delft* (1660/1) (Fig. 31), the finest painting ever made, and its photographic qualities have frequently prompted the suggestion that a camera obscura was used in its creation.

Fig. 31
View of Delft 1660/1
Johannes Vermeer
Mauritshuis, The Hague

Like Caravaggio and Vermeer, the painter Juan Sanchez Cotan (1560-1627) shared a preoccupation with the modulating qualities of light. Although not generally associated with camera obscuras, his paintings display characteristics indicative of its use. His *Quince, Cabbage, Melon and Cucumber* (1602) (Fig. 32), denies recession into space beyond that of the picture plane, as the objects appear on the same plane, typical of projected images. For all the naturalism with which they are depicted, the isolation of each dramatically lit object, contrasted by infinite dark backgrounds, where no shadows fall, renders them otherworldly. By eliminating unnecessary distraction, the observer is forced to re-evaluate both what and how they see.

Fig. 32
Quince, Cabbage, Melon and Cucumber 1660
Juan Sanchez Cotan
San Diego Museum of Art

Cotan's humble objects become almost sanctified through their transformation. As a lay brother of the Carthusian Monastery, he seems to have been particularly inspired by mystical notions that emphasised the sacred values of a simple aesthetic life. Hanging foodstuffs on threads in cool dark '*cantareros*' or larders was a common method for preservation in Spain. This kept perishable items from touching and

spoiling one another or sitting on a surface where the air could not circulate beneath. Anything that hangs inevitably draws our attention to the laws of gravity, and, since images produced by a camera obscura appear inverted, our normal perception of gravity is challenged. Objects, which we know to have weight, are cast adrift in space in a mysterious way.

The Dutch artist Willem Kalf (1619-1693) is also thought to have used a camera obscura to study lighting and colour effects, which seem almost more important than the subject matter in his paintings. In his *Still Life with Nautilus Goblet* (1660) (Fig. 33), light appears to dissolve the material properties of objects, so that they are only just perceived from the surrounding darkness. The delicate bowl and goblet, penetrated softly by light, seem almost transparent, and the red wine glowing behind them in the dark space appears to float independently of the glass that holds it. As with Cotan, the apparent weightlessness of the objects transforms them, so that they do not seem to be of this world.

Fig. 33
Still Life with Nautilus Goblet 1660
Willem Kalf
Thyssen-Bornemisza Collection, Madrid

The Camera Obscura and Photography

Early in the 19th century, the most common form of camera obscura was a simple box with a lens at one end. The lens projected an image onto a mirror that in turn reflected it onto a ground glass screen. Although an image could then be traced on translucent paper placed over the glass, the image could only be captured by drawing. Henry William Fox Talbot (1800-1877), later to become a pioneer of the modern day camera, was particularly frustrated by his inadequate attempts at sketching whilst on holiday in Italy in 1833, wondering if by using the optics of the camera there might be a way of fixing the image on paper by the chemical action of light. He later wrote in *The Pencil of Nature*, 'I reflected on the inimitable beauty of the pictures of nature's painting which the glass lens of the camera obscura throws upon the paper',[25] and thought, 'How charming it would be if it were possible to cause these natural images to imprint themselves durably and remain fixed upon the paper!'[26]

Extensive experiments conducted in the early 1800s by Fox Talbot in England, and Daguerre and Niépce in France, into the chemistry of photosensitive emulsions which could be used to coat metal or paper plates which would fix images projected by the camera obscura were finally successful. However, photography could only fix and reproduce a still image, and thus differed from a camera obscura image which was capable of movement. Scientific progress, which included the ability of photography to produce multiple images, was seen as one that would have a democratising effect on society. This could also be said to be true of the spread of the use of the electric light bulb in the 19th century, which marked a turning point in man's control over darkness. The contemporary commentator Jonathan Crary, notes that during the period from the late 1500s to the end of the 1700s, the camera obscura, 'subsisted as a philosophical metaphor, a model in the science of physical optics, and was also a technical apparatus used in a large range of cultural activities.'[27]

Instruments of knowledge became appropriated for show business or entertainment, to feed audiences hungry for spectacle and new invention. In 1979 J Beckmann wrote in his *A History of Inventions and Discoveries*, 'Jugglers, indeed, seldom exhibit any thing that can appear wonderful to those acquainted with natural philosophy and mathematics; but these even often find satisfaction in seeing truths already known to them applied in a new manner'.[28] Optical lanterns had been renamed 'magic lanterns'

by the end of the 18th century, in order to satisfy the public enthusiasm for 'ghost shows'. In the 1850s John Henry Pepper, an analytical chemist, became director of the Royal Polytechnic Institution in London, an establishment that endeavoured to disseminate scientific knowledge to the public. Pepper believed this could be done by making science entertaining, and he enjoyed explaining complex concepts and devices by using optical illusions. It was in this way that he came to devise the *Ghost Show*, and although Pepper never pretended that his ghosts were anything but illusions, he became a renowned showman who thrilled audiences all over the world with his magical touring *Pepper's Ghost* (Fig. 34).

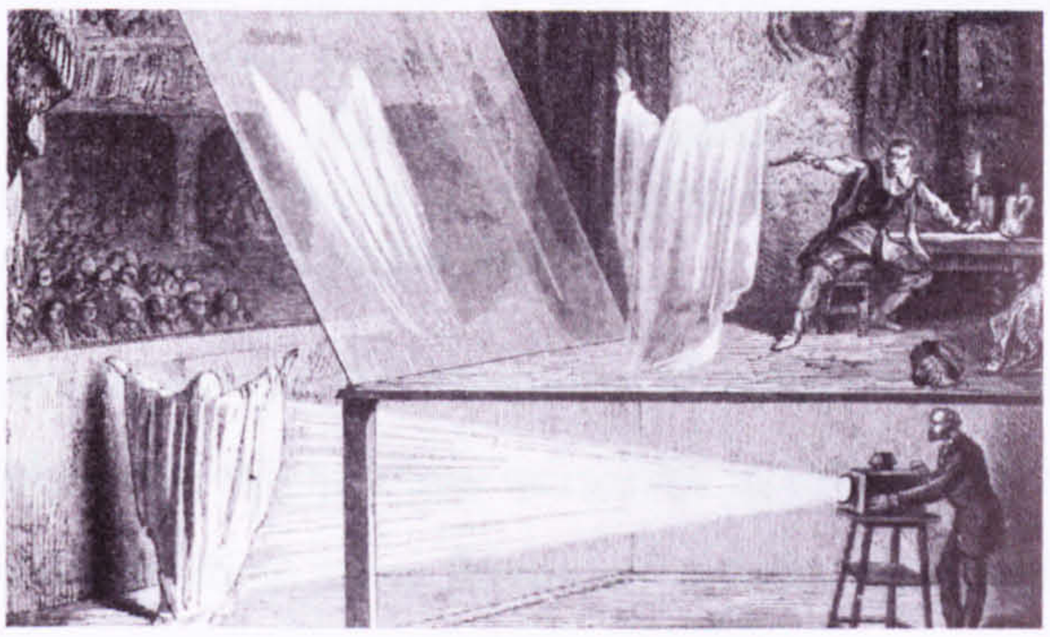


Fig. 34
Pepper's Ghost
Illustration from *Marion's Wonders of Optics* 1868

As the array of optical entertainments, such as magic lanterns, stereoscopes, zoetropes, kaleidoscopes and phenakistiscopes began to proliferate early in the 19th century; they offered an eradication of vision from the stable and fixed paradigm represented by the camera obscura, prompting a new evaluation of visual experience. This was, however, largely unaffected by the advent of photography, although the demand for optical improvements was mainly prompted by its invention. The evolving modernity at the end of the 19th century saw the abandonment of optical projection as representative of the truth.

Vision was no longer a distinct and isolated phenomenon, as scientific understanding developed, showing the importance that the other senses played in visual perception. Crary recounts a British neurologist in 1886 who exemplified a widespread anti-optical understanding of vision:

> In your visual reflexes there is a regular jumble of sight, touch, hearing, the kinaesthetic sense, in fact of all the senses, with a few of the appetites, several distinct instincts, and the whole group of the higher faculties of reason, memory, judgment, attention etc. – such a jumble, in fact, that it is quite impossible to say where sight begins or where it ends, or, in some of the reflexes, to see what sight has to do with them at all.[29]

There was considerable interest in 19th century psychology of the study of optical illusions, such as the Necker Cube (Fig. 54), which raised questions about the relativity of individual perception. Optics, physiology, psychology and even the nature of consciousness all seem to have a bearing on how illusions can be explained and understood, and even today much remains uncertain. Whilst illusion may be difficult for science to explain, it is embraced and exploited by artists and entertainers to enhance and illuminate reality. Illusions are generated when the eye and the brain are confused. Knowledge stored from the past influences our predictive perceptions and combines with images received by the eye, so that they are essentially temporal and unstable. As Richard Gregory, an acknowledged expert on visual perception writes:

> Eye and brain combine to give detailed knowledge of objects beyond the range of probing touch. Just how this is achieved remains in many ways mysterious [...]. Illusions are essentially phenomena of perception. They cannot be phenomena of the physical object world for they are systematic deviations from physical fact.[30]

The desire to escape the harshness of reality frequently draws us towards a fictional world where we might allow ourselves to dream and be enchanted by mystery. Artists entertain with their own forms of magic, by manipulating the picture plane and modelling three-dimensional forms. They perform compelling perceptual tricks, to 'fool the eye'. Art and magic enlist similar strategies of illusion and deception in order to lead viewers to the transformative power of the imagination. Albert Einstein (1879-1955) considered mystery to be essential to the well being of mankind, commenting:

> The most beautiful experience we can have is the mysterious. It is the fundamental emotion, which stands at the cradle of true art and true science. Whoever does not know it and can no longer wonder, no longer marvel, is as good as dead, and his eyes are dimmed.[31]

The images produced by a camera obscura have an enduring power to enchant and delight. They produce direct and unmediated images that have a compelling, and at times, mesmerising effect upon the observer. They appear more real than real, so that they are able to undermine the viewer's perception of reality and illusion. Marina Warner, discussing how optical devices may affect the senses of the observer, writes:

> The taming of illusion has only begun with deeper understanding and ever more ingenious techniques of simulation: even in the conditions of bourgeois home projection and mass entertainment there has remained something stubbornly weird – or in that overused word, 'uncanny' – about the images optical devices can create, especially since the advent of the cinema. The world accessible to the senses began to fall away a very long time ago, perhaps in Plato's cave; it began turning into an insubstantial pageant of

optical illusion, placing the observer in the dislocating yet oddly pleasurable situation of not knowing where reality begins and ends.[32]

20th Century and Contemporary Practice

Influenced by Freud and the Surrealist movement of the 1930s, Rene Magritte (1898-1967) exploited the ambiguous relationship between illusion and reality. He presents a logic which contradicts the laws of common perception. An air of disconcerting mystery permeates his dreamlike paintings, where seemingly impossible contradictions are made to seem entirely acceptable. Magritte borrowed the title of Freud's essay *The Interpretation of Dreams* (1900), for his 1952 painting of the same name (Fig.35), where objects and text appear juxtaposed. However, the text is integrated into the composition of the picture in a very different way to van Eyck's 15th century *Annunciation.*

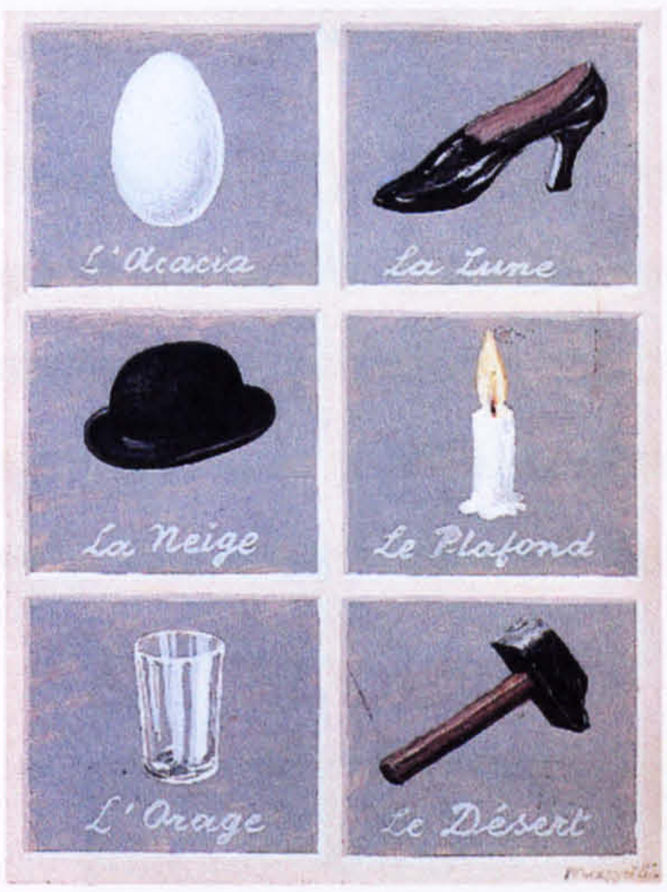


Fig. 35
The Interpretation of Dreams 1952
Rene Magritte
Timothy Baum, New York

Magritte's juxtaposition of ordinary objects in *The Listening Room* (Fig. 36) produces a disturbing and uncertain vision of reality. An ordinary apple is rendered so large that it completely fills the room, resulting in suffocating anxiety and feelings of helplessness as sometimes experienced in dreams. Magritte's concern is to provoke particular feelings or responses in the observer, but as in dreams, not to provide an answer.

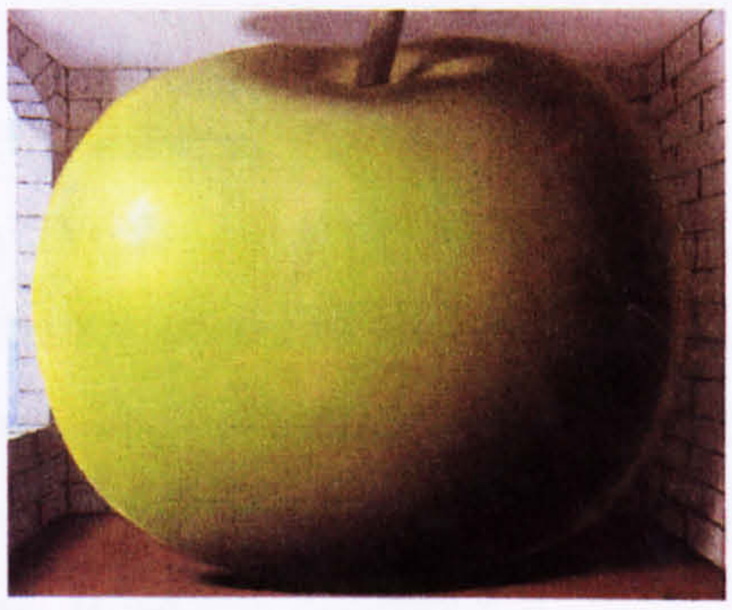


Fig 36
The Listening Room 1958
Rene Magritte
The Menil Collection, Houston

His paintings are frequently concerned with the denial of gravity, for example in *Golconda* (1953) (Fig. 37) the viewer is forced to review their perception of the everyday world. It also addresses repetition of the same thing, whereby an ordinary object is duplicated.

Fig. 37
Golconda 1953
Rene Magritte
The Menil Collection Houston

In *Carte Blanche* (1965) (Fig. 38), Magritte demonstrates how the brain makes assumptions about what the eye sees, and quickly 'fills in the gaps' in order to make sense of something. Upon closer observation however, the viewer must re-evaluate their initial perception in order to understand the truth of the fiction. The rider, horse and trees seem to oscillate between the visible and the invisible, translucency and opacity.

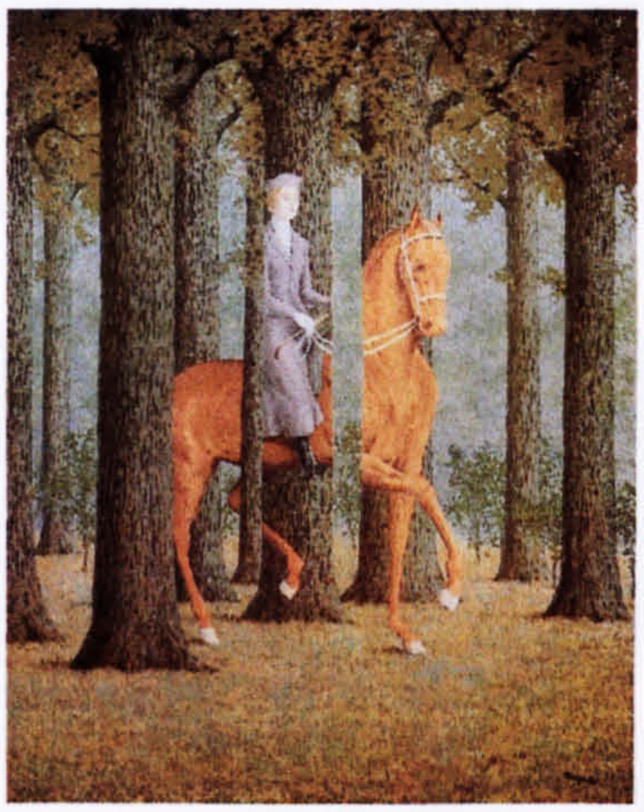


Fig. 38
Carte Blanche 1965
Rene Magritte
National Gallery of Art,
Washington

The disparity between the real and the illusory has been explored in Tim Head's installation *Displacements* (1977) (Fig.39), where real objects were juxtaposed in a gallery with projections of slide transparencies taken earlier of the same objects in the gallery space. The positioning of the projections caused visionary displacements, such as images of a chair and a bucket of water appearing to tilt precariously over their real counterparts. Head has described it thus; 'Illusion and reality are superimposed upon

one another in such a way that, despite the clarity of the 'devices' employed, the discrepancies between them can never satisfactorily be resolved'.[33] There is a deliberate strategy to undermine the certainty of the observer so that the boundaries of truth and reality are questioned.

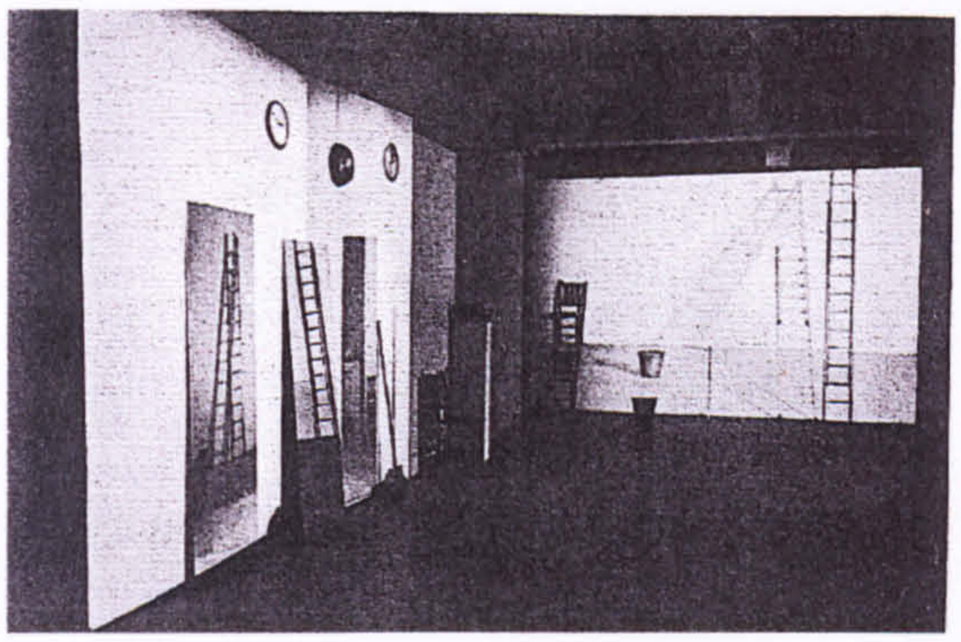


Fig. 39
Displacements 1977
Tim Head
Rowan Gallery, London, 1977

In his black and white camera obscura photographs, Abelardo Morrell transforms the familiar into the remarkable. The dynamic charge comes from the way gravity is dramatised. Like Alice in Wonderland, the viewer of Morrell's photographs contemplates a world turned inside out and upside down, where outside cityscape inhabits and is juxtaposed with the interior of hotel bedrooms as in Fig. 40. The photographs are made with exposures of sometimes up to eight hours, so the passing of traffic and pedestrians do not register. They have a stillness that cannot be confused with stasis. Although the final images have a disorientating effect upon the viewer, they are reproductions, and as such, lack the immediacy of live imagery.

Fig. 40
Camera obscura image of the Pantheon in the Hotel des Grands Hommes, Rome, 1999
Abelardo Morrell

Rodney Graham employs historical devices as a conceit. He deliberately maintains the natural phenomenon of inversion in pinhole photographs when exhibiting them, as for example in *Napoleon Tree* (Fig. 41), rather than turning them the right way up. This uncanny depiction of upside down space forces the observer to reconsider their

perception of the ordinary and everyday. The photograph is not altered, but its presentation goes against expectation. The old maxim for momentous change, 'turning the world upside down' says something about just how disorientating this is and how difficult we find it. Experiments in visual psychology have established that the destabilising effects of prolonged exposure to visual inversion are not readily overcome.

Fig. 41
Napoleon Tree 2002
Rodney Graham

Graham also used a replica US mail wagon converted into a camera obscura (Fig. 42) to travel the world and take photographic post cards (Fig. 43). These may be novel and interesting ways of using the camera obscura and in the case of the *Camera Obscura Mobile* may be able to produce images in real time on a vertical screen, as well as take a lasting photograph, but the images remain largely conventional.

Fig. 42
Camera Obscura Mobile 1996
Rodney Graham

Fig. 43
Camera Obscura Postcard
Rodney Graham
Rome 1997

Chris Drury's work defines, dissolves and renews perception about the relationship between nature and culture. It draws attention to something that is outside of the work itself, and is not self-referential. *Wave Chamber* (1995) (Fig. 44) is built from natural materials and sits comfortably in the landscape relying on strong daylight to project images of waves onto a flat floor, which forms the screen (Fig. 45).

Fig. 44
Wave Chamber 1995 (Exterior)
Chris Drury
Keilder Forest

Fig. 45
Wave Chamber 1995 (Interior)
Chris Drury
Keilder Forest

Although providing the viewer with live moving images, these images are essentially the same as those in conventional 19th century walk in camera obscuras; it is the means of presentation that is different. This kind of 'repackaging' of the camera obscura has been a popular strategy in recent times, which although attesting to its enduring fascination, uses only daylight and does not manipulate images or extend its potential in artistic terms.

The work of Bill Culbert is primarily concerned with light and dark. An understanding of light is presented as something like a quest for the definition of perception itself, an investigation of our world and how we know it. Through extreme simplicity he explores the extraordinary otherness of familiar objects such as light bulbs, which he uses to create powerful metaphors about our relationship with the natural and artificial environment, in works such as *Bulb Shadow II*, 1976, and *Bulb Box, Reflection II*, 1975. Here Culbert does not attempt to deceive the viewer or create mystery.

Fig. 46
Bulb Shadow II, 1976
Bill Culbert

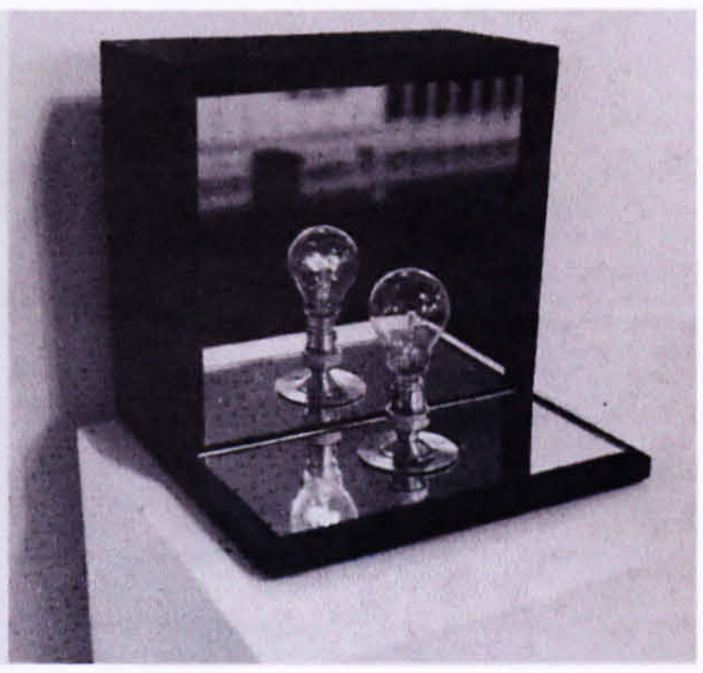


Fig. 47
Bulb Box, Reflection II, 1975
Bill Culbert

In *Celeste*, 1970, a translucent cube containing a bulb within a black box is peppered with symmetrically placed pinholes. It acts as a camera obscura inside out, so that many images of the bulb are projected onto the outside of the box. This produces interesting optical effects, but is not intended to provide a contemplative or mystical experience.

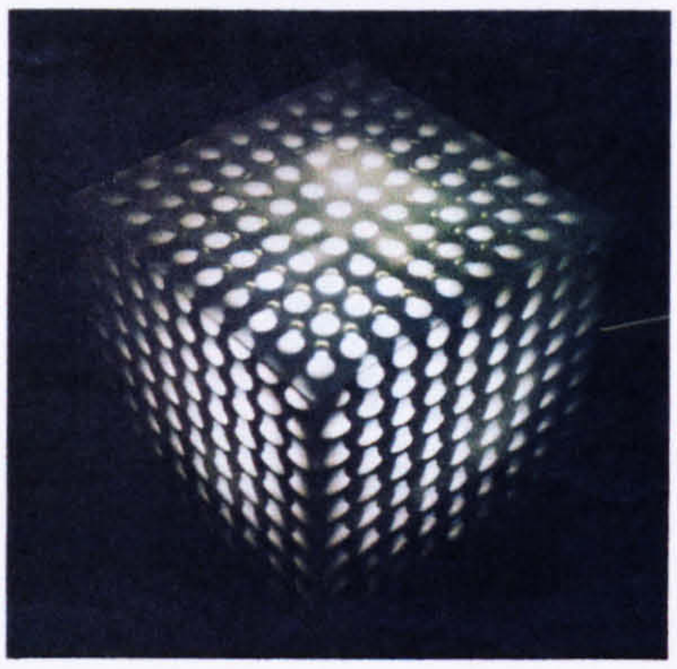


Fig. 48
Celeste, 1970
Bill Culbert

With a light touch and an economy of means, Richard Torchia has been more inventive in exploiting the camera obscura. Torchia uses artificial illumination, and ordinary objects to produce live projections onto white walls. In a four part installation, he refers to the four elements of air, water, earth and fire, showing large frontally projected images such as: a small feather gently animated by convection currents (Fig. 49); an enlarged glass of water; and a sand timer, both of which appear upside down. In the fourth part, he uses a candle flame, a metal sheet pierced with many pinholes, and what appears to be translucent paper, onto which multiple images of inverted candle flames are back projected, in a manner not dissimilar to Culbert's *'Celeste'*. Although the candles produce multiple images, there is no interaction between the projected objects, and no contrast between opacity and translucency.

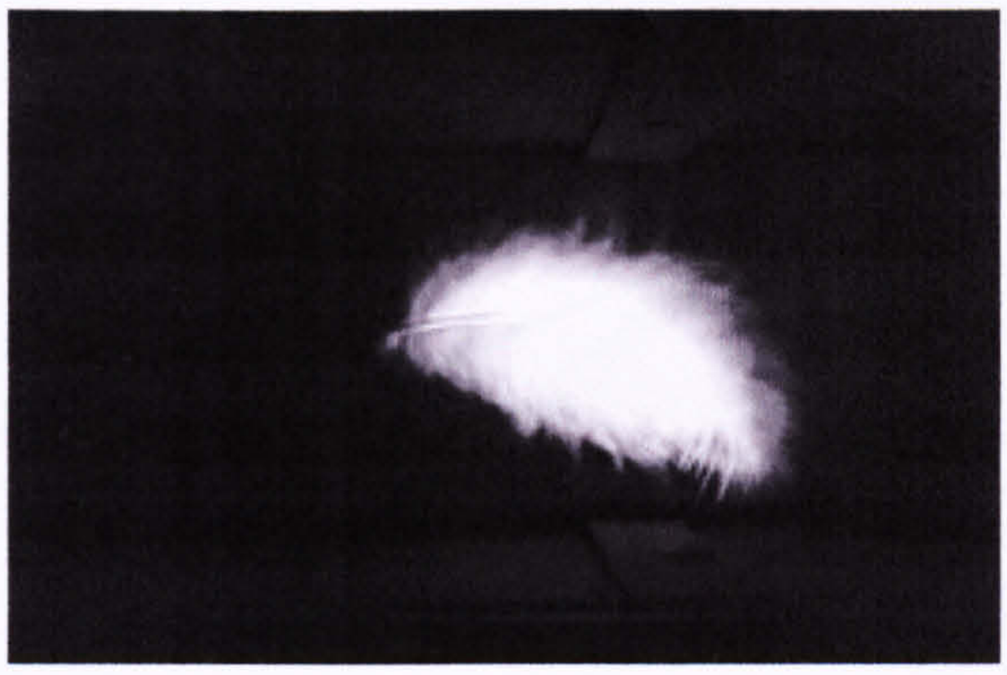


Fig. 49
Plume, 1996
Richard Torchia
Schmidt/Dean Gallery, Philadelphia

The installation *Line Describing a Cone* (1974) (Fig. 50), by Anthony McCall, does not involve a camera obscura. It acts as a kind of film, but exists only in real, three-dimensional space, and addresses the projection of light itself. Using a fog machine to fill the entire space, a single point of light is projected onto a screen, curving slowly around in an arc until it finally rejoins the original point to complete a circle, which forms a 'cone' of light. Each 'film' lasts for the thirty minutes duration of the projection. It does not refer to anything other than itself and there is no illusion, and is a primary, not a secondary experience, with viewers able to walk through, around or under the beam of projected light.

Fig. 50
Line Describing a Cone, 1973
Anthony McCall
Reinstalled at Hayward Gallery, 2004

The primacy of experience of such an installation means that it can only be reproduced by its reinstallation. Fig 50 appeared in an exhibition catalogue supported by a diagram (Fig. 51), to help describe a piece that is difficult to document.

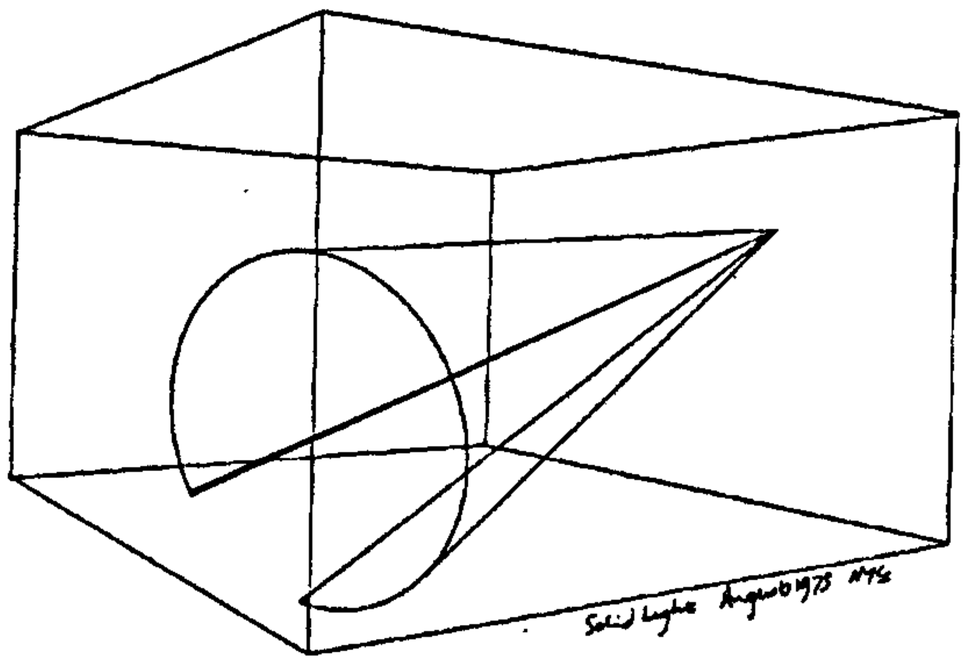


Fig. 51
Diagram of *Line Describing a Cone* 1973
Anthony McCall

A diagram was used as a substitute for a photograph of James Turrell's *Ivor Blue*, installed in 2004, in an exhibition catalogue (Fig. 52). Not only was a diagram necessary to explain the installation, there was no photograph of the actual artwork because no acceptable picture had been obtained. The installation comprised a large rectangular aperture in a wall of a large otherwise dark room. Within and behind this aperture was deep blue light of indeterminate depth. This underlines the uniqueness of experiential work, and the difficulty of its documentation, as encountered in this research. Diagrams, photographs, or verbal descriptions can give an idea of such installations, but they can never equate to the first hand experience of the observer, and it is precisely these characteristics that make the direct experience so distinctive. Ralph Rugoff writes of Turrell's work:

> Many of his works are extremely sensitive to changes in the viewer's position: and just as their appearance is partially contingent on our movements, our spatial orientation is recognised by the changing facets they reveal to us. This makes their photographic documentation an absurdity: you have to experience them to get any idea of what they are up to.[34]

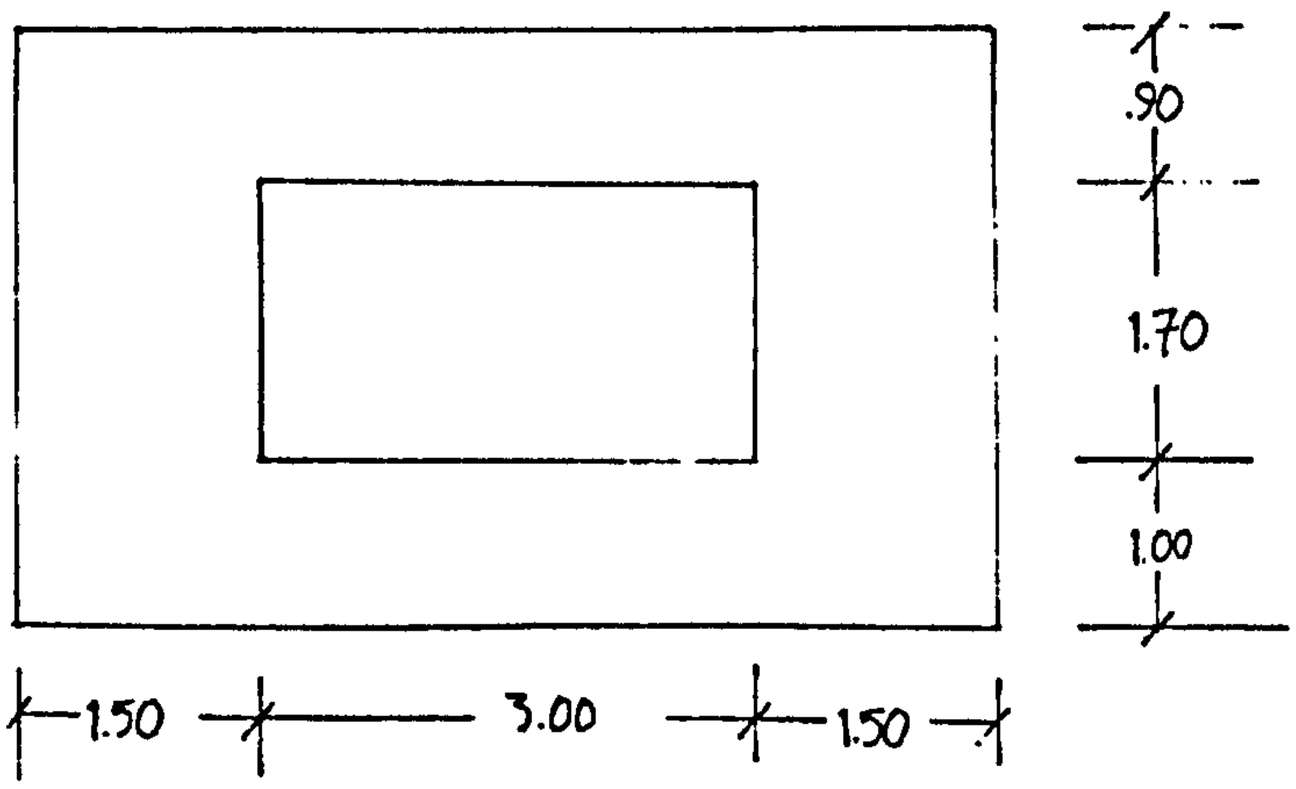


Fig. 52
Diagram for *Ivor Blue* 2004
James Turrell

James Turrell sets up experiential installations where light is both subject and object, devoid of any literal content. The existence of these installations depends entirely on the materiality of architectural spaces, in conjunction with the manipulation of light. Directly addressing visual perception, they are pared down to the essence. Turrell states that, 'Whilst there is a rich tradition in painting about light, it is not light – it is the record of seeing – the material is light and it is responsive to your seeing – it is not vicarious'.[35] Observers who have only before experienced light as illumination on objects can become disorientated and experience visual confusion when presented with a total visual field where there are no spatial clues.

In Turrell's cross-corner projections such as *Afrum-Proto* (Fig. 53), an object seems to have been created purely out of light, by using two powerful artificial lights to project flat shapes onto two adjacent flat walls. When viewed from a certain distance, an apparently three-dimensional floating white cube appears to hover between ceiling and floor. The closer the viewer gets, the flatter the cube becomes, eventually resolving into a rectangle of light projected into a corner. As the viewer moves away from the corner, the cube materializes again and in the process alters the viewer's perception of the size of the surrounding space. Dependant upon the viewer's position, the cube both 'is' and 'isn't' there.

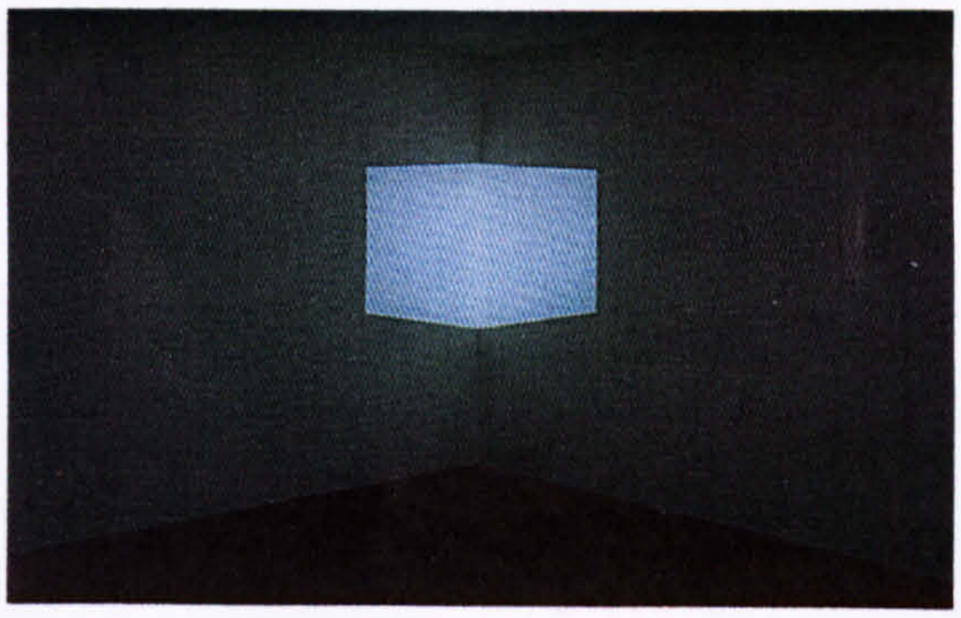


Fig. 53
Afrum Proto 1966
James Turrell
Whitney Museum, Houston

This ambiguity is caused by the way we perceive three-dimensionality, since our visual system is stereoscopic. In Turrell's cross–corner projections, the light is tied to the fact that the room is three dimensional, so our visual system makes assumptions, giving precedence to three-dimensionality. Even when the truth is known, the brain, through the programming of memory, insists on understanding in a certain way. Observers, moving around the space, can experience a dimensional flip similar to that demonstrated by the classic and ambiguous Necker Cube (Fig. 54), which flips in its

spatial orientation, either spontaneously or through the viewer's own control, and it is the latter which Turrell considers central to the effectiveness of his work.

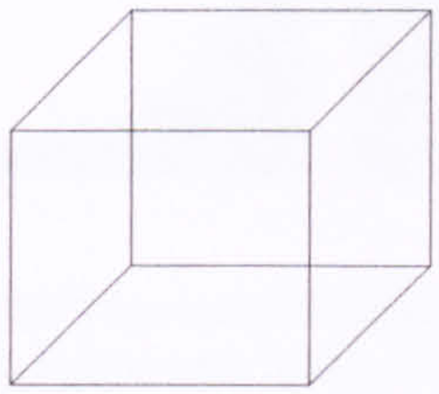


Fig 54
Necker Cube, which 'flips' from an above right to a below left eye level perceptual plane

Turrell's 'skyspaces' employ both natural and artificial light, such as the one at Keilder in Northumberland (Figs 55 & 56), which evolved from his early experiments with the interaction between interior and exterior spaces developed at the Mendota Hotel in California in the 1960s. At Keilder, Turrell simply and elegantly manipulates normal perceptions of light and space. A sharp edged opening in a horizontal roof gives direct access to the sky, which the viewer sees as pure colour, framed, and constantly changing. The aperture can be read purely as an opening for deep, unfathomable space, but also as the sky appearing to be 'brought down', so that it can also be read as a flat surface, as if the enormous volume of the atmosphere were visually compressed into a layer. But, like the flip of the Necker Cube, it perceptually slips and changes. The colours seen at the opening vary according to the natural light conditions, combined with the controlled and manipulated light surrounding the viewer inside.

Fig. 55
Skyspace, 2000 (Roof)
James Turrell
Keilder

Fig. 56
Skyspace, 2000 (Exterior)
James Turrell
Keilder

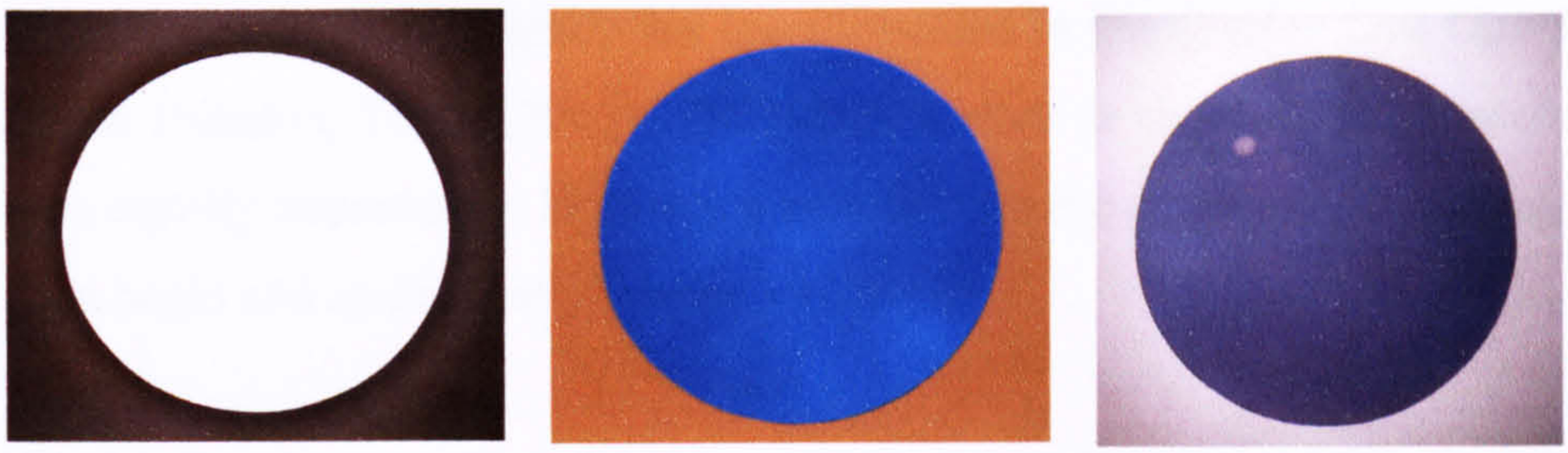


Fig. 57
Skyspace 2000 (Aperture of interior, looking upwards; with light changing from day to night (from left to right), with interior light becoming stronger
James Turrell
Keilder

At dusk for example the colour of the sky becomes an increasingly deeper blue and the flat expanse across the opening of the chamber becomes ever more opaque, reaching the greatest density and impenetrability when the interior and exterior levels of light are nearly equal. As darkness increases outside and the inside light around the perimeter of the inside space (the source of which is not visible to the viewer), becomes more dominant, the colour of the sky takes on a solid velvety appearance, which seems to descend to the point where it might be touched by the viewer (Fig. 57).

Turrell very specifically directs how and what the observer sees. Although the viewer becomes aware that their perception is being manipulated, the means are not apparent, but this denial of means is intended to enhance their viewing experience. The lack of spatial clues for the observer is replaced by sensations of floating or being cast adrift, on the cusp of the real and not real, in a suspended, almost semi-conscious state. Turrell's work has a peculiar sense of time; he does not attempt to arrest, reproduce or manipulate time, but rather directs and controls the way in which the observer experiences the passage of real time, over which man has no control.

Turrell's work is frequently referred to in spiritual terms. Experiencing one of his skyspaces is not unlike being inside in a religious building, or even perhaps a camera obscura, where a proper sense of time is undermined. Time is what is required to allow the eyes to adjust to another way of seeing, and to contemplate what is seen. This may lead to the mystical or spiritual, and as reference to the outside world becomes more distant, these feelings may also be tinged with anxiety. The quest for the elemental seems to carry a spiritual dimension, and in Turrell's case this may originate in his Quaker upbringing, where the individual search for the 'inner light' is paramount, combined with his studies of perceptual psychology. It seems appropriate

therefore that a Turrell skyspace has been installed in the *Quaker Live Oak Meeting House*, in Houston, Texas (2003). If Turrell's work is about directing seeing, then perhaps equally important is Hockney's assertion for the necessity of looking, 'visual art must begin and end in really intense looking.'[36]

Job Koelewijn also organises the way viewers see in *Cinema on Wheels* (2003) (Fig. 58), by situating them in a darkened mini cinema, facing a glassless rectangular opening, which frames the street outside. Objects, not light itself, are the chief focus, and the viewer is given a first hand experience where their perception is nevertheless altered. Although the real and the illusory are juxtaposed, there is no optical trickery. The viewer becomes a willing participant in this game of 'make believe'. Blurring the boundaries between fiction and reality, the 'cinema' provides a dark haven from which to view a real moving 'film' of people going about their everyday business in the street. Observers are almost, but not totally removed from the outside world, as they would be in a camera obscura, since as they watch, the activities of the street outside can also be heard.

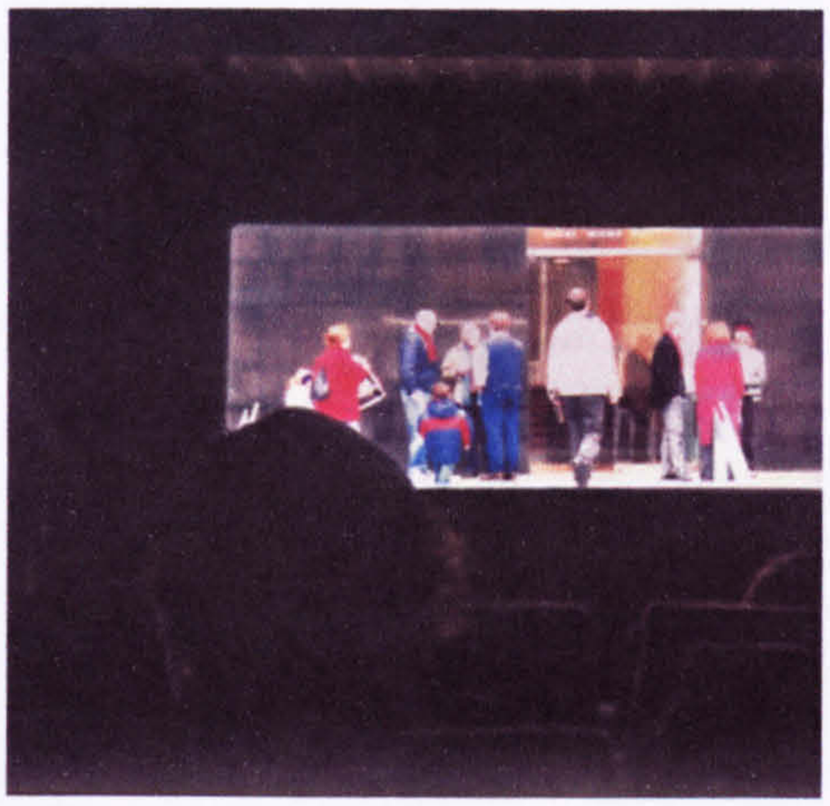


Fig. 58
Cinema on Wheels 2003
Job Koelewijn
Henry Moore Institute, Leeds

Cinematography has been much inspired by painting. The filmmaker Peter Greenaway considers Vermeer's paintings to have had a strong influence on film making, resembling the greatest film stills in history.[37] In Vermeer's paintings, areas are indicated rather than finished, so that, just as the brain fills in the gaps between film stills, it fills in the gaps of Vermeer's brushwork, and it is particularly the photographic qualities of Vermeer's paintings, which so enchanted Proust. David Hockney has also commented on the filmic qualities of Caravaggio, who was concerned with carefully staging lights, costumes and gestures to 'set the scene' in the same way as a film

director would do. Martin Scorsese claims that he and other film directors have been much influenced by Caravaggio and his dramatic use of illumination.[38]

Although Bill Viola does not use camera obscuras, his work is reminiscent of the images they produce. His videos and films are frequently inspired by religious paintings, and the intensity of human passions. *The Greeting* (1995) (Fig.59), references Pontormo's painting, The *Visitation* (1528-9), but does not restage it; rather it is used as an inspiration. The viewer is aware of watching moving performers, but views the scene more like a painting. Light dramatically highlights the faces and bodily movement of the performers, reminiscent of the theatricality of Caravaggio's paintings. The images appear on flat plasma or LED screens on the walls, giving them an affinity with paintings. Whilst Caravaggio captures a dramatic moment, Viola seems to gently animate a painting, slowing down and extending a 45 second piece of film to ten minutes. This extreme slow motion, together with a lack of sound, imbues it with a mesmerising and dreamlike quality, which disrupts the observer's notion of time. It feels that any single moment could be extracted as a still image to remake the painting. However, *The Greeting* is a film and as such is a secondary experience, which can only ever be a representation of time. Crary describes the collage of filmic images as, 'A contradictory form of synthetic unity in which rupture is also part of an unbroken flow of time, in which disjunction and continuity must be thought together.'[39]

Fig. 59
The Greeting 1995
(Video stills)
Bill Viola

Despite the fact that camera obscura projections have no physical endurance, their enigmatic and mesmeric quality seems to imprint itself indelibly in the mind's eye.

However durable the images produced by paintings, photographs, films and books, these will always remain second hand experiences that cannot compare with the uniqueness of live imagery. Images in real time flow seamlessly without interruption, with no individual frames to be joined together. Camera obscura projections possess clarity, yet, at the same time, like the Mona Lisa's eyes, have a mystical and dreamlike softness. And like dreams, they ultimately defy successful description or capture. The images can only finally reside in the mind of the observer who has seen them, to be viewed again from time to time through memory.

It is no surprise therefore, that throughout several centuries, the camera obscura has been a device of enduring fascination for mankind. Artists, draughtsmen, scientists, magicians, showmen, entrepreneurs, and military forces, have used, or been inspired by its images. Due to the matchless quality of its images, chemical and digital photography and film have not replaced it, and it will no doubt continue, in its various guises, and enriched by artistic developments such as those of this research, to delight generations to come.

CHAPTER 2

Methodology

The literature and exhibition review established the historical and contemporary framework within which the research was undertaken. Proust's *À la Recherche du temps Perdu* was a key text in examining the transitional nature of objects and spaces. John Hammond's seminal book on camera obscuras provided essential background knowledge, as did the Science Museum's collection of models, including Hammond's own. Visits to public camera obscuras in Bristol, Aberystwyth, Edinburgh, Greenwich, and Knighton, emphasised the importance of live imagery. Installations such as Turrell's *Skyspace* at Keilder, and Koelewijn's *Cinema on Wheels* in Leeds, demonstrated the destabilising effects of undermining depth perception, and in this connection, Gregory's texts on perceptual psychology were invaluable. The transformative abilities of light were evident in Caravaggio's dramatic *Supper at Emmaus,* and the still life paintings of Cotan and Kalf showed the effectiveness of specifically focusing the observer's attention. The blurring in da Vinci's *Mona Lisa* and paintings by Vermeer displayed how movement could be implied in a static image. Freud's discourses on dreams and the uncanny were visually manifested in the work of Magritte. The photographs of Morrell and Graham demonstrated the destabilising effects of inversion, whilst Viola's films and videos showed how movement could be used to manipulate our sense of time.

From this review, notions of the uncanny and the transitional were identified, and these became central to the research, gaining increasing resonance as the research progressed. I realised that the camera obscura was a medium through which I could explore these ideas, and the concepts of the uncanny and the transitional were used to inform an evolving critique that enabled me to evaluate the research. Studio investigations evolved through a sequence of 'studies', divided into four stages. As the descriptions of studies confirm, each had an initial aim, procedure and conclusion, which were considered in relation to the key concepts, and informed the subsequent study. As the research progressed, I moved from studies involving mock-ups to more finished installations, in which the methods of presentation and representation became increasingly important.

Studio investigations commenced with studies involving the modulation of light and shadow. Consequently, these effects were recorded using pinhole photography. The implied movement suggested by the blurring of images resulting from long exposure photography emphasised the importance and potential of live imagery. Therefore, camera obscura rooms were constructed and fitted with appropriate lenses. Artificial light was then established as the principle medium to illuminate objects, because natural light is unreliable and not always powerful enough. Artificial light also enables the removal of the camera obscura from the familiar world. It then became apparent that ordinary, easily recognisable objects should be used as vehicles through which the everyday could be transformed, and the choice of objects played a vital role in the research. A programmable lighting control device, together with a move from front to back projection, was crucial in developing the research. Consequently, actual objects were juxtaposed with projected imagery and further contextualised into 'domestic' surroundings. When it became apparent that these were too contrived, and that the related objects detracted rather than enhanced the actual projections, the related objects were removed. The quality of the projected imagery, its presentation and relationship to the observer's position became paramount. The natural inversion of projected imagery was exploited using independently moving objects. The introduction of motors enabled several inanimate objects to be rotated in and out of focus in a controlled and continuous manner, and repetition of the same thing was achieved through multiple projections. The research concluded with three fully functional camera obscura installations, together with small scale camera obscuras, photographs, video, diagrams, notes, and other supporting documentation.

STUDIO INVESTIGATIONS

LIST OF STUDIES

STAGE I

1.1 Study creating shadows
1.2 Study recording shadows
1.3 Study tracking shadow progression
1.4 Study creating objects with shadow
1.5 Study with opposing light sources
1.6 Study using pinhole photography outdoors
1.7 Study using pinhole photography indoors
1.8 Study using single pinhole photography in domestic interiors
1.9 Study using double pinhole photography in domestic interiors

Conclusion to Stage I

STAGE II

2.1 Camera obscura construction
2.2 Study with four sided camera obscura projections
2.3 Study with isolated light
2.4 Study with moving images
2.5 Study with candles
2.6 Study with light bulbs
2.7 Study with light bulb filaments
2.8 Study with scale using light bulb
2.9 Study with varying intensities of light and scale
2.10 Study with simultaneous light projection in four directions
2.11 Study with real and projected imagery using lighting dimmers

Conclusion to Stage II

Technical evaluation:

i Lenses
ii Illumination
iii Front v back projection
iv Screens

STAGE III

3.1 Study in contextualisation - microwave
3.2 Study in contextualisation - turntable
3.3 Study in contextualisation – kitchen
3.4 Study in contextualisation – window
3.5 Secondary screens
3.6 Study in movement with fish

3.7 Study in movement with rain
3.8 Study in movement with snow

Conclusion to Stage III

Technical evaluation:

i Documentation
ii Extraneous light
iii Curtain screens
iv Studio installation
v Plain screens

STAGE IV

4.1 Study with multiple installations
4.2 Study with visually dissolving surfaces and eliminating means of suspension
4.3 Study with suspended objects exploiting means
4.4 Study with illuminating light bulb
4.5 Study with multiple imaging
4.6 Study with triple imaging
4.7 Study with smoke
4.8 Study with translucency
4.9 Study with two objects
4.10 Study with three objects
4.11 Study with rotation using a motor
4.12 Study with rotation using two motors
4.13 Study with multiple images of rotating fish
4.14 Study with transparency

Conclusion to Stage IV

STAGE I

1.1 Study creating shadows

Initial studies began by investigating how light falling on objects casts shadows. As Leonardo wrote, "The forms of bodies would not show their particularities without shadow".[40] Shadows of course can only move if either an object or a light source is moved. The passage of time through the movement of shadows cast by daylight onto objects can be noted, for example, by using a sundial.

The first studio study set out to examine how light falling on objects can cast shadows that assert and emphasise form. Six small white painted wooden blocks were attached vertically to a white wall. Lights were directed from opposite directions onto the blocks to study the shadows cast (Figs.1.1 & 1.2). Of the many permutations explored, a sample is included here.

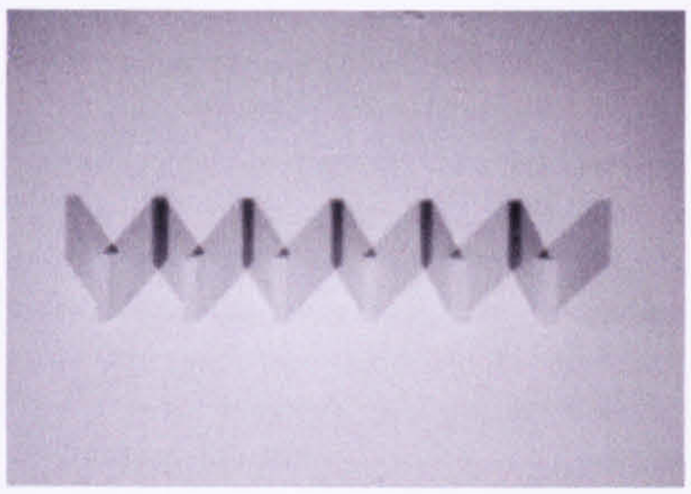


Fig. 1.1
Shadows with two light sources (a)

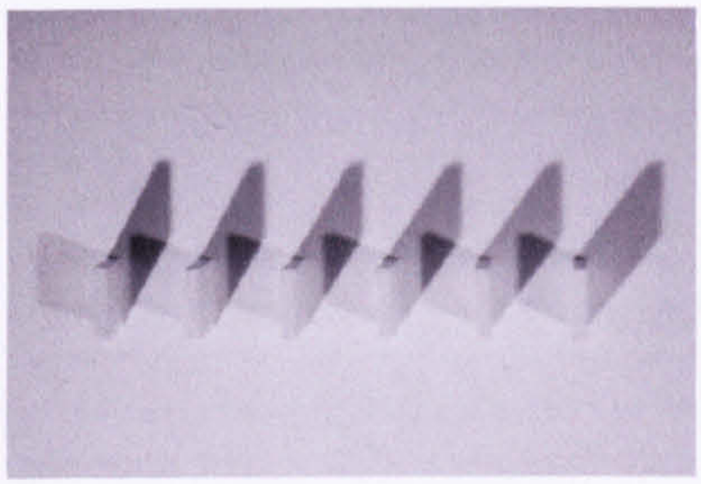


Fig. 1.2
Shadows with two light sources (b)

The study showed that a wide variation of effects could be achieved. When the shadows were darker than the objects, the forms of the objects lost visual prominence and became inseparable from the shadows. The shadows appeared to create other objects, in a similar way to the work of the contemporary artist, Vera Rohm, who transformed two dimensional shadows into three dimensional sculptures, sometimes as multiples which then created their own shadows, or by combining an object and its shadow to become a three dimensional object.[41] However, the research shadow studies were intended to inform further studies rather than be seen as finished pieces.

The study suggested that if shadows could visually appear to create the impression of other objects, then painted shadows could be made to look indistinguishable from real shadows.

1.2 Study recording shadows

This study sought to record shadows cast by light falling on the six blocks used in the previous study. Differing intensities of light were directed onto the blocks, from varying distances. The shadows cast were copied in paint on the walls to see how real they would appear when the real light sources and their shadows were removed. The painted shadows all appear above the blocks and the real shadows below the blocks (Figs. 1.3 & 1.4).

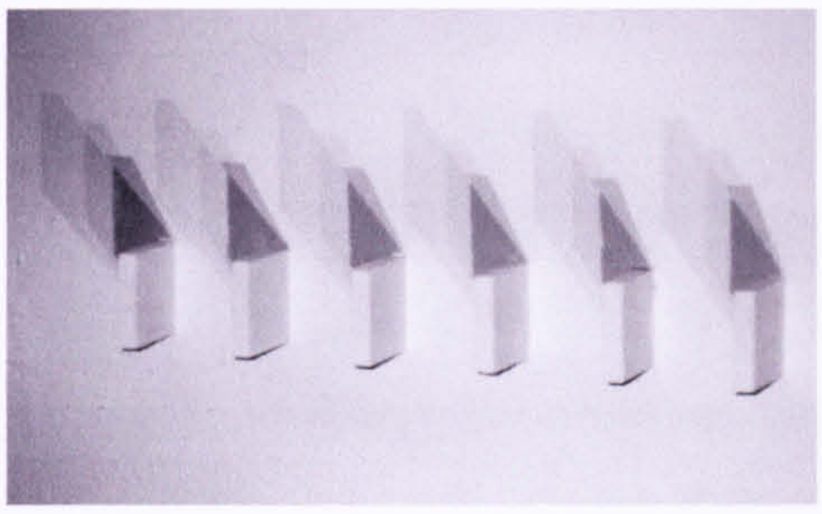


Fig. 1.3
Recording shadows

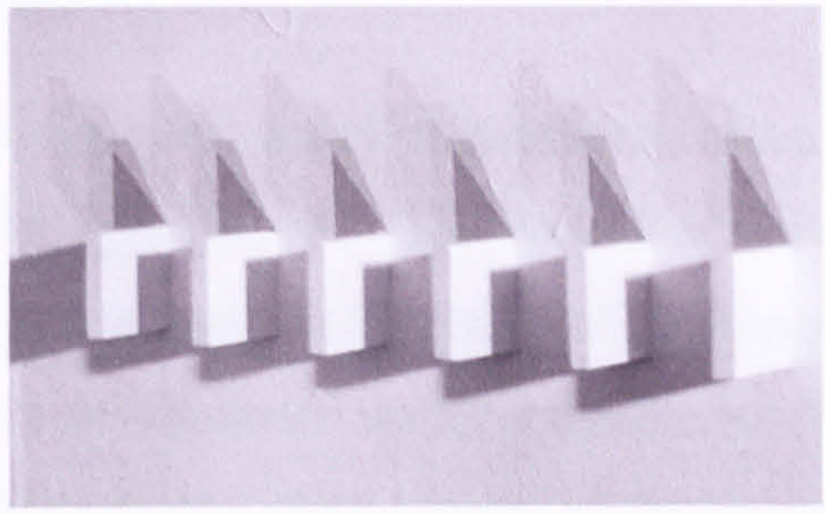


Fig. 1.4
Recording shadows

The results showed that whilst the painted shadows were superficially convincing, close observation revealed the real shadows to have softer, more blurred edges, which were more difficult to emulate using paint. It was noted that the closer the source of light was to the object, the darker and sharper the shadow cast. This study had associations with an installation by contemporary artist Caroline Broadhead. *In Ready to Tear,* 1996, the real object hangs in space and its shadow is painted on a nearby wall. However in the research studies the real object and its shadows were combined so that they were more ambiguous and confusing to the eye.[42] The research studies were also intended to inform further studies rather than become finished pieces such as those of Broadhead.

1.3 Study tracking shadow progression

Whilst the previous study recorded only a small number of cast shadows using paint, it suggested an almost endless number of permutations were possible. This study therefore aimed to track the arcing movement of a light source, from one side of a

single object to the other. In Fig 1.5, the gradual progression of shadows was recorded in outline on the wall at each stage of the movement of the light source, in the manner of a sundial.

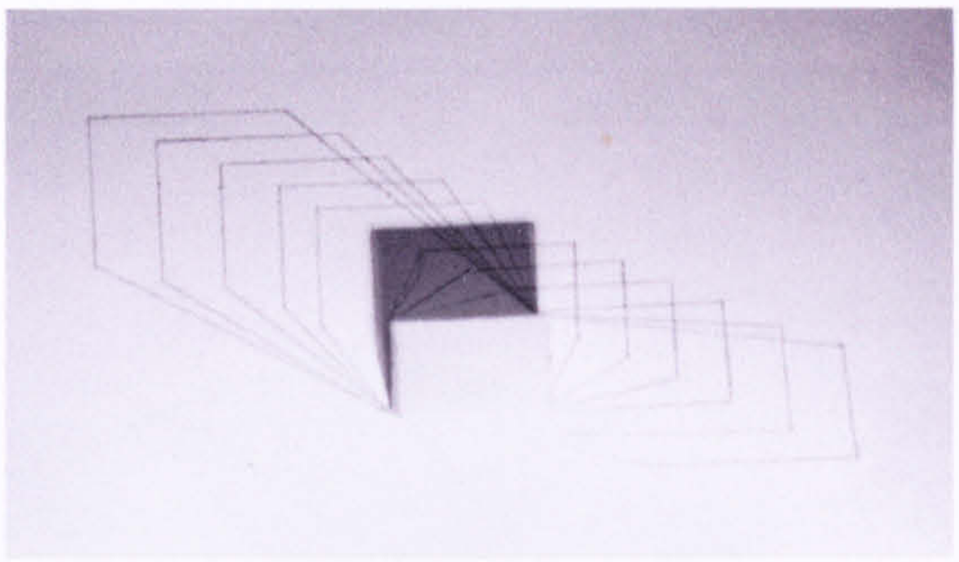


Fig.1.5
Tracking shadows

This gave an illustration of the range of variations that could be produced from a single form, merely by altering the direction of the light source. The dark area shows one position of the real shadow, and the drawn lines trace its incremental positions. The artist Jan Dibbets also explored the tracking of shadows, as for example in *Shortest Day at My House in Amsterdam*, 1970, where eighty photographs of the same scene were taken by a stationary camera every eight minutes from just before dawn to just after sunset and these photographs later displayed together as a grid.

This study suggested the creation of a three dimensional form through shadow.

1.4 Study creating objects with shadow

This study aimed to create the illusion of a three-dimensional object using shadow. A flat piece of Perspex was propped vertically on the floor across a corner, touching both walls (Fig.1.6). Light was directed towards the corner from a low level position until the edges of the Perspex cast just enough shadow across the adjacent corner walls, to give the appearance of a solid horizontal top, implying that a solid object had been placed in the corner.

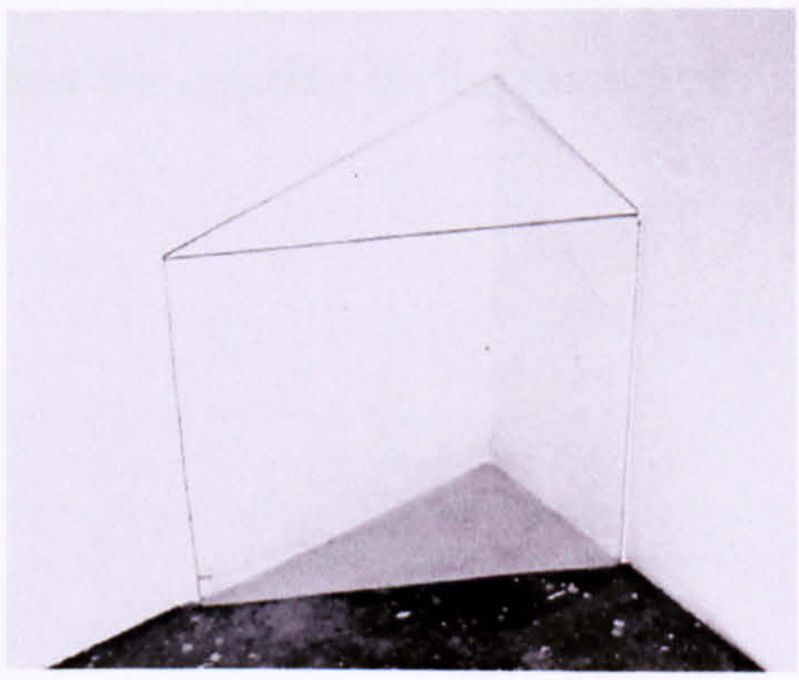


Fig.1.6
Perspex form on floor

In Fig. 1.7, the piece of Perspex was mounted horizontally into the corner by two edges, and light directed from above until the shadow cast below the flat piece of Perspex created the illusion of a solid form.

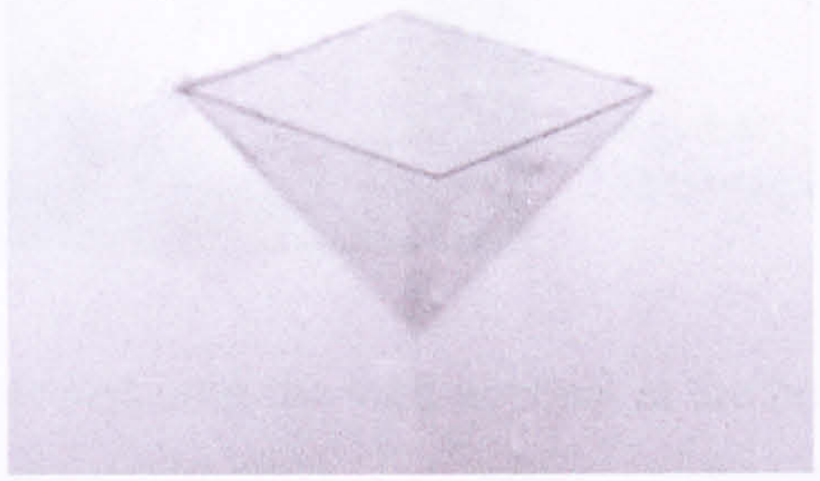


Fig. 1.7
Perspex form on wall

The study showed that the illusion of a three-dimensional object could be created using a flat piece of Perspex and the modulation of light.

It proved more difficult to visually dissolve objects than create them through the manipulation of light. Even a thin white square of paint on a wall can create a small amount of shadow, depending on the strength and direction of the light, which whilst not apparent from a distance, becomes visible when viewed close up. It therefore supports Leonardo's claim that shadow is stronger than light.[43]

1.5 Study with opposing light sources

In the previous study the position of the light source had been important in creating a seemingly solid object. This study aimed to investigate the effects of light directed from opposite positions, to see if light projected from behind an opening facing the viewer would have the same appearance as light projected from the opposite direction, onto a flat screen below the opening on the same wall.

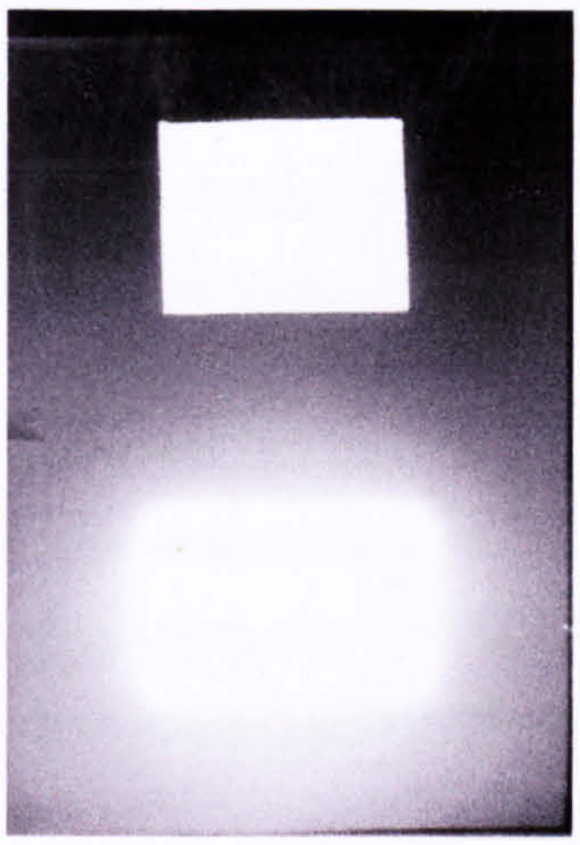


Fig. 1.8
Opposing light sources

The light projected onto the wall appears at the bottom of Fig.1.8, and the light coming from behind the opening, above. Although they did not look the same, the photograph (Fig. 1.8), implies they were very dissimilar, when in reality they appeared much more alike. This is due to the camera's response to reflected and transmitted light. The study demonstrated the difficulty of projecting light from opposing directions.

This group of studies provided useful background knowledge on the behaviour of light and shadow according to its strength, direction, and modulating abilities, and led to investigations whereby the effects of restricting and controlling light were recorded photographically.

1.6 Study using pinhole photography outdoors

In order to record the effects of restricting the amount of light entering a dark chamber, pinhole photography was used.[44] During these investigations, a notebook recorded lighting conditions and length of exposures, etc, so that the results could be predicted with increasing accuracy. Because of the prolonged length of time needed for the exposure of pinhole photographs, a sense of the passage of time could also be recorded in a single frame.

Initially small boxes with blackened interiors were turned into pinhole cameras. Photographic paper was used to produce a paper negative, which was then processed to produce a positive photograph. The photographs were small, and showed some distortion. Distortion is a natural characteristic of pinhole photography, since rays of

light enter the aperture to the darkened chamber at different angles and therefore at different distances, and these acute angles caused the images to become stretched anamorphically. Manipulating the distances between aperture and negative can deliberately increase these distortions or 'anamorphism'.[45]

The most successful photographs were taken when very strong light caused sharp contrasts of light and shadow. An increasing concern with exploiting distortion led to a pinhole camera that would deliberately distort images being created from a circular coffee tin, 15.5cm diameter by 19cm high (Figs 1.9 & 1.10).

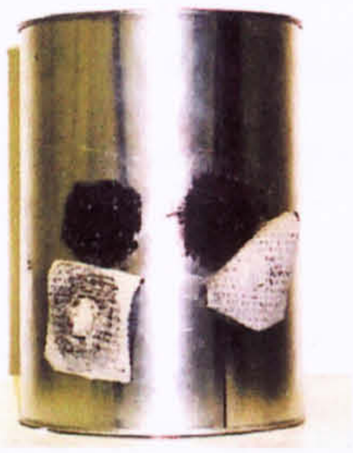


Fig. 1.9
Pinhole camera
exterior

Fig. 1.10
Pinhole camera with blackened
interior

The first photographs using the tin were taken outdoors using a single pinhole. The images produced showed some distortion since the tin was circular. In Fig.1.11, the conditions were windy during the exposure, causing the camera to rock gently back and forth. This produced a doubled image of the scene resulting from the varying positions of the pinhole camera.

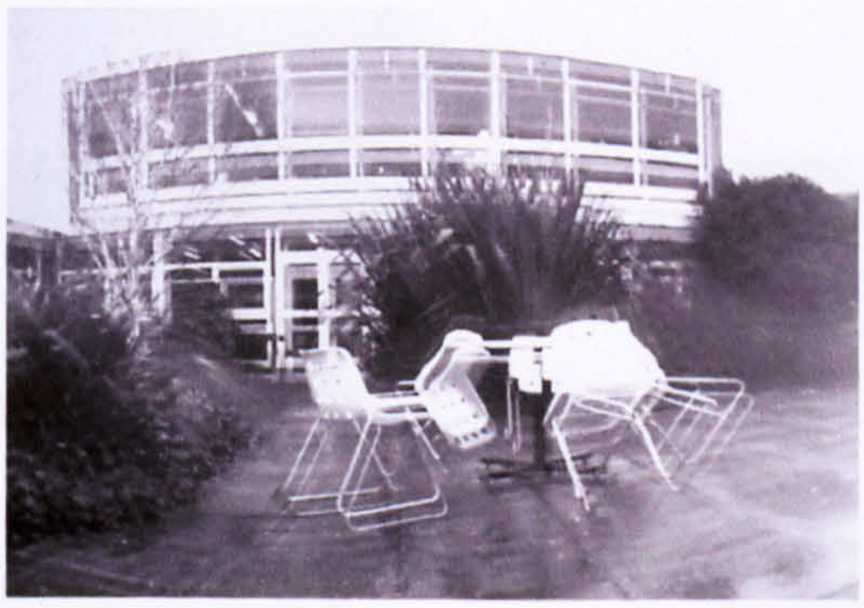


Fig. 1.11
Image doubled by chance

This prompted a second pinhole to be made in the tin so that a doubled image could be obtained (one hole could still be covered if a single image was required). Fig.1.12 shows the deliberately doubled image of a single chair using the two pinholes and the increased distortion due to the curvature of the tin.

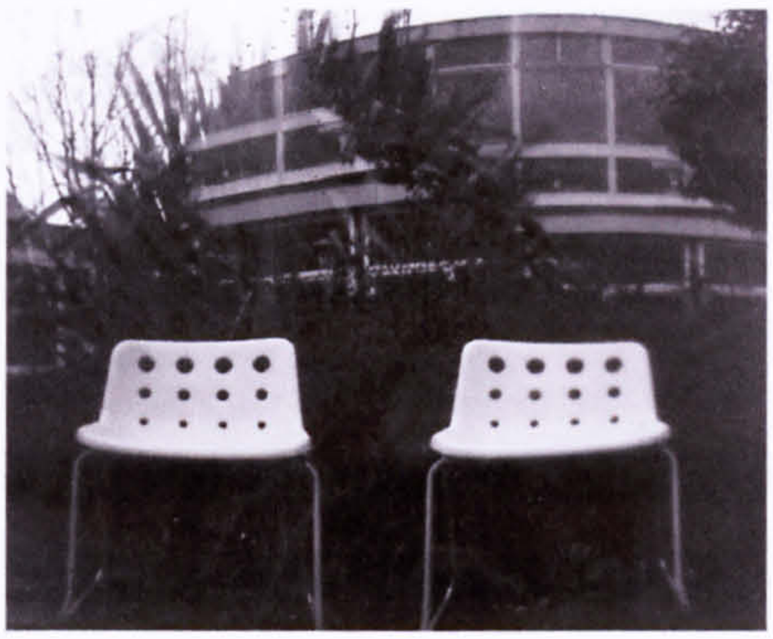


Fig. 1.12
Doubled image using two pinholes

This study recorded the effects of using two pinholes outdoors, and prompted a study to record the effects of using the two pinholes indoors.

1.7 Study using pinhole photography indoors

In order to discover how the tin pinhole camera would work indoors, the tin was placed inside a room. Fig. 1.13 shows the tin, reflected in a mirror, taking its own single picture. Fig. 1.14 depicts a double image using two pinholes. Fig.1.14 also demonstrates that the images become less distinct using two pinholes, even if the exposure time is reduced. This is probably because the overspill of light from one aperture fogs the image made by the other. The reduced levels and greater complexity of light sources indoors resulted in longer exposure times and less predictable results than those taken outdoors.

Fig. 1.13
Single pinhole image

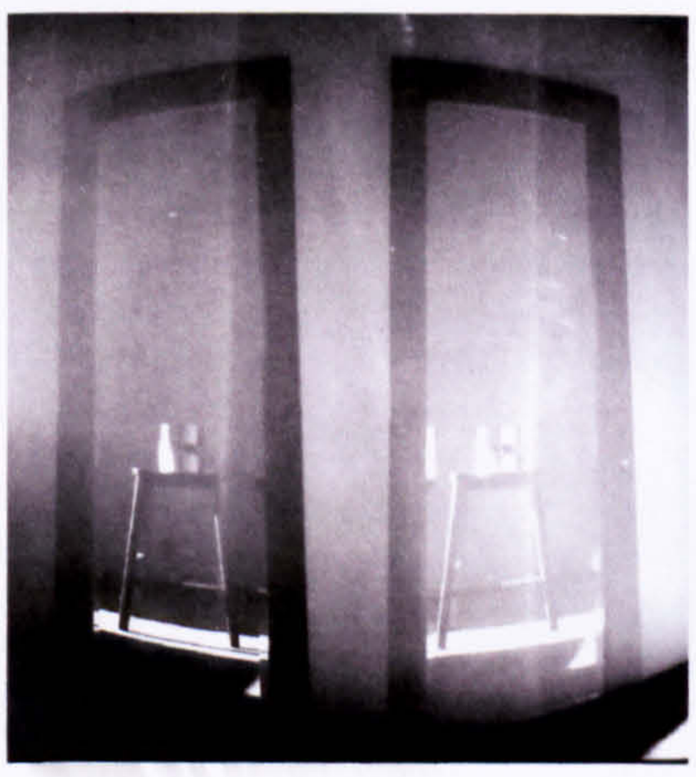


Fig. 1.14
Double pinhole image

Figs.1.13 & 1.14 show arbitrary interiors, and in order to develop the pinhole photography further, the significance of Proust's descriptions of domestic interiors was seen as a starting point for the following studies.

1.8 Study using single pinhole photography in domestic interiors

The previous study introduced interior scenes for the first time. Proust and Freud both focused on the effects domestic interiors can have on their occupants; Proust in *À la Recherche du Temps Perdu,* and Freud in his claim that notions of the uncanny are apt to be particularly potent in the familiar surroundings of the home. In order to open up the possibilities of recording distortion, and thus to subvert the familiar, the tin with a single pinhole was used to take photographs of domestic interiors (Figs. 1.15, 1.16 & 1.17). Since the greatest degree of distortion was visible at the outer edges, larger sheets of photographic paper were wrapped around the inside of the tin as far as possible without covering the pinhole. Light reached all of the paper, so that the extreme curvature caused increased distortions in the resulting photographs.

Fig. 1.15
Dining Room, pinhole photograph

These images display the kind of rupture of normality invoked in Proust's narrative, where the young narrator, half asleep as the dimming or increasing light enters his room, is no longer certain of his surroundings and unable to locate the furniture and the architectural features of his room properly.

Fig. 1.16
Landing, pinhole photograph

In Fig. 1.17, a dog lying under a chair (on the right hand side) for the first half of the exposure, moved away for the second half, leaving a transparent and ghostly image.

Fig. 1.17
Dog under table, pinhole photograph

Apparent circularity is evident in the work of the 17th century artist, Carl Fabritius. Like his contemporary, Samuel van Hoogstrataen, who made perspective boxes[46], he was interested in perspective and illusion. Fabritius' *A View of Delft* (Fig. 1.18) shows a curving panorama, which may have been intended to be mounted on the curved back of a perspective box in order to counter the discrepancies in scale that would occur if a wide-angle effect were sought. It would also rectify to an extent the variations of exposure levels due to bringing the distances between aperture and picture plane closer to equal (the phenomenon of 'vignetting' as previously discussed). *A View of Delft* is similar in appearance to the interior pinhole photographs, maybe concurring with claims that Fabritius used a camera obscura with a curved screen.[47]

Fig. 1.18
A View of Delft 1652
Carel Fabritius
National Gallery, London

The study showed the successful recording of the effects of light and shadow in domestic interiors using pinhole photography. The curvature of the camera, together with the necessarily prolonged exposures, caused ordinary domestic interiors to appear strangely distorted and uncanny.

1.9 Study using double pinhole photography in domestic interiors

Following earlier doubled pinhole imaging, this study aimed to explore the effects of doubling within interior settings. Fig. 1.19 was taken using one pinhole and moving the tin to a slightly different position half way through the exposure. In Fig. 1.20, two pinholes were used, and the tin remained stationary for the duration of the exposure, which was half that for Fig.1.19. There was little apparent difference between the resulting images, since the overall exposure time was the same using both methods.

Fig. 1.19
Hall
Single pinhole photograph, repositioned during exposure

Fig. 1.20
Hall
Double pinhole photograph

Although the pinhole photographs were clear, there was a softness that is seldom apparent in photographs created using conventional cameras. This softness was perhaps further enhanced because the negative was also the photographic paper. Since some of the exposures were of considerable duration, some as long as thirty minutes, the movement of the sun caused the light to change with the passage of time. The latter caused even greater ambiguities in the final photographs, where the interplay between light and the shadow had changed.

These photographs related directly to the aim of the study in recording the effects of light and shadow. The circular camera and double pinholes were successful in producing subverted images of familiar interior settings, whose results were largely unpredictable. The strangeness of the images was due in part to the blur that results from long exposure photographs when movement is a part of the subject. However, photographs are static images, and my increasing interest was in developing the potential of live imagery.

<u>Conclusion to Stage I</u>

These studies investigated the modulating effects of light and shadow, which were then recorded graphically. The effects of light emanating from opposing sources were also examined. This was followed by studies that restricted the amount of light entering a space, and these were recorded using pinhole photography. The subject matter of these photographs progressed from arbitrary subject matter and exterior views, through to indoor scenes, and domestic interiors, which began to invoke notions of the uncanny. This was followed by the deliberate exploitation of the natural propensity of pinhole photography to distort images, in an attempt to further undermine reality. The overall conclusion of these studies was that the distortion of objects and spaces in these photographic images did not appear to have obvious potential for further exploration at this stage of the research. It was realised instead that the research could be developed further through an exploration of live imagery.

STAGE II

2.1 Camera obscura construction

Up to this point the studies had dealt with photographically recording projected imagery. However, the main concern now was to explore qualities of the pinhole photographs, such as doubling and transparency, through live projections, using a cubicle or room type camera obscura.

The aim of this study was to gain a full understanding of the operating principles of various versions of camera obscuras. Several room type public camera obscuras were visited, including those in Bristol, Aberystwyth, Knighton, Greenwich and Edinburgh. In all of these, the images are presented horizontally, so that the observer can move around the table to view them the right way up (Fig. 2.1). A studio model of this type was constructed, using 1.5mm MDF board, 40cm high (Fig. 2.2).

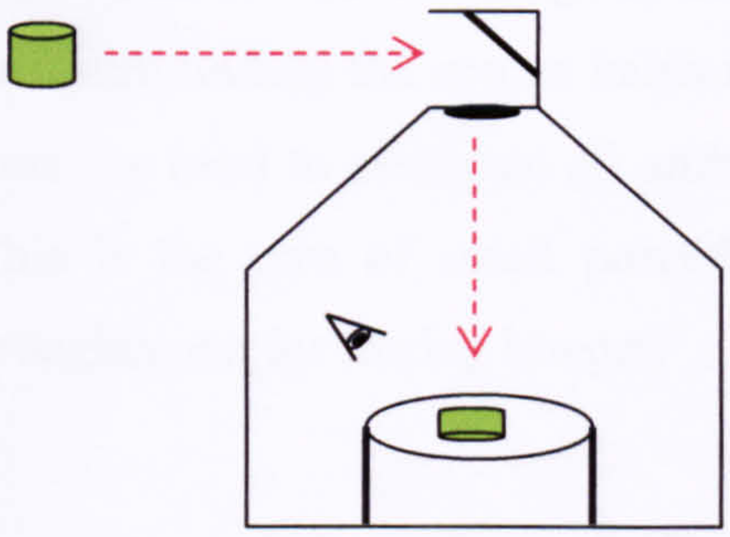


Fig. 2.1
Diagram of public camera obscura

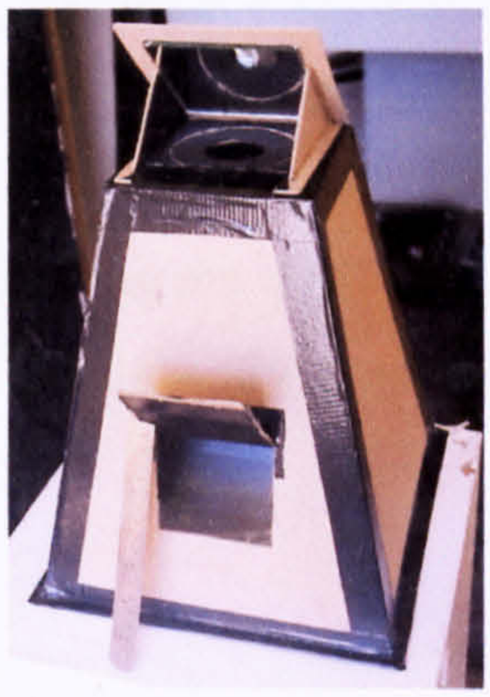


Fig. 2.2
Model based on public camera obscuras

This was followed by a simple box type model (Figs. 2.3 & 2.4), constructed of 1.5mm thickness MDF board, based on Fig. 2.3, which was 33cm long and fitted with a 13cm focal length bi-convex lens.[48] This was stopped down by about one third, to improve the clarity of the image. At the opposite end was a translucent screen of tracing paper. This produced a well-focused, reversed and inverted image, which was viewed from the outside of the box.

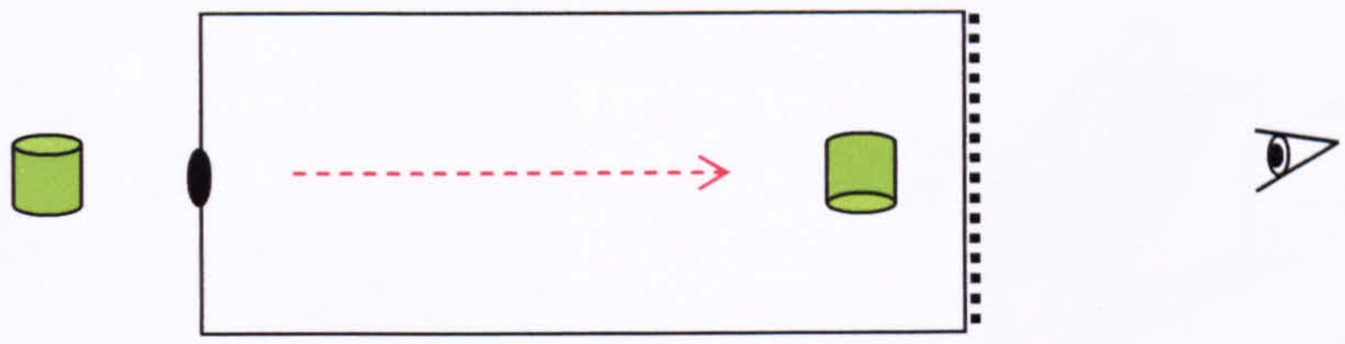


Fig. 2.3
Diagram showing back projection
(Red arrow denotes direction of light)

Fig. 2.4
Model for back projection

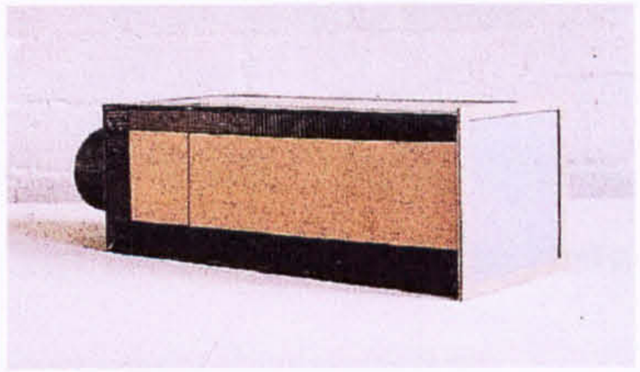


Fig. 2.5
Model for back projection

Figs. 2.6, 2.7 & 2.8 have a mirror (shown blue in Fig 2.6) set at a 45° angle inside the box. This reflects the image up onto a translucent screen. The shield at the top of the box surrounding the screen helps reduce ambient light. A black cloth can be placed over the head to eliminate all ambient light, thus improving the quality of the image. This is the type of small portable camera obscura traditionally used by artists or draughtsmen for tracing images.

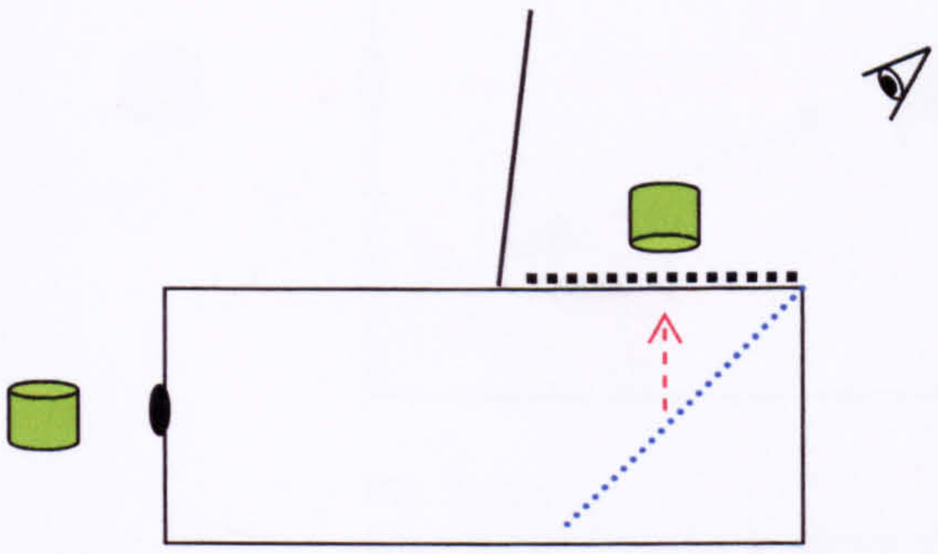


Fig. 2.6
Diagram of box type
camera obscura suitable
for tracing images

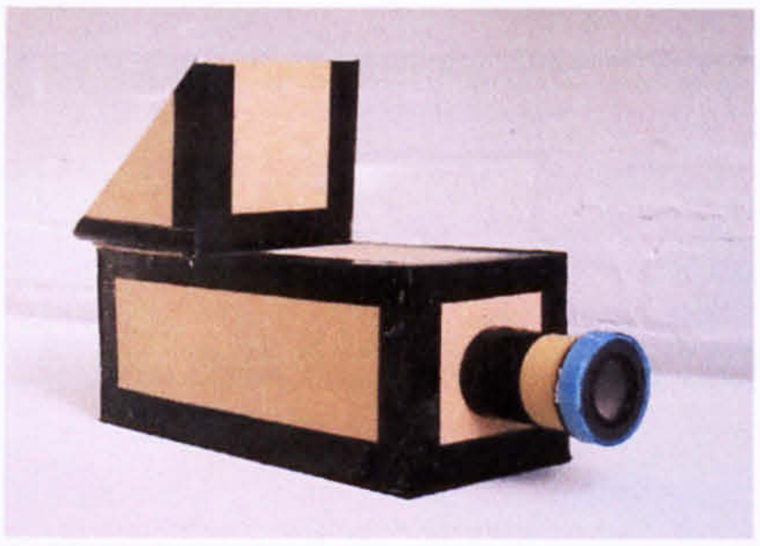


Fig. 2.7
Model of box type camera obscura for tracing showing lens

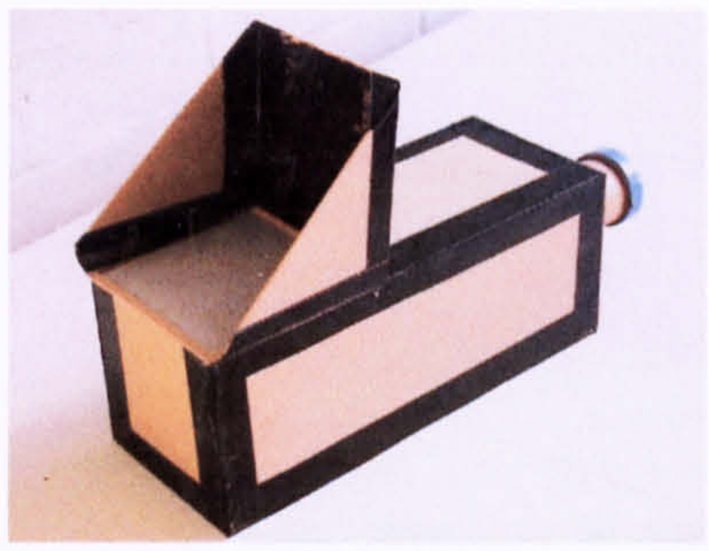


Fig. 2.8
Model of box type camera obscura for tracing, showing screen

NB A simple box camera obscura with a second image-forming lens presents a correctly orientated image, (Fig. 2.9) but this is awkward and the image dim.

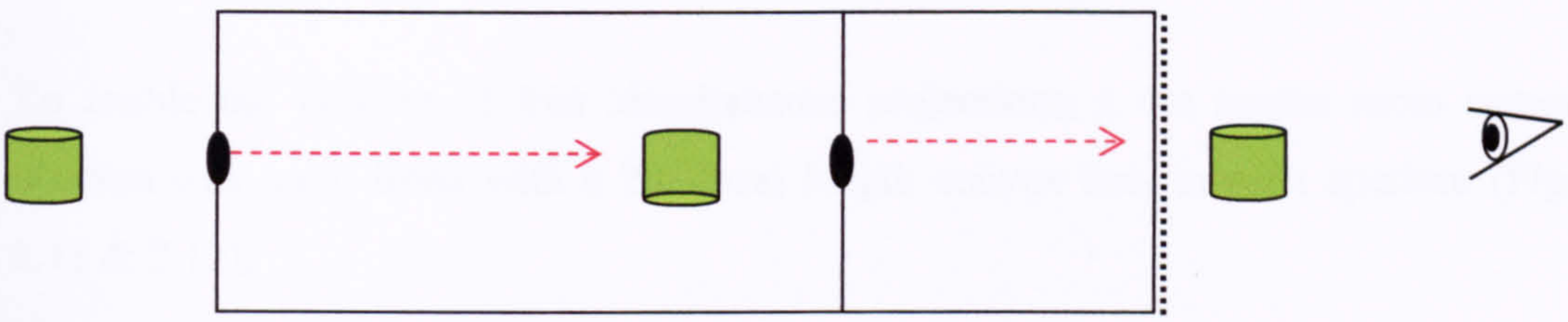


Fig. 2.9
Diagram showing second lens to correct inversion

Fig. 2.10 shows a room type camera obscura as constructed in the studio. An inverted image appears in the same darkened space as the viewer, on a white wall opposite the lens. The projection is positioned above the observer's head, so that the observer does not obstruct it.

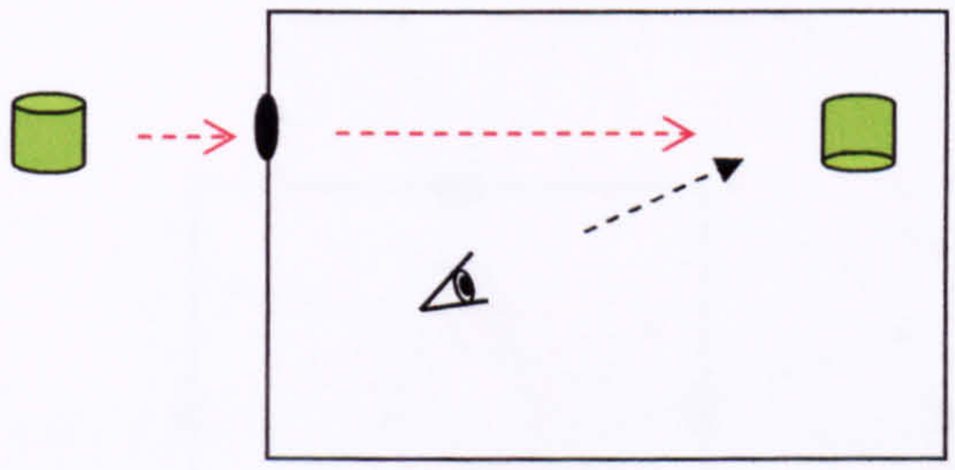


Fig. 2.10
Diagram of room type camera obscura

The construction of these models helped to clarify their working principles and how they might be used. It confirmed the intention of using a room type version where the observer is placed inside the camera, but not in presenting the images horizontally in the traditional way, but vertically, like a painting on a wall. The double pinhole

photographs in the previous studies now prompted an interest in producing multiple images rather than conventional single images.

2.2 Study with 4 sided camera obscura projections

This study aimed to discover how several images projected from different directions could interact with each other within a space. This might produce a much more expansive panorama than would be possible with a single aperture. The observer would be able to move around inside the camera in order to view the images. The individual strength and clarity of these images would be assessed. This study used daylight and the images produced were of the surrounding view.

To enable the viewing of four simultaneous projections, a 4m square room camera obscura was used, fitted with a 2m focal length convex lens in each aperture (Figs. 2.11 & 2.12).

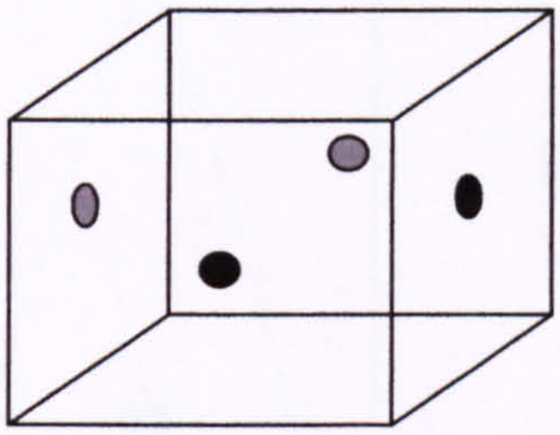


Fig. 2.11
Diagram of four-sided camera obscura

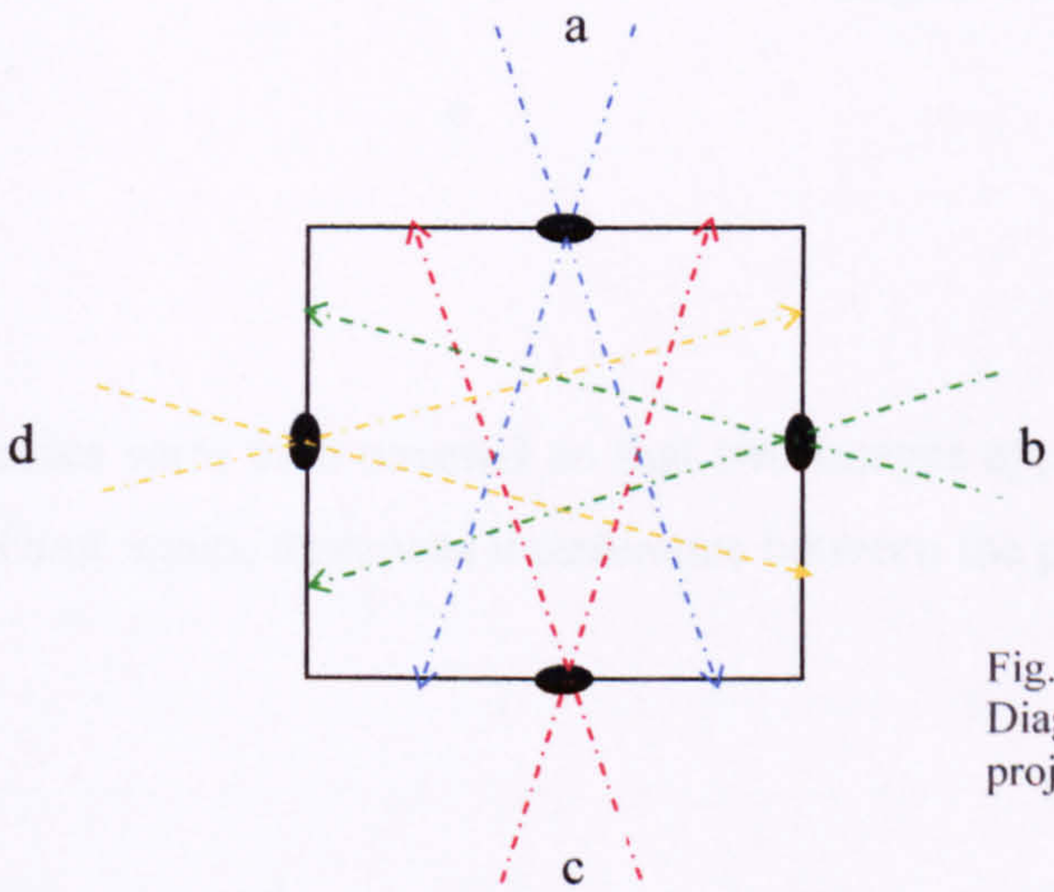


Fig. 2.12
Diagram showing four projections

Although images appeared on the four internal white walls, there was interference between the projections. The diagrams indicate the general extent of the projections, which extend further in reality, but distort (anamorphically), as the angles increase at their extremities. Additionally, according to the position of the sun, some images were stronger than others. Only when sunlight was directly overhead were the images equal.

In order to discover if the clarity of the images increased with fewer apertures, one lens was covered (b), so that three projections were produced (Fig. 2.13). This improved the quality of the projections, especially the one on the wall (b) where the lens had been covered, as there was now less interference from the other images.

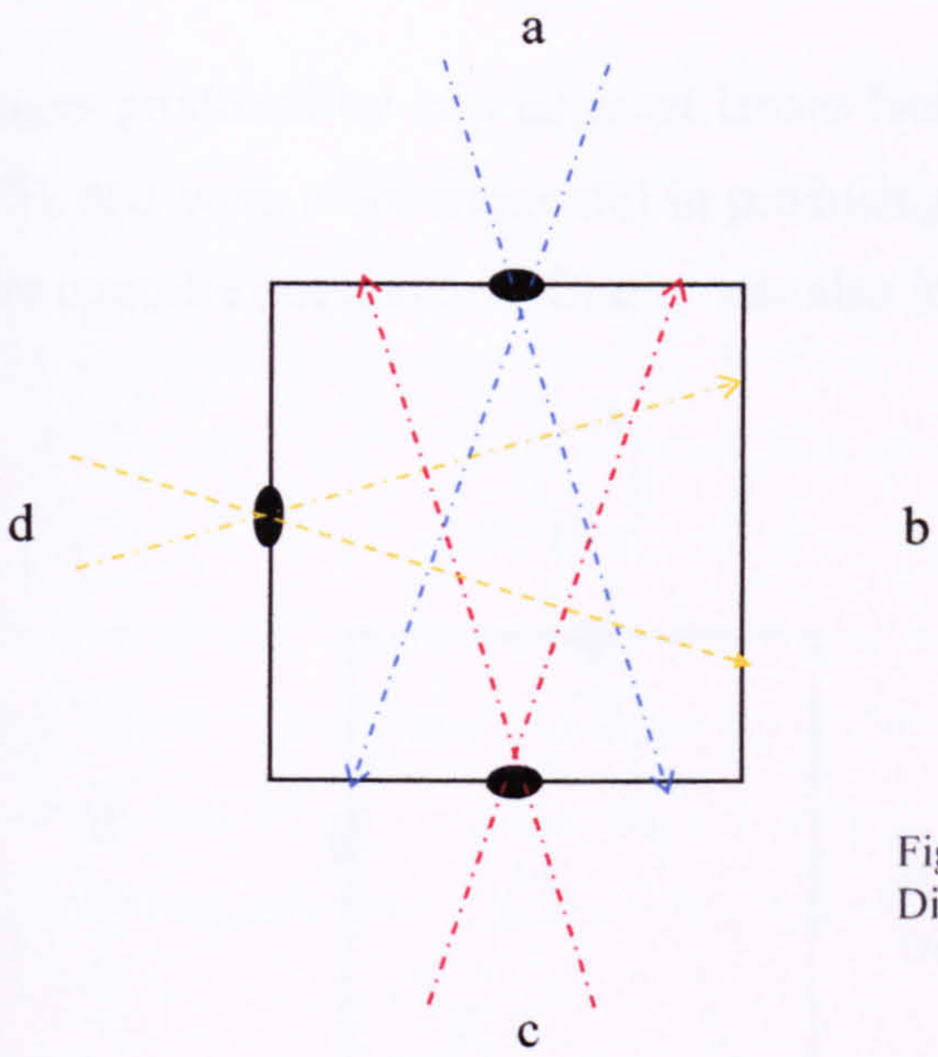


Fig. 2.13
Diagram showing three projections

Two lenses were then covered so that two images appeared opposite (a) and (c) (Fig. 2.14). Once again, there was interference between the projected images.

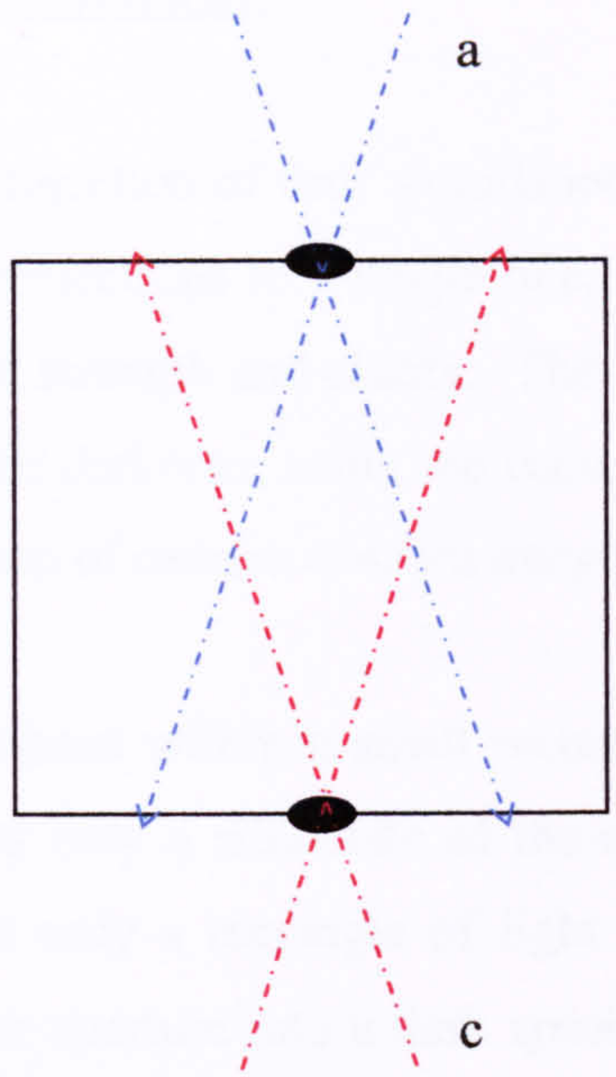


Fig. 2.14
Diagram showing two opposite projections

Images produced by two adjacent lenses had the least interference (a) and (d) (Fig. 2.15), and were more successful in producing clear images than when the projections were opposite one another. Clarity was also improved as less light entered the room.

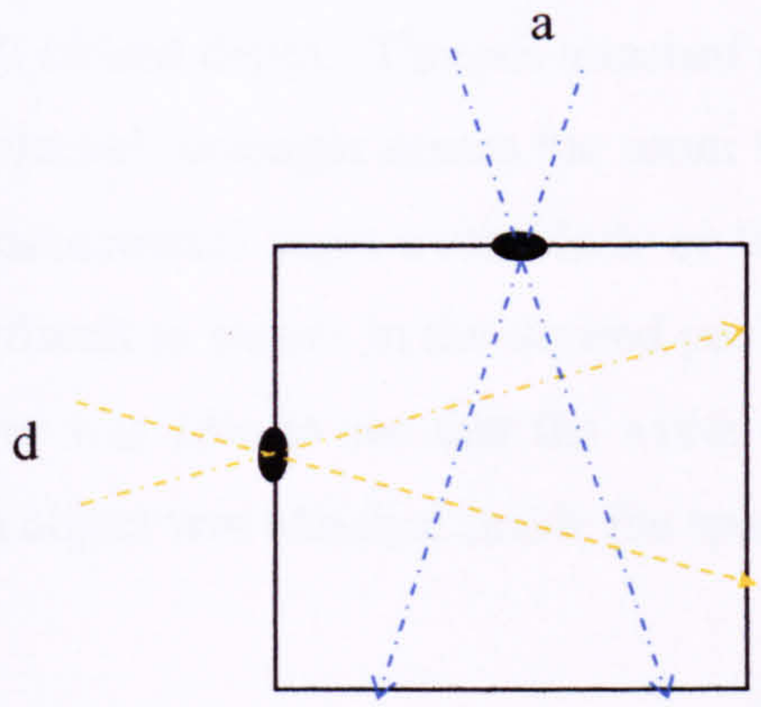


Fig. 2.15
Diagram showing two adjacent projections

The result of these studies demonstrated the perceptual ambiguity of merging images projected from different directions. They also proved the superiority of projections from a single direction in terms of strength and clarity. The double pinhole photographs had already confirmed that more than one projection from the same direction was feasible, and this was developed further in Stage IV of the research. However, there was a disadvantage in that the observer was apt to obstruct the projections because they occupied the same space as the projections on the walls.

2.3 Study with isolated light

Following the projection of four simultaneous projections, this study aimed to reduce the number of projections to a single one, since images projected from one direction have the greatest strength and clarity. The aim was to make an object appear to float, unattached, in the darkness, using the camera obscura room, a study inspired by della Porta's description of camera obscura images appearing to float or hang in the air.[49]

An apple was placed within a small rectangular space illuminated with natural light from behind, but only a silhouette of the apple was projected. The object was then removed so that only a rectangle of light was projected. Light passed through the small rectangular aperture into a dark space 3m deep, then through a 1m focal length meniscus lens into the camera obscura room, where a projected rectangle of light appeared on a white screen (Fig. 2.16), focused at 1.5m. Because the entire screen was white, the rectangle appeared flat, and did not give the illusion of an object floating in space. The screen receiving the image was painted black, apart from a white rectangle corresponding to the projected rectangle of light. This was more convincing, but still lacked depth. Threads attached a piece of white card of corresponding size to the projected rectangle across the room to try and give the impression of depth. This was unsuccessful since even black or 'invisible' thread reflected light, and the card was difficult to secure in the desired position so that it did not move (Fig. 2.17). The observer was able to see that the white area was on the same plane as the black and that an object was attached inside the space.

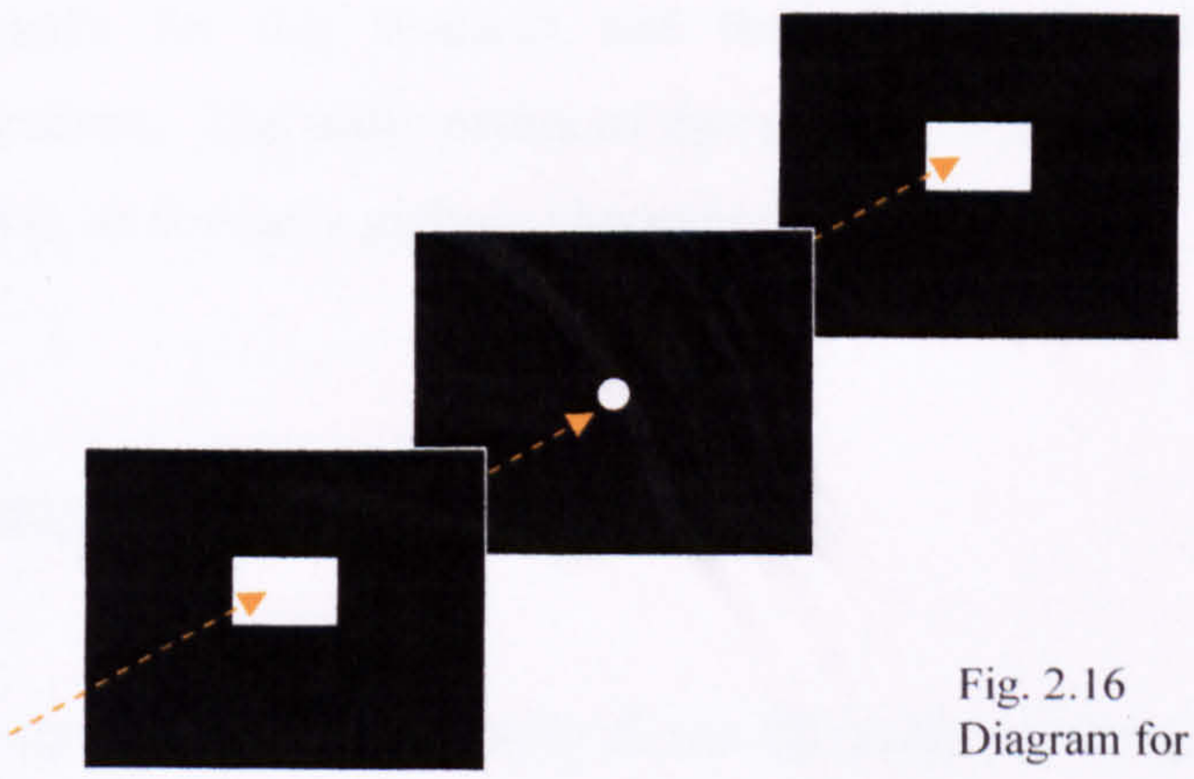


Fig. 2.16
Diagram for isolated light

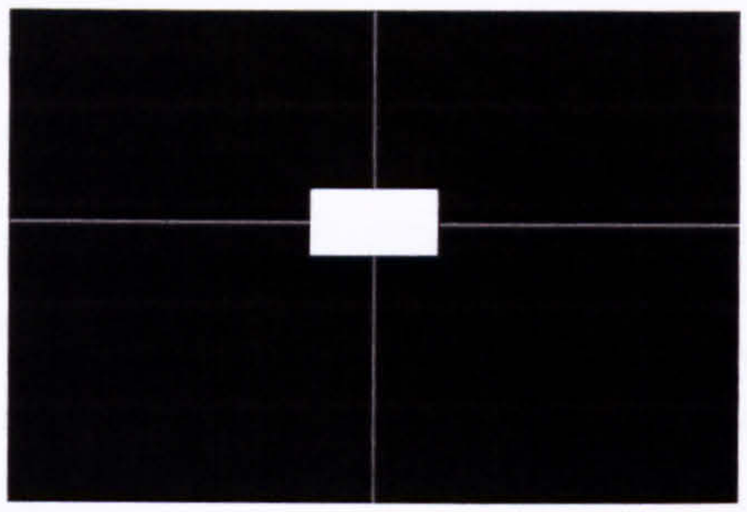


Fig. 2.17
Diagram with white card secured by thread

The card was then positioned on the end of a rod (Fig. 2.18) so that no means of support could be seen. This was only successful if the position of the observer was restricted and not able to see around the side of the card, nor obstruct the light entering the room.

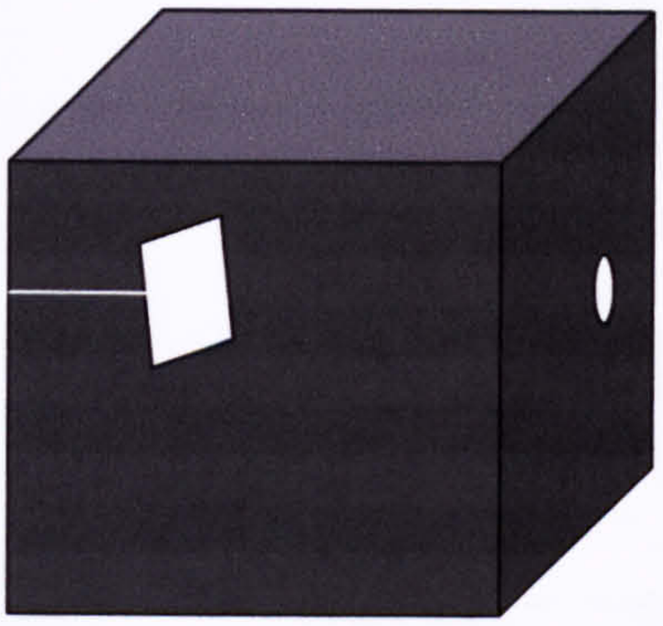


Fig. 2.18
Diagram with white card attached to rod

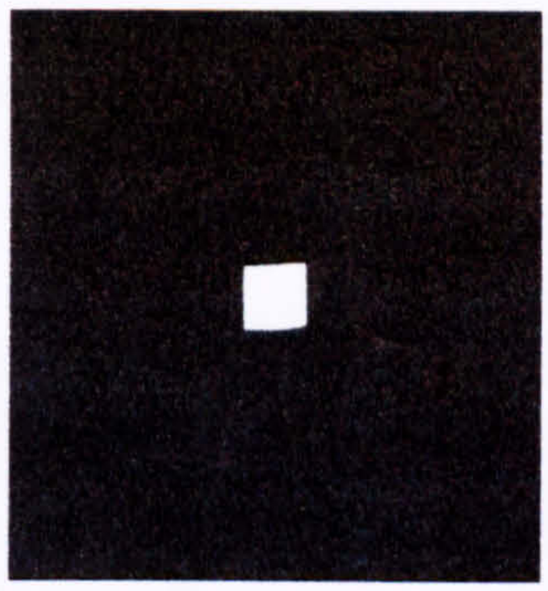


Fig. 2.19
Photograph of card attached to rod

The photograph (Fig. 2.19) gives the impression of success, but in reality the study was awkward and unsuccessful, primarily because the viewer shared the same space as the projection and card. The study emphasised that the projection of light alone lacked significance for this research and that objects should be used for subsequent investigations. The static nature of this study also stressed the need for the movement of objects, as the early pinhole photographs had done.

2.4 Study with moving images

This study set out to deliberately distort the projected images of a moving object. This was prompted by the anamorphic distortions observed in images projected at extreme angles in the pinhole photographs in Stage I studies, and in Study 2.2.

The camera obscura room was fitted with a 2m focal length convex lens. A person illuminated by daylight would pass in front of a lens from a to b (Fig. 2.20). Since light travelling in straight lines produces the best and truest image when the screen receiving the image is opposite the lens, an image appearing on a screen at a 45° angle to the lens will appear distorted and less focused. In this study, the inverted image of the person walking appears first on screen c as slightly stretched or anamorphic. As the pedestrian progresses, the image approaches the corner towards d, and at the corner appears to jump, and then progresses normally, and undistorted, towards e. Where it meets the corner, the image appears once more to jump, and then progress towards f, becoming increasingly distorted again.

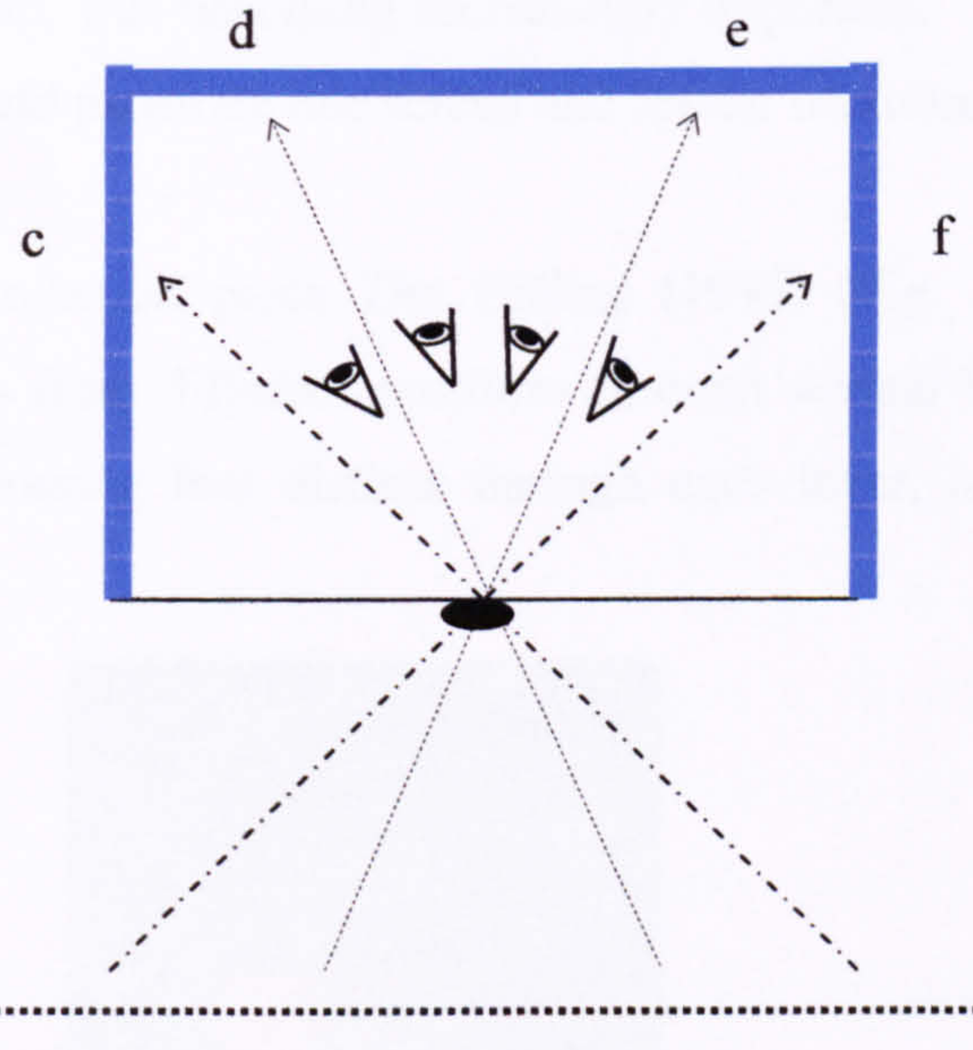


Fig. 2.20
Moving images – person walking

Person walking from a to b, with their inverted image moving from c to f

It was evident from the results of this study that an inability to control natural lighting would restrict the rapid progress of future studies and that artificial light should be used. This meant that smaller, artificially lit spaces were required, and that smaller independently moving objects should be used.

2.5 Study with candles

The previous study highlighted the limitations of using daylight as a light source. Consequently, only artificial light was used from this point onwards. Referring to the

experiments with candles by the 10th century physicist and mathematician, Alhazan, candles were used as a starting point. I realised that since a candle is its own light source, it would be an intriguing object to work with, and one which is ordinary and instantly recognisable.

The camera obscura room was again used for this study. A 40cm fl bi-convex lens of 6cm stopped down to 4cm provided a good working format. The candle flame and candle were visible when projected onto a solid white screen. A black candle replaced a white one, thus eliminating the candle image so that only the image of the flame was visible. By altering the distances between lens, screen and object, the size of the candle flame image could be controlled. The notion of transparency, where images appear to overlap, was becoming increasingly important. This study aimed to project images that would penetrate one screen and appear on subsequent screens behind.

Bill Viola's projection piece *The Veiling* (1995) (Fig. 2.21), back projected two separate images from different positions through several layers of translucent scrim, fading and becoming less distinct through each layer, to finally meet and diffuse together.

Fig. 2.21
The Veiling (1995)
Bill Viola

The screens for my study needed to be transparent, yet solid enough to accommodate a visible image. Fine white nylon fabric proved the most suitable, and several screens were hung at different distances, to see how focused the images would appear on and through the layers (Fig. 2.22). Unlike Viola, I was concerned with maintaining the focus of images in this study.

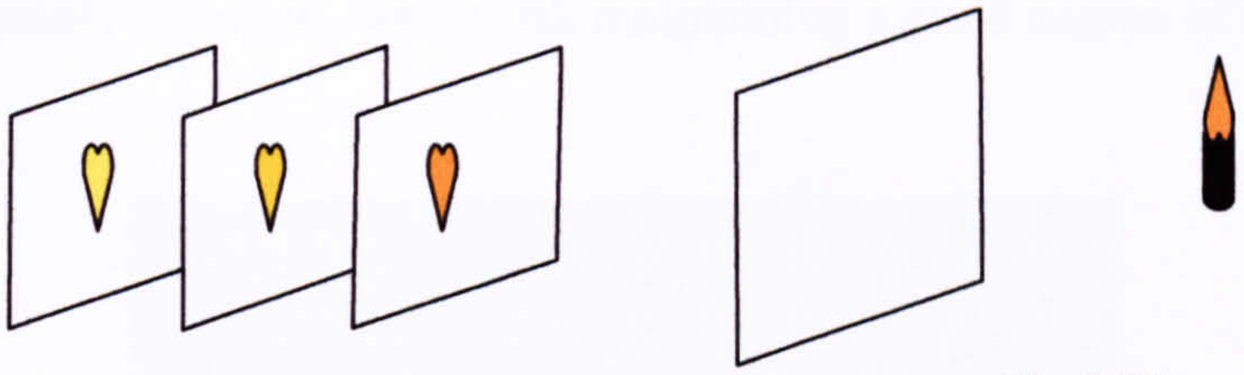


Fig. 2.22
Candle with gauze layers

The focus diminished as the distances between the screens increased, but three images of reasonable quality were produced with the screens about 15cm apart. The images lost clarity and focus the further away from the lens they were and as they passed through the layers; the image on a fourth screen being poor. However, the natural movement of the candle flame suggested that other independently moving objects might be used.

2.6 Study with light bulbs

This study aimed to explore the potential of a light bulb, which like a candle flame, was capable of projecting its own image and is likewise an ordinary and easily recognisable object.[50] Additionally, the glare of a candle flame reduced its ability to be viewed clearly (and had practical limitations), whereas the strength of a light bulb could be altered from 25w (approximately equal in strength to a candle), to 150w, and yet still be seen more clearly.

A 25w opaque bulb was used to project an image onto a white screen. This was replaced by a clear 40w light bulb, which produced a more interesting image, because its intricate internal structure was clearly visible when projected (Fig. 2.23). A 40cm focal length bi-convex lens of about 6cm diameter stopped down to 4cm was used.

Whilst it is difficult to view a light bulb with the naked eye, as is attempting to view the sun, the projected image of a bulb and its delicate internal structure is very sharp. The camera obscura softens the glare of the bulb, enabling it to be clearly observed. Although the projected images are two dimensional, they have a strong three-dimensional appearance, which is somewhat disconcerting. Tests also showed that by

adjusting the distances between bulb, lens and screen, the bulb image could be considerably enlarged, whilst still maintaining a good degree of clarity.

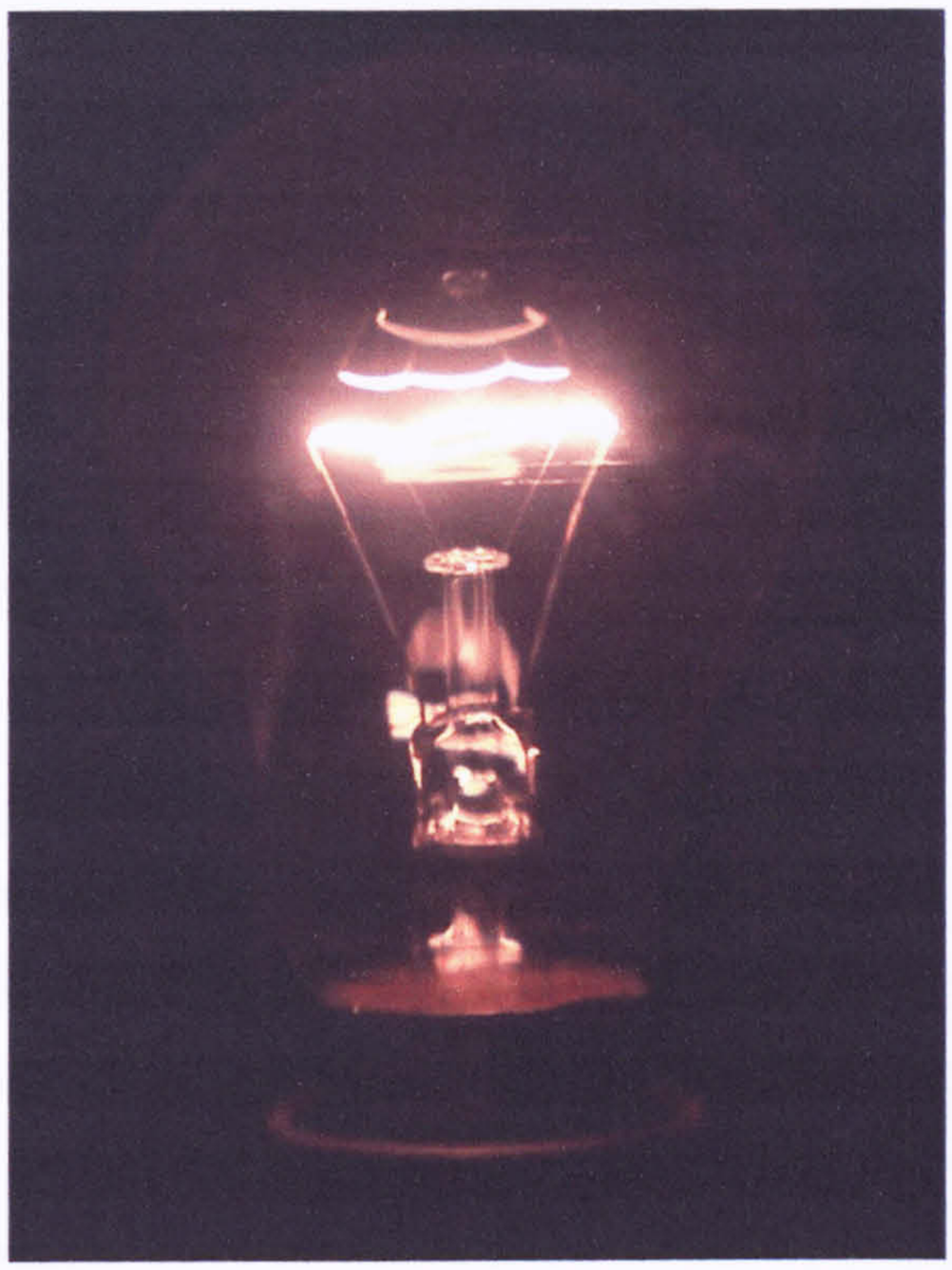


Fig. 2.23
Light bulb projection

2.7 Study with light bulb filaments

This study set out to ascertain the effect of multiple images using a clear bulb and a screen with many pinholes. As the light is emitted from the filament, multiple images of this were successfully projected onto a screen. A further study using the same method aimed to see if a whole room could be covered with filament images. A 150w bulb was placed inside a large wooden box, which had been drilled on the top and all four sides with many pinholes. The box was placed centrally in a dark 3m square room. Filament images, varying in size with the distance of the filament to the walls and ceiling, were projected onto the walls of the white room. Because pinholes were used, reasonable focus was maintained whatever the distances, although the further the pinhole was from the wall, the larger and less distinct were the images (Fig. 2.24).

Fig. 2.24
Multiple images of bulb filament

This study produced multiple bulb filament images of reasonable clarity, primarily because light and object were one and the same. The repetition appeared as a phenomenon in itself rather than seeing the actual image. Illuminated objects would not have sufficient strength to produce live images using the pinholes, although they had been produced through the long exposures of pinhole photography. Although there were similarities with Bill Culbert's *Celeste*, in this study the randomly placed multiplied filament images had a strange and ambiguous appearance, unlike *Celeste*.

2.8 Study with scale using light bulb

The previous studies demonstrated the potential of enlarging the projected light bulb image, whilst largely maintaining the quality of the image. Therefore this study aimed to enlarge a projection as much as possible and see how well the image retained its clarity. The image of a single 60w bulb was projected onto a white screen in a darkened space about 6m long, where the other walls and ceiling were black. A 40cm focal length bi-convex lens of about 6cm diameter, stopped down to 4cm was used. A bulb was placed opposite the lens higher than the viewer's head so that the viewer would not obstruct the projection. By adjusting the distance of the bulb to the lens, and increasing the distance of the lens to the screen using all available space, an enlarged bulb image nearly 2m high of good clarity was produced (Fig. 2.25).

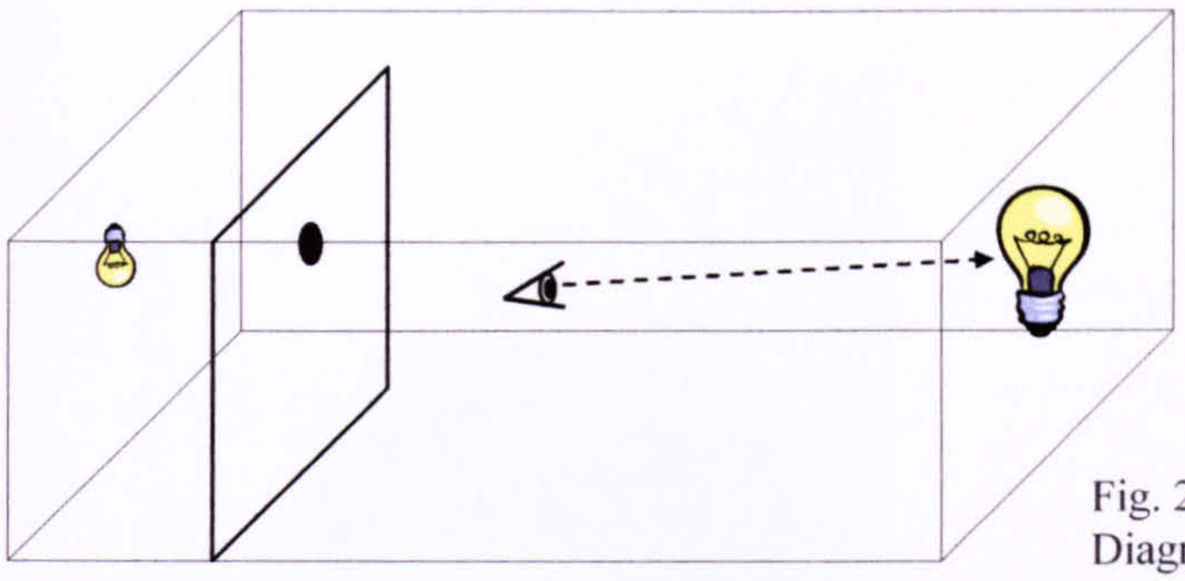


Fig. 2.25
Diagram for enlarging bulb image

When the viewer initially entered the dark installation space from a normally lit space, they could see little, but as their eyes gradually adapted to the darkness after perhaps three to five minutes, depending on the person, an image of the bulb filament could be discerned.[51] The rest of the bulb and its outline were gradually revealed to the observer, becoming stronger and brighter.

As in the gradual revelation of forms by the increasing daylight in Proust's narrative, the light bulb image in this study was initially barely discernable and then gradually revealed itself over time. In the study, the body's visual system could not be hurried, just as with Turrell's skyspaces the cycle of day and night dictates the speed of change. The observer could only surrender to nature's timescale, as their senses slowed to a state more readily conducive to calm.

The study showed that even though the image was enlarged, it retained its clarity, losing little detail. In order to document the enlarged image, photographic paper was placed on the wall that received the projection, and the lens stopped right down to about 0.6cm. The strong filament needed only a couple of seconds exposure time, but the rest of the bulb required about twenty minutes. A compromise of eleven minutes eventually produced an acceptable image, although the filament detail could not be captured photographically as well as the rest of the bulb. When processed, the negative become a positive, producing an unconventional image of a light bulb (Fig. 2.26).

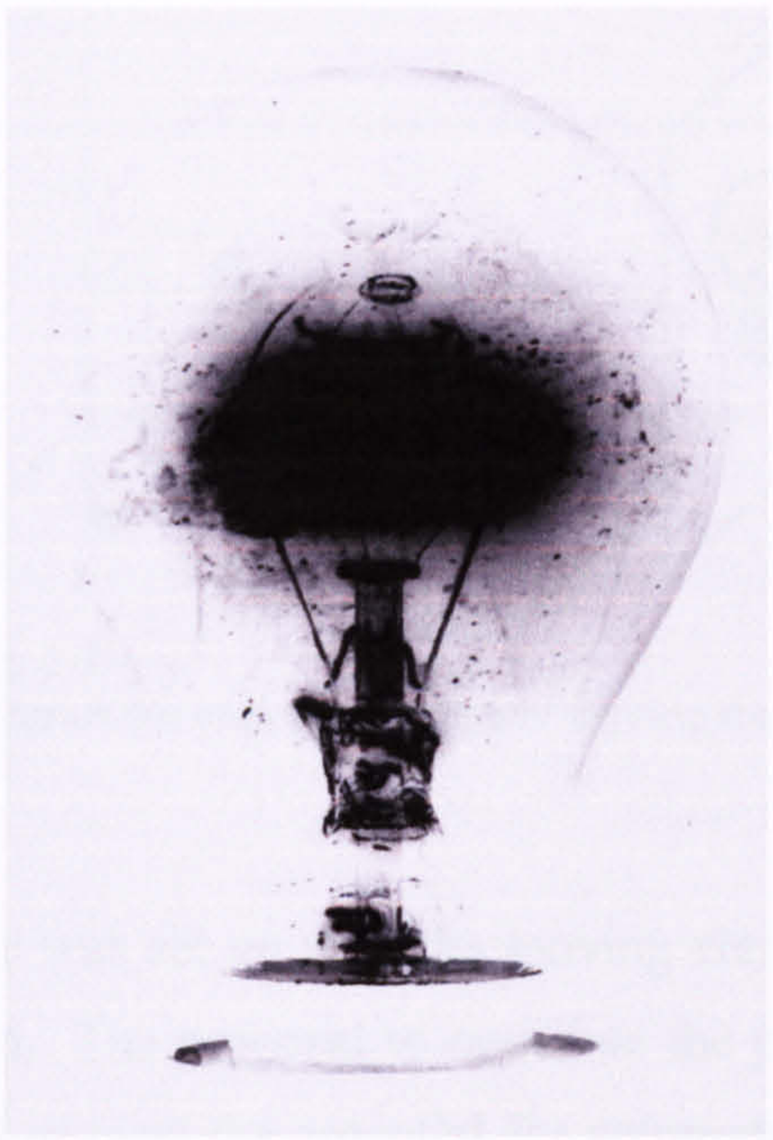


Fig. 2.26
Pinhole photogram of light bulb

2.9 Study with varying intensity of light and scale using light bulb

Based on the last study in which a projected light bulb image was enlarged, this study aimed to alter the size and intensity of the image as the observer watched. The image of a normal light bulb would initially be almost imperceptible, and then gradually become larger and brighter, until it filled the screen, consequently illuminating the room. The whole process would then reverse, so that the bulb gradually became smaller and dimmer until it was once again imperceptible, and the room in darkness. The study would not rely on the adjustment of the observer's eye, but be regulated by the use of a light dimmer. Two separately moving elements were required, whereby a 150w bulb placed in the box with a 30fl lens, moved slowly away from the lens a very short distance (a), and the screen (b), would move slowly (but a much greater distance), starting at 45cm away from the lens and extending to perhaps 5 to 6m.

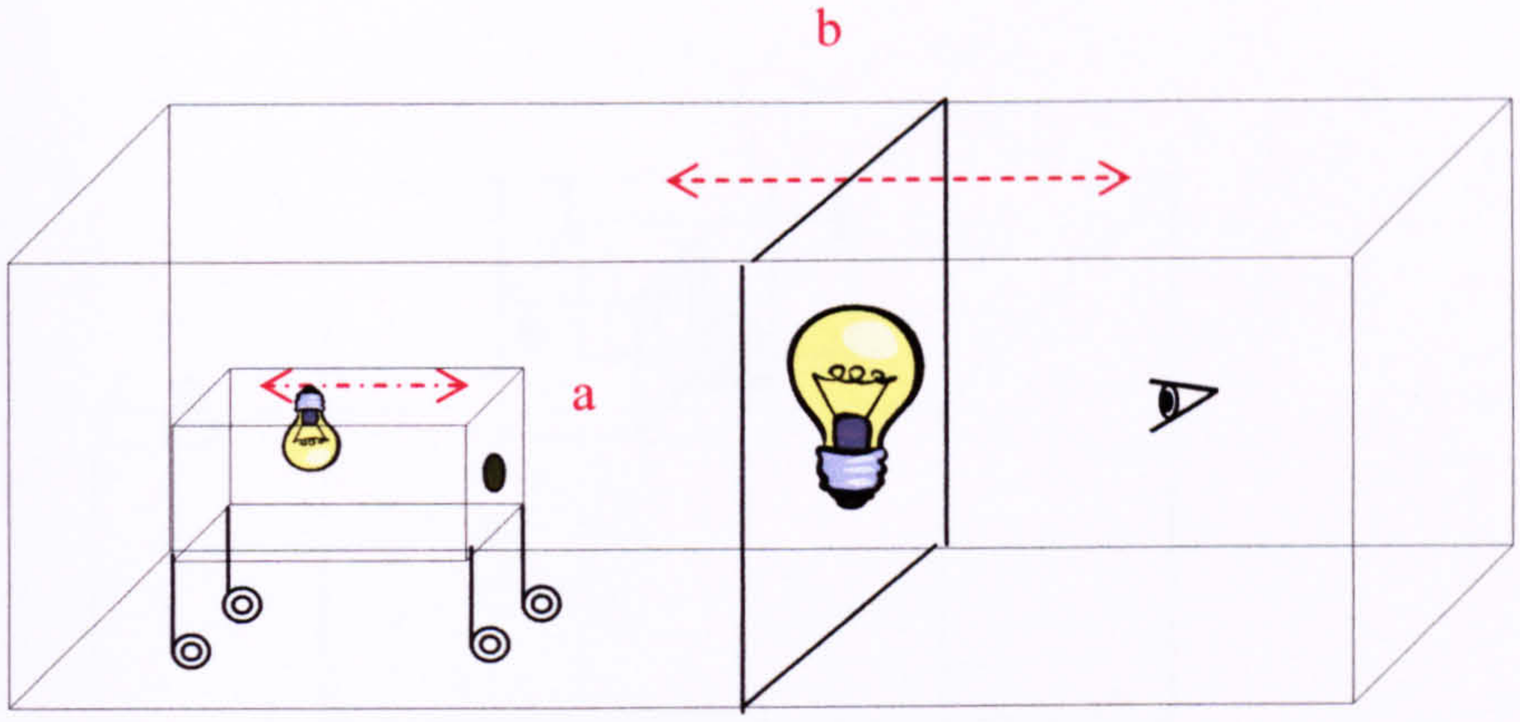


Fig. 2.27
Diagram for back projecting and varying size and intensity of light bulb

The study was set up with the moving elements being adjusted manually using front projection. The proposal to automate the project was over ambitious and unrealised, but it did suggest the potential for automated light sequencing in further studies. Fig. 2.27 shows how the study would have been improved using back projection, so that the viewer would be unaware of the moving apparatus and not obstruct such a large projection.

2.10 Study with simultaneous light projection in 4 directions

This study sought to alter the light levels of light bulbs through automation. Four bulb images would be projected onto the walls of a room simultaneously (Fig. 2.29). A 150w clear bulb was placed in each self-contained camera obscura box; the latter blackened inside and fitted with a 40cm fl bi-convex lenses (Fig. 2.28). These boxes were placed on a suspended platform above the viewer's head, positioned 76cm from each wall surface where the projections would appear. The bulbs were mounted on bases within the box, so that when projected, the bulb images would appear to 'hang' like real bulbs. (For safety the boxes had ventilation holes in the top fitted with a baffle to prevent light escaping). To eliminate the reflection of light from the interior of the boxes on the walls surrounding the bulb image, an extra screen with an aperture was set between the bulb and the lens.

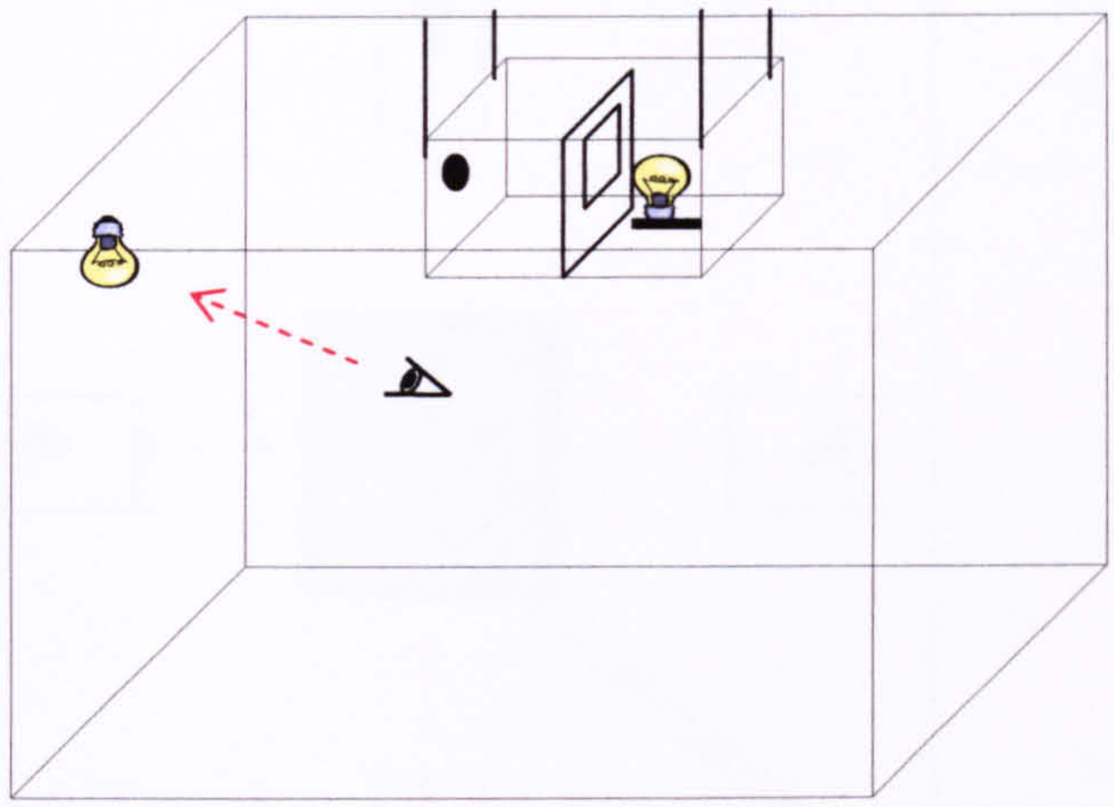


Fig. 2.28
Diagram of single bulb box

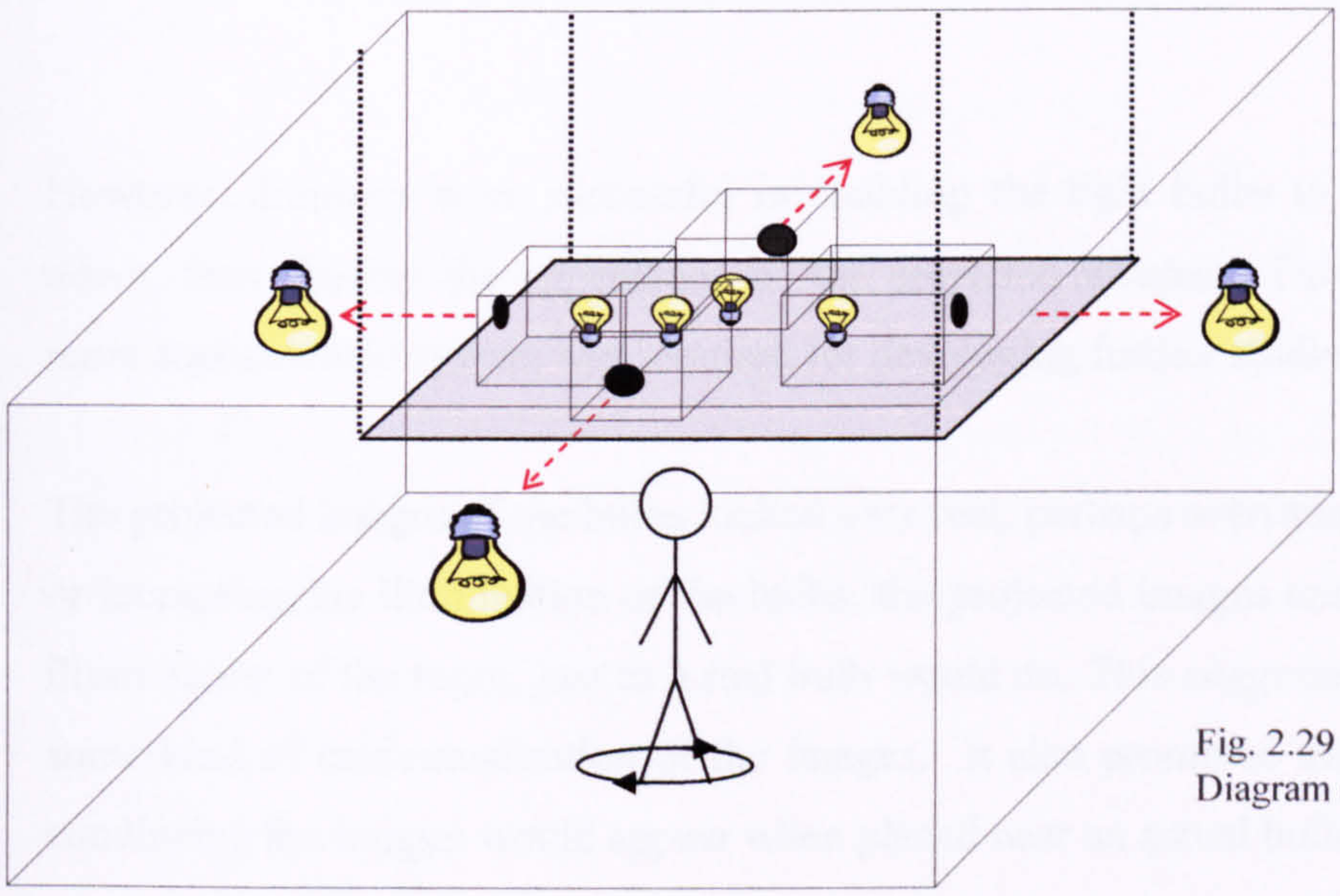


Fig. 2.29
Diagram of four bulb boxes

Successful installation relied on the distances between the lenses and walls being exact. Overall the installation was cumbersome, requiring the viewer to be in a particular position with the platform of boxes close overhead, in order to see all four-bulb images simultaneously. This could have been overcome using back projection where the viewer entered a small room, and would not see the mechanics of the installation (Fig. 2.30), but the additional space required made the installation unworkable within the limitations of the research.

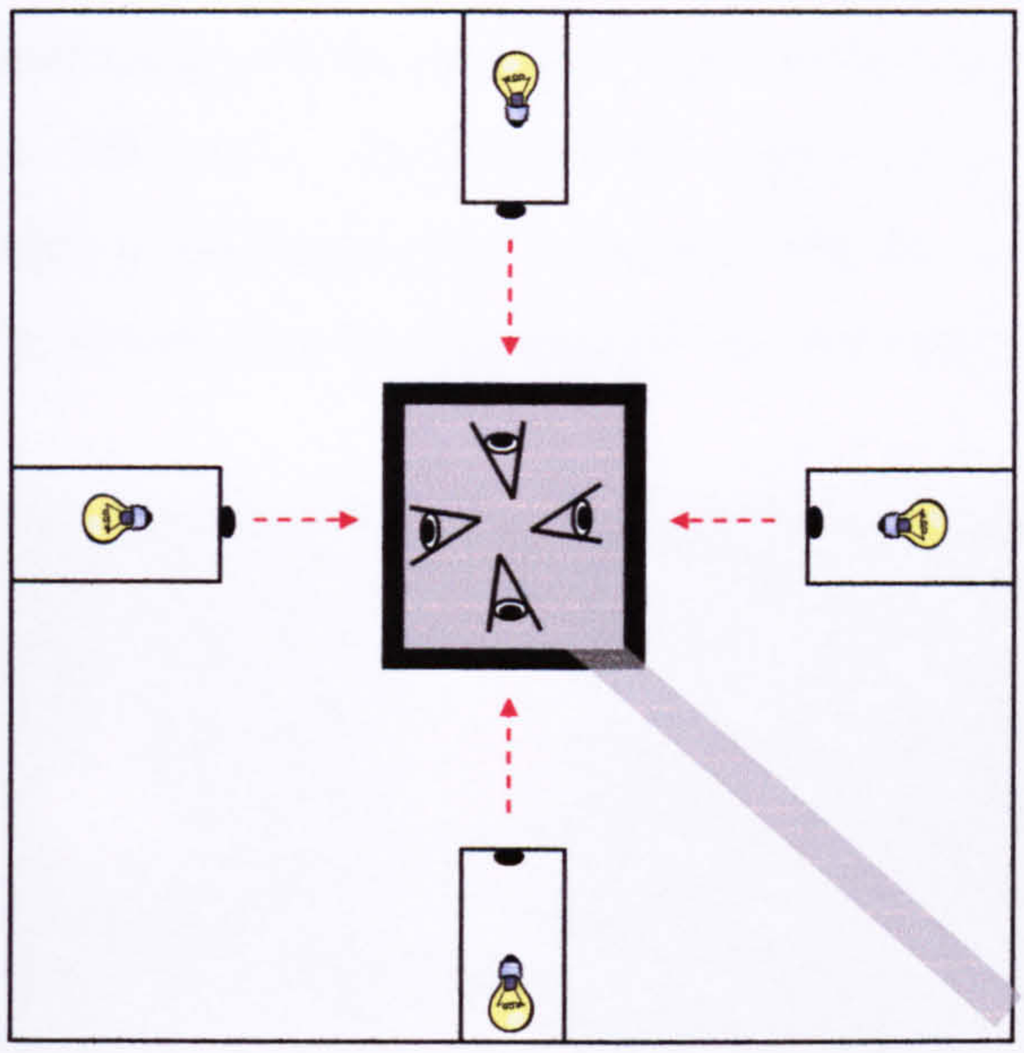


Fig. 2.30
Diagram for back projection with four bulb boxes

However, dimmers were successful in enabling the light bulbs to be turned up and down, thus altering the appearance of the projected images. This suggested that a more sophisticated system was required for developing further studies.

The projected images of the bulbs looked very real, perhaps even surreal. By dimming or increasing the illumination of the bulbs, the projected images uncannily altered the illumination of the room, just as a real bulb would do. This suggested the potential for some kind of contextualisation of the images. It also prompted the question of how convincing the images would appear when placed near an actual bulb.

2.11 Study with real and projected imagery using lighting dimmers

This study set out to juxtapose an actual light bulb with a projected image of a light bulb, in order to compare their appearance.

Two compartments were set side by side; a real bulb on the right hand side and a projected bulb image on the left (Fig. 2.31). Whilst a projected bulb image looked realistic on its own, when placed near an actual bulb, it was immediately apparent that the first was not a real bulb. The bulbs were connected to dimmers that could be manually operated, enabling them to appear of equal strength. Photographic

documentation (Fig. 2.31), suggests that they are similar, but in reality the real bulb appeared more yellow, with the projected bulb having a bluer hue. The projected bulb on the left gently illuminated its compartment, whilst the real bulb on the right produced a more pronounced halo of light. The filament of the bulb projection could clearly be seen, but the brightness of the real bulb prevented this.

Fig. 2.31
Projected bulb on the left with real bulb on the right

Attempts to match the real and projected bulb using dimmers failed, although Fig. 2.31 showed that a 100w bulb for projection and a real 60w daylight bulb gave the best match. This study showed that, although the projected bulb had a three-dimensional appearance when seen on its own, when placed next to an actual bulb the difference became obvious. However, if the real object and the projected object were different, the differences between the two might be less noticeable, as they might not be so closely compared.

Conclusion to Stage II

In this series of studies, full and model camera obscuras were constructed. The projection of live imagery began to be investigated. The need to use ordinary objects was recognised, and candles and then light-bulbs were introduced into the studies. Although Bill Culbert used light bulbs, there is no uncertainty about their reality. The studies with light bulbs illuminating a room suggested that the projections might be contextualised with other objects. Artificial light replaced natural light in the illumination of ordinary objects. Significant developments were made when multiple images began to be explored using simultaneous projection, the juxtaposition of real and live imagery, and the introduction of a programming device to control lighting. At

this stage, a comprehensive evaluation of the technical issues of lenses, illumination, front and back projection and screens, was undertaken as follows:

Technical evaluation

i Lenses

At this point it became necessary to consider what lenses had been used and to clarify those that were most appropriate. A wide variety of spherical convex, concave, and bi-convex lenses with different focal lengths and diameters had been tested. Studies proved that convex, or spectacle type lens, worked well for projecting images of naturally illuminated views, for which 1, 2 and 4m focal length lenses of 5.5cm diameter, stopped down by about a third, were used. Obviously, the greater the focal length used, the larger the space required for projection.

For objects illuminated indoors, 25, 30 and 40cm focal length bi-convex lenses were used. The diameter was generally 5cm, but to get the best balance between sharpness and brightness of images, they were stopped down to about 3.7 or 3.8cm. This also helped reduce distortion towards the edges of the projections. The best focal length of lenses used was decided by the shortest possible working distance from light sources and the least amount of space required. The most suitable working lenses were found to be standard 50mm diameter 25cm bi-convex lenses, stopped down to about 4cm, and these were then used throughout the research.

ii Illumination

Manual dimmers were clearly limiting progress, and it had become increasingly evident that a more sophisticated means of controlling illumination was required. Therefore an automatic lighting control device was introduced. This was a 'Sound LAB' 4 channel DMX Dimmer Pack and connecting 'Sound LAB' 54 channel DMX controller. This device could operate four separate scenes, so that lights could be manually programmed on dimmers, and the speed of these programmes altered, providing good flexibility for light modulation. For instance, one light bulb could be illuminated and gradually become brighter, or fade, as another gradually became illuminated. Once programmed, different programmes containing the chosen sequences could be activated to operate repeatedly on a loop. This provided greater

potential for transforming the appearance of objects and that of the spaces they occupied, thus playing an important part in the research and its progression.

It had become increasingly apparent that the possibilities of projecting recognisable objects should be explored in subsequent studies. It was also important that they should be familiar and commonly encountered in everyday life, as for instance, the light bulb. The reason for this is that the ambiguous appearance of a well-known object is more likely to prompt notions of the uncanny. Conventional walk in camera obscuras using daylight to project an exterior scene into a darkened room are not uncommon, but the projection of artificially illuminated objects is unusual.

Tests proved that light sources of up to 400w might be required for a single projection, although in many cases 200w were sufficient. Generally, one or two 100w spotlights were positioned to the front and side of an object (Fig. 2.32). This was sufficient to produce a bright image, but two 100w spotlights positioned one above the other on each side improved the overall illumination by lighting both the top and bottom of an object (Fig. 2.33).

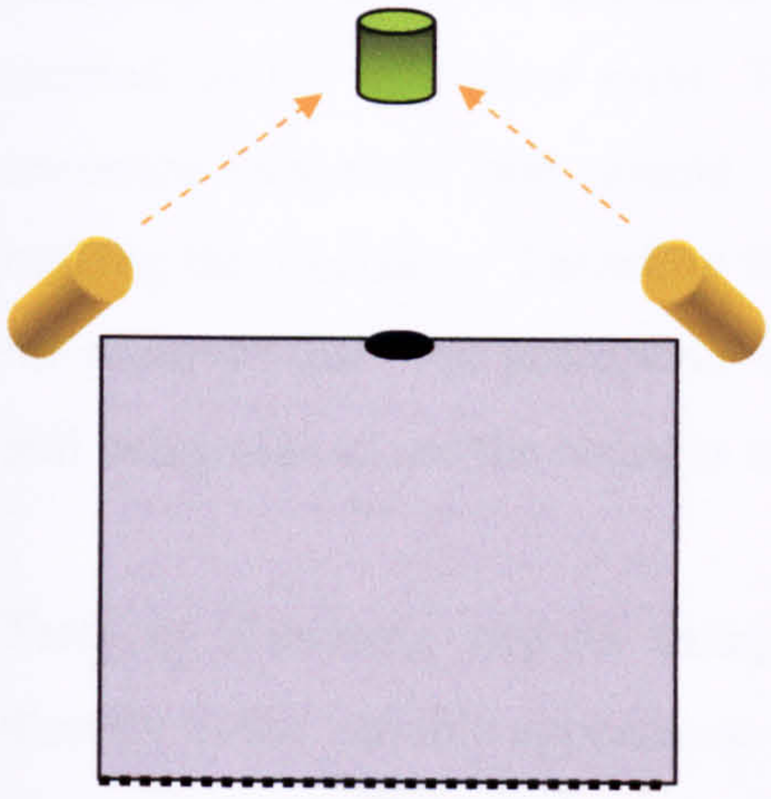


Fig. 2.32
Diagram of object illuminated by two spotlights

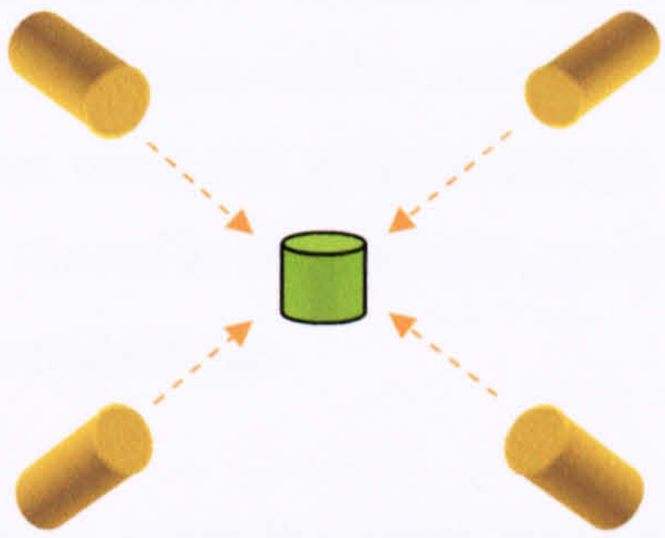


Fig. 2.33
Diagram of object illuminated by four spotlights

The spotlights on each side could be programmed to work independently of each other. For instance, the lighting programme was set so that initially the screen was dark with no object visible. Subsequently, light gradually illuminated first the left and then the right hand side of the object, until the object was fully illuminated. The light then slowly faded away on the left hand side, followed by the light fading away on the right hand side.

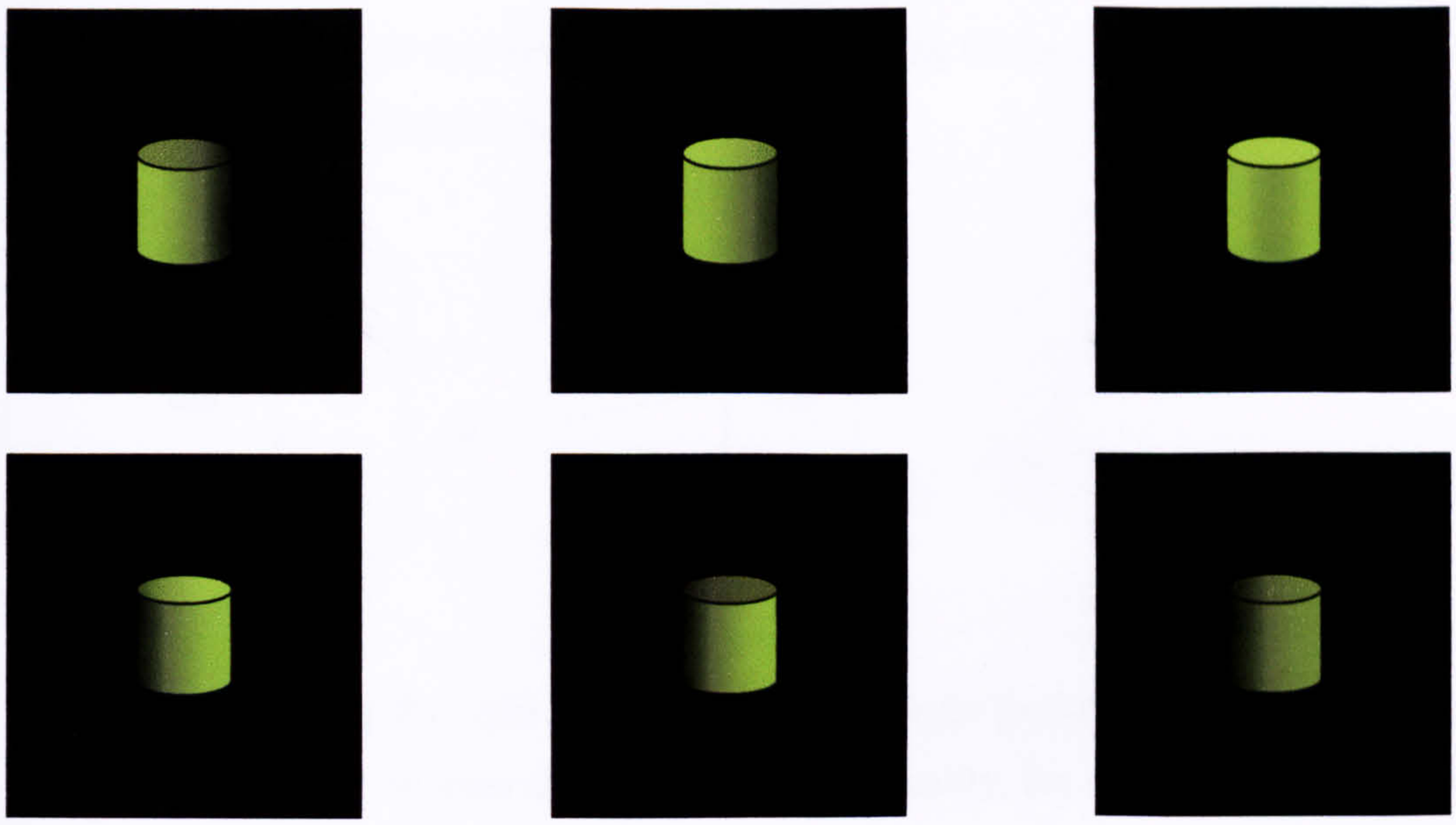


Fig. 2.34
Diagrams showing light revealing and concealing an object through light manipulation

The speed of the programmed sequence could be adjusted as required, and incorporate changing speeds within the same programme. The most effective changes in speed seemed to be very slow ones. The length of time eventually chosen for a single sequence was about one minute. The attention span of the observer was crucial in making this decision. Therefore the sequence needed to be slow enough to suggest to the observer that their perception was being slowed in corresponding proportion, whilst still being able to see the changes in the projected images.

Tests to illuminate objects using the lighting controller were successful, referring directly to the variable appearance of objects changed by light in Proust's narrative. In the semi-darkness, in the state between wakefulness and dream, the observer is held in an uncertain and suspended state between seeing and knowing what is in front of them.

iii Front v back projection

Early studies with candles and light bulbs had used front projected images that appeared in the same space as the observer, who viewed the projected image on a vertical white wall, or screen (Fig. 2.35). Whilst the bulb images appeared above the

viewer's head, at a height at which the viewer might expect to see a bulb, not all projections could avoid the viewer physically blocking the projection, thus limiting the possibilities of front projection.

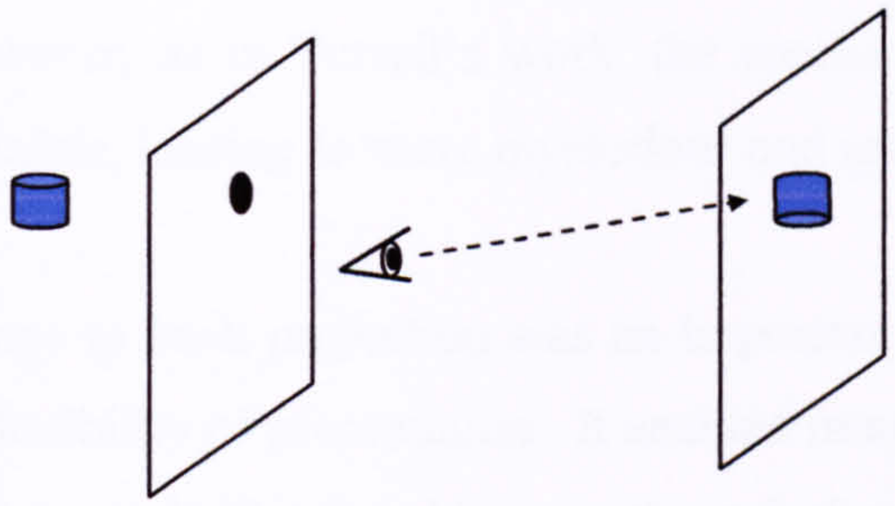


Fig.2.35
Diagram of front projection

Although tests using the light bulb proved that images projected directly onto white screens were perhaps sharper and of better overall quality, the scope of back projection outweighed the limitations of front projection (Fig. 2.36). The main advantage for the research was that by using back projection, the image of an illuminated object could be seen against a totally black background, as if floating in space, and this was not possible using front projection, because the screen is (usually) white.

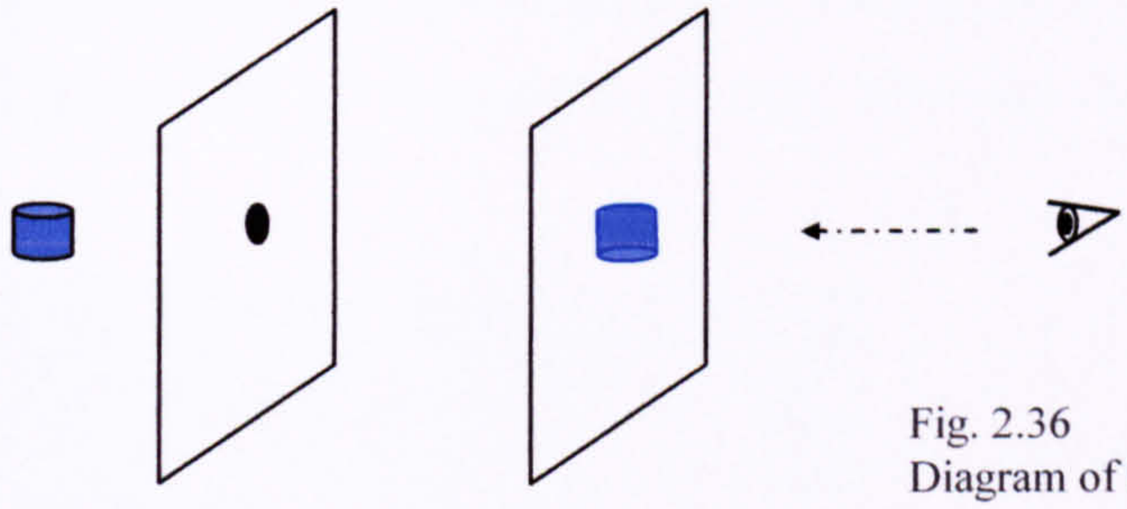


Fig. 2.36
Diagram of back projection

iv Screens

The decision was made to change the method of projection from front projection, where the observer shares the projection space, to back projection, where the observer does not see the source of the projected image. Previous studies such as the four bulb boxes had been awkward and clumsy, but might have been more successful if the images had been back projected. Back projection using translucent screens of oiled paper or ground glass appear to have been first mentioned by Leonardo da Vinci.[52] Screens for these studies needed to be rigid, opaque enough to accept an image, yet translucent enough for the image to be seen from the other side, maintaining its sharpness without becoming too diffused. Eventually a fine acid etched glass proved to be the most suitable.

Images could now be positioned in any place where the viewer could look directly at the screen. It was discovered that whilst front projected images could be seen from any position, back projected images were only properly visible when viewed straight on. However, as in Turrell's work, the mechanics of the image's creation were no longer visible, leading to more mysterious and enigmatic experiences for the viewer.

The change to back projection was an important one for the research, since it offered greater flexibility of presentation. It enabled images to appear isolated in space against dark backgrounds like the objects in the paintings of Cotan and Kalf, giving rise to an increased sense of ambiguity for the observer.

STAGE III

3.1 Study in contextualisation - microwave

This study aimed to use back projection to juxtapose a projected image with a real object. A microwave oven was chosen as an ordinary object that has a natural screen. A light bulb was used as it might have surreal connotations when juxtaposed with a microwave, and its projected image was small enough to avoid the loss of focus typical of larger camera obscura projections.

The back of a microwave was removed and the interior painted black and lined with black velvet to eliminate reflection. The metal mesh was removed from the door, and an etched glass screen replaced the original clear window. The microwave was placed on a worktop against a false wall with an aperture smaller than the back of the microwave, so that an image would be projected right through the aperture in the wall, the back of the microwave, and onto the screen at the front of the microwave. A light bulb, mounted on a block, was positioned so that the block was not visible, with the inverted image of the bulb appearing to hang inside the microwave (Fig. 3.1).

Fig. 3.1
Bulb projection in microwave

Although the projection itself was successful, the juxtaposition of object and image lacked any surreal connotation, and a more appropriate object was sought.

Therefore a mug hanging on a thread replaced the light bulb. The photograph (Fig. 3.2) shows how the image would ideally appear, as having no thread, although in reality the thread was visible. Because the mug was hanging, there was some natural movement, and the moving image within the microwave had an unsettling appearance.

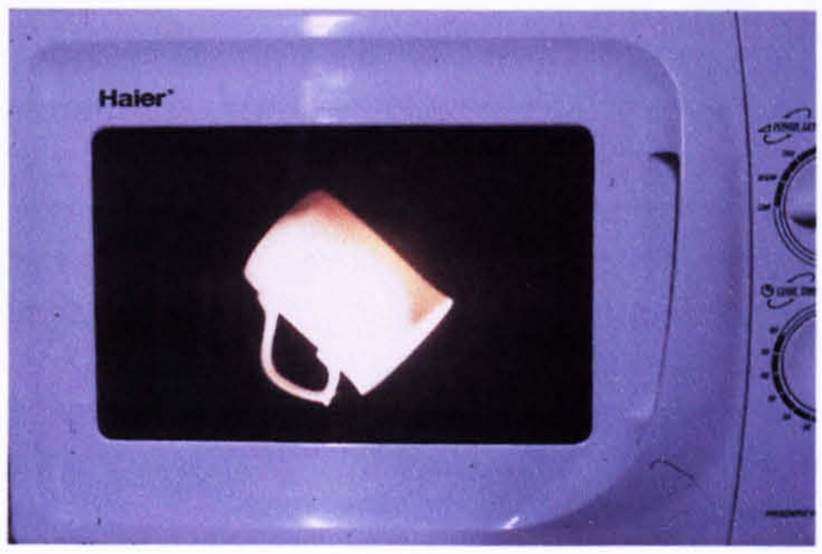


Fig. 3.2
Mug projection in microwave

Although there had been no direct relationship between a light bulb and a microwave, there is between the latter and a mug. Both are concerned with food and therefore the kitchen. This suggested that whatever object was chosen for future studies, it should be depicted in its normal everyday context or environment. This would perhaps be more likely to evoke the uncanny than an unlikely juxtaposition of objects. However, the mug also lacked credibility because it was hanging on a thread, which would not occur normally. Objects in microwaves generally sit on rotating turntables, and this, together with the slight swaying of the hanging mug, emphasised the importance that movement might play.

3. 2 Study in contextualisation - turntable

This study aimed to make an object appear to rotate within the microwave. A motor would be used to rotate a microwave turntable, with an object placed on it, so that the object would appear to rotate inside the microwave. Focus was lost when the rotating object was not placed centrally. If placed near the edge of the turntable, it came into focus for a short time, then was either not visible, or out of focus. Four different objects were placed on the turntable; with vertical black velvet dividers to reduce reflection (Fig.3.3), so that the objects would appear in focus, one by one, as the turntable rotated. Because the objects were necessarily close to the dividers, reflection from the dividers was unavoidable. Three objects and three dividers and two objects and one divider were used (Fig.3.4), but the divider was always visible at some point. The divider was subsequently made less visible by programming the lights so that as the object rotated away from the centre of the screen, the light dimmed so that it was dark when the edge of the divider passed the screen (Fig.3.5). The light then came on again as the next object came into view.

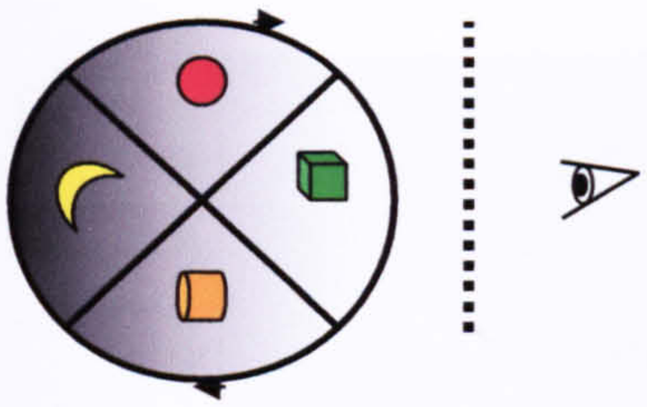


Fig. 3.3
Diagram of turntable with four objects

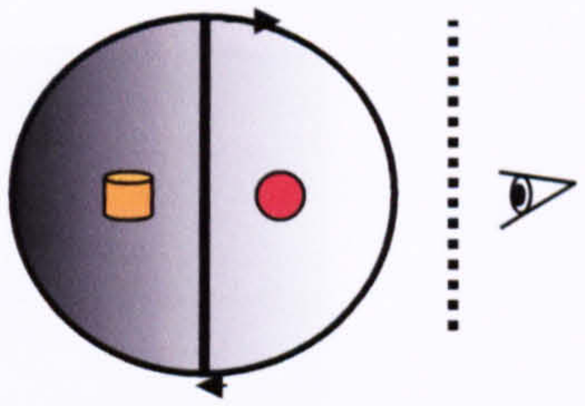


Fig. 3.4
Diagram of turntable with two objects

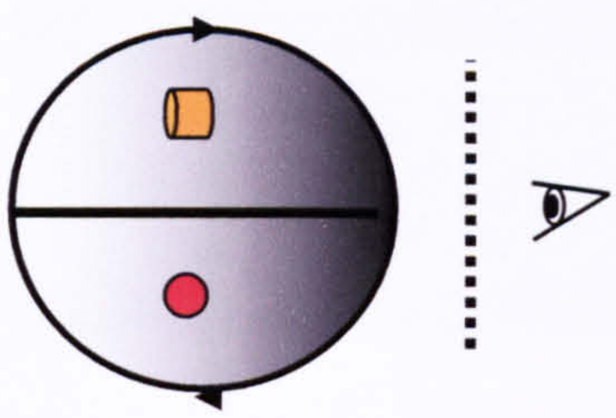


Fig. 3.5
Diagram of turntable showing divider hidden by darkness

It also proved difficult to disguise the turntable on which the objects were placed, even when covered with black velvet. The turntable remained visible and the front out of focus. Further investigations into rotation were therefore put to one side, though taken up again later in Stage IV. This study underlined the difficulty of eliminating reflection, which was apt to spoil the resulting projection, and also showed that sufficient space around an actual object was imperative.

3.3 Study in contextualisation – kitchen

This study aimed to place the microwave in a more realistic domestic type setting to contextualise it. The previous study highlighted the incongruous appearance of the microwave on its own and that the context in which it was located was important. Therefore the microwave was installed in a faux kitchen setting (Fig. 3.6), which was dimly lit so that the projection was still visible.

Fig. 3.6
Microwave in kitchen

This was an improvement on the previous presentation of the microwave and image. It was thus envisaged that additional projections might be made to appear in other domestic objects situated in a kitchen that had natural screens, such as a cooker or washing machine.

Mona Hatoum's installation *Deep Throat* (Fig.3.7), takes the viewer on a journey through the artist's body using a medical probe. The resulting video is contextualised by being projected onto a plate, which, although a moving image, is not viewed in real time, thus lacking the qualities of a live projection such as explored in this research.

Fig. 3.7
Deep Throat, 1996 (video still)
Mona Hatoum

3. 4 Study in contextualisation – window

The aim of this study was to explore other suitable domestic objects that had natural screens. A window was considered as a suitable screen within the 'kitchen'. A frame was fitted with etched glass (Fig. 3.8), but this did not look like a real window. However, the addition of a make shift glazing bar made the window appear more realistic (Fig. 3.9).

Fig. 3.8
Window

Fig.3.9
Window with glazing bar

This in effect created two separate screens, which suggested projecting two separate images, one into each pane. Therefore, two independent objects were illuminated, using two lenses (Fig. 3.10).

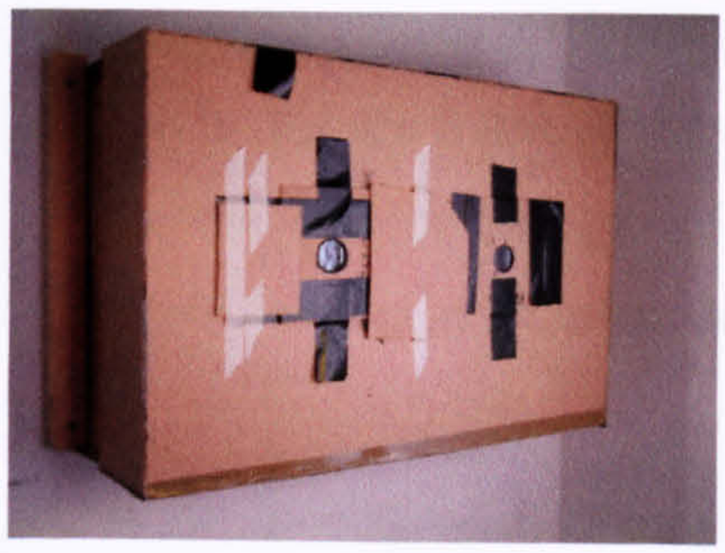


Fig. 3.10
Two lenses for projecting two images

Despite the objects being placed opposite their respective lenses, the images were picked up by both lens and appeared in the opposite screens. A divider was placed at right angles between the two lenses to try and eliminate this (Fig. 3.11). This was largely successful in separating the images, although there was some reflection from the divider itself, since it was unavoidably close to the lens.

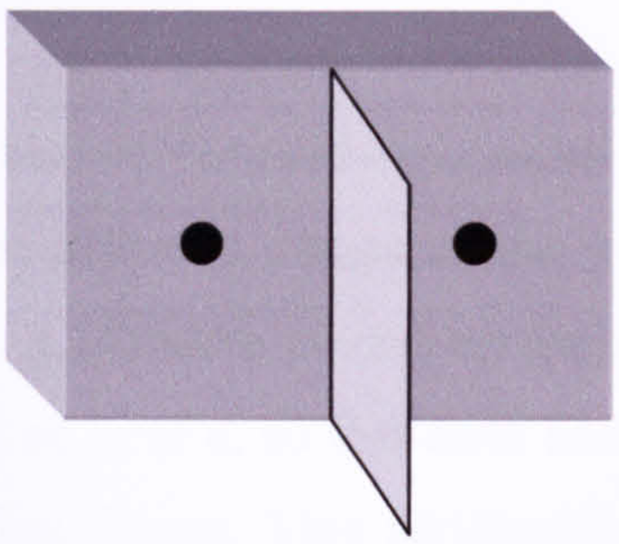
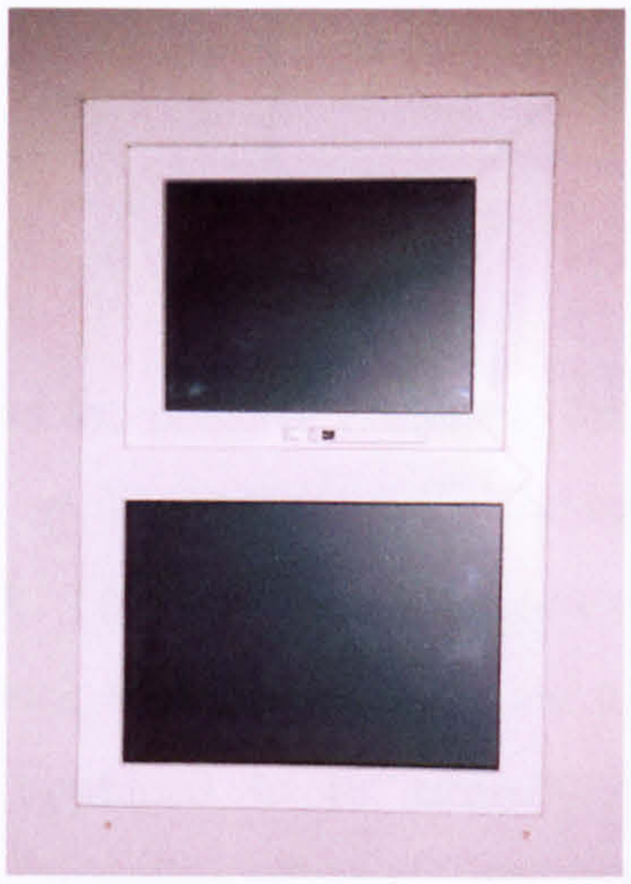


Fig. 3.11
Diagram showing divider to separate projections

A real window was then set into the wall, which was much more convincing (Fig. 3.12). It was set vertically and the box with two lenses (Figs. 3.10 & 3.11) was also turned vertically behind the window.



a

b

Fig. 3.12
Real window installed

Unfortunately, the top frame of the window, which would normally open, was recessed back from the bottom one by 1.5cm, so the two panes were on different planes, presenting difficulties in focusing the two projections (Fig. 3.13).

a

b

Fig. 3.13
Diagrammatic side view of screens on different planes

3.5 Secondary screens

The aim of this study was to overcome the problem encountered in the previous study of the different planes of the windowpane screens. The two etched screens a and b (Fig. 3.14) were placed on the same plane, with an additional piece of clear glass in front of b, at c, so that both images would appear in focus, but with glass against the window frame. This additional piece of glass in front of the etched screen did not adversely affect the quality of the image.

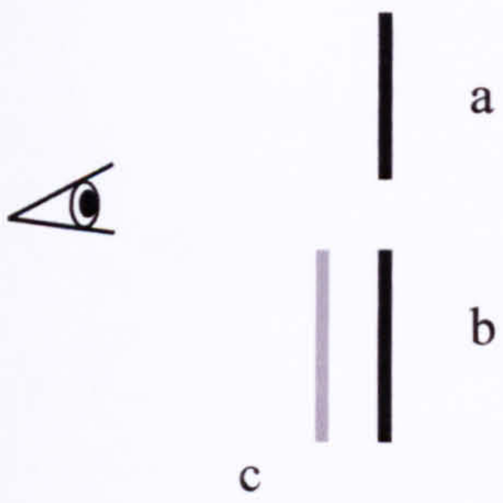


Fig. 3.14
Side view of plain glass in front of screen

In fact it had the positive effect of placing the image further back behind the window, rather than on its surface, since the actual screen on which the image appeared was further back. This resulted in the screens of other objects such as the microwave also being set back with a sheet of plain glass at the front (Fig. 3.15). The image of the mug now appeared to be actually inside the microwave, thus undermining the observer's perception of depth, which was therefore a significant development for the research.

Fig. 3.15
Etched glass screen set back behind plain glass in microwave

Whilst it had been difficult to project images so that they did not appear to be placed on surfaces, the hanging of objects was reconsidered. The hanging mug had demonstrated the importance of choosing suitable objects. The window was used to

show two separate projections of washing that owing to the natural inversion of projections, appeared to hang upside down outside the window (Figs. 3.16 & 3.17). Washing seemed appropriate to be seen outside a kitchen window. A fan activated the washing so that it would appear to blow in the breeze, but its noise was intrusive and did not create the same effect as real wind.

Fig. 3.16
Washing outside

Fig. 3.17
Close up of washing

Because a complete line of washing could not be shown in focus, the number of objects was reduced to a pair of socks in one windowpane and a flannel in another, which resulted in a rather unnatural appearance. The window could have been turned horizontally with the panes side by side, so that the washing would have appeared on one washing line, rather than one line on top of the other (Fig. 3.16). However, the results of the study suggested that this was not warranted. Due to the difficulty of making inanimate objects move, the study prompted a quest for objects that could move independently, and also play on the absence of gravity through inversion.

3.6 Study in movement with fish

This study sought to explore the potential of using independently moving objects for projection. It also aimed to investigate the ability of the camera obscura to produce an inverted image, so that although the image would appear real, it would also be strange. Fish were chosen as independently moving objects which could practically be contained within a small area. Goldfish were used because of their brightness and reflective qualities and because they also look similar whether inverted or not, so that

if they appeared to be swimming upside down, it would not be immediately obvious, and the deception therefore more subtle.

Fish are often kept in illuminated tanks. Special tank lights incorporated in the tank lid did not provide sufficient illumination for projection, so the tank was also illuminated from the front and sides (as in other studies). Fish tanks are sometimes set into wall recesses with the front of the tank flush with the wall, and the objective of the study was to produce a similarly naturally encountered scene.

It was necessary that the complete tank was not visible to the observer, since the inversion would be obvious if the tank's extremities could be seen. Therefore the aperture was made smaller, so that it did not include the entire tank (Figs. 3.18 & 3.19). An etched glass screen was placed on the inside of an opening in the wall, which would show the inverted scene to the viewer through back projection (Fig. 3.18). The viewer would therefore assume that the screen was the front of the actual tank.

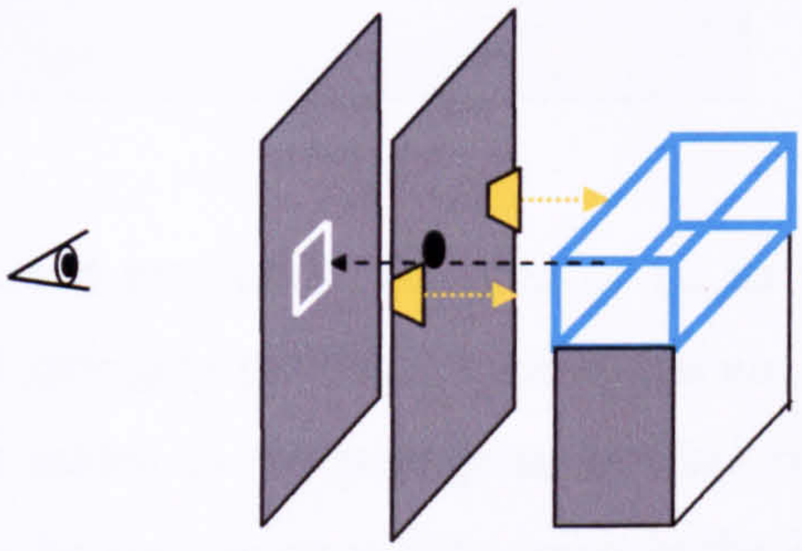


Fig. 3.18
Diagram of fish tank

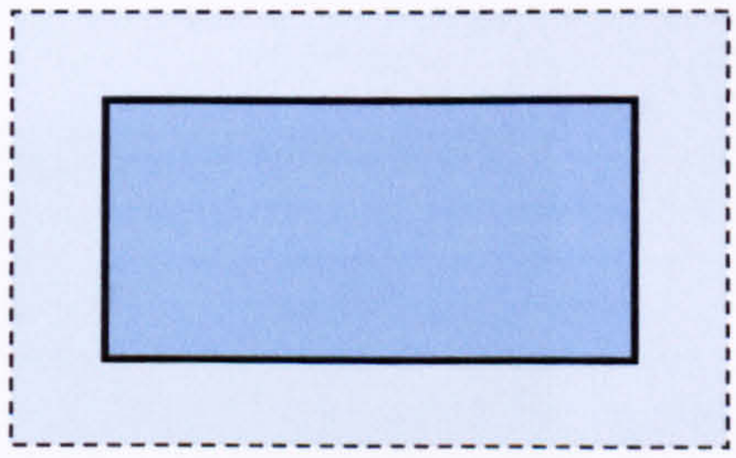


Fig. 3.19
Diagram showing aperture smaller than tank

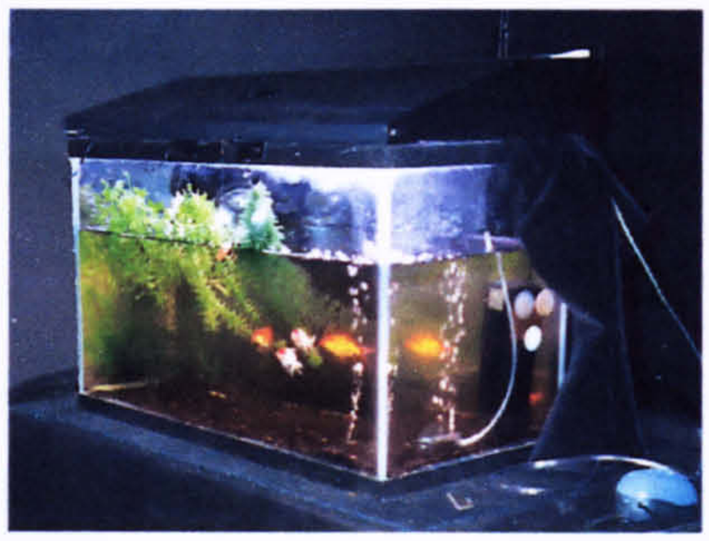


Fig. 3.20
Fish tank installation

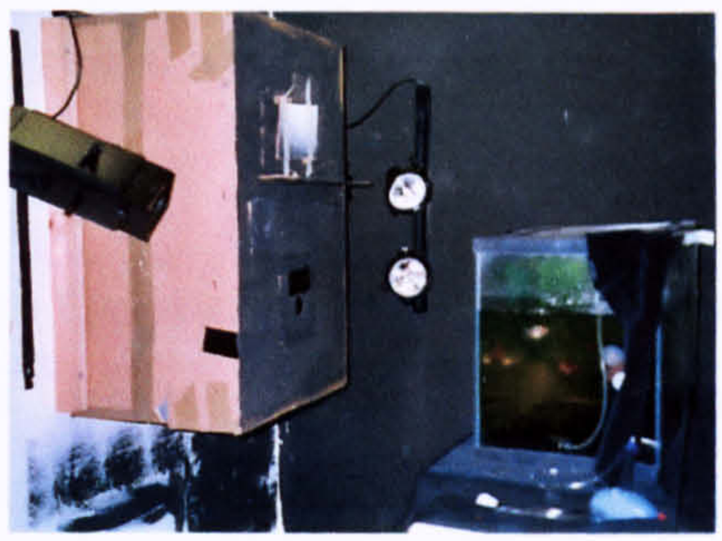


Fig 3.21
Fish tank installation with lights

The tank was filled almost to the top with water, and weed hung from the top of the tank (Fig. 3.22), so that when projected, it would appear upright.

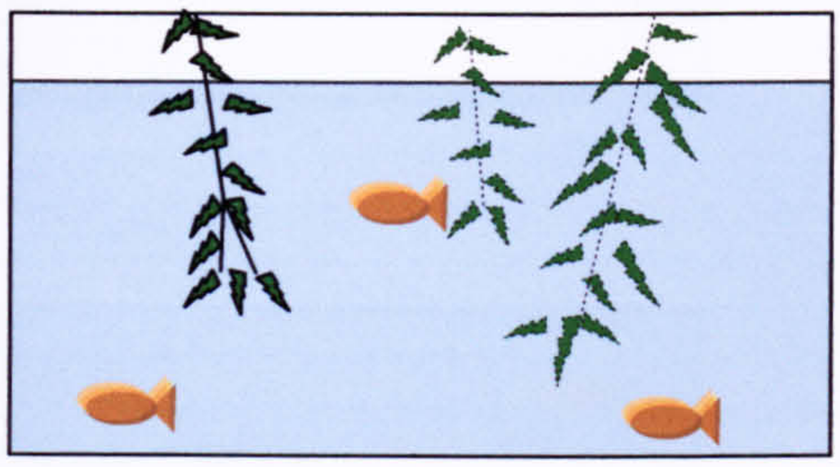


Fig. 3.22
Diagram showing weed

In the inverted projection, the area of air as well as that of water in the tank was visible, but strangely the water appeared as air, and the air as water. This unexpected appearance added to the perceptual confusion, and the fish, which seemed so real, appeared to be swimming upside down in the air, above the water below. In order to exploit this ambiguity, the level of the water was lowered, so that this unusual effect was more obvious (Fig. 3.23).

Fig. 3.23
Video still of fish showing inversion

Light reflecting off the glass of the tank caused extraneous reflections in the projection. However, black velvet fabric placed against the rear and sides of the tank eliminated this problem.

The fish only appeared in sharp focus for brief moments as they passed at the appropriate distance from the lens. This was unsatisfactory, as they needed to be in focus more frequently. This problem was largely overcome by suspending a solid food pellet in a position of sharp focus where the fish would stay for longer to feed (Figs. 3.24 & 3.25).

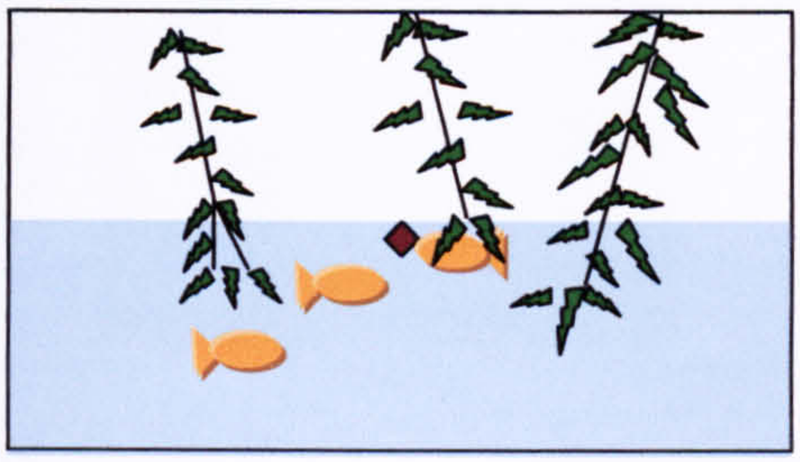


Fig. 3.24
Diagram showing food attached to weed

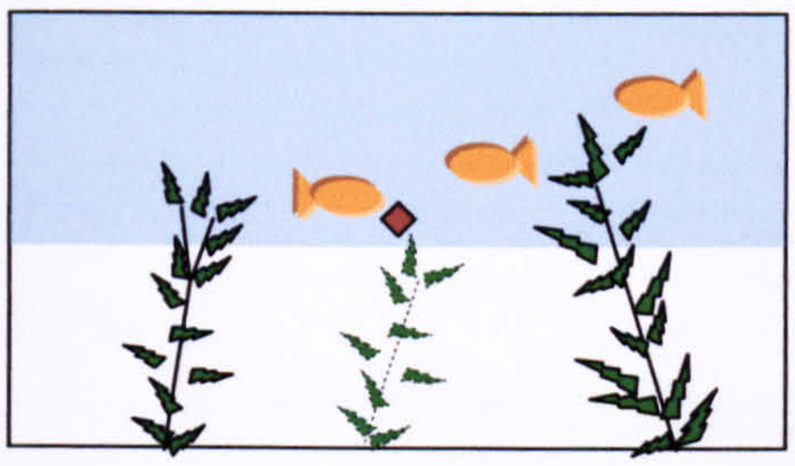


Fig. 3.25
Diagram of final fish tank projection

The study was successful because there appeared to be an absence of gravity as the fish swam upside down in the air whilst the weed appeared upright, adding to the visual ambiguity of the projected image, and successful subversion of the ordinary. The combination of upright and inverted images in Abelardo Morrell's photographic work are static images perhaps more easily 'constructed' in a photograph, and therefore less ambiguous than encountered in live imagery.

The disadvantages of the study were of a practical nature; strong lights shining on the fish and the attendant heat build up over time were not desirable for the fish's welfare, so that sustaining the installation for prolonged periods might be difficult.

3.7 Study in movement with rain

The intention of this study was again to concentrate on the ability of a camera obscura to produce an inverted image. It was hoped that the difficulty of using live creatures in the previous study could be overcome using other independently moving objects. Water was used to simulate rain so that it would appear to fall upwards, instead of down, in an apparent absence of gravity. The rain would appear to fall outside the window of a dimly lit room containing the observer (Fig. 3.26).

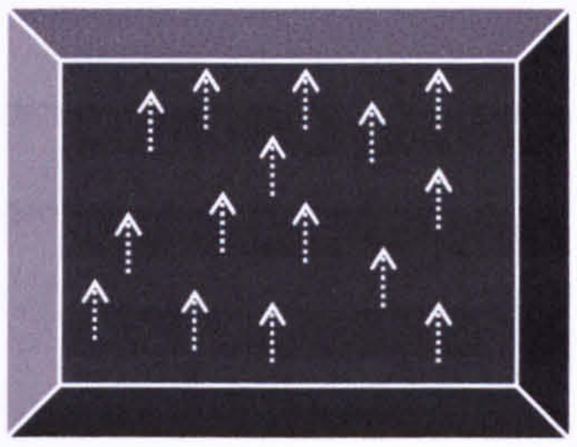


Fig.3.26
Diagram of proposed effect of rain falling upwards

A hose pierced with holes in the bottom was suspended at high level, so that the raindrops would fall in a line of focus, with a tray on the floor to catch the 'raindrops'.

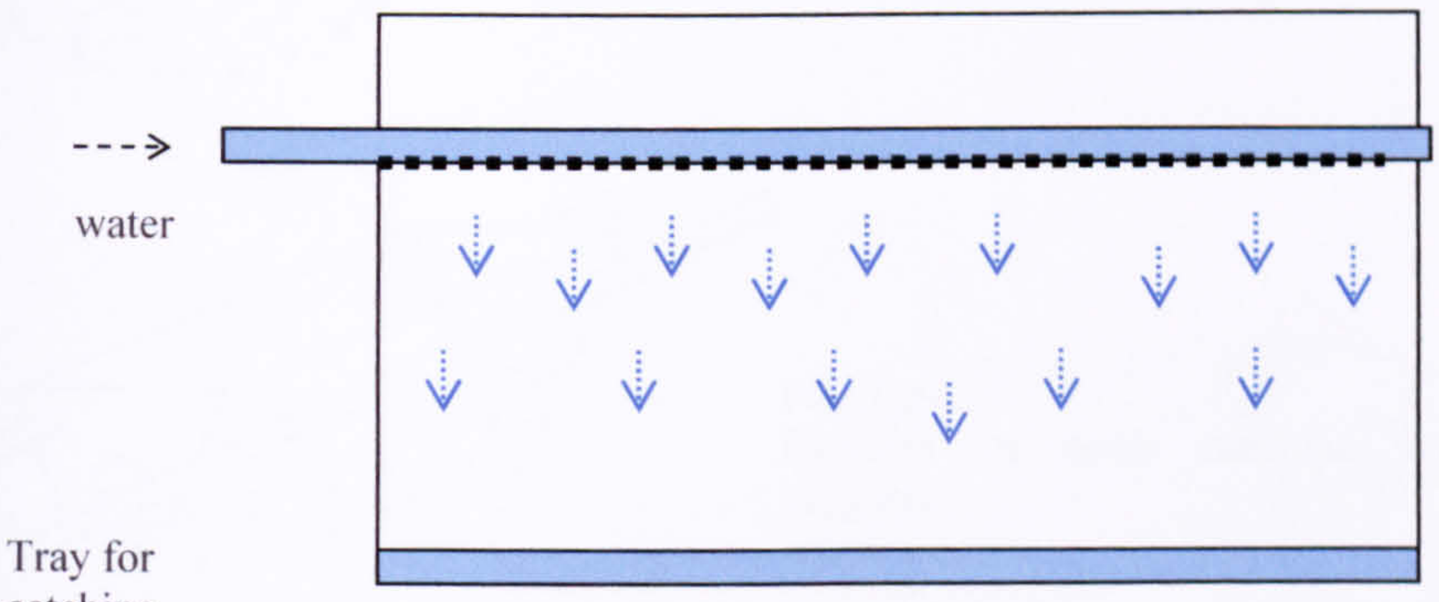


Fig. 3.27
Diagram of rain installation

However, the speed of the falling drops was too fast for them to be recognised as raindrops; they appeared as a blur and could not be distinguished when photographed. The study suggested that something that would fall more slowly was required.

3.8 Study in movement with snow

The difficulties of the previous study led to snow being used instead of rain, as it falls more slowly. Real snow could obviously not be used, and a company producing various types of fake snow was consulted. The slowest falling 'Foss Snow', made of small plastic pieces, was selected. It was anticipated that this would fall slowly enough to be recognised as snowflakes and not seen as a blur.

Methods of facilitating the 'snow' to fall in a controlled and continuous manner were investigated. A simple hand operated device was constructed (Fig. 3.28) that could be motor driven. The trough filled with fake snow rested on supports (Fig. 3.29) and a rotating cylinder was operated by a turning handle. The rotating cylinder pushed snow down through the holes set in a line in the bottom of the trough, which would then fall at the correct distance from the lens to appear in focus on the screen.

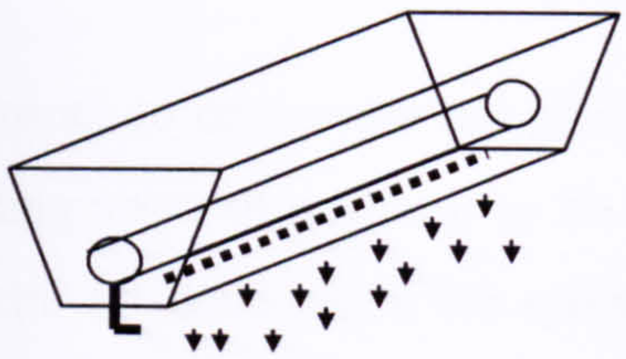


Fig.3.28
Diagram of snow machine

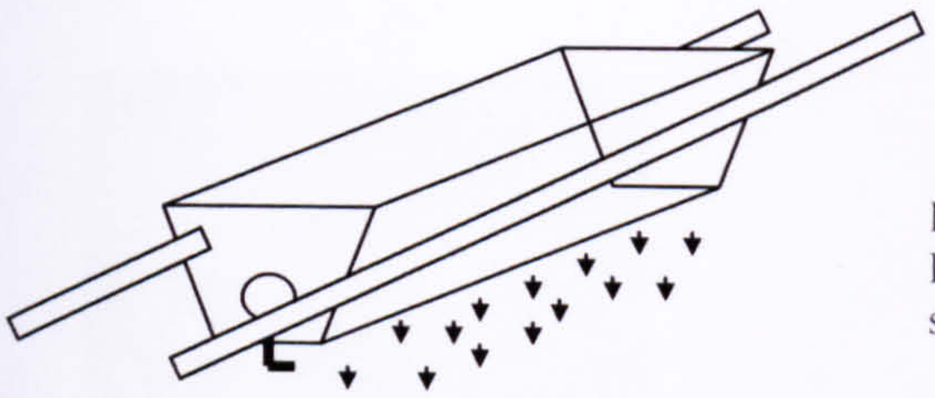


Fig. 3.29
Diagram of snow machine with supports

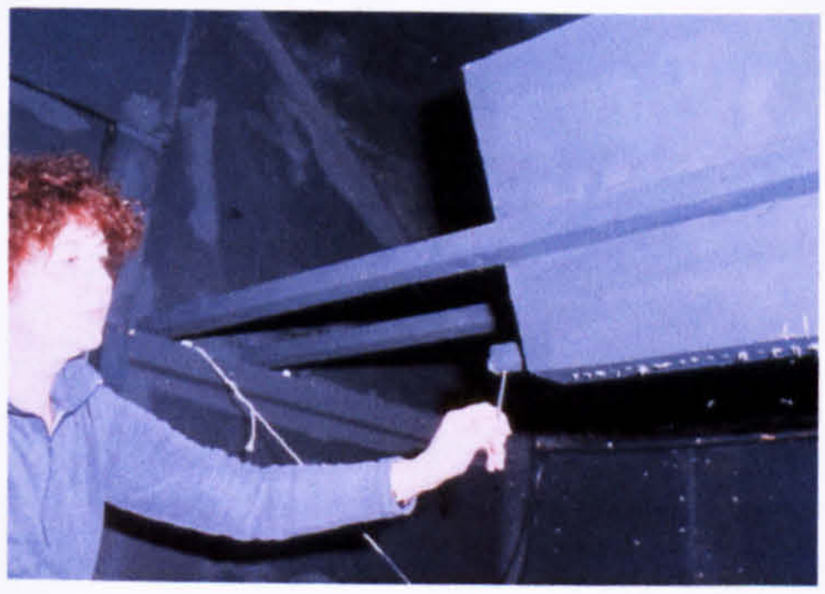


Fig. 3.30
Manual operation of snow machine

The device operated by hand worked satisfactorily. It was anticipated that the snow would float slowly rather than fall quickly like water, but it still fell too quickly. Blowers were noisy and failed to slow the fall of snow, or make it flurry. Light also failed to adequately illuminate the snow, although this was slightly better than the rain. Perhaps because it was dry rather than wet, it did not reflect light like real snow. The glow of light from the lens was also visible, so that it appeared as in Fig. 3.31

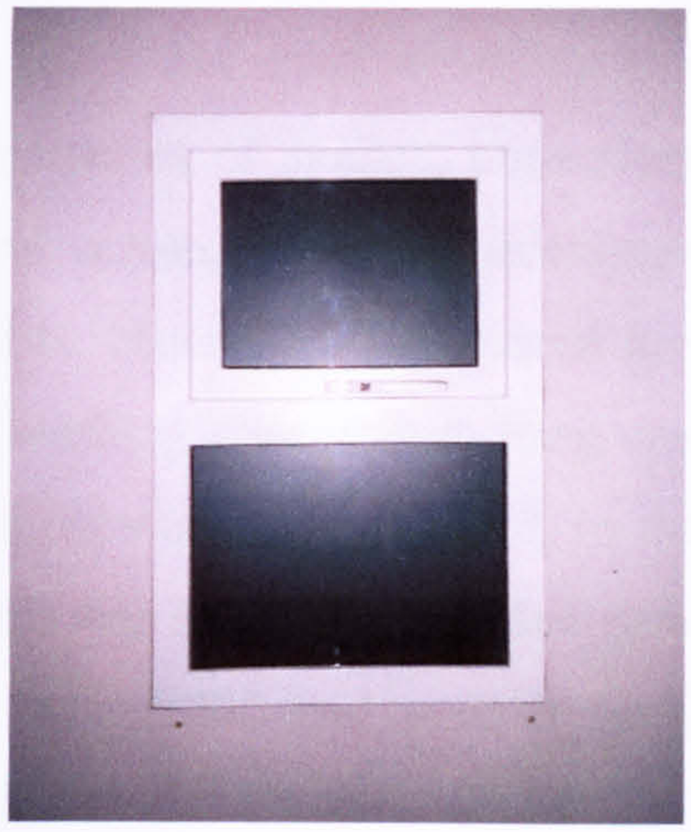


Fig. 3.31
Snow at window, with light glow

In order to counteract the glow from the lens, and to give a solid background to the falling snow to enable it to be seen more easily, a branch with ivy was placed in the centre of focus where the sphere of light would appear, with the snow falling just in front (Fig 3.32 & 3.33). This was also intended to make the scene more realistic.

Fig. 3.32
Ivy-clad branch

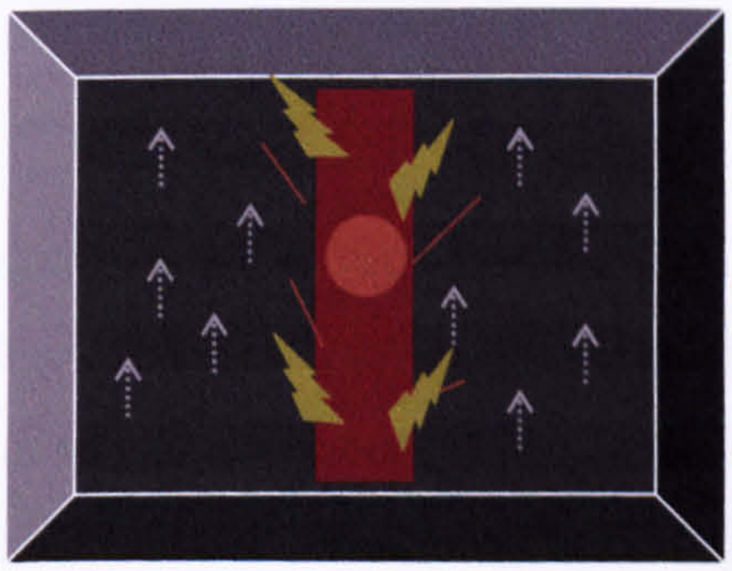


Fig. 3.33
Diagram showing limited improvement

The result was that although the ivy clad branch helped to eliminate the lens glow, and succeeded in making the scene more realistic, the snow was too insubstantial to be

seen properly, and fell too quickly to be recognisable. Therefore the inversion was not really apparent either. Photographic documentation was likewise unsuccessful. The only way in which this study could really be successful would be for real snow to be observed through a camera obscura.

Conclusion to Stage III

In this series of studies, projections were introduced into actual objects that had a natural screen, such as a microwave and a window, through which various scenes could be observed. The natural inversion of projected images began to be exploited with washing appearing to hang upside down outside the window. Movement of the actual objects was introduced, so that the washing appeared to be blown by the wind, but this was not successful. Independently moving objects, such as fish in a tank, were more successful, and seemed particularly surreal, as they were appeared to swim upside down in the air. The fish tank appeared as if set into a wall and showed that contextualisation with actual objects might not be desirable after all. Studies with rain and snow, which were intended to exploit the apparent absence of gravity, were unsuccessful.

At this stage, various practical issues were evaluated and addressed as follows:

i. Documentation

The quality of softness observed in camera obscura images is likewise observed in photographs of these images. Such softness however should not be confused with a lack of correct focusing of lenses, and is a quality that artists such as Leonardo and Vermeer seem to have appreciated and deliberately exploited in their paintings.

Since camera obscura projections are experiential, they are not intended to be viewed through reproduction. Diagrams have been used where photographic documentation was difficult or inadequate, particularly in instances where all parts of an installation are being discussed. Difficulties encountered with documenting the work of Turrell and McCall have already been discussed.

Front projected images are easier to photograph, but back projected ones more difficult. Back projected camera obscura images lose some definition since they are projected onto glass which has a graininess to it, and therefore do not reproduce well. Fig. 3.34 shows the typical feature of back projection where the viewer effectively looks through a slightly grainy screen into the light that comes through the lens, as a kind of circular glow. To some extent this is ignored by the eye, but more obvious when photographed. It is not as apparent when the objects are small and solid, but more noticeable with larger, more solid objects. Repeated studies and authoritative confirmation (see ii below) proved that this feature could not be altogether eliminated in back projection, but by judicious choice of object, be made less noticeable. The snow machine study highlighted the problem of not having a solid object to reflect light, yet a solid white card could be equally problematic, since it exacerbated the glow or flare of light.

The poor and blurred image in Fig. 3.34 demonstrates the difficulty of capturing a moving object using conventional photography. Fig. 3.35 shows a still taken from video footage, which was more successful in capturing movement.

Fig. 3.34
Conventional photograph of fish

Fig. 3.35
Video still of fish study

The area of projection captured by photographic reproduction is considerably reduced to that visible to the human eye (perhaps by as much as half). It should therefore be noted that photographs and video footage of projected imagery in this thesis are inadequate reproductions of the live projections.

ii. Extraneous light

As discussed, the problem of extraneous light from the lens interfering with the image on the screen is more apparent in a photograph than in reality. The fact that this could not be totally eliminated using back projection was confirmed by the Science Museum in London. However, by the careful selection of objects, this phenomenon could be made less apparent.

iii. Curtain screens and studio installation

A persistent problem encountered in back projection was of extraneous light reflection from behind the illuminated object that interfered with and adversely affected the projected image. It was important to eliminate as much light as possible, since the darker the background to the illuminated object, the better the appearance of its projected image, and the more isolated the object appears when thrust towards the viewer out of dark space. As in the light projections and skyspaces of Turrell, a lack of depth perception can have a destabilising effect upon the observer.

In order to make the area behind the illuminated object as dark as possible, and to reduce reflection, black velvet curtains (which reflect the least light), were hung as closely as possible to the object without obstructing the light illuminating the object (Fig. 3.36). The curtains cast shadows behind, and where these shadows crossed over, the shadow was even darker. Black velvet on the wall behind the object also reduced reflection and made the background darker. These measures to increase the contrast between light and dark considerably improved the quality of the projected images.

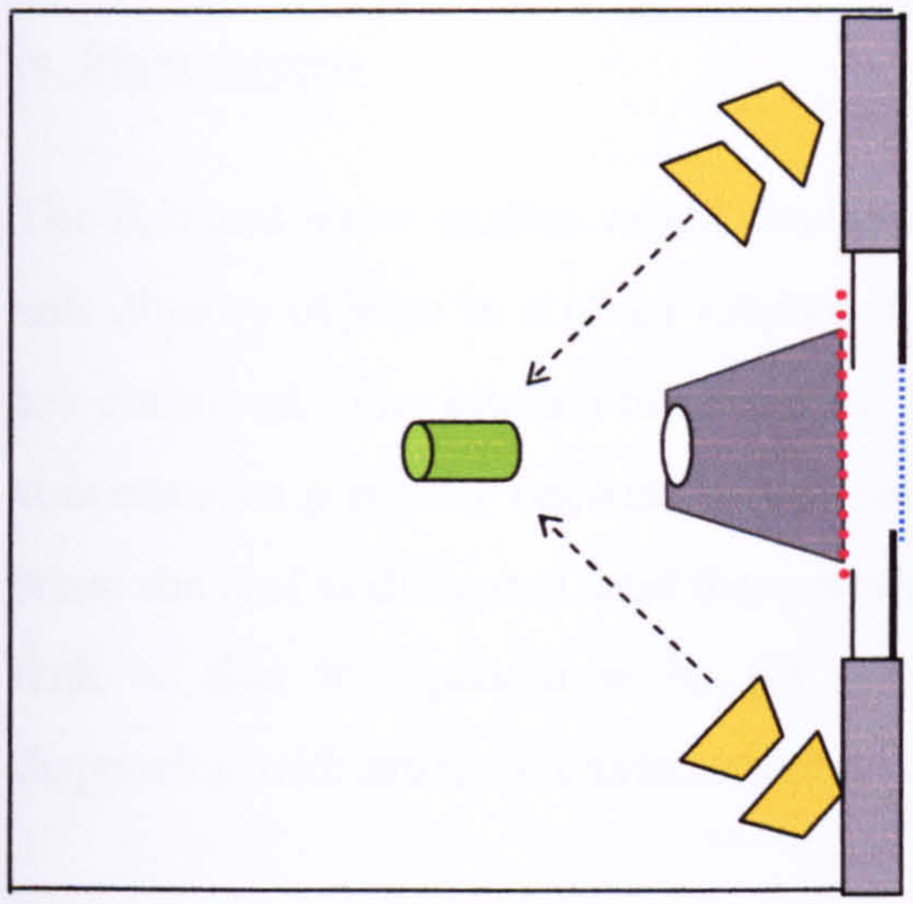


Fig. 3.36
Diagram of installation before curtain screens

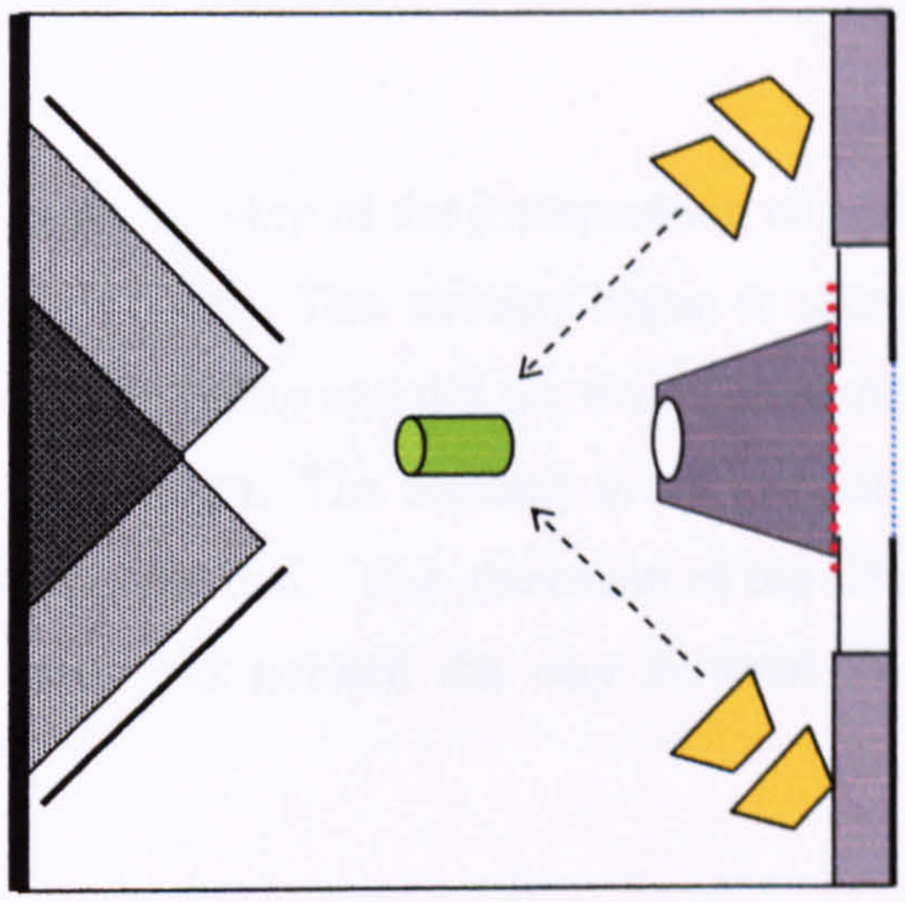


Fig. 3.37
Diagram of installation with curtain screens

Plain glass

Object

Spotlight

Lens set in adjustable diaphragm

Etched glass screen (red)

Black curtain screen to create shadow behind illuminated object

Shadows cast by curtain screen with darker area where shadows overlap

Black velvet on rear wall

iv. Plain screens

The fish and snow studies raised doubts about the validity of the juxtaposition of real and illusory objects in a quasi kitchen or similar room. This strategy began to seem too contrived. The kitchen for example, lacked credibility and did not evoke uncanny connotations precisely because it was not a real kitchen. The uncanny is apt to occur when the real is disrupted, and these settings were not real. The placement of the fish tank so that it appeared to be set into a wall had pointed the way forward for dispensing with artificial environments.

The abandonment of the objects in which to place the projections would be a radical change. The projections themselves would become all important without their attendant objects. The viewer's attention had been diverted from the projections themselves by their surroundings, and whilst physically these juxtapositions had been successful, it was decided that future studies would focus on improving the screens and the quality of the projected images. This meant that the observer's attention could now focus only on the projections, without distraction. Ambient light had always diminished the quality of the projections in a room, and this decision justified its total elimination.

Projections would henceforth appear on screens recessed into the wall, as setting the screen back increased the ambiguous situation of the projections, thus undermining the viewer's ability to judge depth. Turrell's *Ivor Blue* particularly influenced this, where a large rectangle opens onto a homogenous space flooded with colour, which makes it impossible to evaluate the depth of space.

By concentrating only on the presentation of the images, a more direct and contemplative quality was introduced, that was totally lacking in any excrescences, rather like the still life paintings of Cotan. The size of screen would no longer be restricted to that of an object such as a microwave, so that the projected object would lack visual clues to locate it and therefore emphasise its isolation in space. This, like the work of Turrell, would present a greater challenge to the viewer's perception. The observer would now enter an entirely dark space, resembling a typical walk in camera obscura where the only light would come from the projection itself. The darker the observer's space, the better the clarity of projected image, and therefore the entire

room, including the ceiling and floor, were painted matt black, to improve the quality of the projections.

The plain glass screen at the front facing the viewer was now superfluous. Normal glass had reflected light that interfered with viewing the projections. Even etched glass has a reflective side, which had previously faced the viewer to give authenticity to microwave screens and windows. Having discovered that the quality of the image itself was not affected by which side faced the viewer, the etched side could now face the viewer, thus eliminating all reflection. This was a welcome improvement that greatly enhanced the viewing experience.

Screens were recessed into the wall from between 7cm to 12cm. The aperture in the wall was smaller than the screen, making it more difficult to judge the plane on which the image appeared in relation to the wall, and increasing the ambiguity of the image's location. The edges of the recess were angled back so that they could not reflect light (a strategy observed in Turrell's installation, *Ivor Blue*) that would give visual clues about even the existence of an aperture. An observer entering a completely dark room was now less able to easily determine the locations of wall, aperture, screen or image. Now the observer's concentration was directed only on the images before them, which in turn did not appear to be in a space that was bounded by walls, or floor, or ceiling. This was not unlike Job Koelwijn's *Cinema on Wheels,* where the attention of the observer is limited to the screen and their perceptual uncertainty is heightened by the location of the images.

STAGE IV

4.1 Study with multiple installations

A move to a much larger studio provided the opportunity to implement changes and construct three specific dark spaces with a central observation area (Fig 97). This increased space proved beneficial to the research. Although the observer could now view three different images from the same area, the projections were not related to one another as the images shown in the kitchen had been. Each was intended to be a separate experience, to be seen sequentially and not simultaneously.

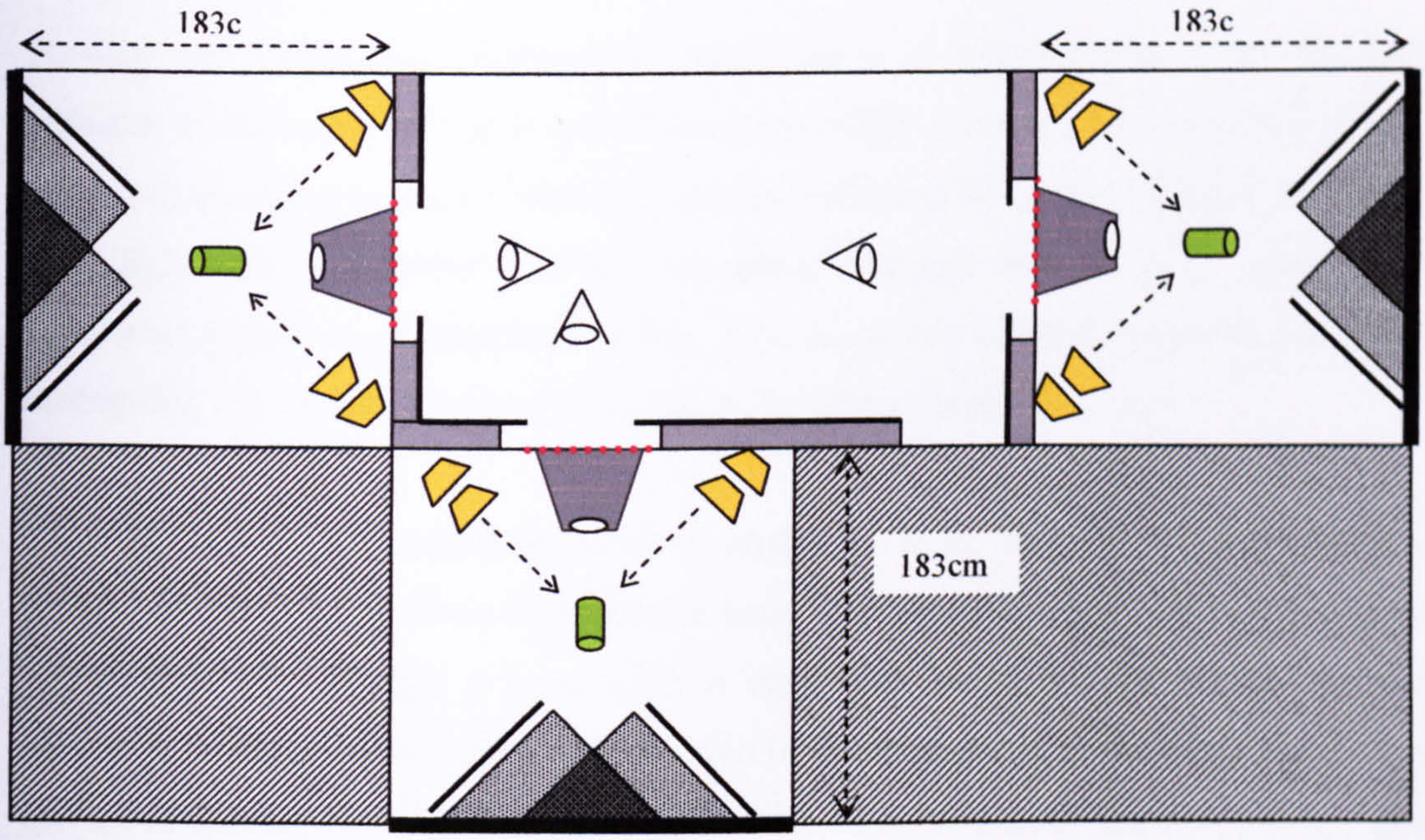


Fig. 4.1
Diagram of three installations with observer area, showing plain glass in front of translucent screens removed

The size of projected images could be altered by the adjustment of lenses and distances. Extreme enlargement of an image however, as in the enlarged light bulb installation, required an extensive space. If the huge apple in Magritte's *Listening Room* could appear so strange and surreal, then surely changing the size of the objects projected in the research could prove equally unsettling. However, the many tests carried out manipulating the sizes of projected objects had surprising results. The conclusion seemed to be that unless the object was juxtaposed with another of a very different size, like the apple in the room of Magritte's painting, no tension was created. When the objects were isolated in space, without reference or comparison to other

objects, even doubling the size of an object surprisingly seemed barely noticeable, with the observer seeming to accept these alterations without question. The exception to this was the obvious and greatly enlarged light bulb image that appeared related to the room it was in, similar to Magritte's apple in *The Listening Room*, which becomes suffocatingly huge in relation to the constraints of the space it inhabits. It was decided that the size of projected images would be generally maintained, but adapted where and when appropriate.

4.2 Study with visually dissolving surfaces and eliminating means of suspension

Bearing out Leonardo's observations that shadow is stronger than light, the early research studies showed that it was difficult to visibly eliminate altogether the surface on which an object is placed, since any surface reflected light, even if black velvet, the least light reflective material of all, was used, although this did help considerably. Ideally an object would appear as in Fig. 4.2a, since this might increase its perceptual ambiguity, but usually appeared as in Fig. 4.2b, where there was none.

The only way for the surface on which an object sits to be invisible to the viewer is to move the object up or down opposite the lens. This is very much a matter of minute adjustment, and although it is possible to show just the object, the object can only appear at the edge of the screen. It will also be unsatisfactory, since either the surface on which the object sits will be just visible (Fig. 4.2c), or a small amount of the object will be out of view (Fig. 4.2d).

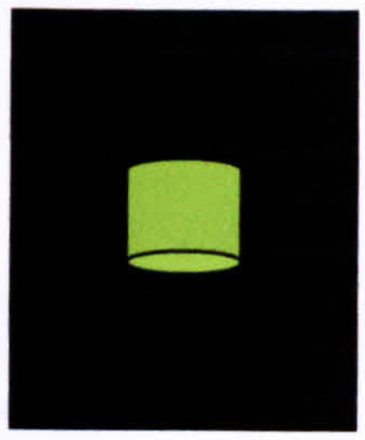


Fig. 4.2a

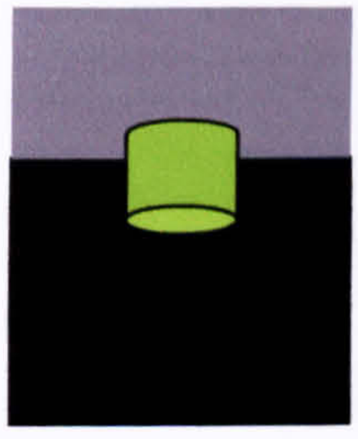


Fig. 4.2b

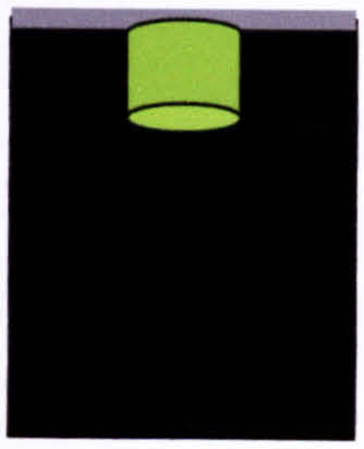


Fig. 4.2c

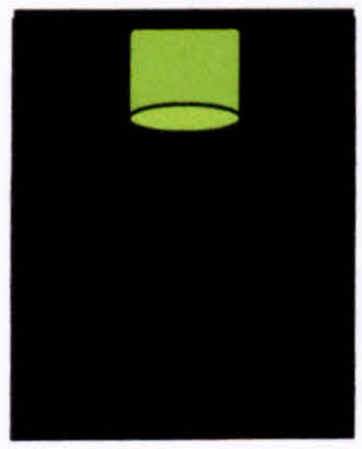


Fig. 4.2d

Fig. 4.2a, b, c & d
Diagram of studies to eliminate surfaces

A light bulb, mounted on a black painted base and carefully placed, could be positioned so that only the bulb was visible. It seemed to make little difference which way up the light bulb image appeared, so a bulb was hung so that its image appeared the other way up, near the bottom of the screen so that the flex was not seen. The hanging light bulb had suggested that other suitable objects might be suspended, such as the cup. Suspending an object without seeing its means of hanging however meant that the image could not appear in the centre of the screen (Fig. 4.3).

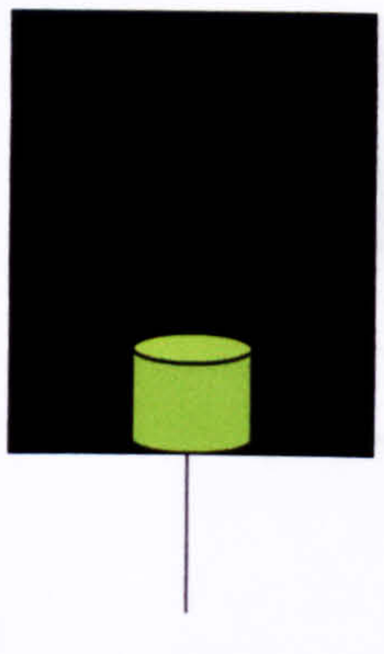


Fig. 4.3
Diagram showing elimination of thread by positioning

If the object were to appear in the centre of the screen, the thread would be visible as in Fig. 4.4. Black thread helped to disguise this, but was not totally invisible, since it reflected some light (Fig. 4.5). Ordinary invisible thread reflected even more light than black, and was not suitable. A very fine invisible thread used by magicians was obtained in the hope that this would truly be invisible. Although less visible than other threads, it could still be seen.

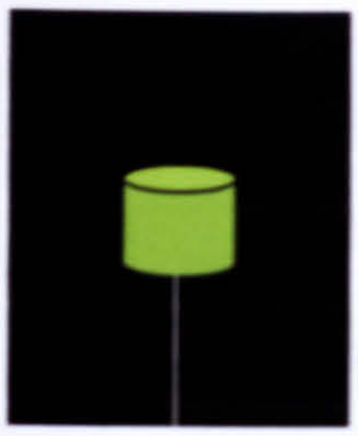


Fig. 4.4
Diagram using black thread

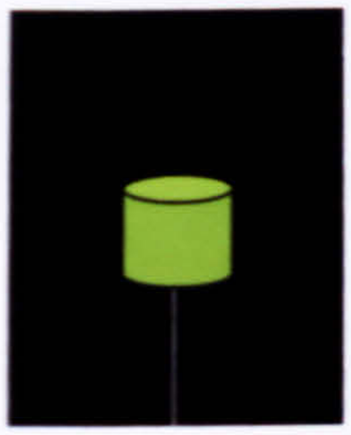


Fig. 4.5
Diagram using 'invisible' thread

4.3 Study with suspended objects exploiting means

The aim of this study was to seek suitable objects which would have a natural affinity with being hung, such as the vegetables hanging in Cotan's *Quince, Cabbage, Melon and Cucumber*, given that it seemed impossible to eliminate the appearance of hanging threads altogether. It was decided that they should become part of the work, and that it was the objects themselves that would need to change. The projection of some hanging objects, like a notebook, or a cup, worked well, but looked somewhat unnatural.

A single apple was hung on a piece of string so that the string was deliberately visible (Fig. 4.6). This was satisfactory because instead of attempting to disguise the string, (which had never been totally successful), it became integral to the work.

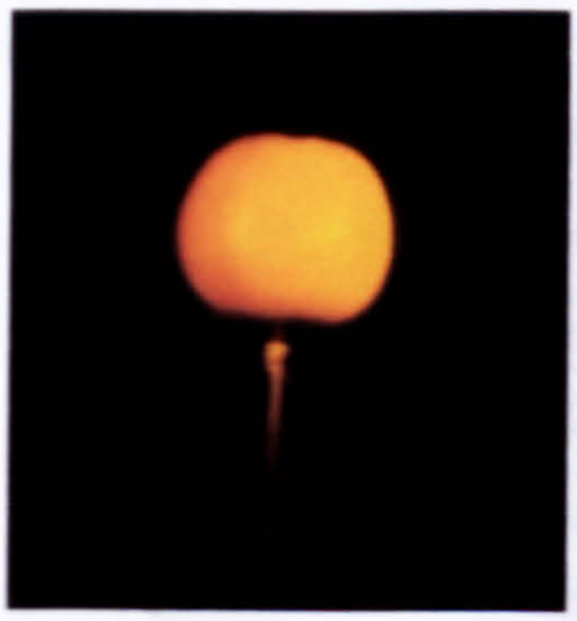


Fig. 4.6
Projected apple showing string

A reel of green string was then hung by its own material, so that the means of hanging and the object were integral, in the same way as the light bulb was its own light source (Fig.4.7)

Fig. 4.7
Green reel inverted

This was more successful because it exploited the effect of inverting the object through projection, thus causing it to appear to deny gravity and seem strange and uncanny. Objects known to have weight appeared weightless when inverted, and the apparent tension of the string seemed to make no sense at all when the heavy object was at the top. A practical problem had been successfully overcome by choosing objects with an intrinsic connection with hanging, whilst at the same time exploiting the natural inversion of camera obscura images.

4.4 Study with illuminating light bulb

The intention of this study was to alter the appearance of a familiar object, by the modulation of light, thereby intensifying its ambiguity. In Stage II, a light bulb had been made brighter or dimmer, but now a light bulb would itself be lit.

A bulb was hung opposite a single lens and placed between two sets of spotlights (Fig. 4.8). The bulb was programmed so that at first it was barely perceptible, and as the level of illumination slowly increased, become recognisable. The bulb then dimmed, and slowly became illuminated by spotlights on either side. These lights then dimmed and the sequence was repeated.

Fig. 4.8
Light bulb illuminating itself

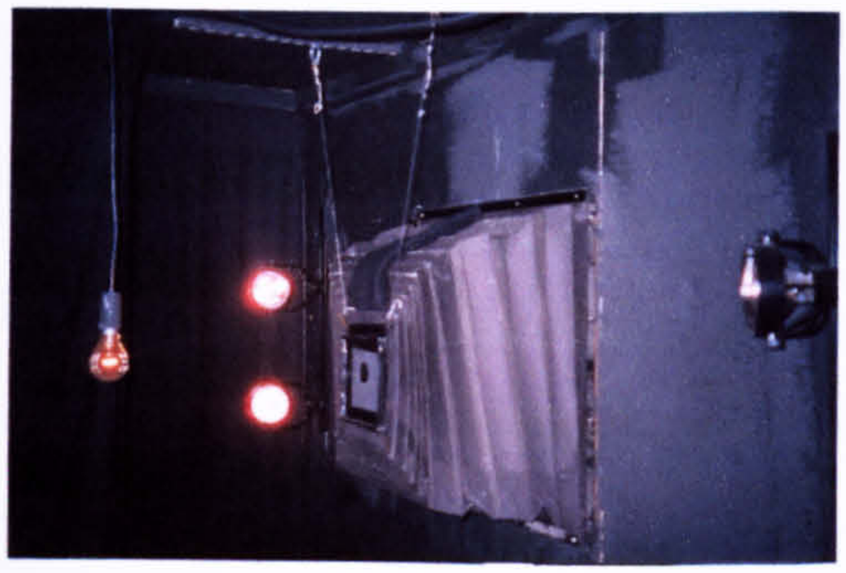


Fig. 4.9
Light bulb illuminated by spotlights

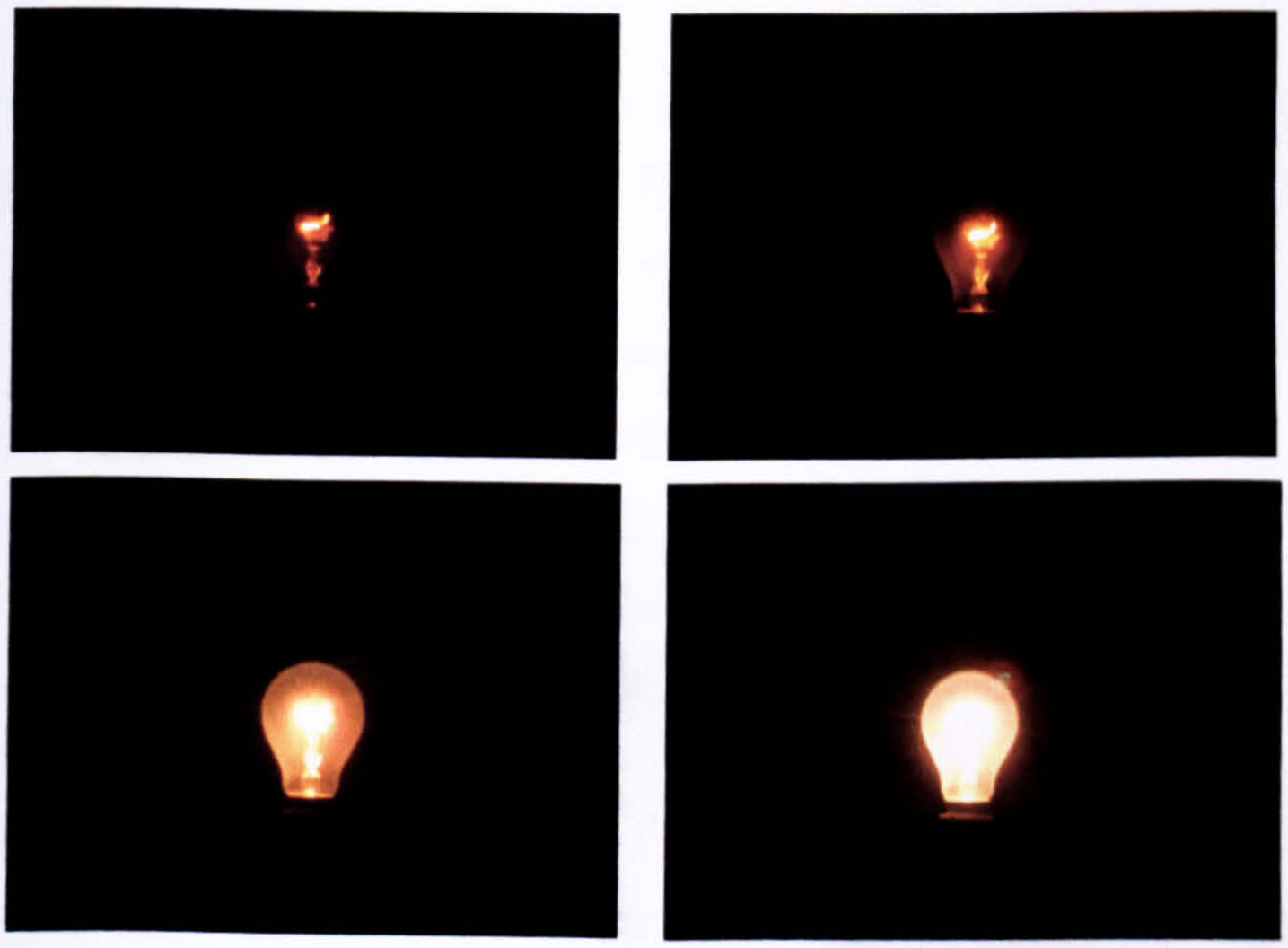


Fig. 4.10a, b, c & d
Light bulb illuminating itself becoming brighter

Fig. 4.11
Light bulb illuminated by spotlights

This study altered the appearance of the bulb by varying its means of illumination. At first the observer perhaps did not question the appearance of the bulb when illuminated by itself, but as the illumination changed, previous assumptions began to be undermined.

4.5 Study with multiple imaging

This study set out to investigate the potential of doubling the projected images in order to explore notions of the uncanny. The doubling or multiplying of images earlier in the research with pinhole photography was now investigated further. If the pinhole camera with two holes could produce doubled images, it should be possible to produce two identical projected images using two lenses.

An apple was suspended opposite two identical lenses set next to one another horizontally (with centres 8cm apart) (Fig 4.12). Two identical images appeared side by side on the screen (Fig.4.13).

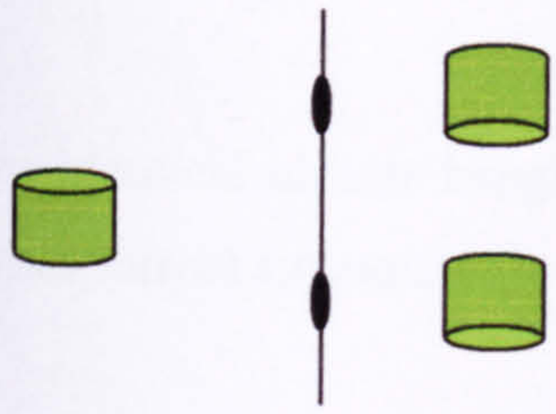


Fig. 4.12
Diagram of object opposite two lenses

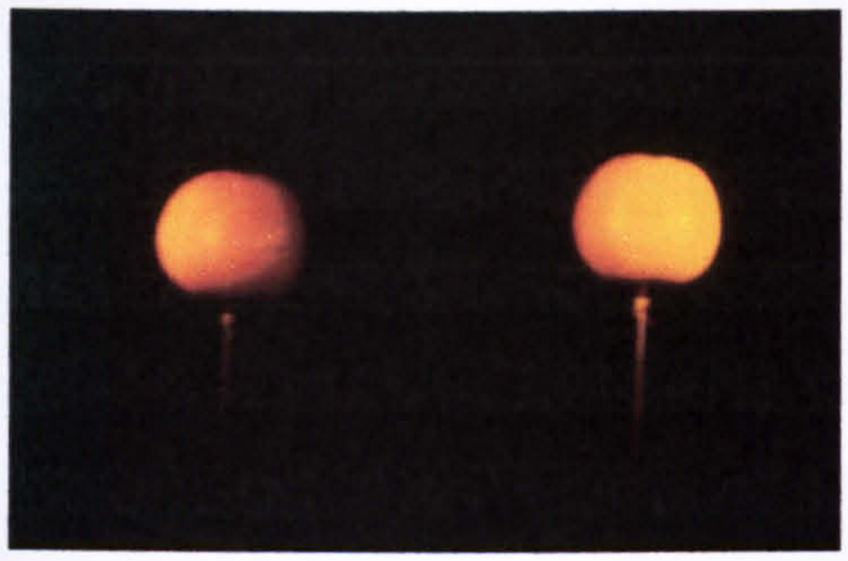


Fig. 4.13
Double inverted apple projection

Because the lenses were too far apart, focus of the projected images was lost at the outer edges as the distance between the lens and one side of the object and the other were too great (Fig. 4.14).

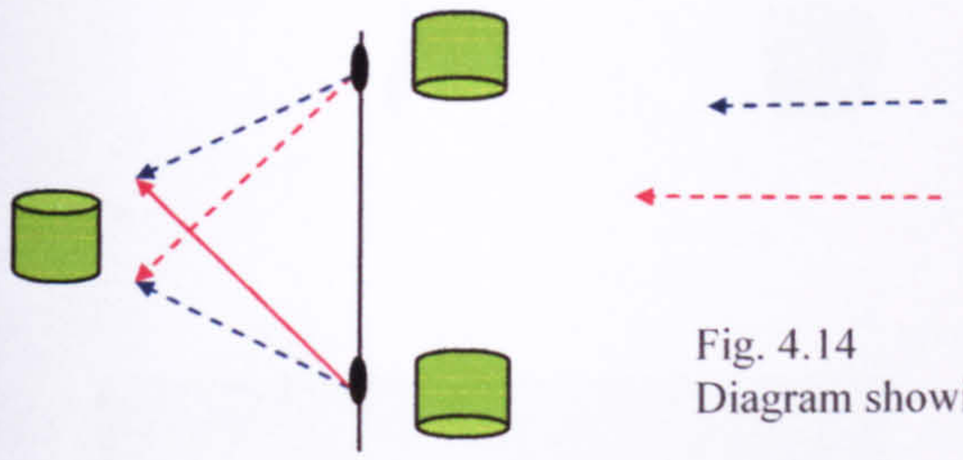


Fig. 4.14
Diagram showing lenses two far apart

Placing the lenses closer together (with centres 5cm apart) improved the quality of the images (Fig 4.15).

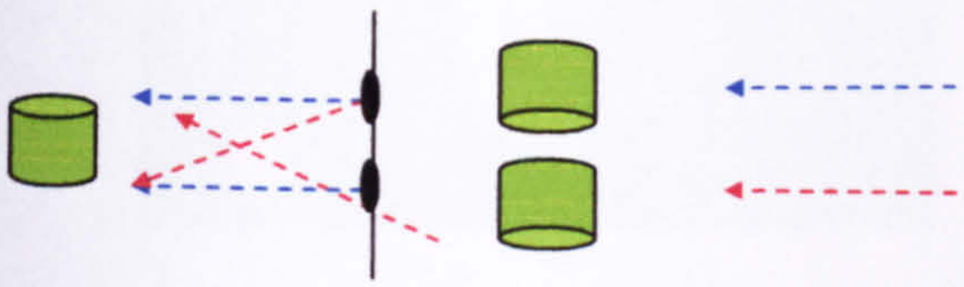


Fig. 4.15
Diagram showing lenses closer together

The two identical objects hanging upwards and swinging identically in tandem had a somewhat surreal appearance.

4.6 Study with triple imaging

The effectiveness of the previous study prompted a study to explore triple projection. A single green reel was suspended opposite three lenses set together horizontally. Initially the lenses were placed with centres 5cm apart, but focus was lost at the outer edges of the projections, and therefore the lenses were repositioned as close together as possible, with centres 4.5cm apart. This improved the focus of the outer edges of the projections (Fig 4.16).

Fig. 4.16
Diagram showing object, three lenses and three projections

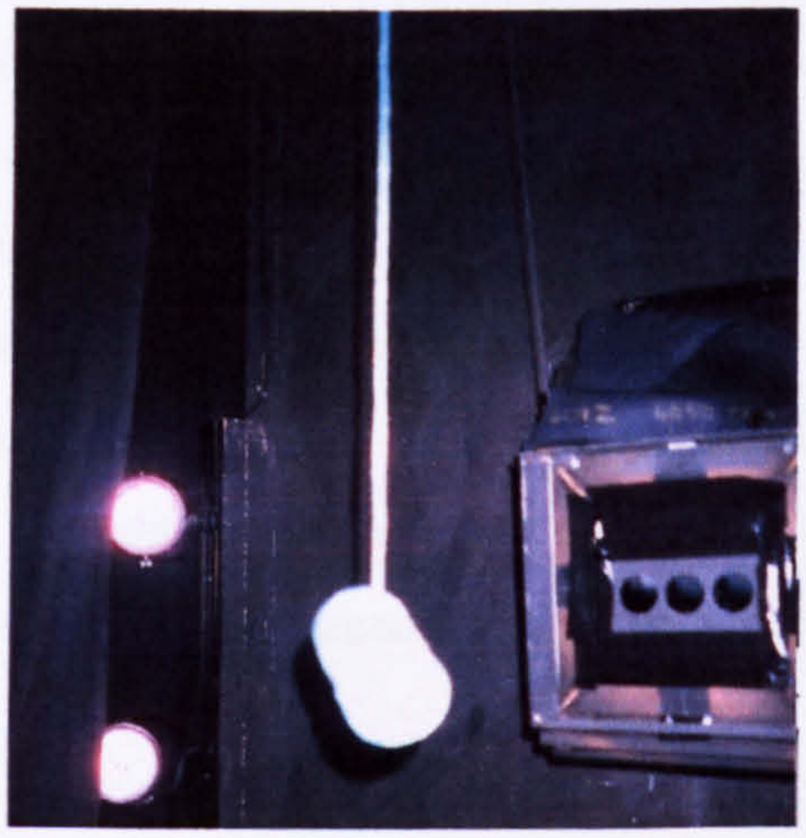


Fig. 4.17
Green reel opposite three lenses

The successful production of three clear images demonstrated the potential of the camera obscura to increase the ambiguous appearance of ordinary objects.

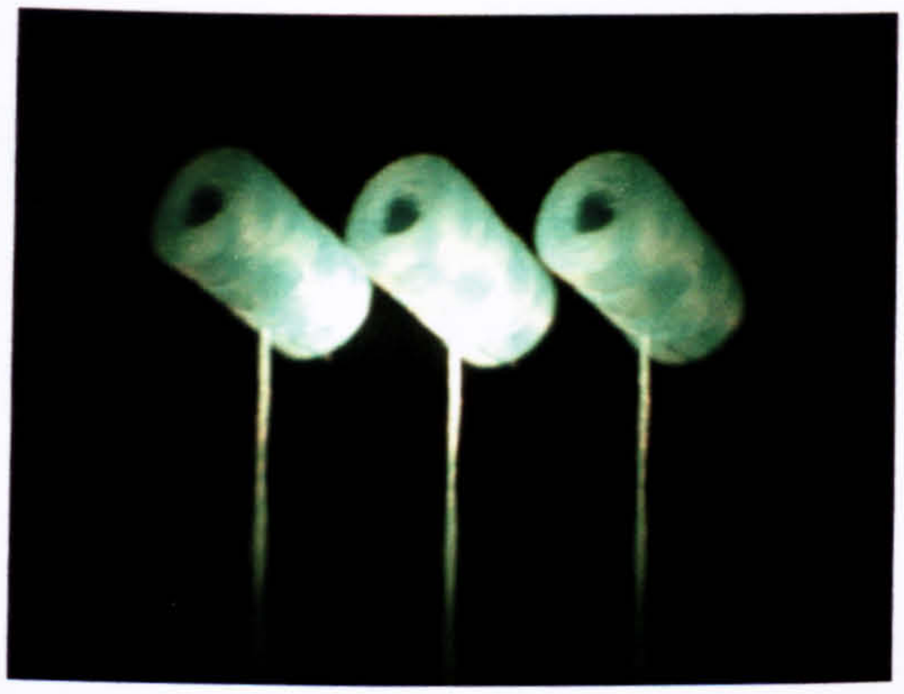


Fig. 4.18
Triple reel projection

If more than three lenses were used alongside one another, focus of the outside images would become very poor. It was also considered that increasing the number of projected images further would be unnecessary, confusing and merely gimmicky.

4.7 Study with smoke

As a result of the previous study to produce triple imagery, the aim of this study referred to previous studies such as the rain and snow, to find suitable independently moving objects. Smoke was chosen as it moves independently, but more slowly (when not subject to a draught), than rain or snow. Smoke from an incense stick moving slowly in a relatively controlled manner should be identifiable, and not appear as blurred as rain or snow. The image inversion would be self-evident, as the smoke appeared to move uncharacteristically downwards and contrary to gravitational forces. An incense stick was placed opposite the three horizontal lenses as for Study 4.6 (Figs. 4.19 & 4.20).

Fig. 4.19
Incense stick with smoke swirling

Fig. 4.20
Incense stick with smoke as a line

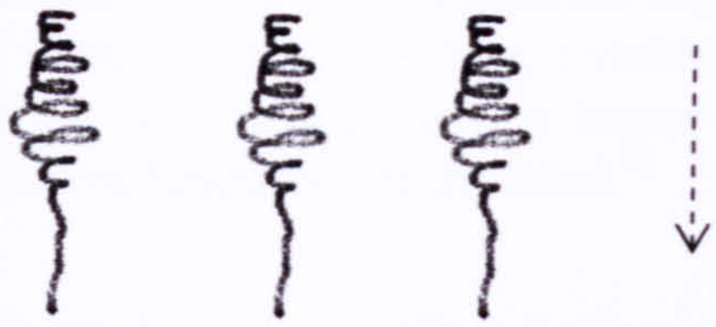


Fig. 4.21
Direction of smoke when projected

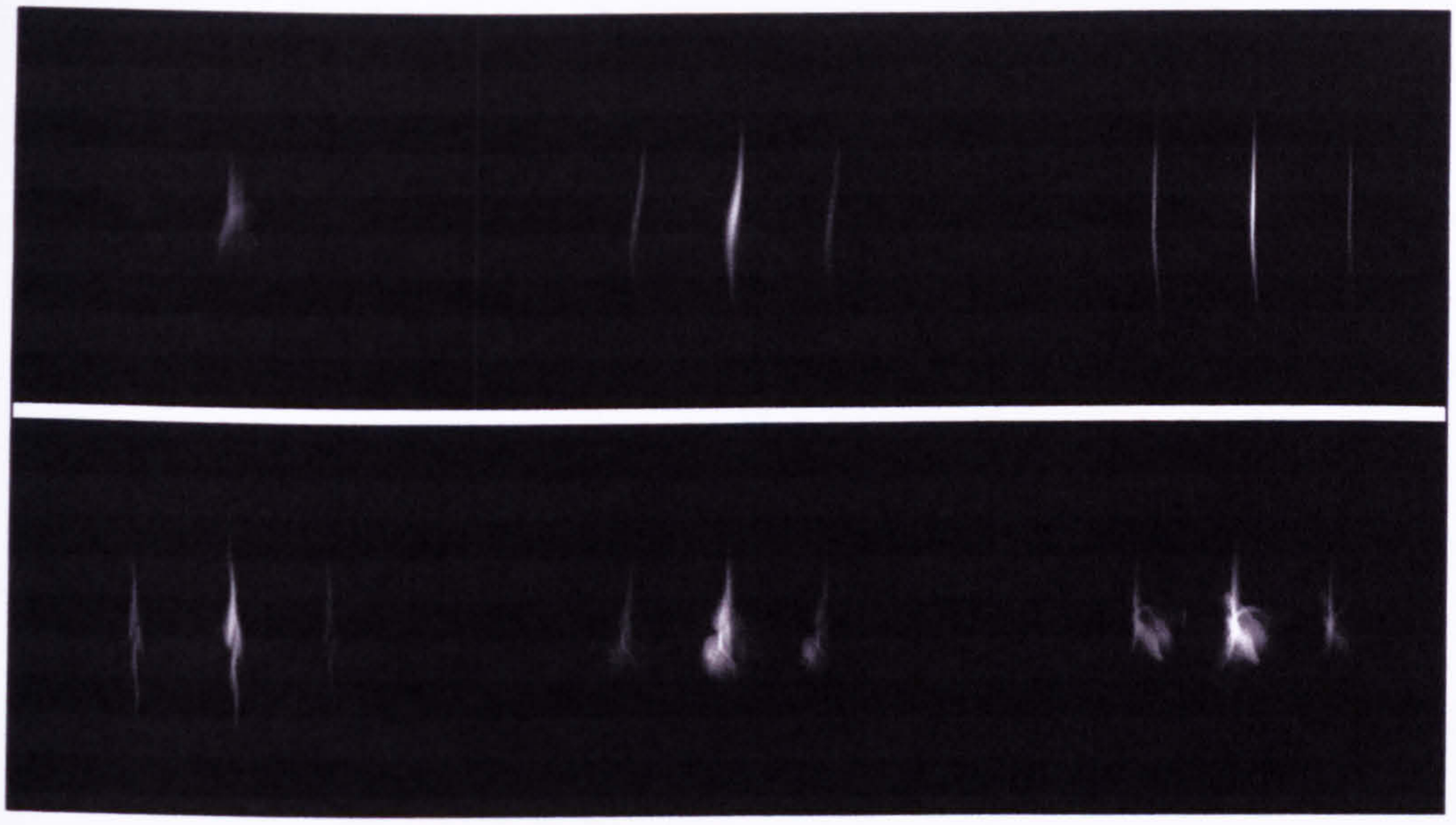


Fig. 4.22
Video stills of projected smoke moving downwards

The result of this study was that the images produced by the constant and independently changing movement of the smoke were mesmerising (Fig. 4.22). A naturally repeating pattern emerged as the observer watched, so that at times the smoke settled down, moving downwards almost in a straight line, and at others, slight air turbulence caused it to swirl dramatically. It would settle again and the sequence would repeat. The three separate images moving identically seemed uncanny. Importantly in this study, the smoke, unlike water or snow, moved very slowly, and was therefore identifiable. For perhaps the first time, there were no problems with either a thread or means of support. The plumes of smoke, appearing in apparent isolation, had an otherworldly appearance, which undermined the certainty between reality and illusion. This dislocation from the outside world, together with the slow progression of the smoke became almost hypnotic, or trance inducing. Dennis Wier, of the Trance Institute in Bruetten, Switzerland, claims that:

> The necessary and sufficient condition for a trance to occur is whenever there is a sustained cognitive object loop of sufficient length of time to cause dissociation. A cognitive object is an abstract way to denote a thought, any thought, whether it is a word, an idea, a feeling, a vision. When a set of cognitive objects repeat often enough, you will go into a trance [...]. The trance always implies that some cognitive functions are disabled.[53]

Although smoke did not reflect light as effectively as more solid objects, it was more successful than rain or snow. Like the fish study, the smoke installation projected independently moving images, but in the same way, could be difficult to maintain over a prolonged period of time. The incense sticks would periodically need replacing and the build up of smoke might cloud the installation space and reduce the clarity of the images. However, this study was successful: the three constantly changing images moving identically as gravity was apparently denied, seemed surreal, and perhaps due to the very slow speed of the moving images, they were also mesmerising and mysterious.

4.8 Study with translucency

This study aimed to develop the potential of images to overlap and merge. It had been observed in the green reel study that when the images were multiplied, and their widest sides faced the viewer, they appeared to merge slightly and become transparent. Wider objects were considered for multiple projections, so that the overlap would be more pronounced. An envelope 14 cm wide was hung opposite the three lenses (Fig. 4.23). When it was seen as an edge only, it became a line, giving no clues as to its existence as an envelope. As it rotated slowly, the three images appeared separate when sideways to the viewer (Fig. 4.24), but as they continued their rotation became clearly recognisable (Fig. 4.25), finally crossing and merging with one another, giving the appearance of translucency where they merged (Fig. 4.26).

Fig. 4.23
Envelope suspended

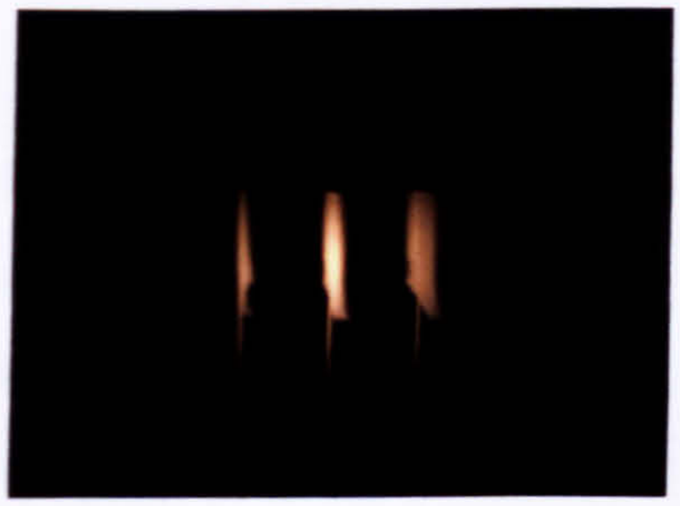


Fig. 4.24
Envelopes ambiguous but separate when sideways

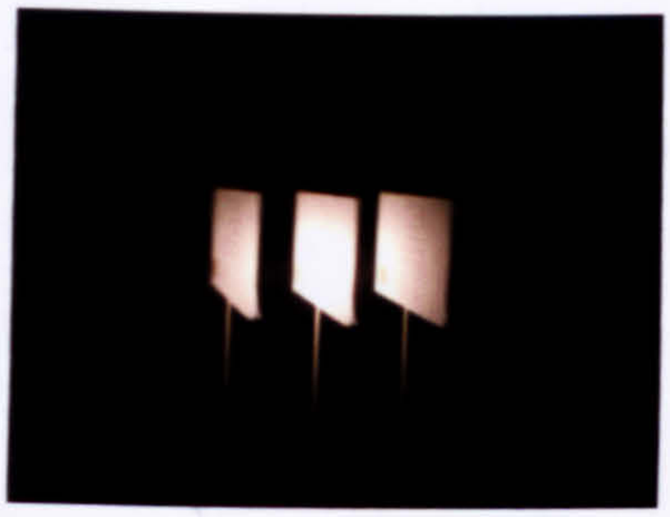


Fig. 4.25
Envelopes becoming recognisable

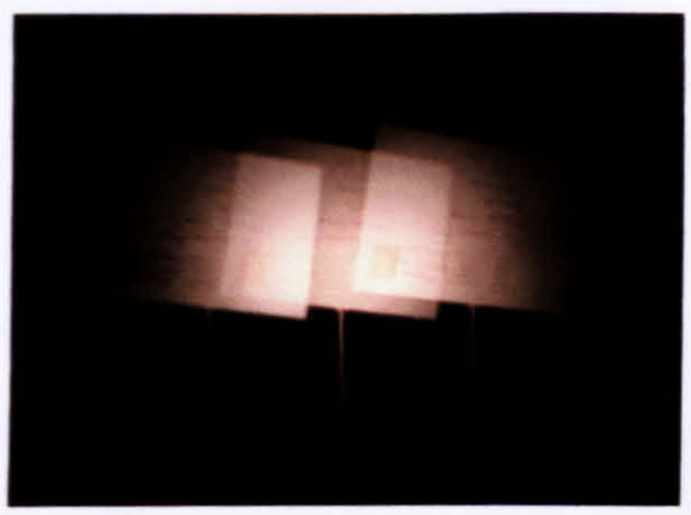


Fig. 4.26
Envelopes appearing to cross and merge

The envelopes, already strange because of their multiplication, first looked solid, and then inexplicably appeared translucent and ephemeral. A similar ambiguity is evident in Magritte's painting, *Carte Blanche*, where the impression of translucency is shown through the overlapping and juxtaposition of images.

In order to fully exploit the effects of translucency, it was found that the objects needed to be more than 13cm wide for the images to cross over, and the centres of the lenses 4.5cm apart, so that the objects would appear separate when they rotated. Envelopes were useful for experimentation, as they created good variations of shape and shadow as they turned. However, they had no natural connection with hanging. Suitable objects also needed to adhere to certain physical criteria:

- Could be suspended
- Not too heavy
- Wide enough to produce images which merged with each other, yet narrow enough to appear separate when turned sideways
- Not too large or deep as to cause too much loss of focus
- Light or bright colours, which reflected light well

Cabbages and melons fitted the above criteria, making reference to the hanging still life objects of Cotan. Cabbages and melons were cut in half and suspended on string. This gave them the ability to appear separate when seen sideways, but when they turned with the wider cut surface facing the viewer, to cross over and merge. The high water content of melons caused them to pick up extra light and glisten. The tension of string with a heavy object appearing at the top of it successfully highlighted the subversion of gravity, yet did not look out of place (Fig 4.27).

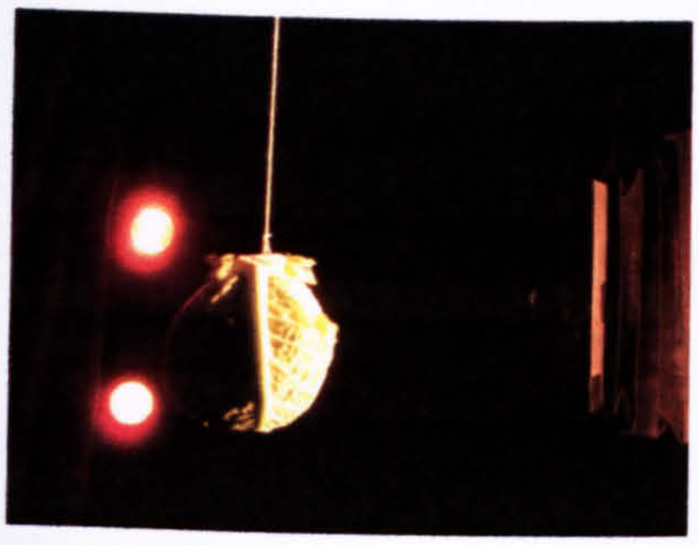


Fig. 4.27
Cabbage suspended

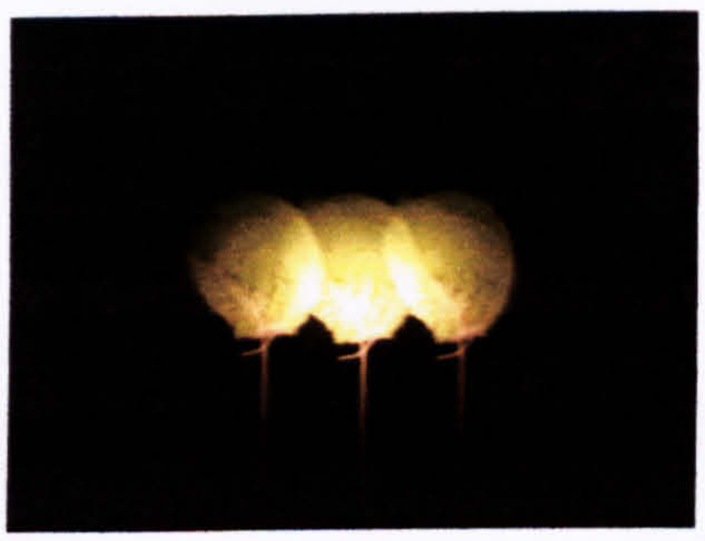


Fig. 4.28
Outside of cabbages merging

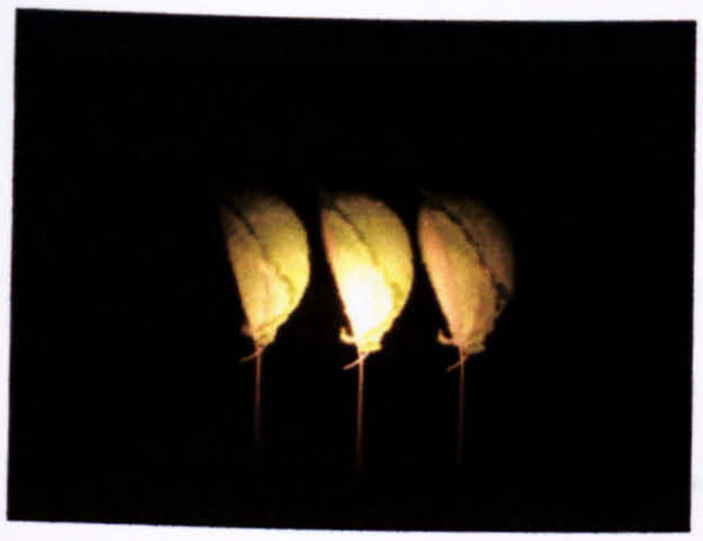


Fig. 4.29
Cabbages separate

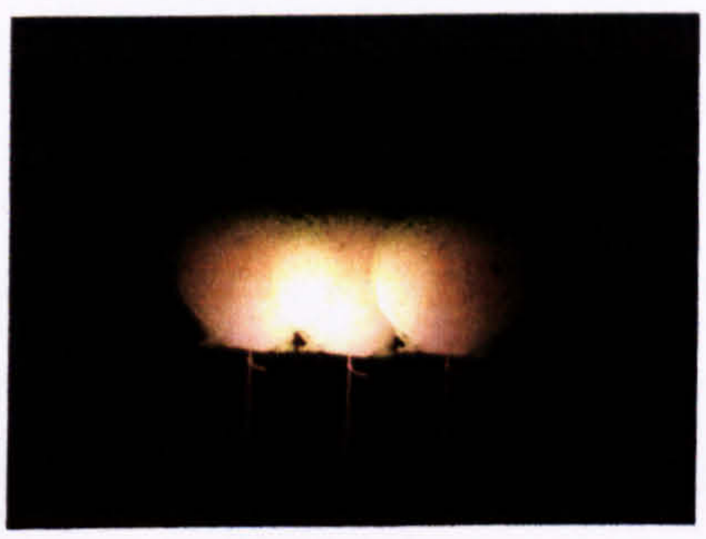


Fig. 4.30
Cut side of cabbages merging

This study demonstrated the ability of the camera obscura to perceptually transform a single object through multiple projections. It also highlighted the need for the controlled rotation of the object to accentuate the transition between solidity and translucency as the object moved.

4.9 Study with two objects

The intention of this study was to introduce additional objects to the multiple projections. As in previous studies, ordinary objects were used. Rather than choose two completely different objects, two similar objects (cotton reels of different colours) (Fig.4.31), were selected and suspended in front of two horizontally placed lenses with centres 5cm apart.

Cotton reels were suitable because they were small, and the colours could be selected, and perhaps most appropriately, a cotton reel might more naturally hang by its own thread. This would also emphasise the consequence of inversion. A pink reel and purple reel were selected (Fig. 4.31).

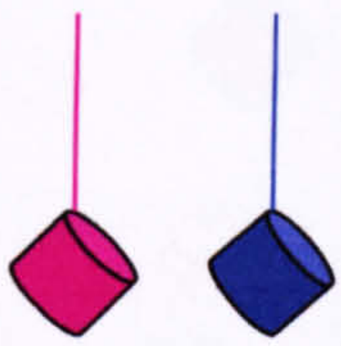


Fig. 4.31
Diagram of two reels hanging

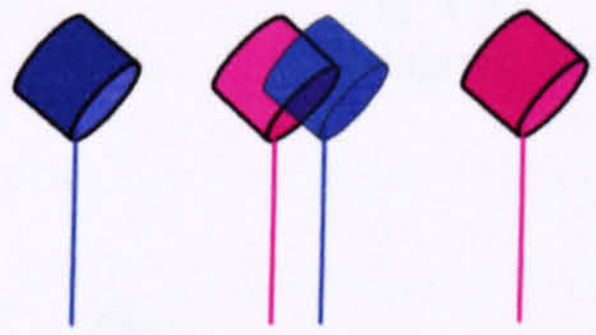


Fig. 4.32
Diagram of purple reel dominating pink reel

Images of the two central reels were observed to be superimposed on top of one another and translucent as they merged, but the purple reel dominated the pink reel. (Fig.131). Therefore, the purple reel was replaced by a turquoise reel, giving a better colour balance (Fig. 4.33).

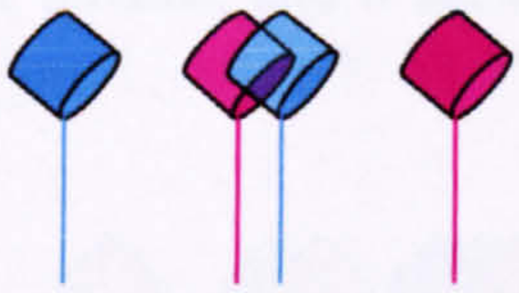


Fig. 4.33
Diagram of colour balanced reels.

The dominance of one reel over the other now only occurred when one object was closer to the lens than the other. If the distance of each object to the lens was equal, the images appeared the same, with neither image dominating (Fig. 4.34). It was just possible to observe that where the images crossed, the turquoise and pink merged to become purple.

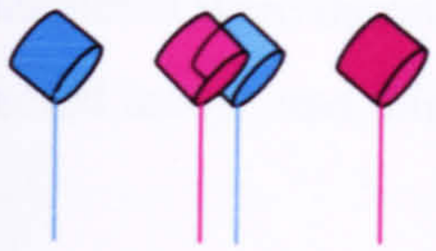


Fig. 4.34
Diagram of pink reel when closer to lens dominating turquoise reel

4.10 Study with three objects

The intention of this study was to add a third, lime green reel, to see if this enhanced the appearance of the already multiplied objects (Fig.4.35)

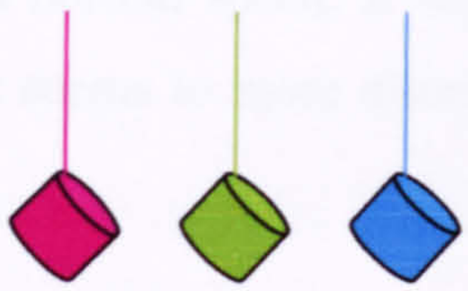


Fig. 4.35
Diagram of three coloured reels

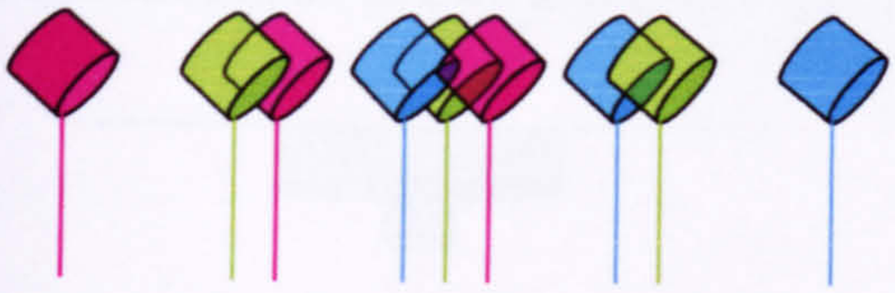


Fig. 4.36
Diagram of projected reels

The projected images were sharp, but because there were so many, they merely looked fussy and confusing (Fig.4.36). However, attention was drawn to the impression of tension and lack of gravity as the reels appeared to be balanced at the top of their slender threads, and it seemed that this might be enhanced if more thread was visible (Fig 4.37).

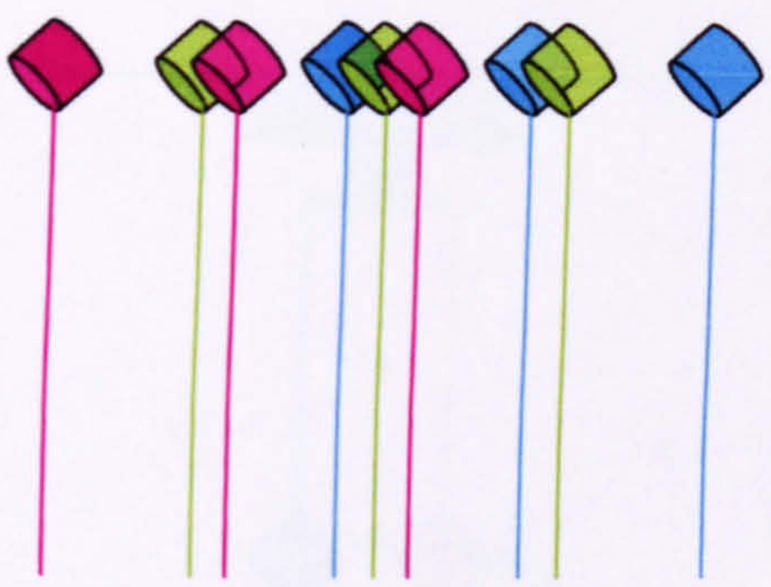


Fig. 4.37
Diagram showing lengthened threads

Adjustments were therefore made so that as much thread as possible was visible in the projected image, and this increased the impression of tension and denial of gravity.

4.11 Study with rotation using a motor

The chance movement of hanging objects in previous studies, such as the mug in the microwave, had suggested their controlled movement. The aim of this study was to introduce a motor to rotate objects in perpetual motion, and regulate the speed of their rotation. The seemingly self-propelled mobility of inanimate objects had already shown their capacity for invoking notions of the uncanny. If Bill Viola's *The Greeting*, was seen at normal speed, it would be seen as normal film, but due to its extreme slowness, it seems to more closely resemble a painting being brought to life through movement.

Initially a small 2 rpm motor was attached overhead, which rotated a single cotton reel attached to it, on its own axis (Fig. 4.38). This was positioned opposite two lenses.

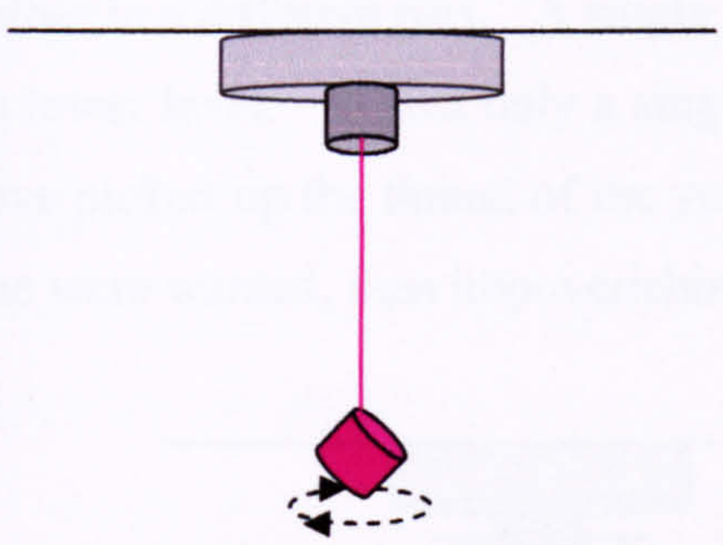


Fig. 4.38
Diagram of reel rotated by motor

An arm was then attached to the motor spindle so that it could rotate two reels together, with the threads 9cm apart (Fig. 4.39). A 12 rpm and a 1 rpm motor were also tested.

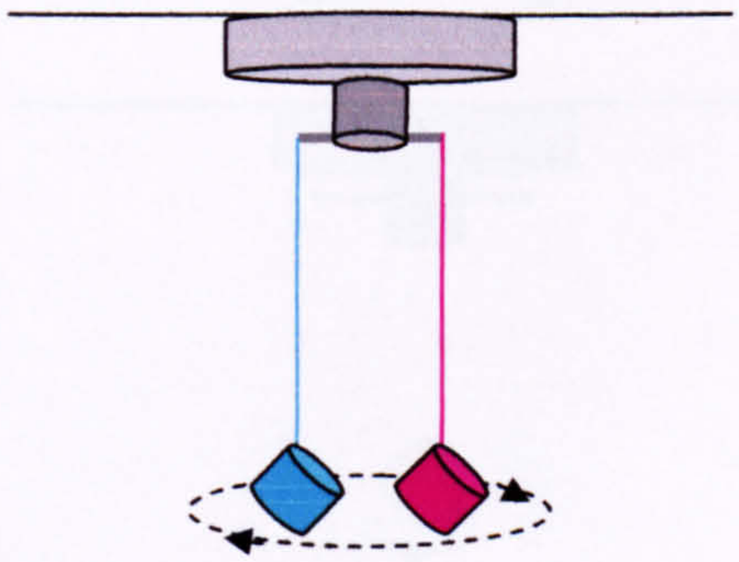


Fig. 4.39
Diagram of two reels rotated by motor

The results of the study proved that the motors worked well in regulating the rotation of objects. The slower movement of the 1 and 2 rpm motors seemed the most effective in producing mesmerising images, as well as slowing down the senses of the observer. When the objects were rotating on an arm attached to the spindle, they rotated in a wider circle, thus drifting in and out of focus. Earlier studies had endeavoured to keep the projected object in focus at all times, but this study again demonstrated that it was beneficial to embrace the camera obscura's optical possibilities, because the drifting in and out of focus during rotation enhanced the bewildering appearance of the objects.

4.12 Study with rotation using two motors

This study aimed to rotate objects simultaneously at different speeds; therefore a second motor of 1 rpm was introduced to rotate a third yellow reel.

This new motor was placed at a different level (Fig. 4.40) in a similar way to the previous window projections were one object was visible in one part of the screen and another in a different part. A single reel was hung opposite an additional single lens at this lower level. Whilst only a single object was visible on the screen, the two lenses above picked up the thread of the yellow reel, producing two additional threads where none were wanted, thus impoverishing the overall images (Fig. 4.41).

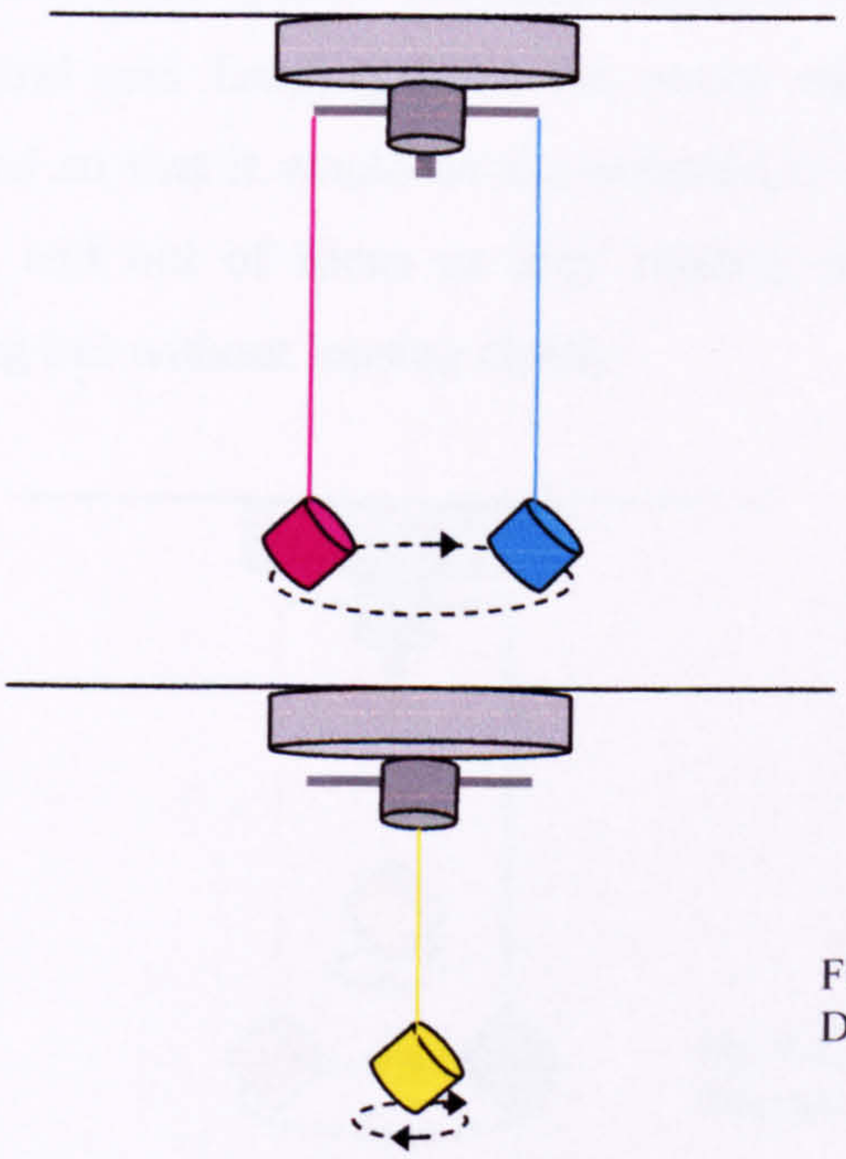


Fig. 4.40
Diagram of two motors

However, whilst the image of one yellow reel was visible, rotating on its own axis, with the images of the doubled pink and turquoise reels rotating at a lower level when inverted, the thread from the yellow reel was picked up by the two lenses above and doubled a and b, along with the threads of the pink and turquoise reels, thereby detracting from the overall effect. However, the additional lens allowed the yellow reel to be some distance from the others, yet still in focus.

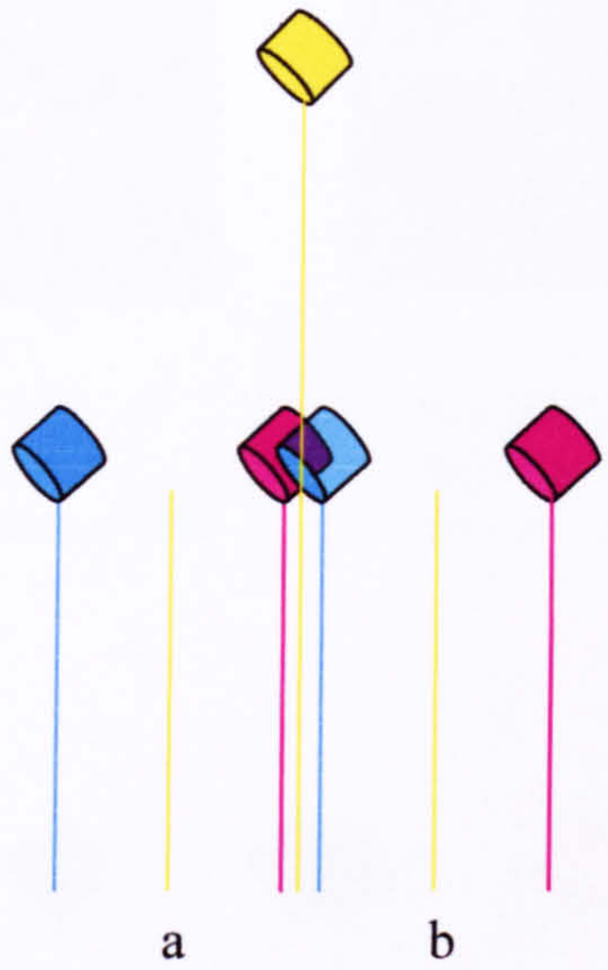


Fig. 4.41
Diagram of projection using two motors

The simple and successful solution was to dispense with the second motor and additional single lens, and merely to hang the third yellow reel from the rotation spindle (Fig. 4.42). One 12 rpm motor rotated all three reels. At this speed, the detail of the pink and turquoise outer reels (the threads being 9cm apart) orbiting more quickly around the yellow reel that rotated on its own axis, could clearly be observed. The central reel hanging from the centre naturally rotated more slowly and was positioned so that it would be the constant centre of focus. The outer rotating reels came in and out of focus as they rotated, at a speed fast enough to be visually disturbing but without loosing clarity.

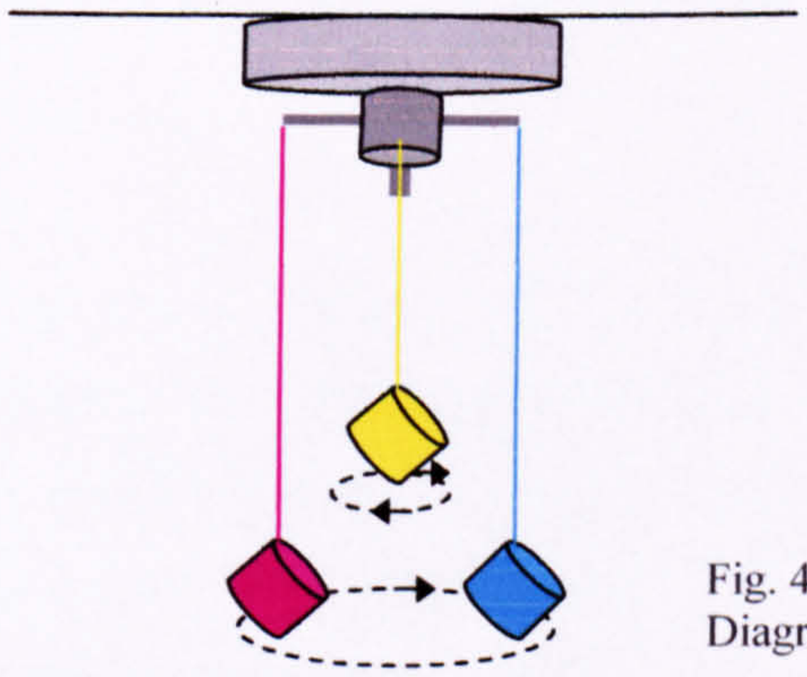


Fig. 4.42
Diagram of one motor rotating three reels

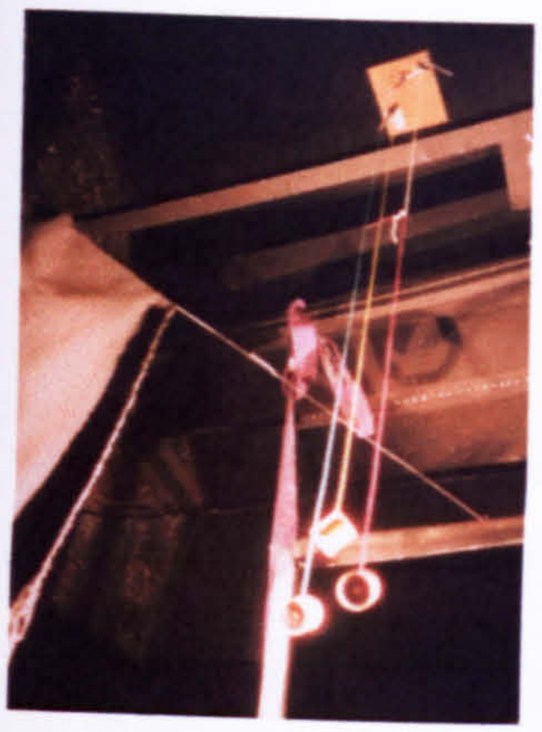


Fig. 4.43
Reels hanging from bar attached to motor spindle

Fig. 4.44
Reels opposite two lenses

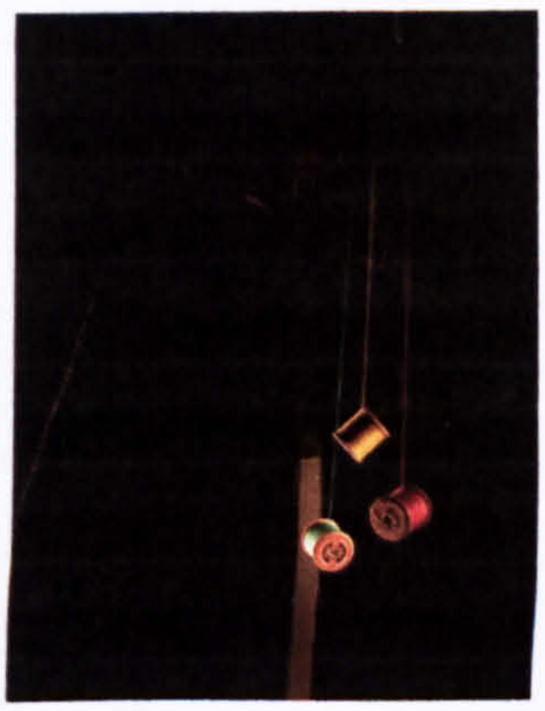


Fig. 4.45
Illuminated reels

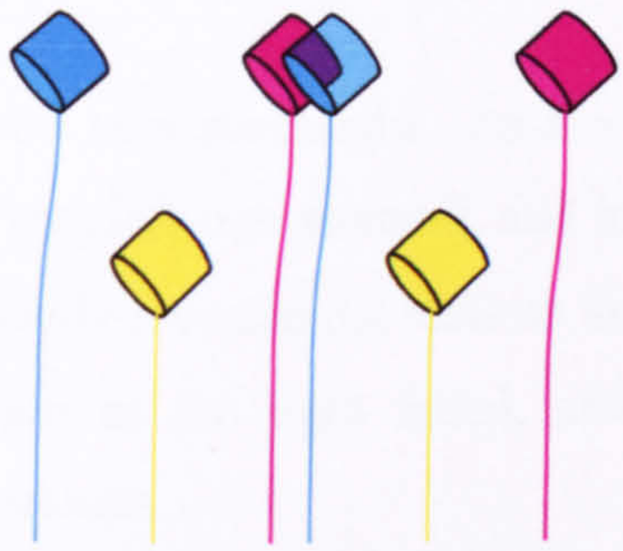


Fig. 4.46
Diagram of projection using three reels

Once again, the video stills (Fig. 4.47) do not capture the extent of the area seen by the eyes. They show the threads to be barely visible, and very short. In reality the threads look much longer and also strangely appear to get wider as focus is lost towards the bottom of the projection.

Fig. 4.47
Video stills of rotating cotton reels

This study was very successful. As the projected objects drifted in and out of focus, they seemed tangible one moment, and intangible the next. The increasing strength of the light gradually revealed the reels so that they became recognisable, and then slowly concealed them as the light faded, and they were once again consumed by the enveloping darkness.

4.13 Study with multiple images of rotating fish

This study set out to find other ordinary objects suitable for rotation and projection, which met the criteria set out in previous studies for suspending objects, such as being wide but thin, possessing a natural affinity for being suspended, small enough not to lose too much focus, not too heavy, and which reflected light well.

Plaice were selected because they are wide, but flat, so that when rotated, would appear separate when sideways, yet when seen widthways the tripled images would cross over and dissolve. Plaice also have good variation in appearance, with the upper part being brown with bright orange spots, and the underside pale and whitish. The plaice cannot always be recognised as a fish, since at one point in the rotation it

becomes a line, slightly convex at its mid point, and certainly ambiguous. The skin is moist and reflects light well, increasing its apparent tangibility and enhancing its three-dimensional appearance (the live goldfish shared similar qualities). Plaice are generally around 20cm long, so adjustments were necessary for the fish to fit the screen. It was suspended on fishing line with a hook through its mouth, as if it had just been caught and hung up. As before, three lenses were set horizontally with centres 4.5cm apart.

Focus was concentrated on the centre of the plaice, with its extremities slightly out of focus. However, this did not detract from the resulting images, but rather increased the ambiguity of the object. I was again reminded of the way painters such as Leonardo and Vermeer had capitalised on effects such as loss of focus.

The suspended fish was attached to a 1rpm motor overhead, so that it rotated slowly. When the light level was low, it was difficult to identify the object. The wet surfaces of the fish caught the light at various points during its rotation but at other times appeared matt. The fleshy texture of the fish, particularly its underside, gave it an organic appearance that other objects had lacked.

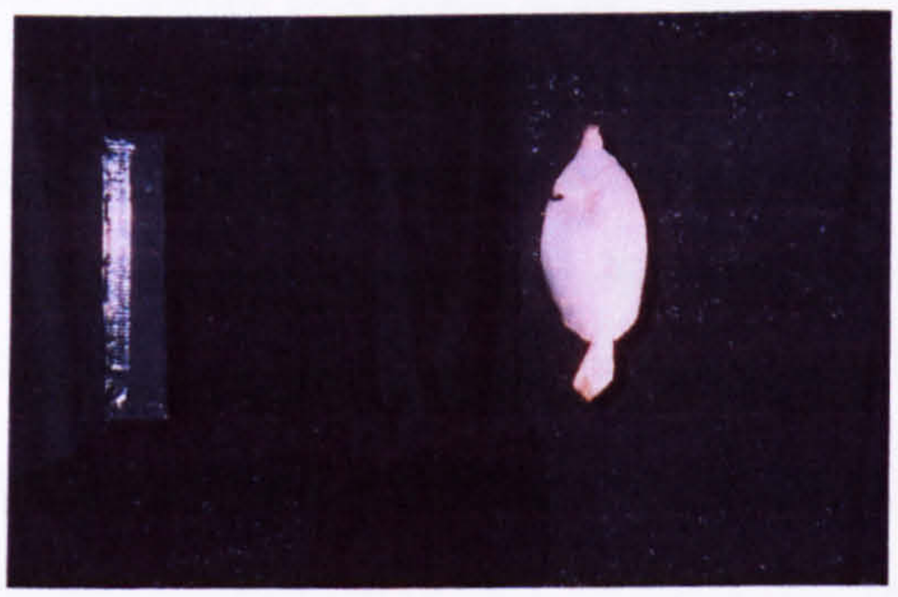


Fig. 4.48
Plaice suspended

The lighting sequence began with a dark screen, and then light gradually illuminated the plaice until it was totally illuminated, the lights slowly dimmed and the programme repeated on a loop. Because the lighting sequence was not synchronised with the rotation, the two were random, thus increasing the variation of appearance of the plaice, so that the same view would sometimes be very dim, and at others, very bright.

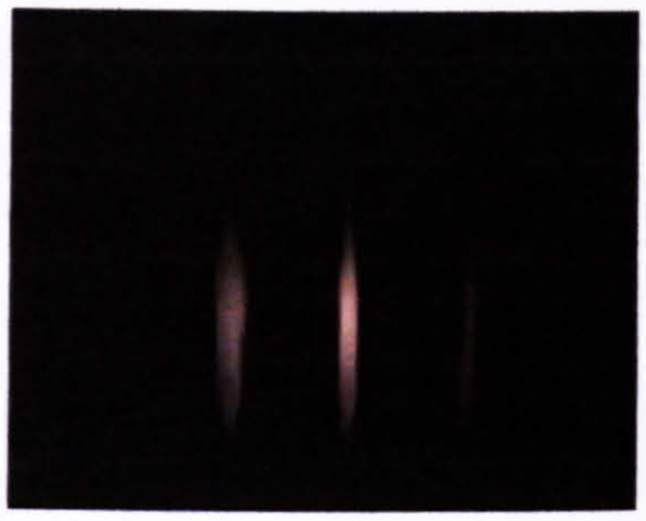


Fig. 4.49
Side view of plaice

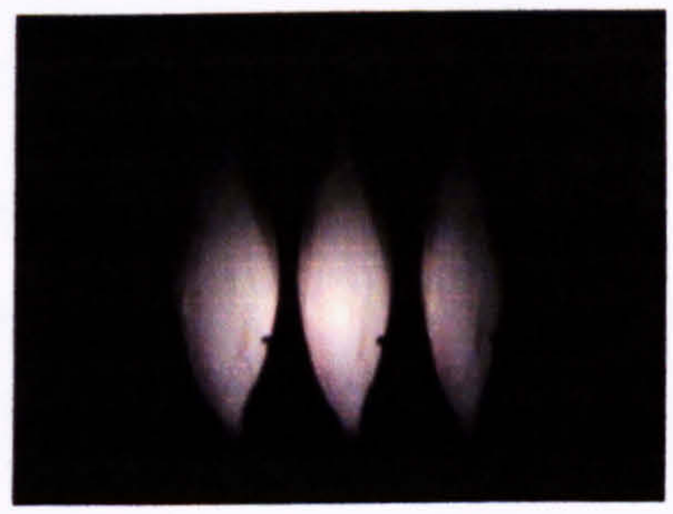


Fig. 4.50
Under side of plaice

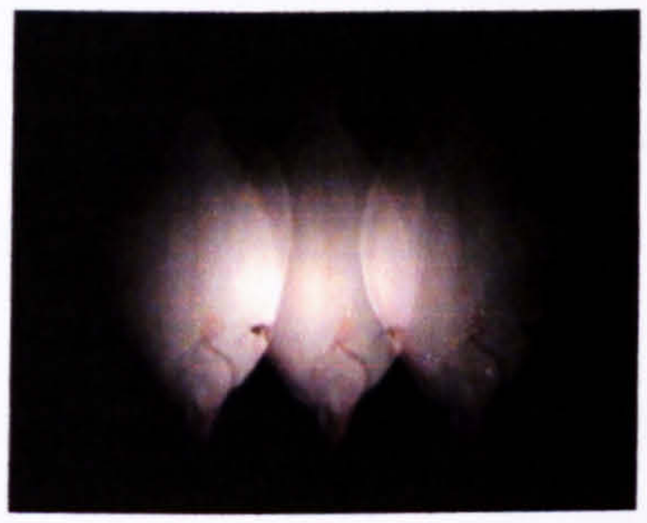


Fig. 4.51
Underside showing translucency

Fig. 4.52
Upper side of plaice

Uncertainty was increased by the fact that the plaice's mouth and tail were slightly unfocused. When the side edges of the plaice were sideways to the observer, focus was also lost. Because of its fleshy appearance, the plaice seemed more tangible than other objects that had been used, but also more enigmatic and ethereal. Although dead, the moist, glistening flesh of the plaice, together with its very slow movement, also gave it the appearance of being alive, and this ambiguity was unsettling.

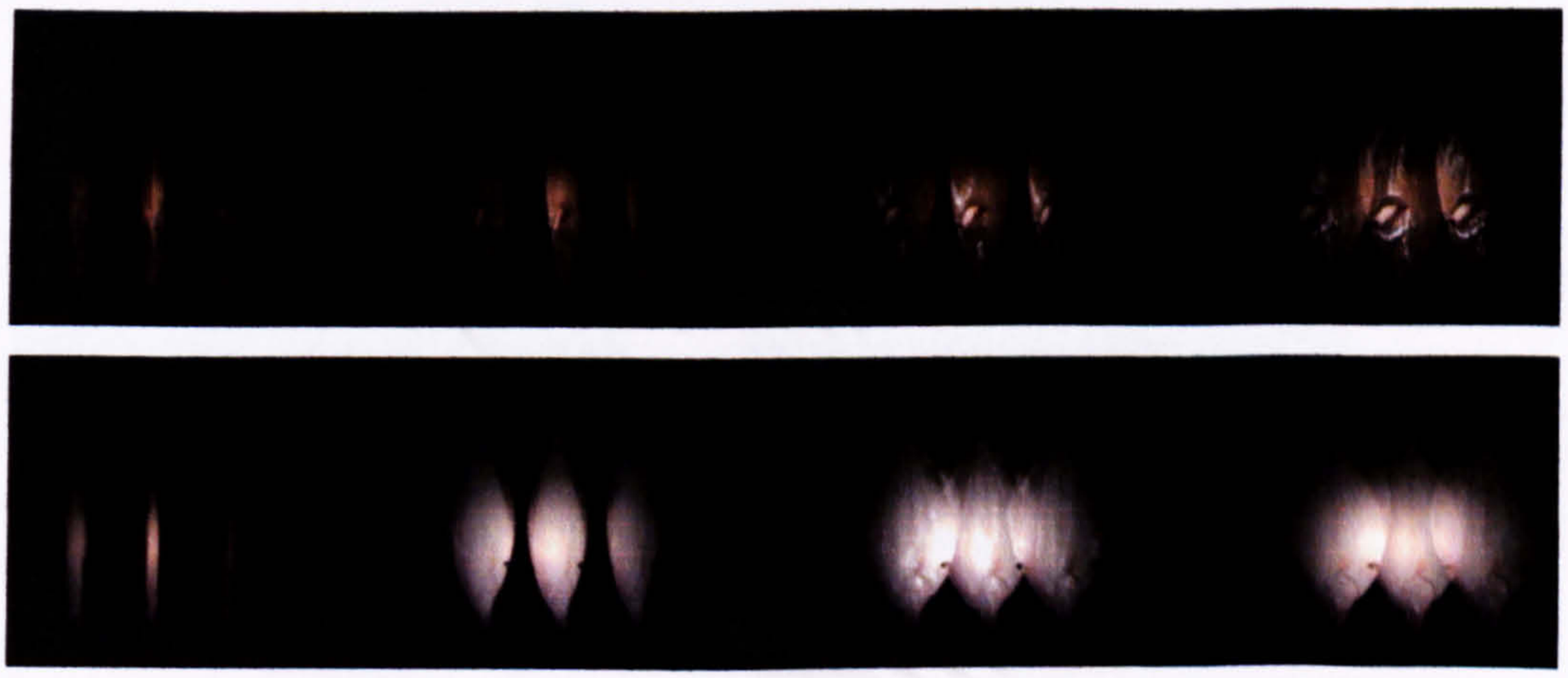


Fig. 4.53
Video stills showing rotation of plaice

NB. Once again, photographic documentation gives an inadequate and incomplete representation of the real event.

It was observed that when the programmed lights were turned off, studio lights dimly illuminated the fish from behind. This caused it to appear faintly transparent, rather like an x-ray. This was an unexpected discovery that suggested potential for development.

4.14 Study with transparency

The aim of this study was to exploit the effects of light shining onto the plaice from behind as observed in the last study.

An additional spotlight was positioned behind and below the plaice (Fig. 4.54/5/6&7) and directed upwards onto it from below. This gave a much stronger x-ray effect, and was therefore incorporated into the lighting sequence.

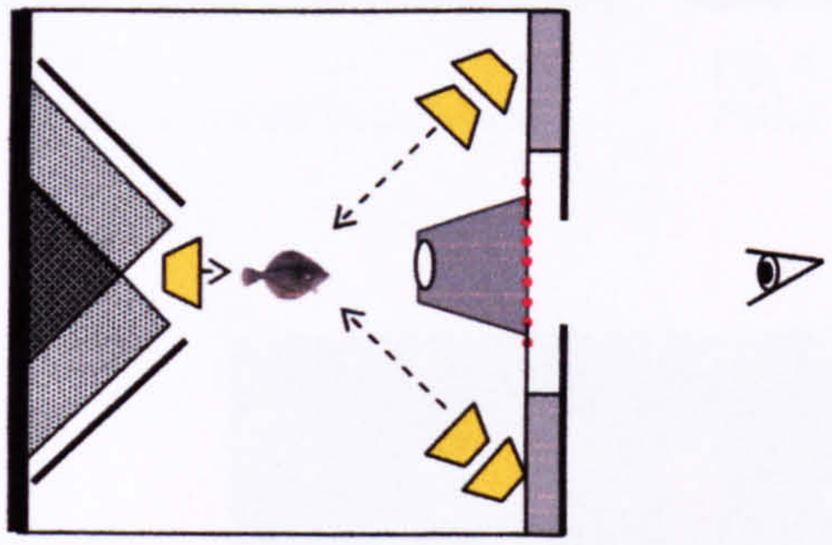


Fig. 4.55
Diagram of installation showing light source behind plaice

4.56
Plaice dimly illuminated from behind

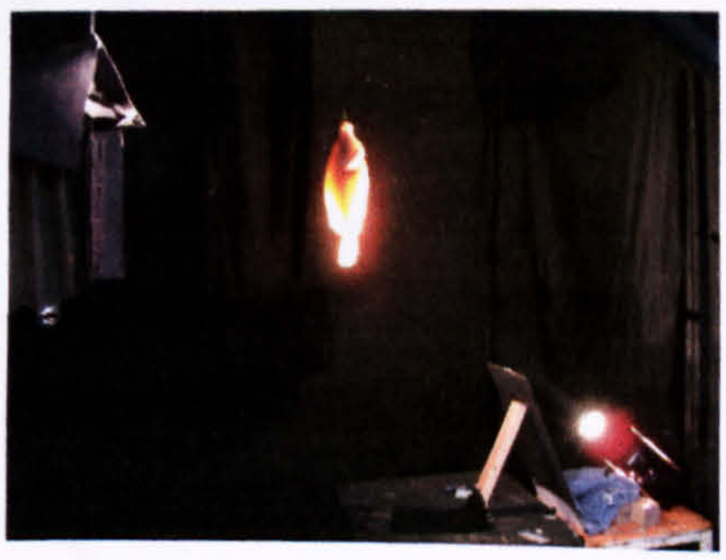


Fig. 4.57
Plaice strongly illuminated from behind

Strong illumination of the plaice from behind gave it a very different appearance. It effectively increased the ambiguity of the plaice, to become one of the most effective studies in transition.

The very slow rotation of these otherworldly images entice and mesmerise the observer and induce an increasing awareness that time is being slowed or even suspended. Viola's *The Greeting* similarly fascinates and seems to manipulate our sense of time. Jean Wainright writes of Viola:

> Time, Viola has often stated, is the 'water' that we exist in, and there is in extreme protraction a greater awareness of that materiality. We become conscious of the slowing of time, allowing us time to digest more information; the move towards stasis empowers our perception.[54]

Fig. 4.58
Plaice illuminated from behind

Fig. 4.59
Plaice illuminated from behind

Fig. 4.60
Plaice illuminated from behind becoming recognisable

As this additional lighting effect proved successful with the plaice, it was then tested with other objects previously used, such as the envelope (Fig. 4.61, green reel (Fig. 4.62) and cabbage (Fig. 4.63). This resulted in successfully increasing the ambiguity of all these objects, and this lighting effect was incorporated into the programming of lighting sequences.

Fig. 4.61
Envelope illuminated from behind

Fig. 4.62
Green reels illuminated from behind

Fig. 4.63
Cabbage illuminated from behind

Conclusion to Stage IV

This series of studies showed that the projections did not need to be juxtaposed with objects to enhance their appearance, and rather that it was the images themselves that were important. Important improvements were made to screens and their situation. Greater attention was paid to improving the quality and presentation of the images and the position of the viewer. The observer now occupied a place that was like reality yet removed from it and was also silent. Greater ambiguity in the physical location of the images had a disorientating effect upon the observer. The problems of visually dissolving surfaces and means of suspension were overcome by exploiting what had previously been deemed a deficiency. Drawing attention to a denial of gravity in turn

also heightened notions of the uncanny. Multiple imaging was particularly successful in transforming the appearance of objects through duplication, so that they oscillated between solidity and transparency as motors rotated them. Inanimate objects, notably the plaice, acquired a sense of animation that undermined the certainty of the observer.

CHAPTER 3

Conclusion

An exploration of notions of the 'uncanny' and the 'transitional' soon became central to the development of the research. The uncanny can be encountered in the familiar surroundings of the home, where the ordinary becomes strange and unfamiliar. Pinhole photography of domestic settings succeeded in producing unusual and uncanny images, which although significant, were static. However, the aesthetic qualities of the passing of time displayed in these long exposure pictures, such as double imaging and sharp and blurred focus indicated the contribution actual movement might play in future studies. This was particularly apparent with regard to the transitional. From these initial studies, there also began to emerge a taxonomy of visual effects that became the means through which notions of the transitional and the uncanny were explored and critiqued. These effects involved contrast of light and dark, change between sharp and blurred focus, opacity, transparency, translucency, and inversion. Increasingly these visual effects became the means through which the everyday could be subverted and notions of the uncanny and transitional explored.

This led to the important development of projecting familiar objects, such as a light bulb, with artificial light. Through changing the sequences of artificial light, the bulb could show a range of visual effects extending from the clearly recognisable, to that of an image that was recognisable through its profile only, all internal detail being absent. The image could also be enlarged, so as to appear disturbingly large and almost suffocating, like the apple in Magritte's *The Listening Room*. However, whilst Magritte's objects remain static, the light bulb projections were real and transient, and therefore more capable of challenging the preconceptions of the observer as to the aesthetic and perceptual possibilities of such an object. These studies marked the first significant development in the research, as they demonstrated how the camera obscura could be used as a transformative device, which could challenge visual perception.

Since light bulbs are naturally found in domestic settings, this prompted an exploration into the juxtaposition of projected imagery with real objects. The limitations of front projection led to a key decision in changing to back projection. These two developments subsequently enabled the image of a mug to appear inside a microwave

and be further contextualised in a 'kitchen' (Stage III, Study 3.5). The appearance of a mug hanging upside down, as well as being rotated, caused the mug to drift in and out of focus, evoking the uncanny and the transitional.

This led to studies involving the natural inversion of projections, which gave an uncanny and surreal interpretation of gravity (Stage III) reminiscent of the paintings of Magritte. An absence of gravity was exploited with goldfish in a tank, where water looked like air and air like water, so that fish appeared to be swimming in the air, above the water. Additionally weed was suspended upside down so that it appeared the right way up when projected. The appearance of the fish constantly changed from being clearly focused to being blurred (Stage III, Study 3.10). Whilst the photographs of Morrell and Graham had exploited inversion, these were static images, and did not have the potential for movement, therefore lacking ambiguity and variation. Neither did these photographs incorporate simultaneously both focused and unfocused images that so enhanced ambiguity in the research projections. This study proved how the camera obscura could both heighten the uncanny and have a visually destabilising effect. It also suggested how the projections might actually be enhanced without contextualisation or related objects and the latter were therefore removed.

The decision that the projected images themselves would be the subject of the research demanded improving the quality of the projections, their presentation, and their relationship to the position of the observer. The observer was therefore isolated from the outside world, standing in a black box where the contrast between light and dark was pronounced. By eliminating other visual references, the attention of the observer was focused entirely on the isolated images that appeared to be cast adrift in space, drifting in and out of focus. Unlike Turrell's installations however, there were objects, but similarly the observer was confronted with spaces where their sense of depth perception was challenged, and their temporal experience of time undermined. This caused the observer to feel a sense of exclusion from the outside world but located within a space of clearly defined limits such as that of the fairy tale, where ordinary objects were seen to behave uncharacteristically.

Notions of the uncanny were further enhanced by the important development of multiple projections, which referred to the doubling effects in the earlier pinhole photographs. The tripled images of smoke, swirling gently downwards in the darkness

in a permanent state of transition, were strange, as well as having an ethereal and otherworldly quality (Stage IV, Study 4.6). Although Torchia had used candles to produce multiple images of a moving object, the means were apparent and their presentation not one that might evoke uncanny or mystical associations. In Caroline Broadhead's '*Ready to Tear*' the original and the double, whilst at first perhaps uncanny, remain static and become knowable. The multiple projections of the research however maintained their transience and ambiguity.

Observations of the natural and artificial movement of objects in previous studies prompted the introduction of a motor. In a study with multiple projection and three cotton reels, a motor controlled their rotation, causing two reels to move in and out of focus, whilst a third rotated more slowly, but remained constantly focused. The rotation of the cotton reels was slow enough for the details of the images to be clearly observed, but fast enough to destabilise perception. The images and identities of the multiplied cotton reels, apparently supported by their own fragile threads, interacted with one another by appearing to merge and separate in a perpetual state of transition (Stage IV, Study 4.13). Viola's projections in *The Veiling* used several planes, so that the images remained clearly separate and could not interact with one another as the images of plaice or cotton reels had done. No ambiguity was intended and neither could they be experienced in real time.

The apparent transparency of the cotton reels as they merged was further exploited when an envelope was projected in triplicate. Since an envelope is thin, the images were seen first as lines and then, during rotation, appeared as planes, merging as the images crossed, so that from appearing solid, they became transparent and insubstantial (Stage IV, Study 4.9). These studies culminated in suspending a plaice, which is wide and flat, and had a connection with being hung (Stage IV, Study 4.13). Suspended on fishing line, it rotated slowly on its own axis. Although instantly recognisable as a fish when seen flat, it changed dramatically from appearing ambiguously as a line, to being clearly recognisable when it became a plane during its rotation. The tripled images, oscillating between opacity and translucency were in a constant state of transition. This scene was further enhanced by the cycle of light sequences, which caused the objects to be even more dramatically placed on the edge of being recognisable. The varying intensities and sources of light reflecting on the

moist flesh of the plaice, together with its unhurried movement, added further doubt as to whether it was actually dead or alive.

Whilst other artists have been involved with many of the issues that have concerned this research, none have used them to produce imagery in real time in this way. Variations in light sources and intensities using ordinary objects do not appear to have been used in connection with the camera obscura, and neither has it been used in association with narrative or to deliberately subvert the familiar. Single projections have predominated, so that duplication of the same thing, together with the alternation between opacity and transparency has demonstrated the capability of the camera obscura to produce live imagery that is evocative of the uncanny and the transitional.

Freud describes the uncanny as a state of mind and hyper-normal perception, so how can one hope to trigger what is almost a paranormal experience, through experiment. Proust captures through memory and active imagination a sensation unique to his boyhood but one which he is made aware of through his interest in optics. As the uncanny is essentially about an experience, perhaps therefore one can only pursue the uncanny and never capture it.

However, where the camera obscura has previously been used to directly reproduce reality, this research has shown its capacity to undermine reality by challenging perception in an original and unprecedented way. Together with what Steadman calls its "special visual feel" and ability to produce images which "seem to be condensed to their very essence", this research has revealed the camera obscura to be a device with hitherto significantly unrealised potential in terms of contemporary artistic practice, which it has now considerably realized and extended.

ENDNOTES

1 For further reference, MA Dissertation entitled *Are Truth and Reality in Architecture and Sculpture Undermined or Enhanced by Illusion and Uncertainty?* 2001, Storey, J.A.,University of Gloucestershire, Pittville Campus Library

2 Kemp, M., *The Science of Art*, (Yale University Press, New Haven & London, 1990), p.193

3 Steadman, P., *Vermeer's Camera*, (Oxford University Press, New York, 2001), p.157

4 Shattuck, R., *Proust's Binoculars* (Random House, New York, 1963), p.6

5 Brassaï, *Proust and the Power of Photography*, (University of Chicago Press, Chicago & London, 2001), p.137

6 'It is true that, when morning drew near, I would long have settled the brief uncertainty of my waking dream, I would know in what room I was actually lying, would have reconstructed it round about me in the darkness, and - fixing my orientation by memory alone, or with the assistance of a feeble glimmer of light at the foot of which I placed the curtains and the window - would have reconstructed it complete and with its furniture, as an architect and an upholsterer might do, working upon an original, discarded plan of the doors and windows; would have replaced the mirrors and set the chest of-drawers on its accustomed site. But scarcely had daylight itself - and no longer the gleam from a last dying ember on a brass curtain-rod, which I had mistaken for daylight - traced across the darkness, as with a stroke of chalk across a blackboard, its first write correcting ray, where the window, with its curtains, would leave the frame of the doorway, in which I had erroneously placed it, while, to make room for it, the writing-table, which my memory had clumsily fixed where the window should be, would hurry off at full speed, thrusting before it the mantelpiece, and sweeping aside the wall of the passage; the well of the courtyard would be enthroned on the spot where, a moment earlier, my dressing-room had lain, and the dwelling-place which I had built up for myself in the darkness would have gone to join all those other dwellings of which I had caught glimpses from the whirlpool of awakening; put to flight by that pale sign traced above my window-curtains by the uplifted forefinger of day'. Proust, M., *À la Recherche du Temps Perdu, Vol. 12*, (Chatto & Windus, London 1972), pp. 256, 257

7 The first projection device and ancestor of the slide projector, invented in the 17th Century. Initially called 'optical lanterns', they later became known as 'magic lanterns', and were often used for projecting 'Ghost' shows.

8 Proust, M., *À la Recherche du Temps Perdu, Vol. 1* (Chatto & Windus, London 1973), p. 56

9 René Descartes in Warner, M., *Eyes, Lies & Illusions*, Hayward Gallery, ed. by Mannoni, L., Nekes, W., & Warner., (Hayward Publishing, London, 2004), p.14

10 Brassaï, op cit., p.113

11 ibid.

12 'It often happened that, in my spell of uncertainty as to where I was, I did not distinguish the successive theories of which that uncertainty was composed any more than, when we watch a horse running, we isolate the successive positions of its body as they appear upon a bioscope. But I had seen first one and then another of the rooms in which I had slept during my life, and in the end I would revisit them all in the long course of my waking dream'. Proust, op cit., (1973: 6, 7)

13 Freud, S., *Art & Literature, Vol. 14* (Penguin Books, London, 1990) p. 364

14 ibid. p.367

15 Da Vinci, D., <http://en.wikiquote.org/wiki/Leonardo> [accessed 9 August 2005]

16 Da Vinci, L., *Leonardo da Vinci On Painting: a lost book {Libro A}*, reassembled from the Cidex Vaticanus Urbinas 1270 (Peter Owen, London, 1965), pp. 146, 147

17 ibid. pp. 66, 67

18 Warner, M., Hayward Gallery, op cit., p.14

19 'Make a hole in a window of a room [...] as large as a spectacle glass. Then take a glass that is convex on both sides, not concave, like the spectacles of youths who are shortsighted. When this glass is fixed in the hole, shut all the windows and doors into the room so that no light enters except through the glass. Then take a piece of paper and place it in front of the glass so that you see clearly on the paper everything that is outside the house ... here you will see the forms on the paper as they are in reality, and the gradations, colours, shadows, movements, clouds, the ripples of water, the flight of birds, and everything else that can be seen. This experiment needs clear and bright sun, because sunlight has great power in making things visible [...]. Seeing therefore, the outline of things on the paper, you can draw with a pencil all the perspective that appears there, and then shade and colour it as nature displays it to you, holding the paper tightly in place until you have finished the drawing'. Barbaro, D., *Practica della Perspettiva,* Venice, 1568, in *Secret Knowledge*, Hockney, D. (Thames & Hudson, London, 2001), pp. 209, 210

20 'Vignetting' is typical of camera obscura images, where loss of focus and brightness increasingly occurs towards the edges of a projection.

21 By 'optics' Hockney is largely referring to mirror lenses, but his comments regarding collaging apply to images produced by mirror lenses or camera obscuras. He claims that the evidence of 'collaging', which suggests the use of optics, can be observed in many 15th Century paintings.

22 Hoogsraeten, S., van, Artifice *& Illusion: The Art and Writing of Samuel van Hoogstraeten,* Brusati, C., (The University of Chicago Press, Chicago & London, 1995), p.263

23 ibid., p.71

24 'Vermeer's paintings can no doubt be defined as the most perfect still lifes of European art – still lifes in the original sense of the word, that is to say 'silent life' dream of a perfect reality, where the calmness surrounding things and beings almost becomes a substance, where the objects and the figures (treated as objects) give us to understand the secret relationship between them. Time here appears to be suspended, daily life takes on the guise of eternity', Steadman op. cit., p.164

25 University of St Andrews: *William Henry Fox Talbot*: <http://www-groups.dcs.st-and.ac.uk/~history/Mathematics/Talbot.html> [accessed 9 May 2005]

26 ibid.

27 'The collapse of the camera obscura as a model for the condition of an observer was part of a process of modernization, even as the camera itself had been an element of an earlier modernity, helping define a "free", private, and individualised subject in the 17th century. By the early 1800s, however, the rigidity of the camera obscura, its linear optical system, its fixed positions, its identification of perception and object, were all too inflexible and immobile for a rapidly changing set of cultural and political requirements. Obviously artists in the 17th and 18th centuries had made countless attempts to operate outside the constraints of the camera obscura and other techniques for the rationalization of vision, but always within a highly delimited terrain of experimentation. It is only in the early 19th century that the juridical model of the camera loses its pre-eminent authority. Vision is no longer subordinated to an exterior image of the true or the right. The eye is no longer what predicates a real world'. Crary, J., *Techniques of the observer: on vision and modernity in the 19th century* (MIT Press, Cambridge, Mass., 1992), p.29

28 Beckmann, J., *The Great Illusionists* Dawes, E.A., (David & Charles, Newton Abbot, 1970), p.83

29 Crary, J., *Suspensions of perception, attention, spectacle & modern culture*, (MIT Press, Cambridge, Mass., 1999), p.337

30 Gregory, R.L., & Gombrich, E.H., *Illusion in nature and art* (Gerald Duckworth, London, 1973), pp. 49, 50

31 Dawes, op. cit., p. 3

32 Warner, M., Hayward Gallery, op. cit., p.23

33 Lanners, E., *Illusions* (Holt, Rinehart & Winston, Austin, Texas, 1977), p.33

34 Rugoff, R., *Lost Horizons*, Issue 18: Tate Magazine, (Spafax Publishing, London Summer, 1999), p.27

35 Turrell, J., Adcock, Craig E., *James Turrell: The Art of Light and Space* (University of California Press, Oxford, 1990), p.114

36 Hockney, op cit., p.245

37 *Private Life of a Masterpiece: The Art of Painting*, Vermeer: (BBC 2 Wales, Broadcast 9 April 2005)

38 Scorsese M, Times 2, 23 February 2005, p.15, extracted from interview with Matt Wolf, *Caravaggio*, Royal Academy Magazine, February 2005

39 Crary, op cit., p.344

40 Da Vinci <http://www.artchive.com/artchive/L/Leonardo/Leonardo_notes.html> [accessed 13 August 2005]

41 

Schattenlayrinth, Vera Rohm, 1998, (painted steel), Wolbert, K., *Vera Rohm: Wandering Shadows* (G & H Verlag), Berlin, 1999, p. 106

Schattenprojektion, 1991, Vera Rohm, (corten steel) op. cit. p.78

42

Ready to Tear, 1996, Caroline Broadhead (Scorched silk with shadow in paint and pencil), Peters, T., & West, J., *The Uncanny Room,* (Luminous Books, 2002), p.31

43 *Leonardo da Vinci, notebooks*: p.4, <http://en.wikiquote.org/wiki/Leonardo_da_Vinci> III [accessed 10 August 2005]

44 The tiny aperture of a pinhole and a long exposure is capable of producing a photograph with a greater depth of field than those taken with a conventional camera. It ensures that objects near and far all appear in focus in the final photograph.

45 'Anamorphism' is an extreme form of perspective, created by a distorted projection or drawing which appears normal when viewed from a particular point, such as the skull in Holbein's *The Ambassadors*.

The Ambassadors, 1533, Hans Holbein, National Gallery, London, (Postcard, National Gallery, London)

Detail of anamorphic skull, *The Ambassadors,*
<http://www.mywebtiscali.co.uk/artfanamorphosis/skull.html> [accessed 11 September 2005]

Details of anamorphic skull viewed from the side, *The Ambassadors*, ibid.

46 Such as the *The Peepshow*, 1655-6, Samuel van Hoogstraeten, National Gallery, London

47 Peter Kemp and Quentin Williams have claimed that Fabritius constructed his panorama by using a camera obscura with a curved screen. Steadman, op. cit. p.21

48 This research is indebted to John Hammond's diagrams and descriptions of camera obscuras in *The Camera Obscura: A Chronicle* (Adam Hilger, Bristol 1981), and for access to the Science Museum's collection of models

49 Della Porta , G.B., *Magiae Naturalis*, Naples, 1558, Eng. Trans. 1658 (reprinted by Basic Books, New York, 1957), p.19

50 Normally light is only noticed by the objects it illuminates and not as a communication medium. Marshall McLuhan refers to electric light as 'pure information' because it is both the means and the end. McLuhan, M., *Understanding Media: the extensions of man*, (Routledge, London, 1993) p.20

51 Total dark adaptation can take from half to one hour.

52 "If you cannot find a smooth glass, take a sheet of fine parchment, oil it well and then dry it". Leonardo da Vinci, *Treatise on Painting [Codex Urbinas Latinus 1270, Vol. I.]*, (trans. by McMahon, A.P., Princeton University Press, Princeton, 1956), p.47

53 Wier, D., Trance Institute, Brutten, Switzerland <http://www.trance.ch/intro.htm> [accessed 26 July 2005]

54 Townsend, C., *The Art of Bill Viola* (Thames & Hudson, London 2004), p.123

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