I+E Illumination and Emanation; Light as Body Adornment and the Implications of Wearable Light

Ulrike Doris Oberlack

Degree awarded by
University of the Arts London
Doctoral Award

Thesis Submission
May 2011

Abstract

I+E Illumination and Emanation; Light As Body Adornment and the Implications of Wearable Light is practice-based research that exploits advances in miniature light sources in order to establish new forms of aesthetic expression through wearable light.

I+E investigates how wearable light interacts with the body and its environment; it explores how this interaction shapes the visual perception of the body and establishes a critical framework for the description and evaluation of wearable light.

Practice working with light and body crosses disciplines from jewellery and fashion to fine art, performance and lens-based media. Wearable light, however, is a new field with few precedents and potential for future applications in sportswear, therapeutic rehabilitation and personal safety.

A reflexive, and adaptive methodology characterized the research process in which practice was the main vehicle, informed by the selection of critical context and continuous external feedback. Due to the cross-disciplinary nature of wearable light collaborative projects with practitioners in art & design and technological experts were balanced with experimental solo projects.

The research outcome is a body of work that investigates wearable light in a variety of applications such as light jewellery, performance and lens-based media.

Original contributions to knowledge are: in developing an experimental, practice-based research methodology with a particular focus on the role of collaborations vis-à-vis solo projects, and the expansion of the role of the practitioner from designer-maker to ‘auteur’, the focus and conduit in the practice of a new and complex performance art based on wearable light; in developing a critical vocabulary for the description and evaluation of wearable light and in investigating the mechanics of placing light on the body and its effects on the perception of the body in its environment.

Acknowledgements

My research project would not have been possible without the help and support of many others.

I would like to thank my supervisory team, Simon Fraser (director of studies), Stuart Evans and Suzanne Lee, for their inspiration, guidance and support without which it would have been nearly impossible to realize this project in its current wide scope.

I greatly appreciate the Arts and Humanities Research Council AHRC funding this research with a full-time doctoral award over three years.

My research has incorporated a large number of collaborative projects and I would like to thank my colleagues for their generous support, creative input and feedback. The contributors for the following projects have been:

***Alight**:* Union Dance (performance), Heidi Ahsmann (camera, video edit), Mahalia Belo (camera).

Body-Light-Scapes: Rob Popper (photography), Will Thorburn, Jedda (performance).

Sensing Change: Union Dance (performance, production), Rafael Bonachela (choreography), Mavin Khoo (choreography), Jess Bugg (costumes), Derek Richards (multi media), Heidi Ahsmann (video edit).

Radiance: Carol Brown (choreography), Katsura Isobe, Suzanna Recchia, Raymond Roa, Vine Dancers, the children of Woking primary schools (performance), Planet People (music, performance), Sarah Gilmartin (stage lighting), Heidi Ahsmann (camera, video edit), Judith Macfarlane (camera), Woking Dance Festival (production).

New Arenas: Frank Leopold (photography)

Light-Space-Body: Luke Birch, Katsura Isobe, Dominique Monty, Saffy Setohy, Amanda Thompson (performance), Michael Sainte-Croix, Steve Colson (consultants on scenography), Paul Wells, Steve Colson (building of light environments), Heidi Ahsmann, Judith Macfarlane (camera).
Light-Space-Body was part of a larger project, Here Tomorrow*,* based in a fine art context. I would like to thank my peers and Susan Trangmar, Reader at Central Saint Martins College of Art and Design, for the discourse and feedback during the project. Susan Trangmar initiated the ‘Here Tomorrow’ residency at the Lethaby Gallery and Central Saint Martins College of Art and

Design provided the gallery as a space for intensive practice-based research without which *Light-Space-Body* would have been difficult to realize.

I appreciate *SCAN*, <http://www.scansite.org>, sponsoring my video presentation at the Wearable Futures conference in September 2005.

Dr. Jane Harris, *NESTA* Fellow, Reader in Digital Textile Design & Media at Central Saint Martins College of Art and Design, gave invaluable feedback at various points of the project.

Last, but not least I would like to thank my husband Frank, my family and my friends for their generous and continued support of my endeavours along the (long) way.

Ulrike Oberlack

Table of Contents

8 APPENDIX 176

Table of Figures

1 Introduction

I+E Illumination and Emanation; Light As Body Adornment and the *Implications of Wearable Light* [1] is a practice-based research that exploits advances in miniature light sources in order to establish new forms of aesthetic expression through wearable light.

I+E[2] investigates how emissions from wearable light features interact with the body as a dynamic three-dimensional projection space and its surrounding environment. *I+E* explores how this interaction shapes the visual perception of the body in its surroundings. The project aims to establish a critical framework for the description and evaluation of wearable light.

The original title of the PhD was *I+E Illumination and Emanation; Light as Body Adornment* based on the research aim to explore the potential of light as body adornment with a main interest in artificial light as a resource using the latest developments in lighting technology and to evaluate the implications of this research for a range of applications. The objectives were firstly to establish the conceptual and technological dimensions of light as body adornment through a practice-based research. Secondly, to critically review the potential of new technologies in lighting and energy supply with regards to the research. Thirdly, to contextualise the project by critically reviewing the use of light in relationship to the body in contemporary art and design practice. Fourthly, to explore implications of this research for applications in related disciplines and lastly, to seek and integrate external feedback on practice as part of the research project (Oberlack, 2004a; primary source).[3]

The rationale for this research was a lack of existing explorations of light in relationship to the body based on wearability. Advances in technologies such as light emitting diodes[4] and miniature batteries provided the technological base for these explorations.

The research process was driven by a sequence of projects that investigated particular aspects of light as body adornment. The specific remits of the projects were to be informed by the evaluation of process and outcomes of

---

1 *Italics* indicate names throughout the thesis, unless the name belongs to a person.

2 *I+E* as an abbreviation refers to the author's PhD research project throughout the thesis.

3 The thesis uses the Harvard style of bibliographical referencing on recommendation of the University of the Arts London.

4 For an overview of light emitting diode (LED) technology see Schubert (2003).

prior projects in the sequence. A research map detailing the research objects set boundaries for this development.[5]

Expected outcomes were collections of light features created in response to the specific aspects of research investigated in each of the projects.

The research process led to a modification of the research objectives in 2006, at confirmation/transfer stage, to putting added emphasis on collaborations with practitioners from related disciplines and to develop a critical framework for the description and evaluation of light as body adornment. As a clarification of the original research remit, the research objectives included a focus on wearable light and the continuing integration of external feedback (Oberlack, 2006b; primary source). This extension of the research remit was captured in a revised research map.[6]

The change in the title of the research reflects the wider research remit: *I+E Illumination and Emanation; Light As Body Adornment and the Implications of Wearable Light*.

'Light as body adornment'[7] reflected the origin of this research in jewellery. The expansion of practice into applications such as performance and recording of light effects on the body lead to a development of new generations of light features with a focus on functionality as 'performance pieces', not with a jewellery sensibility and intrinsic value of their own. Their application was not focused on light as body adornment, but in the wider sense an exploration of wearable light in different contexts.

The author's background in science has informed and facilitated this study. Though not formally trained, the author's family background is in physics and electronics engineering and the author considered a career in electronics engineering at an early stage. This has provided the author with an understanding of 'light science'[8] and a working knowledge of the technologies required to create wearable light features; it also provided access to a network of scientific and technological advisors.

The research of light and the body might be expected to be a scientific exploration of the interaction of light and the body. However, this research relies on knowledge of the physics of light in order to explore the interaction of light and body within the framework of an art and design practice.

---

5 The original research map is shown in chapter 3, figure 3.1.

6 The revised research map is shown in chapter 3, figure 3.2.

7 Single inverted commas indicate terms and phrases throughout the thesis. Double inverted commas indicate quotations.

8 For an introduction to 'light science' and its relationship to arts see Rossing, Chiaverina (1999).

Outcomes in Outline

The experimental, practice-based research methodology formed the foundation for achieving the research objectives, has developed research practice and outcomes far beyond the original remit and constitutes the most central original contribution to knowledge.

The research methodology set up a reflective process that centred on the development of practice-based projects investigating specific aspects of the research. Their evaluation in terms of practice, process and outcomes informed subsequent projects in the sequence. This approach emphasized the integration of external feedback into the reflection on practice. This 'fixed process, emergent outcomes' methodology took into account the exploratory nature of this research and built multiple reflective cycles into the research.

As a result a 'scaling' effect took place: practice expanded across disciplines in art and design with a corresponding extension of methods and outcomes and an expansion of the role of the practitioner. Reflections on and between the different strands of this 'scaling' fed back into the research and in turn fed into reflections on the research methodology and its development.

A balance between collaborative and 'solo' projects characterized the research process. Due to the cross-disciplinary nature of wearable light, collaborations were of paramount importance and provided expertise, external feedback and creative focus. 'Solo' projects allowed full artistic control of process and outcomes and the exploration of specific aspects in projects on a small scale.

Practice expanded across disciplines of art and design ranging from the design of light jewellery to the choreography and performance of wearable light and their recording and editing in lens-based media. The exploration of wearable light in relationship to specifically designed light environments extended the practice to include scenography.

This expansion of practice had implications for the role of the researcher as it extended from designer-maker of 'light jewellery' to 'auteur', directing and controlling the creative process in collaborative projects. This expansion required the employment of methods appropriate to the new areas of practice. The role of collaborations with experts as a means to rapidly extend methods was investigated as well as training through specialist courses.

Corresponding outcomes extended across disciplines from new generations of light features to light choreographies and their performance to expressions of wearable light in time-elapsed photography and digital video. This led to the

identification and development of a new and complex form of performance and recording practice-based on wearable light that united the different strands of practice and had two modes of expression: live performance and recording in lens-based media. This represents a central original contribution to knowledge.

The development of this performance art based on wearable light was supported by investigations of the characteristics and qualities of wearability and time-based boundaries as central tenets of wearable light leading to an identification of the mechanics of placing light on the body. This presents an original contribution to knowledge in the form of 'Know How' with a pedagogic application.

In response to the scarcity of criteria to describe and assess wearable light in existing contexts the research identified an emerging critical vocabulary and codified it into a typology of wearable light. Though as yet not mature, this critical language shows potential for the application and extension into a wide range of practices concerned with light and the body and presents a central original contribution to knowledge.

Role of Practice in the Research

The research has been primarily practice-based, i.e. it mainly used processes of practice as a method to investigate the research questions. Practice, rather than theory, has been the vehicle and outcome of the research. The research was practice-led in that it addressed questions of practice such as 'how can light be placed on the body, and what effects does that have?'

The research outcomes, however, go beyond practice outcomes to contribute to the understanding of the body in its environment and the building of theory within art and design practice related to the interaction of light, the body and its environment. The research will feed back into practice, in the author's own work as presented and potentially in the work of many others. Using practice, rather than being theory-led research, has made outcomes of the author's work practical, i.e. they work and can be used and developed within some limitations imposed by time, cost and technology.

Schoen (1991) continues to be a primary source for practice-based research and characterizes the author's project well in that it identifies processes of practice as a significant part of the research methodology, while the research is also being led by practice in that it addresses issues and questions faced by art and design practitioners and the research outcomes are practical, that is, they work, can be used and establish a basis for future development.

Structure of the Thesis

Chapter one has so far covered an introduction to the research outlining its development and outcomes as well as a discussion of its base in practice-based and practice-led research in art and design. This chapter goes on to outline an overview of the structure of the thesis and finishes with notes on the rationale for selecting visual material on the accompanying DVD, the complexity of referencing video and still images for a multitude of different aspects and how the DVD is used in relationship to the text.

Chapter two provides a critical review of the context of wearable light, in effect a review of literature and practice. The limited context of wearable light in current art and design practice is contrasted by the variety of practices that work with light and the body in a wider sense. The research strategy for this review has been opportunistic rather than systematic taking into account the nature of the varied contexts and collecting evidence of precedents through lateral encounters. This strategy has lead to a collection of case studies of practice, presented in brief, that typify certain approaches of working with light and the body within their fields and that have particular significance for this research. Examples range from jewellery (2.1), fashion and wearables (2.2) to performance (2.3), fine art (2.4), and lens-based media (2.5). Conclusions (2.6) to chapter two draw out the relevance of this research project in relationship to the multiple contexts.

Chapter three covers research methodology and process. It sets out research approach and methodology and charts its development with particular reference to reflexive aspects of the methodology (3.1). Section 3.2 covers the research process, first 'telling the story' of the unfolding rationale in the research process by charting research outcomes and their impact on key decisions.

The subsequent chronological account maps selected projects that typify certain approaches and aspects of this research and had major impact on the development of the project. The research set out with collaborations for *Evolution* and *Sensing Change* in a performance context. In *Wearable Futures* the author reflected upon these projects for a publication in text and audio-visual format. *Radiance* capitalized on these reflections and through collaborations took the research into new environments for 'light performance' and focused on the recording and editing of moving images of these performances. *New Arenas* put these experiences into practice in 'solo' sessions that explored different outdoor arenas by means of time-elapsed photography. The practice expanded yet again in *Light-Space-Body.* Specific

light environments were designed and constructed in response to prior outcomes and were explored in relationship to wearable light. In this collaboration, the author took on the role of the 'auteur' as a focus and conduit for action in the creative process. Conclusions to chapter three (3.3) comment on contributions to the understanding of practice-based research and outline the relationship between the development of methodology, process and outcomes.

Chapter four considers the dual nature of wearability and time-based boundaries as drive motors and outcomes of research into wearable light. The characteristics of wearability and its implications for the practice and outcomes of wearable light are presented in section 4.1. The features and attributes of the body as a site and a carrier of light constitute the base of wearable light. The choreography of light combines these constituent parts into movement phrases that create a range of light effects on and off the body. This has implications for the scaling of wearable light, its publication and exhibition and the design of wearable light features. Characteristics and qualities of time-based are presented in section 4.2. They cover the complex and transient nature of wearable light and implication for its perception in formal or informal live performances and contrast them with the recording of wearable light presented as a way to extend the timeline of live effect. The requirement of wearable energy supply presents time-based limitations as well as offering possibilities for wearable light. Section 4.3 discusses implications of wearable light for the perception of the body, the protagonist and its effects on social interaction. Chapter four concludes with comments on the dual nature of wearability and time-based boundaries of wearable light as central drive motors and outcomes of this project and their implications for the development of this research.

Chapter five outlines elements of an emerging visual language that developed in the course of the research in response to a in section 5.1, and their codification in a taxonomy,[9] the *Descriptive Analysis Framework (DAF)* in section 5.2. The chapter concludes with a discussion of the maturity of this emerging language and its contribution to knowledge as well as its further potential in section 5.3.

Chapter six presents conclusions of the research, their contributions to knowledge and implications for further research. The experimental, practice-based research methodology presented a central contribution to the understanding and development of practice-based and practice-led research

[9] For the purpose of this thesis 'typology' and 'taxonomy' are used as synonyms.

and featured a balance of collaborative and 'solo' projects (6.1). This resulted in a 'scaling' effect: the expansion of practice with a matching extension of methods and an equivalent expansion of the role of the practitioner culminating in a corresponding extension of outcomes (6.2). Conclusions with regard to research outcomes based on particular characteristics of wearable light are presented in for wearability (6.3) and time-based boundaries (6.4). Contributions to knowledge offered by the development of an emergent critical language of wearable light are discussed in 6.5. A summary of implications for future research with a focus on intentions with regard to the author's practice-based research concludes the thesis (6.6).

Chapter seven, *References and Bibliography*, is divided into four sections covering primary sources, publications, audio-visual material and other Internet sources.

The appendix in chapter eight contains additional case studies relating to the context review (8.1) and an overview of all projects of this research in a framework that assesses their contributions to and impact on different aspects of the practice (8.2).

Accompanying DVD

The accompanying DVD holds selected visual material from the research outcomes. Still and moving images in the thesis and on DVD were selected because they typify approaches to process and outcomes in the research and support the arguments in the thesis. A comprehensive collection of visual material on DVD would not be appropriate due to the vast amount of still and moving images produced in the course of the research.

References to specific video clips on DVD are indicated at the beginning of each section of the thesis so that they may be viewed alongside the text.

Referencing still imagery and video in different sections and contexts presents a complex issue, as they are relevant in different aspects and combinations throughout the text. Moving images in particular give rise to challenges with regards to referencing exact frames. The argument of the thesis is therefore largely built around still imagery with moving images having a supporting function. In order to facilitate the referencing, videos covering collaborative projects have been split into process and outcome components that are indicated in the titles of the respective video clips.

Still imagery shown in the thesis has also been integrated into the visual material on DVD as the output medium impacts upon the visual effects in the images. Print media cannot quite cover the subtlety and luminosity of the light

effects on screen or in projection. As still and moving images were recorded in digital media, their outcomes were viewed and evaluated on LCD screen during their production. The calibration of visual effects on screen is therefore in most cases nearer to the original production than the print medium.

The visual material on DVD is presented as video clips that are organized chronologically according to the projects selected in section 3.2.

- *Evolution* has produced two different videos of outcomes:
  Alight refers to the performance at the Victoria and Albert Museum.
  Body-Light-Scapes covers still imagery in time-elapsed photography.
- *Sensing Change* is presented in videos covering process and outcomes:
  Sensing Change: Process and *Sensing Change: Outcomes.*
- Wearable Futures produced a video as part of its publication output:
  I+E illumination + emanation; light as body adornment.
- *Radiance* is split into videos of process and outcomes:
  Radiance: Process and *Radiance: Outcomes*.
  The latter contains video material of the performances *Radiance/Topos* and *Radiance/White Christmas* and of *Spaces Around and Between*, an experimental stage lighting workshop.
- *New Arenas* produced still imagery largely in solo sessions, shown here in a video format of the outcomes: *New Arenas: Snow & Water*.
- *Light-Space-Body* returns to the split into process and outcomes:
  Light-Space-Body: Process and *Light-Space-Body: Outcomes.*

2 Wearable Light as Observed in Multiple Contexts of Art and Design

Wearable light draws on multiple contexts in art and design as well as science and technology. As a creative practice it occupies a territory at the intersection of light, performance and jewellery. At its centre wearable light features place light sources strategically on the body allowing a simultaneous exploration of the body as a carrier of light and as a dynamic, three-dimensional site of light. This enquiry produces outcomes that cross boundaries from jewellery into performance and lens-based media.

Although there are some early examples, wearable light has only recently become a field of investigation in art and design and does not yet exist as a subject area in itself. This means that the number of precedents for wearable light is limited and hardly any systematic collection or classification of wearable light features is available.[10]

This limited context of wearable light is contrasted by the broad context of theory and practice that can be identified for this research because it sits at the intersection of light, performance and jewellery.

Using light in relationship to the body opens contexts in fine art and lens-based media. One can, for example, argue that most *light art* implies an interaction with the body of the viewer because it plays with the effects that artificial light has on the visual perception of the viewer. While important as a wider context for this research project, Weibel, Jansen eds. (2006) demonstrate that *light art* as a discipline is too large and varied to provide concrete insights for this research project. In a parallel to *light art,* lens-based media rely on light to record imagery and artificial lighting is well established as a means to manipulate light conditions for these recordings (Rossing, Chiaverina, 1999). Even narrowing the focus to practices that centre on the body leaves a widely varied context.

The body as a dynamic three-dimensional projection surface raises questions about how the topography of the body and its movement interact with (wearable) light and how this might transform and dramatize the protagonist.

[10] Suzanne Lee (2005) dedicates one chapter of *Fashioning the Future* to illuminated garments and accessories. This represents a first step towards a comprehensive overview of wearable light features.

This interest in the moving body creates the connection to performance, a wide context in which the use of stage lighting is in most cases an integral part.

Placing light features on the body links wearable light to jewellery and its parallel contexts of fashion and wearable technology. Within these contexts the most direct precedents for placing light on the body are to be found.

In order to focus the argument of this thesis, only material that directly relates to the use of light in interaction with the body is included in this chapter. Evidence of research into the broad context identified for this project can be found in the bibliography with some related case studies for further reference in the appendix.

Given the nature of the multiple contexts, the research strategy for this context review has been opportunistic rather than systematic collecting evidence of precedents through lateral encounters. This research strategy has lead to a collection of case studies of practice, presented here in brief, that typify certain approaches of working with light within their fields and that have a particular resonance with this research project. These case studies lead the review because the literature on light as body adornment is scattered over many disciplines and is in any case not focused on the understanding that underpins this study. As a formal critical discussion of light on the body has not yet been established, much of the evidence takes the form of reports on, or critiques of practice.

The case studies are used to understand a range of ways of using light, to identify criteria for a critical discussion and to develop steps towards building a critique of different practices of working with light on the body. They form a cumulative commentary that looks at light technologies, how they are applied, and their impact on the body.

The review first examines precedents of light and body from a context of design for jewellery (2.1) and its parallel contexts of fashion and wearables (2.2). It then investigates working with light on the body in the context of performance (2.3), fine art (2.4) and lens-based media (2.5). An emerging typology of working with light and the body concludes the context review and positions this research in relationship to the context (2.6).

2.1 'Light Jewellery'; Transient Body-Related Practice

Jewellery in its widest sense can be defined as objects that are active on the boundary of the body (Broadhead, 2005 p. 25). The body is therefore always implied in jewellery even if contemporary work is shown within the contexts of installations or photography and video (Astfalck, 2005).

Jewellery has a long tradition of harnessing natural light by manipulating reflective and refractive materials: polished metal surfaces shine with reflected light and gem stone cutting is geared towards capturing the maximum amount of light in the stone. Working with wearable light sources follows parts of this tradition with new means.[11]

In the late 19th century 'flash jewellery' incorporated tiny electric light bulbs to illuminate imitation gemstones (Wosk, 2001 pp. 73-4). However, due to technological restrictions artificial light sources remained a rare occurrence in jewellery. Even with the advent of wearable light technologies such as light emitting diodes 'light jewellery' is still not a mainstream occurrence in contemporary jewellery.

Most contemporary proponents of 'light jewellery' capture the light within beautifully crafted objects that are worn on the body without an in-depth enquiry into how the light emission interacts with the body. A typical example for this approach is Nicolas Estrada who often integrates small light sources with traditional and organic materials to create jewellery that references myths from his home country Columbia (Grant, 2005 p. 155).

In the wake of the *New Jewellery* movement, however, a strand of jewellery formed that explored light in relationship to the body. *New Jewellery* emerged in the 1960s exploring new materials for jewellery and investigated a wide range of 'objects to wear' in relationship to the body and thus challenging perceptions of jewellery and its boundaries as a discipline (Dormer, Turner, 1985).[12]

A significant number of *New Jewellery* proponents explored the relationship between jewellery and performance (Dormer, Turner, 1985 pp.146-153). The engagement ranged from performance-based pieces that challenged notions

[11] A detailed discussion of the manipulation of reflective and refractive materials in jewellery can be found in Oberlack (2002). Some contemporary materials like acrylics have a particular potential to harness colour from natural light. Appendix 8.1.1 contains a case study that typifies this approach.

[12] The inclusion of Bakker's and Van Leersum's work in the exhibition *Body Covering*, New York, 1968, demonstrates that jewellery linked to a wider area of wearables (Joris, 2005 p. 23). See also Palmer (1991) p. 101, Shorr (1968).

of wearability to an interest in presenting jewellery through performance.[13] This interest was in part fuelled by developments in 20th century performance theatre, in particular Oskar Schlemmer's triadic ballet which derived from the movement of the human body in space and focused on its transformation (Ward, 1983 p. 9-10).[14]

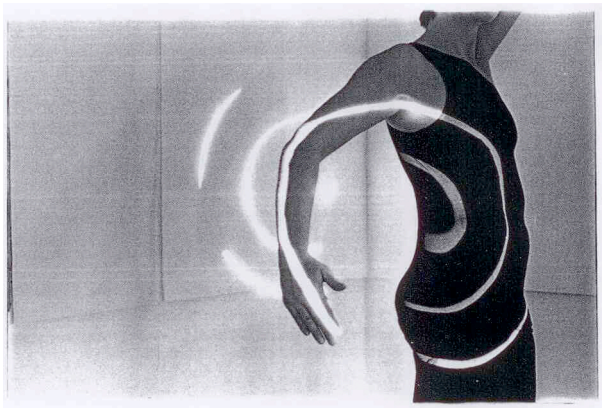

Fig. 2.1[15] Susanna Heron; *Spiral Light Projection*, 1979.[16]

Against this background practitioners such as Susanna Heron and Johanna Dahm began to explore the relationship of light projections and the body in the late 1970s and 1980s.[17] In collaborative experiments with other artists they projected slides on the body and developed stencils[18] in order to create light shapes on the body that fragmented and abstracted the body.[19] This essentially performance-based work was in part captured in lens-based media and now survives in photographs. While Heron moved on to explore the relationship of light, body and space in sculpture, Dahm capitalized on these early experiments by creating brooches that capture and reflect light.

Monica Brugger's *Jeuje* (1999-2000) took the idea of projected jewellery into an installation context. Here the image of a daisy chain is projected on to

---

13 An example for performance-based jewellery is Pierre Degen's work (Dormer, Turner, 1985 p.149-50). Jewellers such as Gijs Bakker and Emmy van Leersum considered presenting jewellery through performance (Joris, 2005 p. 45-6).

14 The triadic ballet was developed at the Bauhaus in Weimar in the 1920s. For a re-print of the original book on the development of the Bauhaus theatre see Schlemmer, Moholy-Nagy, Molnar (2003).

15 Figures are numbered in running order for each chapter i.e. 2.1 - 2.14, 3.1 - 3.19, etc.).

16 Source Crafts Council Gallery (1980) p. 28. See also Ober (1982).

17 For Susanna Heron see Crafts Council Gallery (1980) p. 15, 26-29. For Johanna Dahm see Riklin-Schilbert (1999) p. 123. See also Drutt English, Dormer (1995).

18 In stage lighting terms these stencils might be deemed gobos. See Reid (2001) p. 19.

19 Early explorations for the Masters stage of this research project also used slide projections without having prior knowledge of Dahm's or Heron's work at the time. The slides for the projections stemmed from the specialized slide collection at Central Saint Martin's College of Art and Design. They were selected and tested for their ability to create pattern and form on the body (Oberlack, 2002).

different parts of the body depending on where the participants position themselves in the installation (Sackville, Broadhead eds., 2006 pp.110-1).

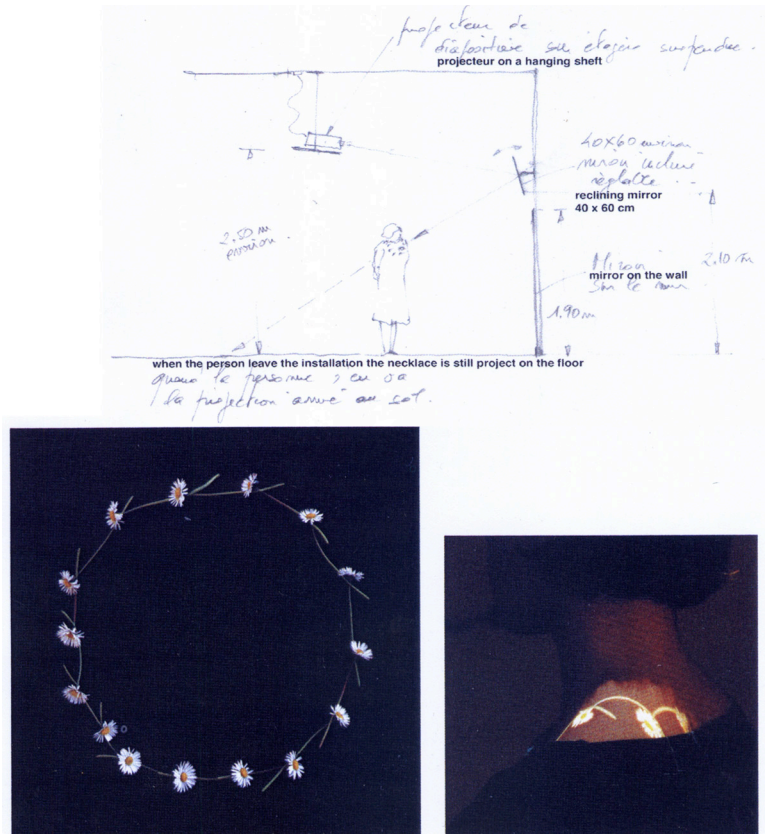

Fig. 2.2 Monica Brugger; *Jeuje,* 1999-2000.[20]

This form of projected jewellery opens the door to performance-based spatial installations and pushes the boundaries of how jewellery can be constituted on the body. However, these 'light works' lose a main characteristic of conventional jewellery – its portability on the body. In these works the body becomes the site for light projections, but is not a carrier of the light sources that project the light onto the body as these are fixed in the spatial arrangement. Drutt English, Dormer (1995) succinctly summarizes the advantages and disadvantages of this type of projected jewellery.

> "One of the advantages of the 'light works' approach, however, is its economy of effort and its respect for the model – the person in the light is not inconvenienced or imposed upon physically. Moreover, … the use of projected light is about as free of the burden of the innate value or preciousness of the material as you can get. On the other hand it is static, it is fixed-point 'jewelry' and consequently contradicts one of the central characteristics of jewelry art – its portability."
> (Drutt English, Dormer, 1995 p. 111)

[20] Source Sackville, Broadhead eds. (2006) p. 111.

The relevance of this type of practice for the author's research lies in its exploration of what wearing light might mean and its investigation of the body as a site of light driven by a jeweller's sensibility and understanding of the body.

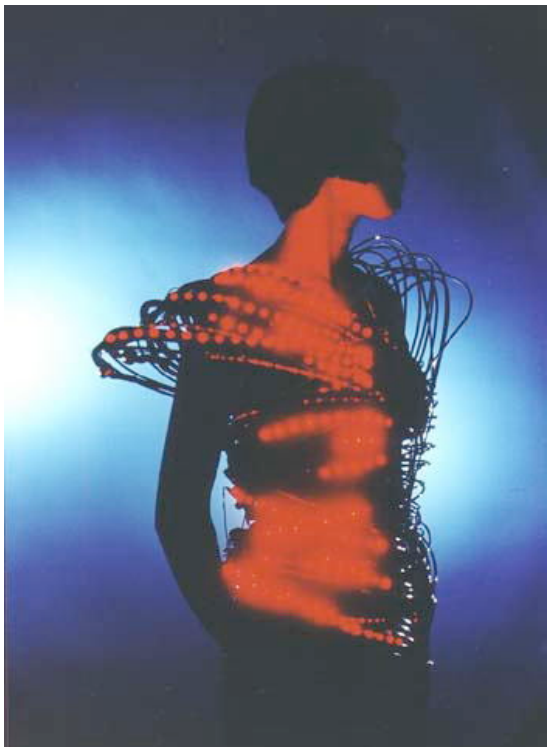

Fig. 2.3 Erina Kashihara; *Misty Wind,* 1993.[21]

Erina Kashihara's work is typical for an ornamental approach to the interaction of light and the body in jewellery. Kashihara has been experimenting with light as a body adornment for over 20 years. In her work she tries "to create a moment of light" (Kashihara, 2006 [Internet]). Her wearable ornaments combine motion sensors with LEDs to create fluctuating light effects as the wearer moves. The light trails, traces and paints these movements in the air (Lee, 2005 p. 97). Costumes such as *Misty Wind* encase and extend the body shape, reconfigure its silhouette and trace its movements.

The LED lights In Kashihara's light ornaments are embedded in larger structures that shape the form of the ornaments and emphasize their character as objects. Light effects take place mainly on or within the objects and are directed outwards to the viewer, not onto the body of the wearer. The body acts as a carrier for the light ornaments and its movements trigger their light display.

[21] Source Lee (2005) p. 97.

Kashihara's work can be seen as following Tanaka's *Electric Dress*[22] in investigating the interaction of body movement and light features on the body with contemporary lighting technologies. Of particular relevance to the author's research is Kashihara's interest in ornamental qualities of light effects where the body not only carries the light display but shapes and propels the light effect through its movements.

2.2 Electric Light in Fashion and Wearables

Electric Light was incorporated into fashion as early as the 19th century when Mrs. Cornelius Vanderbilt wore an *Electric Light* ball gown to the Vanderbilt ball in 1883 and battery powered 'flash jewellery' featured illuminated gemstones (Wosk, 2001 pp. 72-4). The enthusiasm for space-age technology saw a brief resurgence of electrified fashion in 1960s club wear such as Diana Dew's electroluminescent dresses.[23] Fashion designer Paco Rabanne explored the interaction of light and the body through reflective metallic mesh dresses and declared that in future people would be wearing light. His work featured together with Dew's dresses in the exhibition *Body Covering*, New York, 1968, that covered a wide range of 'wearable objects' from space jump suits to tattoos (Shorr, 1968).[24]

Since the advance of light technologies such as LEDs and fibre-optics in the 1990s, illuminated garments have started to appear on catwalks on a regular basis (Lee, 2005 pp. 91-108). Most fashion designers, however, do not explore light on the body through a long-term investigation, but rather exploit it in singular collections. A notable exception is Hussein Chalayan who has employed different types of wearable light sources in a number of collections since the mid 1990s. This is part of his general interest in technology as a means to broaden his language as a designer (Lee, 2005 p. 96).

[22] For Tanaka's *Electric Dress* see section 2.4.

[23] See Lee (2005) pp. 96-7.

[24] See also Palmer (1991) p.101.

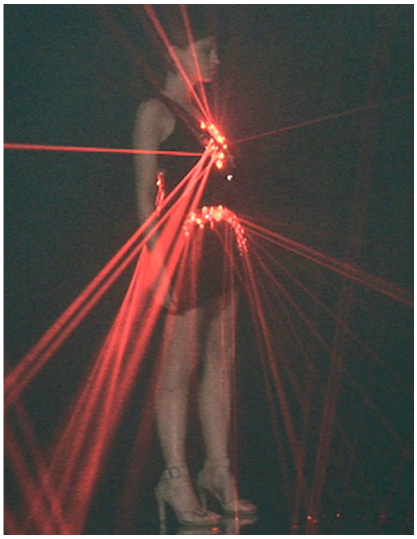

Fig. 2.4 **Naomi Filmer for Hussein Chalayan; *Mouth Light* and *Ear Light*, 1996.**[25] **Hussein Chalayan; *Readings,* collection SS 2008.**[26]

Chalayan's collaboration with jeweller Naomi Filmer produced jewellery exploring internal body spaces with mouth and ear lights that illuminated intimate body spaces.[27] The light features exploit the fact that red light waves penetrate skin tissue and render it almost translucent. The red light spills out of the mouth and seeps through the skin around the earlobe creating an eerie effect. The light effect draws the attention to body spaces that usually escape the wearer and the audience and address the body as a site of light.

Chalayan's *Readings* collection SS 2008[28] conceptualizes light projections as connections between the body and its environment: red lasers project light from the body outward into the surrounding space thereby making the interaction of the body with the surrounding area visible. In order for the laser light to be seen the air must be treated as the laser light will only show when reflected by particles dispersed in the air. This makes these dresses 'catwalk' pieces that explore concepts in an eye-catching way, but need very specific conditions in order to function.

Chalayan's work with light as an immaterial medium on the body is of particular interest to the author's research as he conceptualizes the body as a site of light as well as a carrier and propulsion mechanism for wearable light in interaction with its environment. His work does, however, not investigate in-

---

25 Source Watkins (1999) p. 89.

26 Source Readings collection SS 2008, 2008 [Online Image]. SS 2008: summer season 2008.

27 This project might have been inspired by an image of music/performance artist Laurie Anderson with a light bulb in her mouth. For an image see Ward (1983) p.12.

28 For further information see Chalayan (2011 [Internet]).

depth the dynamic aspects of the interaction between the body as a projection site, the body as a carrier of light sources and the environment.

The field of *Wearables* or *Wearable Tech* has developed since the 1960s and is driven by innovations in wearable computing. In a wider sense the discipline investigates technology in relationship to the body (Rhodes, 2011 [Internet]). Light features regularly as a means to accentuate and make visible events in and on the body. Some of the knowledge developed in *Wearable Tech* has filtered into the market of functional wearables were light features on the body are currently mainly deployed for personal safety.[29]

Sompit Moi Fusakul's *Vein2* is emblematic of approaches that use wearable light features to visualize the physiological and, by implication, the emotional state of the wearer.

Fig. 2.5 Sompit Moi Fusakul; *Vein2,* 2002.[30]

Fusakul's *Vein2* changes its light display according to changes in the heart rate of the wearer who is so to speak wearing her heart on her sleeve. *Vein2* integrates all sensory tools, electronics and lights in one wearable light feature which is triggered by the body of the wearer to display different light patterns. While the light effect takes place on the body and is shaped around it, the physical interaction between the light sources and the body is not the focus of investigation. Instead *Vein2* typifies approaches in wearables that combine biometric sensors and wearable light features to create displays that try to communicate something from the world inside the wearer – their emotional

[29] Case studies for this broader context can be found in the appendix 8.1.4.

[30] Source Vein2, 2002 [Online Image].

state.[31] An alternative approach varies the theme: here light on the body signals or traces human interaction.[32]

The significance of this type of wearables for the author's research lies in its use of the body as a carrier of light features that communicate otherwise invisible or hardly visible events and therefore have the potential to change the perception of the audience and the protagonist. Fusakul's work also brings a jeweller's sensibility to the design of the light features.

Moi by interaction design group *Studio5050*[33] exemplifies wearables that use light to instigate playful exploration and social exchanges.

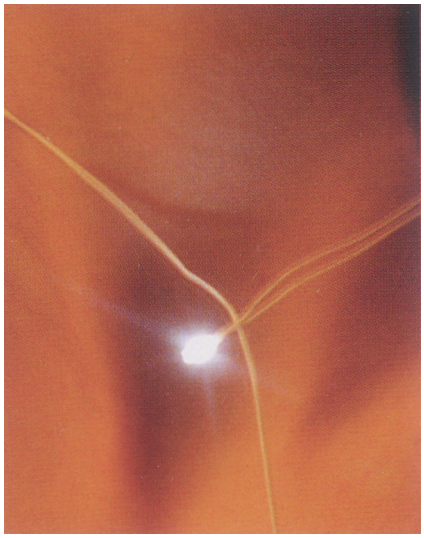

Fig. 2.6 *Studio5050*; *Moi*, 2003.[34]

The wearable light feature consists of a small LED mounted on thin, flexible wire that can be slung on or around different parts of the body. The designers deliberately do not specify how to wear their light feature on the body, but invite the wearers to explore how they want to use *Moi*.

Despite its small size, *Moi* seems to encourage social exchanges as a conversation piece between its wearer and varying audiences. *Moi* invites comments and conversation to a point that designer Despina Papadopoulos of *Studio5050* said that she does not wear *Moi* if she does not feel in an extrovert, outgoing mood (Lee, 2005 p. 100-103).

---

[31] While there are questions about the reliability of biometric sensors to convey complex emotional states, these types of wearable light features have potential as communication tools and therapeutic devices (Stead, 2005). The appendix 8.1.3 contains the case study of a project in a prototype stage that tries to communicate more complex emotional states.

[32] Joanna Berzowska's memory rich garments and Nicole Gratiot-Stöber's interactive rings are typical for this approach. See appendix 8.1.2 for further information.

[33] For information on *Studio5050* see Studio5050 (2011 [Internet]).

[34] Source Lee (2005) p. 100.

Of particular interest to the author's research is the fact that *Moi* investigates the effect that wearing a light object has on social interactions. It encourages creative self-expression of the wearer and social exchanges between the wearer and potential audience. However, *Moi* does not investigate the light effects that are constituted by the physical interaction of wearable light features and the body.

2.3 Performance; Interaction of Light and Body

Artificial lighting used in performances to light the stage or setting almost inherently turns the body of the protagonist into a site of light. However, stage lighting is not necessarily focused on the performers, but rather takes into account the overall aims of the production.[35] While stage lighting has not focused on the development of wearable light, the sculptural lighting of the body required in most dance performances (Reid, 2001 pp. 8, 35-7) conceptualizes the body as a site of light.

This sculptural exploration of the body through stage lighting has been informed and in some cases even driven by the advent of new lighting technologies; from the invention of electric lighting in the late 19th century to the digital technologies that have enabled contemporary performance practice to engage large scale multimedia projections that react live and in real-time to the performer's actions on stage.[36] While the interaction between the performer and the multi-media environment is at the centre of these performances, wearable light does not feature. A notable exception is Seth Riskin whose practice straddles lens-based media and performance and is discussed in chapter 2.5.

Loie Fuller's 'light dances' are presented here as an early example of practice that employs technological advances to create new light effects in relationship to the body. In the 1890s Fuller exploited the recent invention of electric light for her performances and developed light effects based on arc lights.[37]

---

[35] Reid (2001, p. 9) defines stage lighting as "a fluid selective atmospheric sculptural illumination appropriate to the style of a particular production".

[36] Typically developed in collaborations between choreographers, multi-media artists and cybernetic experts these multi-media performances are driven by complex networks of sensors, cameras, computers and lighting.

[37] Arc Lights were the earliest form of electrical illumination. Electric current passing between two hot rods of carbon created a high radiance in the gap between the rods, much like a light arc in electric welding (Current, Current, 1997).

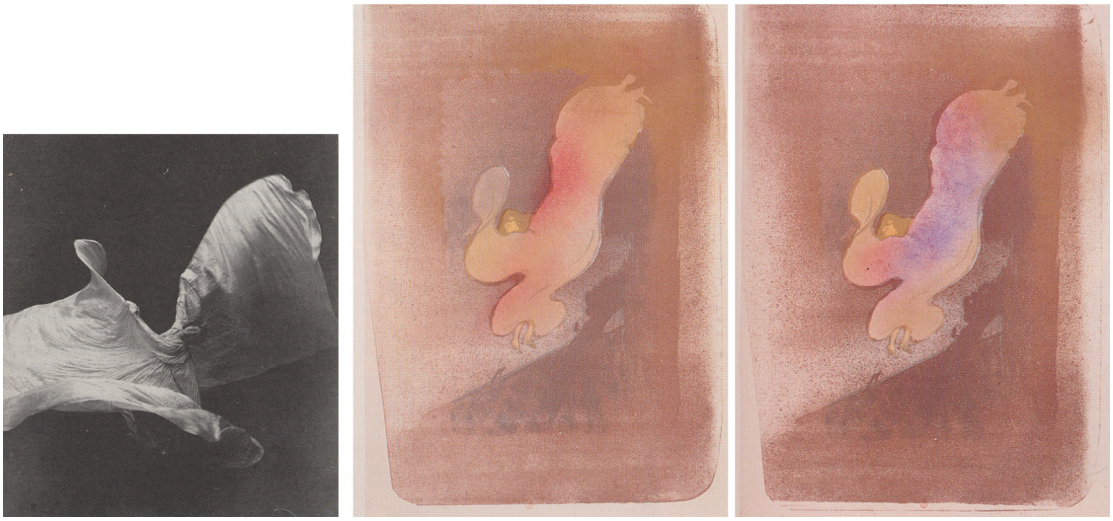

Fig. 2.7 Loie Fuller; *La danse du Lys*, 1900 (left)[38]; Henri de Toulouse-Lautrec; Water colours of Loie Fuller's performance (middle and right).[39]

Loie Fuller caused a sensation with performances such as *Serpentine*, 1891 and *Fire Dance*, 1896 (Current, Current, 1997).[40] These performances imaginatively combined coloured electric light and billowing diaphanous costumes that provided a dynamic projection surface and extended the range of body movement. The effect transformed the performer into a floating apparition of light and cloth which constantly changed its shape.

Fuller's technical repertoire developed through experimental learning and collaboration. Her expertise lay in manipulating light, creating gelatine colour tints and slides with colour effects as well as blending different light sources when projecting them onto the choreographed movement of the costume drapes. She collaborated with her brother Frank on the technological aspects of her performances and hired her own technical crew as her light choreographies became progressively complex (Current, Current, 1997).[41]

The scant documentation of Fuller's work is due to the technical limitations of photography and film during her lifetime.[42] Toulouse-Lautrec's watercolours of Fuller's light choreography (figure 2.7) provide impressions of the ephemeral and painterly qualities of light effects in Fuller's performances rather than focusing on the materiality of costumes and dancer.

---

38 *La danse du Lys* (1900) photograph by I. W. Taber, 1900 (source Current, Current, 1997 p.113).

39 Source Current, Current (1997) colour plates 14,15.

40 See also Lindberg Slayter Reconstructions (2007 [Internet]).

41 See also Lindberg Slayter Reconstructions (2007 [Internet]). Frank Fuller was one of Edison's students (Current, Current, 1997).

42 Black & white photographs and film as well as promotional posters, sculptures and most images by artists of Fuller's generation cannot quite capture the light and colour effects. See (Current, Current, 1997) for examples of photography, sculptures and promotional posters.

Fuller's 'light dances' captured the imagination of her contemporaries and inspired in particular *Art Nouveau* sculpture (Kader, 2000). Her new form of performance art based on the interaction of light, costume and the body became influential across a range of disciplines from stage lighting to cinematic techniques that can be traced for example, to the elaborate interaction of costume, light and stage in Hollywood films and musicals from the 1930s to the 1950s.[43]

The relevance of Fuller's work for the author's research lies in its exploitation of new technologies, its exploration of the body as a site of light and its investigation of the potential of coloured light.

The work instigated by Fuller was continued in the 20th century. The *Bauhaus* theatre (Gropius ed., 1961)[44] worked with light on the body through costumes featuring reflective and absorptive elements. In performances such as Oskar Schlemmer's *Metalltanz* in 1928/9 (Weibel, 2006 p. 161) the costumes optically extended the range of body movement in space thus enhancing the visual interaction of the body and the environment. Reflective and absorptive features in costumes of Schlemmer's *Triadic Ballet* in 1922/3 (Schlemmer, 2003 pp. 35-6) transform the shape and volume of the body and led to a diffusion and dissolution of the figures.

Within Eastern European theatre this tradition continued in *Black Light* theatre (Black Light Theatre, 2010a [Internet]), mainly based in Prague. *Black Light* theatre uses a black box set up[45] to visually fragment and dissolve the body to such a degree that the performer disappears. The interaction of the black box, ultraviolet light and black costumes with ultraviolet light reflective features deliberately disguises the bodies of the performers in order to create an illusion. In this setup the performer is only present as facilitator of this illusion; his body becomes a carrier of reflective features and thus a site of (ultraviolet) light reflection. The explorations of the *Black Light* theatre had repercussions during the 1960s with the development of happenings and in particular fashion design interest in luminescent effects.[46]

---

[43] For examples of visual references see Sennett (1981) pp. 41, 216, 263 and Bailey (1988) pp. 20, 43, 270-1.

[44] The *Bauhausbühne* (lit. *Bauhaus* stage), the theatre division of the *Bauhaus* was headed by Oskar Schlemmer from 1923 (Bauhaus, 2010 [Internet]). See also Schlemmer, Moholy-Nagy, Molnar (2003).

[45] For the black box set up see for example Black Light Theatre (2010b [Internet]).

[46] See for example The Creators Project (2010 [Internet]); Lee (2005) pp. 96-7.

Both the *Bauhaus* and the *Black Light* theatre are of particular interest to the author's research because they explored the body as a site of light reflection and absorption by employing various media.

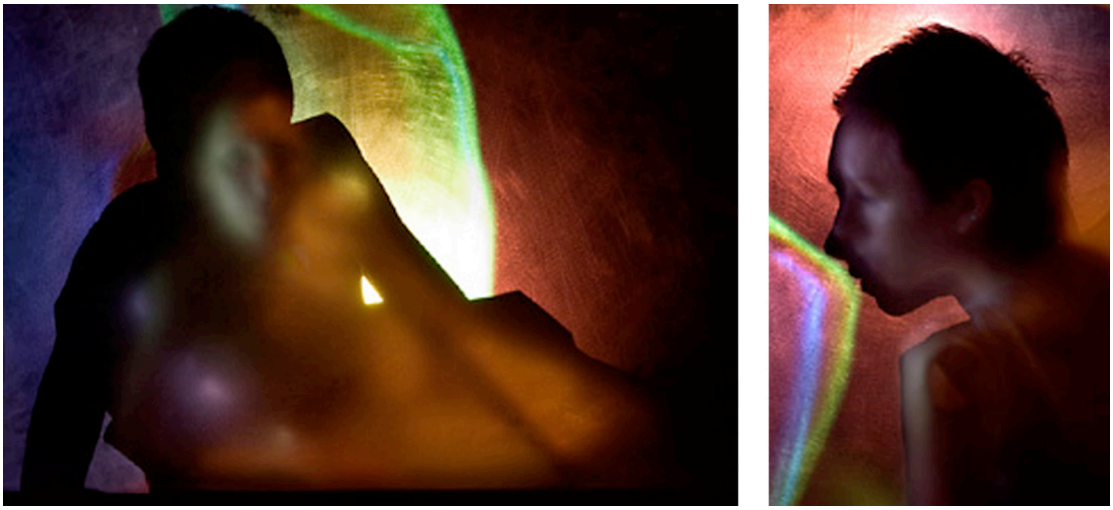

Fig. 2.8 Carol Brown; *The Changing Room,* performance, 2004.[47]

Choreographer Carol Brown's collaboration project with architect Mette Ramsgard Thomsen is emblematic of multi-media performances based on digital technologies.[48] Her performances investigate embodiment in the interaction between performers and virtual 'beings' on stage. These digital presences have an ephemeral quality and display independent behaviour in virtual dance architecture. Digital presence can be embodied in a singular virtual being whose behaviour emerges on stage as in *The Changing Room*, 2004 or can be a swarm of digital agents that create different visual effects as in *Sea, Unsea*, 2005 (Brown, Ramsgard Thomsen, 2005).

From a technical point of view stage lighting outlines the body of the performer and makes it visible for a camera that records the movement of the performer. The camera transfers this information in real time to a computer that creates the virtual being and manipulates its behaviour in response to the dancer's movements. The visual representation of this virtual body is instantly projected onto a gauze screen on stage and the performer responds in turn to this imagery.

The use of computer generated digital projections generates a distinctive aesthetic based on the properties of the computer screen. As well as providing a specific colour palette the digital projection enlarges and accentuates the pixels that constitute the image on the computer screen.

---

47 Source The Changing Room, 2008 [Online image].

48 For further information on Carol Brown and Mette Ramsgard Thomsen see Brown (2008 [Internet]), Ramsgard Thomsen (2006 [Internet]).

Light both mediates the creation of the virtual body and its interaction with the performer. Light on the body becomes a facilitator for the creation of an emergent process of interaction between real and virtual bodies in this environment. However, light as an immaterial medium in interaction with the body is not at the centre of this exploration and the effect of wearable light sources within this environment has not yet been investigated.[49]

Brown's investigation focuses on questions of embodiment and the boundaries of body in our perception of virtual and real bodies. In this context the exploration of negotiating skin as a visual boundary of the body is of particular significance to the author's research, though Brown, Ramsgard Thomsen's investigations did not extended to wearable light features.

Multi-media artist Klaus Obermaier's practice typifies approaches where the collaboration and the resulting performances are driven by the potential of the multi-media set up. While his collaborations use a similar multi-media set up as Brown's, his investigation focuses on the modulation and manipulation of body shape and movement through light projections.[50]

Fig. 2.9 Klaus Obermaier; *Apparition*, performance, *Ars Electronica* 2004.[51]

[49] The exploration of wearable light was the remit of the collaboration with Carol Brown that formed part of this research project and is discussed in chapter 3.2.4. This exploration did, however, not include multimedia platforms.

[50] For further information on the collaboration between Klaus Obermaier and performers such as Chris Haring see Obermaier (2006 [Internet]).

[51] Source Apparition, 2004 [Online Image].

Digital projections created in real-time by a computer overlay the moving bodies of the performers with a virtual layer. This virtual image interacts with the three-dimensional projection surface of the performer's body and creates illusionist effects that both retrace and change the shape of the body. The light projections on the body are often part of a larger set for the whole stage and the bodies of the dancers become interlocked with this giant canvas. Light projections take precedence over the bodily presence of the dancers, and at times the dancers might even seem trapped by the images projected onto them.

Obermaier's investigative focus lies on the interaction between projected imagery and dancers live on stage to re-shape the visual perception of the body within this environment – or the "interaction between virtuality and reality" as Obermaier put it (Obermaier, 2006 [Internet]). The use of digital projection provides a distinctive aesthetic framework that connects Obermaier's performances with the aesthetic of Brown's work despite their divergent investigative interests.

Of particular interest to the author's research is Obermaier's exploration of the body as site of light projections and his use of these projections to manipulate the visual perception of the body. However, Obermaier does not explore the body as location for wearable light sources. It is possible that the complex technological set up of the live digital projections makes the use of wearable light projectors difficult if not impossible. Light projectors located off stage cast imagery onto the body instead.

2.4 Light Art; Light and Body in Fine Art

The 2006 exhibition *Lichtkunst durch Kunstlicht* (*Light Art from Artificial Light)* provided a comprehensive overview of the use of artificial light within the context of fine art and showed that

> "…for nearly a hundred years, artists have confronted this immaterial medium in the form of light bulbs, luminous substances and neon tubes, glowing LEDs and powerful floodlights. Art has increasingly turned from the illusionary representation of natural light to the real application of artificial light. The artwork is transforming itself from a representative screen depicting the wave phenomena of natural light - the prismatic decomposition into rainbow colors - into a real sender of electrons and photons of artificial light. Artists create autonomous, luminous objects and rooms, and even illuminate entire landscapes.
> The electrification of the world inspired artists of different genres such as Futurism, Constructivism, Kinetic Color Music and the Bauhaus. Through art directions such as material painting, film, Kinetics, and Op Art, immaterial

> artificial light created an independent medium: light art. Light art pioneers such as László Moholy-Nagy, Thomas Wilfred, and Zdenek Pesánek illustrate the great elementary attraction this medium has for artists." (ZKM Zentrum fuer Kunst und Medien, 2005 [Internet])

Light artists have focused their investigations on relationships of light and space or light and object. How the viewer perceives these relationships and how this perception can be manipulated are issues that are implicitly or explicitly addressed in light art. However, light and the body in the sense of wearable light hardly exist within a fine art context and Atsuko Tanaka's *Electric Dress* is one of the few examples of this performance-based type of practice.

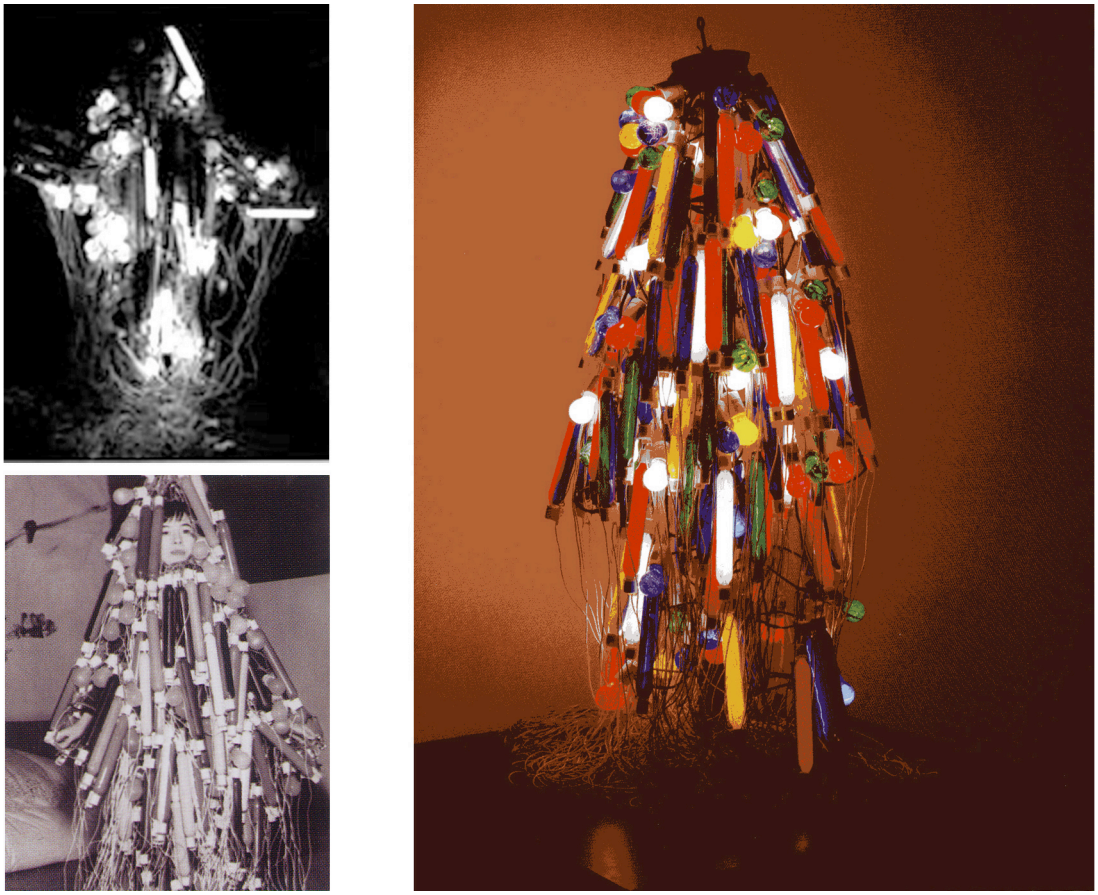

Fig. 2.10 Atsuko Tanaka; *Electric Dress,* 1956 / reconstituted 1986.[52]

Atsuko Tanaka created the *Electric Dress* for a performance happening at the *2nd Gutai Art Exhibition* in Tokyo, 1956 (Lee, 2005 p.104) in response to the rapid influx of technology into everyday life in 1950s Japan.[53]

---

[52] Source (top left) *Electric Dress*, 1956 [Online Image], (bottom left, right) Lee (2005) p. 104-5.

[53] *Electric Dress* was according to Tanaka inspired by a billboard sign illuminated with neon lights (Ming, 2005 [Internet]).

The dress was festooned with incandescent light bulbs painted in coloured enamel paints. The lights descended from the top of the head of the artist, covering and obscuring her body in a tent-like network. A mass of electric cords connected the dress to a console that controlled the light display (Laurence, 2005 [Internet]). The light bulbs flashed on a circuit and therefore colours and shapes on the body changed constantly even before the artist started to move during the performance. However, the weight and complexity of the cable and light bulb network restricted and slowed body movements (Ming, 2005 [Internet]). The artist was quite literally wearing light, enveloped in a multitude of light bulbs and electric wiring that transformed the artist into a fluctuating display of coloured light shapes.

Electric Dress challenges our perception of what is wearable with a costume that alters body movements and is potentially life threatening due to its electric wiring, demonstrating the creative as well as the destructive potential of technology.[54] The performance of the *Electric Dress* is of particular interest to the author's research as it addresses explicitly the interaction of wearable light sources and the body by exploring the visual expression of this interaction: a 'light choreography' in which the body of the performer acted as a carrier of light and as a propulsion mechanism for the light choreography.[55]

[54] Tanaka was aware of the danger of electrocution and decided to cover herself in vinyl for the performance (Ming, 2005 [Internet]).

[55] Tanaka took this exploration forward in drawings that accompanied the *Electric Dress* at the 2nd Gutai Exhibition and initiated a vocabulary of circle and lines that Tanaka elaborated in paintings from 1956 onwards (Ming, 2005 [Internet]).

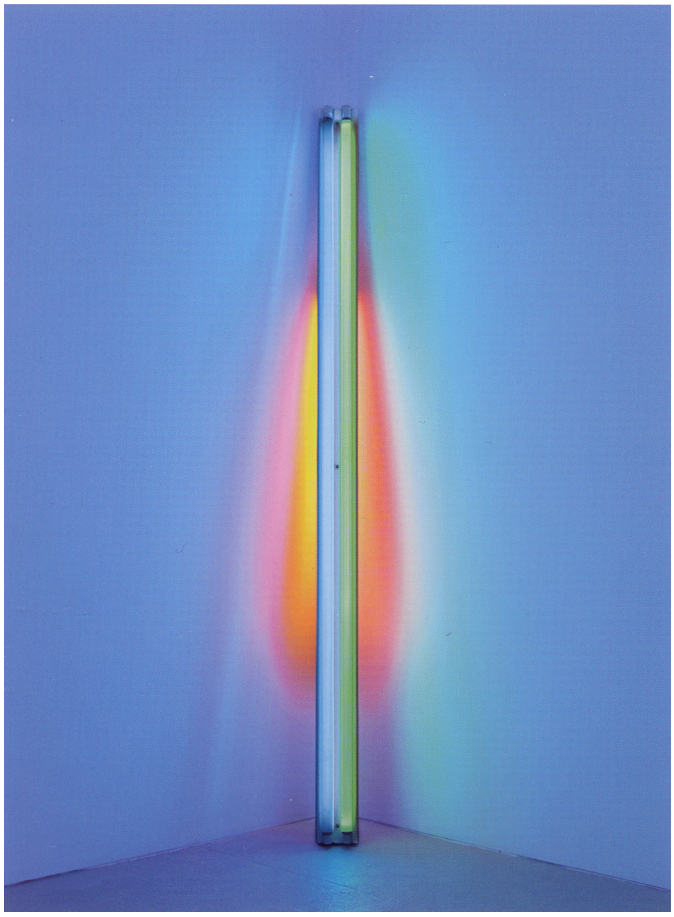

Fig. 2.11 Dan Flavin; *Untitled (to the real Dan Hill)*, 1978.[56]

Dan Flavin's work with fluorescent light pioneered a strand of fine art practice that investigates the interaction of artificial light sources with their architectural environment as well as with their audience.[57]

Flavin worked for over 30 years with mass-produced fluorescent lights to create what he called "light situations" (Hayward Gallery, 2005). His installations responded to the architectural spaces in which he worked and immersed the viewer in a light situation charged with the coloured light of fluorescent tubes. This immersion changes the viewer's physiological perception of colours, as the eye grows accustomed to the fluorescent light, coloured reflections and shadows start to appear in the surrounding environment and on the viewer's body.

In *Untitled (to the real Dan Hill)* the angle of the corner traps the blend of yellow and pink light to create a fiery orange rim. By contrast the blue and green tubes are directed outward into the space and suffuse it with a cool blue

---

56 Source Govan, Bell (2005) p. 77.

57 This focus on the ephemeral nature of the viewer's sensory experience was the base for a strand of installation artists for whom light and space became the main content of their work. James Turrell is one of its proponents (Bishop, 2008 pp. 56-60).

that frames the orange in a dramatic contrast of complementary colours. The effect suggests an illusion of depth in the corner of the room while surprising reflections of the orange light can still be picked up on the body of the viewer moving through the light environment.[58]

Flavin's expert blending of luminous colours is achieved through the positioning of the fluorescent light tubes in relationship to each other and the architectural space that shapes the reflections of their light. The colour fields are structured not only by the tubes but also by setting contrasting colours off against each other.[59]

The architectural space and everyone in it seems to become part of a subtly coloured light volume that is connected to and controlled by the positioning of coloured fluorescent tubes. This coloured 'light situation' creates a somewhat unreal, mysterious, yet utterly accessible experience for the viewer that appeals to an intuitive sense of wonder and mystery.[60] The subtle and enchanting quality of Flavin's work is an inspiration for this practice-based research project.

Light installations such as Flavin's are of particular interest to the author's research as their main focus is an investigation of the body as a medium of reception and perception of coloured light. The body is also addressed as a site of light as Flavin's work is immersive and the body(ies) of the audience become enveloped in coloured light. However, the body(ies) of the audience do not change the shape of the light environment as a whole.

---

58 This account is based on the author's personal experience of the work.

59 These light effects change dramatically even with small adjustments to the positioning and angles of the tubes. The preconception of these light effects through drawing and modelling therefore has its limits as Dan Flavin acknowledged: "You never really know what it looks like until it is done, installed in the gallery." (*In Daylight and Cool White*, 1979; film).

60 The author has noticed that children are particularly drawn to Flavin's light works. They playfully explore the works from all angles and try out light effects in different parts of the coloured light fields. Flavin always resisted interpretations of his art other and his own comments were focused on the physical reality of the works he created (Govan, Bell, 2005).

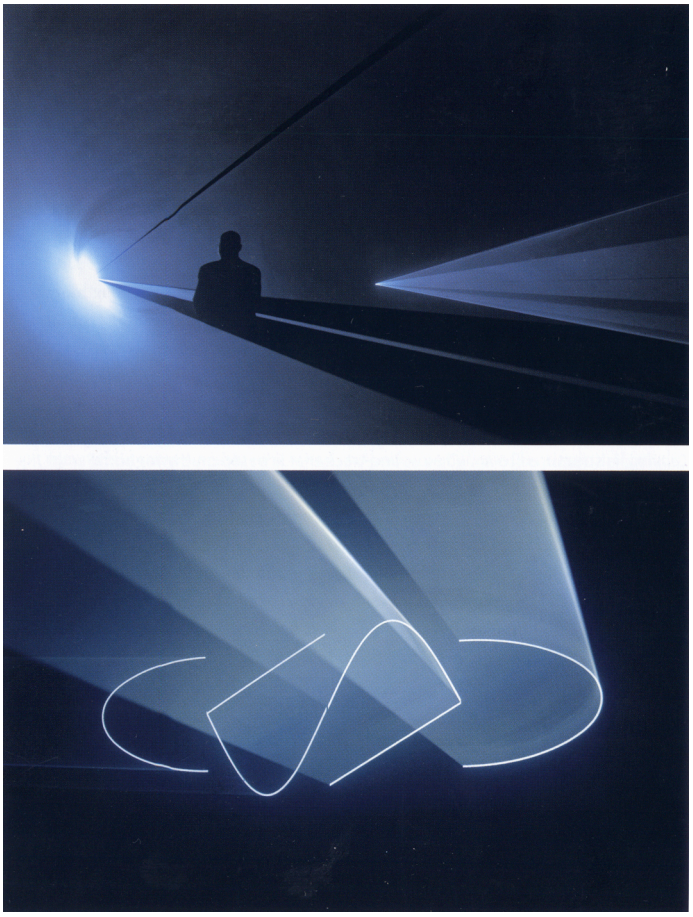

Fig. 2.12 Anthony McCall; *You and I, horizontal III*, 2007.[61]

Anthony McCall's work typifies practices of light and body that operate on the boundaries of disciplines. His "solid light films" [62] are simultaneously film, light sculpture and an installation that provokes interventions by the audience.

In *You and I, horizontal III* lines of light cut through a room in patterns that change over time according to what could be called the 'script' of the film. These lines take on three-dimensional forms as they cross the space between the projection source and the wall and contribute to the sculptural quality of the light in space. A human figure appears in silhouette as it cuts through this envelope of light, breaking the shape of the light sculpture and creating a new spatial entity (figure 2.12 top). On the side turned towards the projector the body becomes a three-dimensional projection surface for the light pattern that it is interrupting. The body(ies) of the audience therefore become an integral part and continuously change the shape and the spatial arrangement of the light environment. This audience participation and representation of the body

[61] Source Musée Départemental d'Art Contemporain Rochechouart (2007) p. 58.

[62] Olivier Michelon in Musée Départemental d'Art Contemporain Rochechouart (2007).

is intended and central to the work as McCall confirms (Musée Départemental d'Art Contemporain Rochechouart, 2007).

McCall's work is relevant to the author's research of wearable light because it addresses the body as a site of light with its capacity to interact with and change the shape of the solid light films. These changes highlight the connection of the body to the spatial features of its environment. The installation also investigates the experience of immersive light situations and conceptualizes the body as a medium of reception and perception of light. Like most other work in fine art and lens-based media McCall's work does not address wearable light in the sense of the body as a carrier of light features.

2.5 Recording of Light and Body in Lens-Based Media

Lens-based media such as photography and film rely on the registration of light on photosensitive surfaces to generate artefacts, i.e. photographs and films. In this sense lens-based media are also light- and time-based disciplines in which the use of artificial light to create imagery has long been established. One could therefore argue that all figurative photography and film inherently deal with light and the body even if wearable light as such is not conceptualized within this context.

There are however, practices that explicitly explore the relationship of light and the body and investigate how light shapes the form of the body and its interaction with the surrounding space when viewed through the lens of a camera.

Bill Brandt's *Nudes* typify approaches that investigate the interaction of light and body in photography.

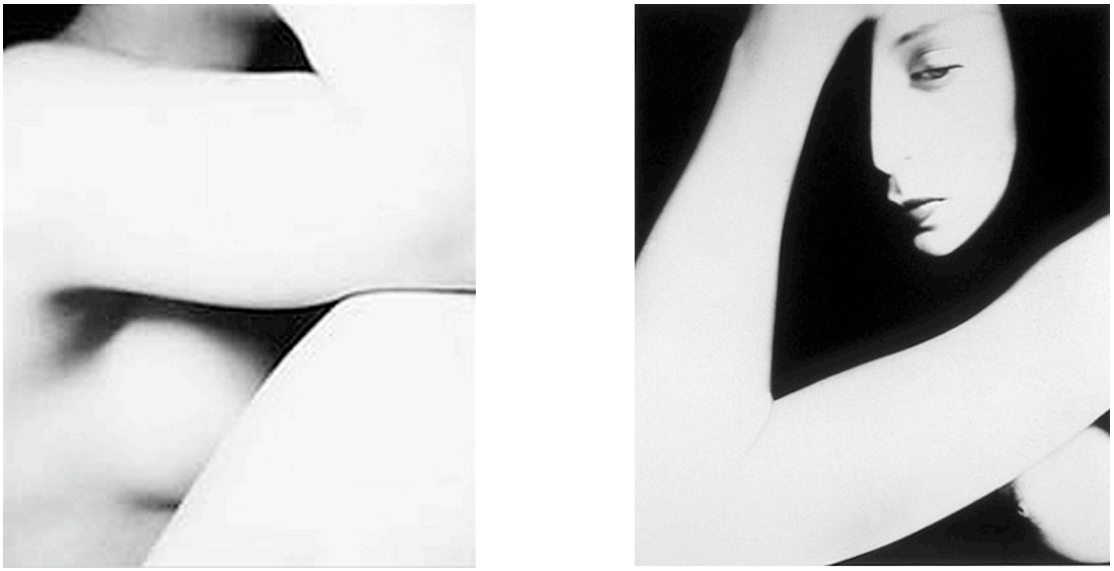

Fig. 2.13 Bill Brandt; *Nude*, 1951, *Nude*, 1952.[63]

Bill Brandt developed his series of black and white *Nudes* in the 1950s using a wide-angle lens. The exaggerated perspectives and the dramatic contrasts of light and shadow reconstruct the landscape of these bodies and transform them into compositions that emphasize the relationship of spaces on and around the body. Brandt referred to his *Nudes* as “experimental interiors” (Fahey, Klein Devlin, 2005 [Internet]) suggesting a conceptualisation of the body as a spatial composition.

In these “experimental interiors” dark shadows meet highlights in sharp lines that trace the silhouette of body parts and render them as almost two-dimensional abstract shapes. These lines shape the spaces on and around the body that contrast the soft tonal modulations indicating the body itself. These spaces between and around the body become the negative space that frames the spatial composition of the photograph.

Of particular interest to the author’s research is the way in which Brandt uses the contrast of light and shadow to focus the viewer’s attention on how the space between body parts forms shapes. The choice of camera lens, frame, and viewing angle leads to a distortion of perspective that contributes to this effect. In these photographs the body becomes a site of light and shadow generated for and by the camera indicating the artistic potential of conceptualizing the body as a spatial composition of light and shadow.

Brandt’s work points to the creative possibilities inherent in recording and exploring wearable light in lens-based media.[64] The use of time-elapsed

[63] Sources *Nude*, 1951 [Online Image], *Nude*, 1952 [Online Image].

photography in particular captures the dynamic of wearable light on the body as practices such as Seth Riskin's light performances and recordings demonstrate.

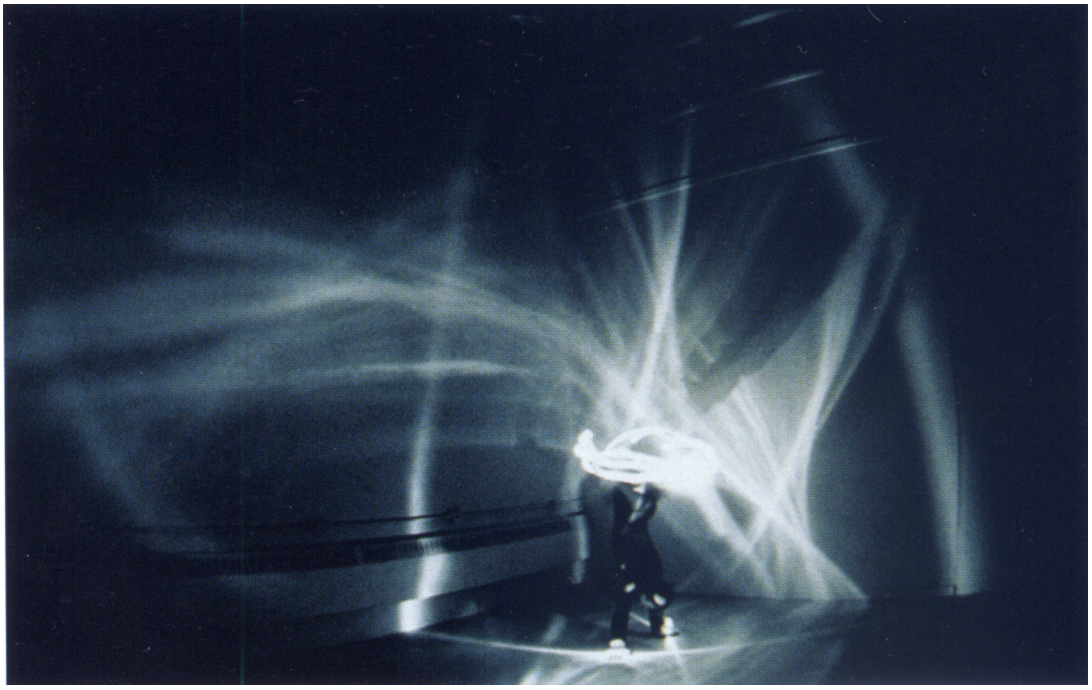

Fig. 2.14 Seth Riskin; *Light Dance,* 1988.[65]

Seth Riskin's practice sits at the intersection of performance and lens-based media. It explores the connection between the body and architectural features of the environment through light projected from the body of the performer. This performance alters the viewer's perception of the space and allows the viewer to experience the features and dimensions of the space in a new way. Riskin declared "light projected from my body, revealing architecture through expressive body movements, enables me to 'sculpt' the spatial perceptions of viewers" (Weibel, 2006 p.165).

One can argue that Riskin works in the tradition of Loie Fuller.[66] Where Fuller employed cloth and light reflections to extend the body into space, Riskin uses emissions from light features on the body to create the connections. However, the 20th century development of lens-based media makes them far more central to Riskin's approach than to Fuller's.[67]

---

64 The role of lens-based media for this research project is discussed in chapter 3.1. Time-elapsed photography here indicates slow shutter speeds that capture an image over a period of time in a single exposure. For further information see Sanderson (2002).

65 Source Weibel (2006) p. 164.

66 See section 2.3.

67 One has to wonder if lens-based media would have played a greater role in Fuller's work had their technology been more advanced at the time.

As the wearable light projects outwards from the performer to mark spatial arrangements and architectural features, the body of the performer does not play a role as a site of light. In the recordings it is only present as a dark silhouette at the centre of the spatial light projections.

Recording of the performance in time-elapsed photography and video capture light patterns that connect the body to the architectural features of the space and create a new sculptural entity. These recordings are powerful artworks in their own right that dominate the visual experience for the viewer.

Riskin's practice has a particular relevance for this research because it deploys the body as a carrier of light and deliberately explores space through the passage and re-passage of wearable light. Time-elapsed photographs and videos of this work show a new abstract 'light-scape' that connects features of the environment with the movement patterns of the body.

2.6 State of the Art for Wearable Light

The body as a medium for the reception and perception of light is an underlying principles of most practices that work with light. Immersive installations such as Flavin's 'light situations' investigate how light shapes our perception of our body and its environment. In these light installations the audience can act either as receptor / perceptor of light or as participants who change the effects of the light installation by interacting with it. Anthony McCall's 'solid light films' typify approaches in which the body(ies) of the audience become an integral part of the light installation; the body thus becomes a site of light and changes the shape of the light environment.

The body as a site of light projections has been explored across a wide range of contexts in art and design. 'Projected jewellery' moved contemporary jewellery towards an installation context that challenged inherent concepts of wearability and portability. Performance practices have a tradition of extending the body as a site of light through light illumination and illusions. From Fuller's 'light dances' to contemporary multimedia performances the investigations of real and virtual bodies have questioned the boundaries of the body as a site and its dynamic relationship to space. In performance projects the sources of light projections are typically not located on the body, but are positioned as static or dynamic light sources in the stage environment. The body therefore becomes a site of light reflection.

While early proponents wearing light sources such as Tanaka risked electrocuting themselves, the advent of miniaturised lighting technologies allowed the safe placement of light sources on the body. This new technology provided the means to turn the body into a carrier and propulsion mechanism for light and thus explore wearable light.

The body as a carrier and propulsion mechanism for light has been explored across varied contexts from jewellery to fashion and wearables. However, the light from these sources typically projects outward into the surrounding space and does not address the body as a site of light. Alternatively the light source on the body acts as a communication mechanism for events taking place on or around the body that would otherwise be invisible. In a third variation wearable light sources instigate social interaction. All of these applications manifest light in or on an object on the body that acts as a carrier without interacting directly with the light emanating from the light object. One of the few examples of the body simultaneously being a carrier and a site of light are Chalayan and Filmer's Ear and Mouth pieces that illuminate intimate spaces on and in the body. However, these pieces do not constitute an in-depth investigation of the three-way interaction between the body as a carrier, the body as a site and the environment.

A further conception of light in relationship to the body is the harnessing of natural light through reflective, refractive or absorptive materials or objects on the body. This has been a characteristic of jewellery for centuries and is carried on in contemporary jewellery through the exploration of man-made materials such as acrylic/perpex. Functional wearables in sportswear employ reflective materials as an in-built safety feature. Performance practices have also used reflective and absorptive features to transform the body as a site of reflected light.

The body as a medium for the perception of light, as a site of light, a carrier of light and a reflector of light interact with the conditions of the light environment and these conditions therefore mediate light effects on and off the body. This interaction can take place 'live' and/or be recorded and reconfigured in lens-based media.

While 'light and the body' has been widely conceptualized across genres in art and design, there is little in-depth investigation of the simultaneous interaction between the body as a carrier of light, the body as a site, and the light environment.

This research set out to address the gap of knowledge with regards to the effects of wearable light on this concurrent interaction, as wearable light features by their nature constitute the body as a carrier of light.

The three-way interaction between the body as a carrier, the body as site of light and the light environment is time-based and dynamic, as the body usually does not stay still for extended periods of time and any movements can change light effects on and off the body.

Therefore wearability and the boundaries set by the time-based nature of wearable light were key concepts and drive motors of the research. Their exploration produced research outcomes with regards to their characteristics, their qualities and the effect these characteristics have on wearable light.[68]

Technological advances have facilitated this research. The advent of light emitting diode technologies (Schubert, 2003) that produce emissions strong enough to project light over a distance has dramatically re-written the potential for the creative exploration of wearable light.

[68] See chapter 4 for a detailed discussion.

3 Methodology and Process

As stated in the Introduction, chapter 1, the original title of the research was *I+E: Illumination and Emanation; Light as Body Adornment*,[69] based on the research question

> "The aim is to explore the potential of light as body adornment with a main interest in artificial light as a resource using the latest developments in lighting technology and to evaluate the implications of this strategic research for a range of applications." (Oberlack, 2004a p.1; primary source)

The author expected to conduct the research by producing four to five collections of wearable light features in response to specific aspects of the research question. The research underwent a number of positive changes as the project developed and the application of wearable light in different contexts and media became the focus of the investigation. This widened the creative and research outcomes; it produced a new generation of wearable light features as well as performances, choreographies and collections of still and moving images, all based on the exploration of wearable light.

Also discussed in chapter one was the use of practice within this research with a note of how the terms practice-based and practice-led[70] research are used, observing that studies of light might be expected to be framed scientifically but that this research is framed in the discipline of art and design practice. However, the researcher's background in science has informed and facilitated this study.

Practice-based research has received much attention in the last two decades. A primary source continues to be Donald Schoen (1991). Its importance here is that it uses the processes of practice as a significant part of the research methodology, and that it is also led by practice in that it addresses problems and questions faced by art practitioners and the outcomes are practical, meaning they work and can be used, and form a basis for subsequent development by the author or others.

Practice-based and practice-led research continues to be subject of intense debate across art and design practice. As the project overview of the research review into practice-led research funded by the Arts and Humanities Research Council AHRC states:

---

[69] This research project is referred to as *I+E* in the rest of the chapter.

[70] The terms practice-based versus practice-led are used here according to Woolley (2000).

> "…the term 'practice-led' research is used to describe a great diversity of practices and methodologies, as well as giving rise to a good deal of debate. It is a relatively new area of research that has yet to gain a 'canon' of methods and exemplars." (Rust et al., 2005 [Internet])

Within this diverse field of definitions and interpretations, Bigg's interpretation of practice-based research seems most relevant to *I+E*:

> "… practice-based research prioritizes some property of experience arising through practice, over cognitive content arising from reflection on practice… …my second explicit assumption is simply that research that can be communicated or disseminated is more desirable than research that cannot be communicated or disseminated, because it will have greater impact in its field." (Biggs, 2004 [Internet] p.7)

Practice-based research therefore has an experiential component and can be communicated to others. Practice is, however, an integral part of the research process as well as the communication of outcomes:

> "I am interested in investigations in which aesthetic judgements are made in relationship to sensory objects and one might argue that this process as well as having an empirical basis, that is could be examined through experimentation, actually arises through the experience of being confronted with these judgements and that therefore the identification of the initial problem, as well as its conduct through experimentation arises in the realm of experience rather than the realm of cognition." (Biggs, 2004 [Internet] pp.7-8)

This interpretation describes the research process and outcomes of *I+E* well. While author's practice in jewellery initiated the research on light as body adornment the practice widened into wearable light in the course of the project. Practice is the main vehicle for the research process and forms an integral part of the communication and dissemination of *I+E* research outcomes.

While practice-based research here indicates a methodology as well as a mode of communication, it does not describe the kind of knowledge generated by *I+E*.

Brown et al. (2004 [Internet]) refer to the conflation of practice-led research, a methodological approach and applied research, a type of knowledge generated by a certain type of research. They proceed to identify a taxonomy that places scholarly research and applied research on opposite ends of a spectrum: while scholarly research creates intellectual infrastructure, applied research finds solution for specific problems. Pure research is located between these opposites as it asks key questions and conducts developmental research that tests relevant issues. In this typology *I+E* can be positioned in the category of pure research. *I+E* asks key questions about the

interaction of light and the body; it investigates hypotheses in relationship to wearable light through experimentation; and it has discovered significant new facts in relationship to wearable light.

As the context review in chapter 2 shows, wearable light in art and design has not been explored extensively as a field of practice and a critical discourse has not yet been established. *I+E* has therefore embarked on an investigation that is largely exploratory in nature, discovering and mapping the territory as the research progressed.[71] The methodology of this exploratory research ensured procedural and intellectual rigour without prescribing a detailed research route in advance in order to avoid curtailing avenues of discovery.

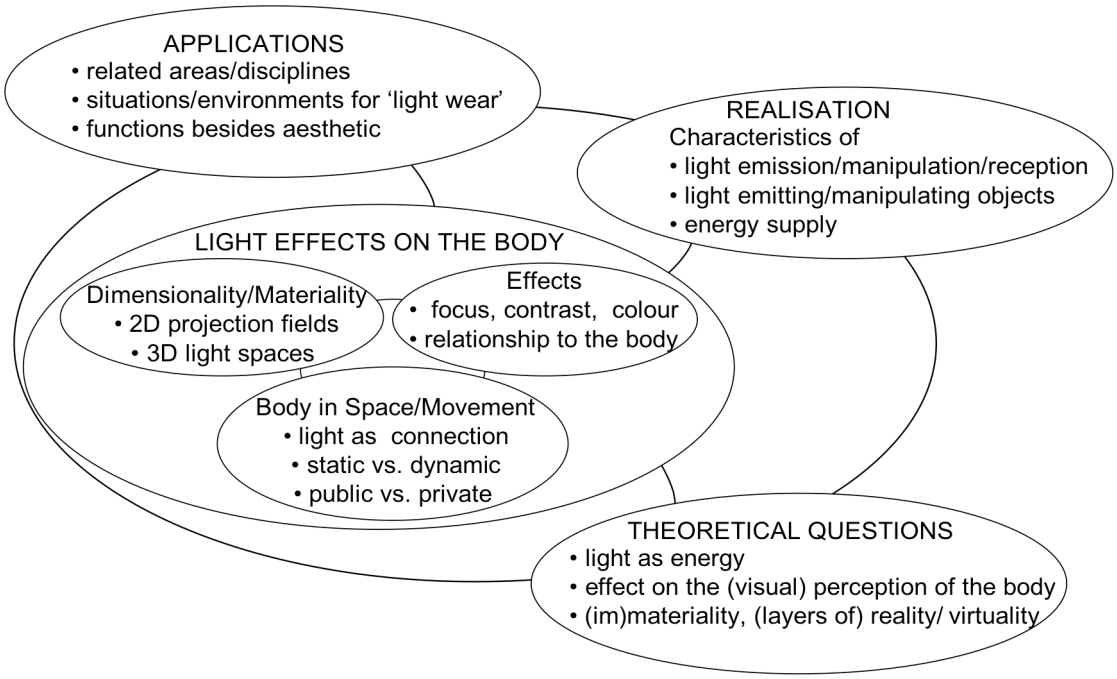

Fig. 3.1 Preliminary *I+E* research map, 2004.[72]

I+E started out with a preliminary research map (figure 3.1), conceptualizing areas of investigation as they presented themselves at this point.[73] Like a geographical map the preliminary research map provided points of reference from which the research developed.

---

71 Hackley (2003, p. 25) characterizes the aims of exploratory research as "an exploratory research design seeks insight and understanding, it does not confirm generalizable facts." Williams (2003, p. 176) supports this position by pointing out "…exploratory research is usually employed when one wishes to begin work on a little researched area…" In this understanding *I+E* as an exploratory research falls in the category of interpretive research as it generates new knowledge through the theoretically informed interpretation of research data (Hackley, 2003 p. 73).

72 Source Oberlack, (2004a) p. 4, primary source.

73 Orna (1995, p. 21) describes this process as "mapping the research territory: known and unknown areas" and demonstrates that these maps can take a text form as well as a visual form (Orna, 1995 pp. 26-30).

Due to the protean nature of the research new themes emerged as it progressed. Dance and performance applications became a vehicle for technological development of the light features, but also provided a platform on which the complex and dynamic interaction between body, light and space was investigated. Recording and editing of the light effects grew from a method of documentation into a creative application in its own right. A revised research map took these developments into account at the confirmation stage of the PhD (figure 3.2).

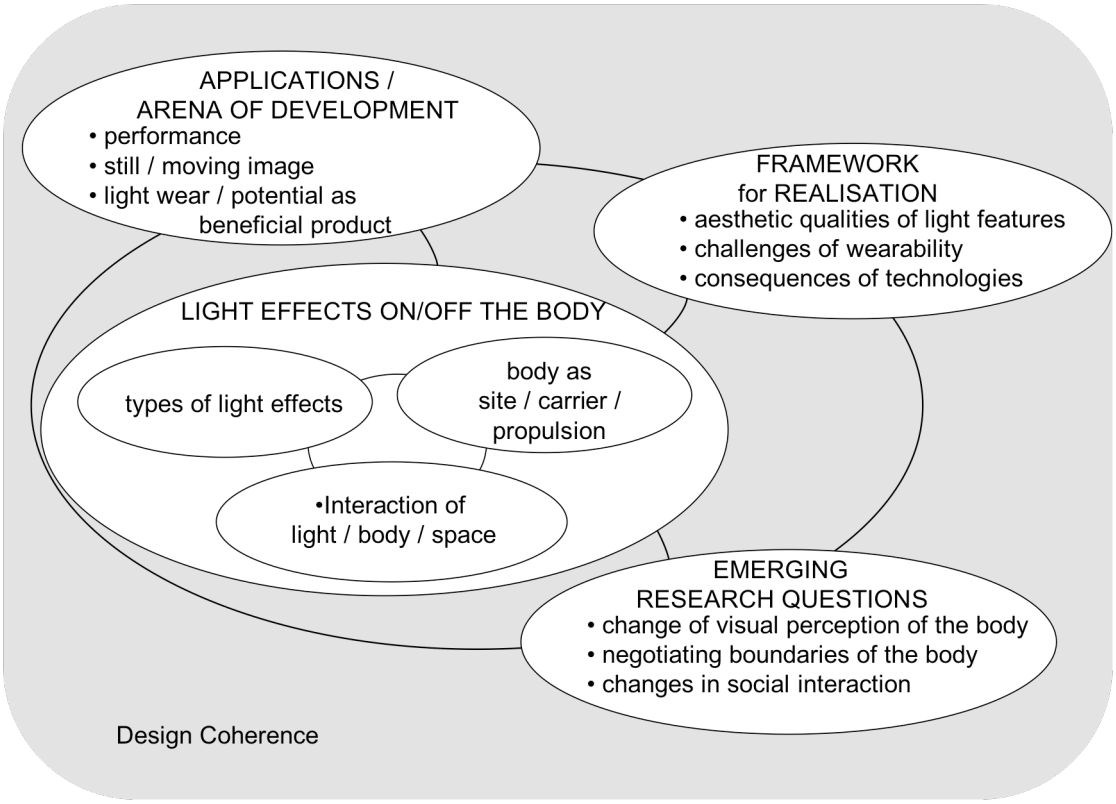

Fig. 3.2 Revised *I+E* research map, 2006.[74]

The research process evolved through a heuristic cycle that moved back and forth between practice-based research and critical context in order to develop a reflective, practice-based knowledge base of subject matter and process. Practice as an artist and designer is imbued with implicit knowledge about aesthetic criteria and process decisions, a “knowing-in-action” (Schoen, 1991) that is based on experience, intuitive, not articulated and often not easily accessible for the practitioner (Gray, Malins, 2004). The critical context reflects upon practice in retrospective “reflection-on-action” (Schoen, 1991) and in forward thinking “reflection-for-action” (Cowan, 1998). Coupled with practice-based “reflection-in-action” (Schoen, 1991) the critical context

[74] Source Oberlack (2006b) p. 6, primary source.

facilitates the emergence of articulated knowledge and criteria for the description and evaluation of process and outcomes of practice.[75]

In order to focus the research process, *I+E* was structured into a series of sub-projects. Each of these projects investigated selected research questions from practice and relating conceptual questions in the critical context. Feedback from peers and experts was regularly sought throughout the project to increase the reflective potential of the process and evaluate its outcome on a regular basis. This led to a considered collection of creative outputs in response to the research questions investigated in the project, but also left room for the development of unexpected outcomes.

The creative outcomes were then published in order to obtain feedback from a wider audience. The type of publication depended on the character of the project and included performances, exhibitions, video screenings, academic papers, lectures and talks for a wider public. Feedback from the publication was integrated into the evaluation of the project and its outcome. This evaluation informed the selection of research questions for subsequent sub-projects, and provided a focal point for the emergence of 'rich descriptions'[76] of wearable light features that formed the base for the development of a critical framework of wearable light outlined in chapter 5.

Due to the cross-disciplinary nature of the research, many of these sub-projects involved collaboration with practitioners from other fields. This provided access to expert knowledge as well as a platform for feedback and for the creation of new ideas between the collaboration partners.[77]

Following this overview of the research approach section 3.1 discusses methods of reflective practice applied in this research. Section 3.2 describes how the rationale of the research process unfolded over a range of significant sub-projects. Section 3.3 presents conclusions.

---

[75] See Alvesson, Sköldberg (2000) for further discussion of reflexive methodology.

[76] See chapter 5.3 for further information.

[77] Stead (2005, p.170) argues along similar lines for collaborations between designers and scientist or engineers: "Ideally, aesthetic experimentation and technological integration should be developed at the same time so that one can adapt to the other."

3.1 Methods of Reflective Practice

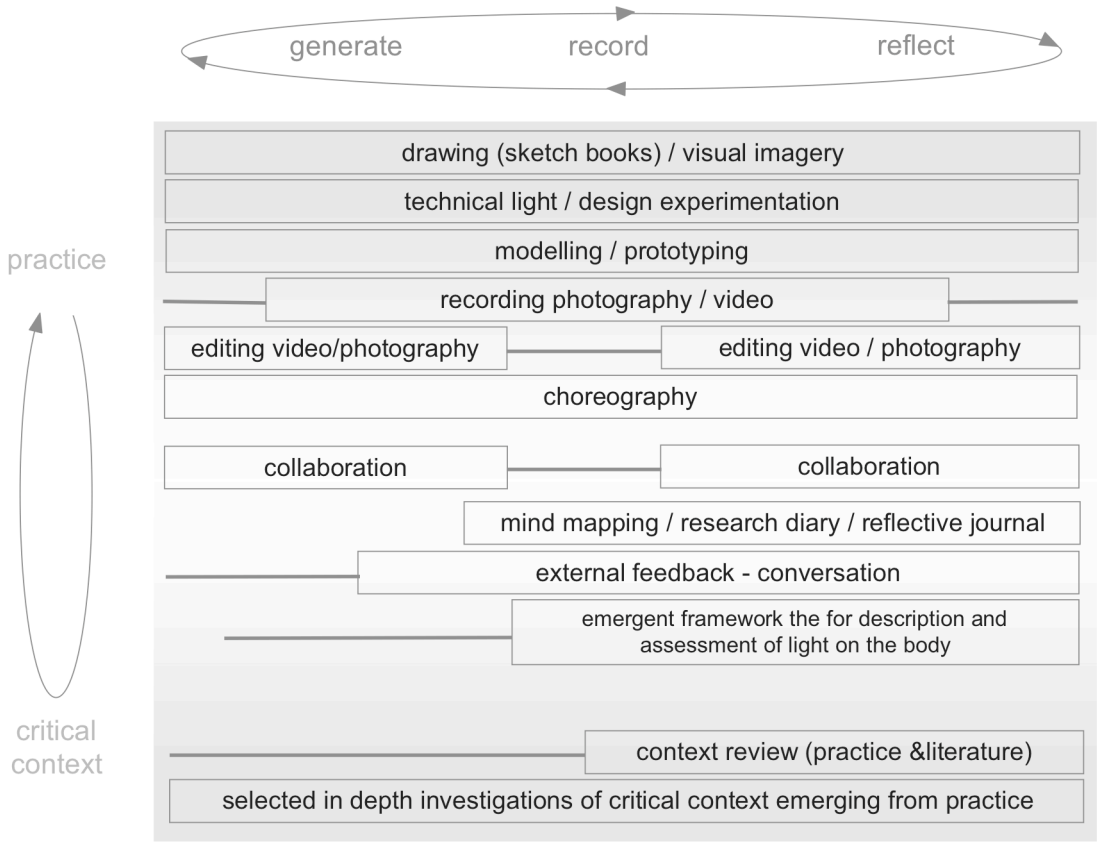

Fig. 3.3 Categorisation of multiple research methods[78]

Figure 3.3 shows an overview of the multiple research methods employed by the exploratory research design of *I+E* in order to facilitate the generation of knowledge through processes of practice, critical reflection and the integration of systematic external feedback. The methods evolved and extended over the course of the research corresponding to the expansion of practice into new disciplines such as performance and lens-based media.

The methods in the exploratory research design are categorised along two axes. The vertical axis shows their relevance to either practice or critical context. The 'middle ground' between practice and critical context is held by methods that are relevant to both modes and can bridge the gap between practice and critical context. This middle ground also shows methods of incorporating external feedback, as they are relevant to both practice and critical context. Conversation and collaboration have proven to be of the utmost value in this respect.

[78] Source Oberlack (2009, primary research).

The horizontal axis relates to the experiential learning cycle (Kolb, 1984) and adapts a model by Gray, Malins (2004, p. 58) that shows different activities in the learning cycle. The positioning of the research methods along the axis reflects the author's analysis of their relevance to the generation, documentation and reflection of knowledge within the research process.

The importance of these methods for the different aspects of learning has evolved in the course of the research. In order to support these changes in the research and its methodology the author acquired additional research and practice skills through short courses and collaboration with other practitioners.

Lens-based media played a significant role in the development of the research process, the widening of its remit and extension of outcomes. Photography and video were initially intended as methods of recording the ephemeral light effects created by wearable light.[79] Their production, however, evolved first into a tool for reflective thinking and then into a creative practice in its own right as the author discovered through her creative practice that the recording of light on the body with time-elapsed photography and video allowed the development of new expressions of wearable light and the body.[80]

Time elapsed photography and video allowed the creation of imagery based on the interaction of wearable light features, the body and the surrounding environment. Small technical variations with regards to the recording and editing process dramatically changed outcomes in the imagery. The time-based nature of video held further creative potential for the exploration of light as body adornment in moving images. It allowed the slowing down of movement in the editing process in order to focus on light effects on the body that otherwise would have been lost to the eye. Transitions between clips led to the exploration of overlaying video as a means to heighten and extend light effects on the body.

Increasingly the choice of wearable light features, the environment and the choreography of body movement became vehicles for the exploration of the resulting light effects in lens-based media. The still or moving image itself became the creative output and creative decisions were geared towards this outcome leading to a widening of the author's creative practice.[81] Explorations in lens-based media also feed back into the creation of a next generation of light features and thus establish a heuristic feedback between the application

---

[79] Chapter 4 discusses the nature of wearable light effects and their constituent parts.

[80] For examples and discussion of outcomes in lens-based media see chapter 5.

[81] Two sub-projects with the explicit aim of exploring still and moving imagery based on wearable light were *New Arenas* and *Light-Space-Body*. See section 3.2.6.

of wearable light in different contexts such as performance and lens-based media and the development of new generations of light features.[82]

The reflective potential embedded in the recording and editing process of digital imagery had a strong impact on the later stages of the research process as the dynamic and ephemeral nature of wearable light with its complex interactions between light features, the body and the environment made it impossible to anticipate visual effects.[83] The immediate visual feedback in digital lens-based media allowed instant assessment of outcomes, informed the aesthetic decision-making process and drove the creative practice in solo and collaborative projects.

In 'solo' projects such as *New Arenas*[84] this visual feedback became the only reference point for the development of new work while 'in session'. In these sessions the practitioner simultaneously assumed the roles of artistic director, choreographer, photographer and performer in an intensive and intuitive creative process where each new image was created in response to the outcome of the last image taken.

In collaborations such as *Light-Space-Body*[85] the visual feedback was a focal point for the development of the creative outcome as well as an important tool for the communication between the collaborators as the author assumed multiple roles: artistic director, photographer, cinematographer and choreographer. Due to the complex and dynamic nature of wearable light choreographic directions could only set boundaries for its exploration. The performers interpreted and explored this loosely structured choreography and each iteration of the same choreography led to a variation of the light effects on the body.

The balance between loosely structured choreography and improvised interpretation by the performer(s) was evident in the outcomes. Decisions on whether to further explore one set of choreographic instructions or move on were based on a largely intuitive and responsive evaluation process that harnessed tacit knowledge gained through experience of working with light on

---

[82] This heuristic circle can drive the creative practice in much the same way that the hard and software development in the IT industry drive each other forward. A new generation of hardware i.e. wearable light features provides new opportunities that are explored through new software applications. At the same time software development also shows where the boundaries lie and then the hardware development responds to these demands.

[83] See chapter 4 for a detailed discussion of this interaction. Time-elapsed photography posed a particular challenge in terms of anticipating outcomes as it traced the movement of light and the body for up to 45 seconds per image.

[84] See section 3.2.5.

[85] See section 3.2.6.

the body in different contexts.[86] This reflective process took into account factors such as role of the body, does the image provide a new interpretation of light on the body, balance and dynamic of composition, scale et cetera.[87] This mode of working required intense and ongoing communication between the performers and the practitioner in collaborative settings and an intense internal dialogue in 'solo' projects.

The most successful sessions within these solo and collaborative projects created a feeling of intense focus and 'flow' where the decision-making process became immediate and experiential rather than driven by rationale discourse. In the evaluation of circumstances leading to these 'flow sessions' two factors stood out – comprehensive preparation of the session and the location of the setting.

Comprehensive preparation covered all areas from setting aims and researching the programme for the session to selecting and briefing collaborators as well as executing support such as securing a suitable location and procuring equipment. This phase of preparation allowed the practitioner to take stock of information and build boundaries for the session. It therefore reduced the challenges of simultaneously assuming multiple roles in the session and provided the platform to commit to a process of immediate response to any creative output arising in the session. The location of these sessions played a vital role. The most successful sessions were characterized by quiet, undisturbed settings without distractions and without time pressure both in indoor and outdoor environments. In combination with the fact that the recording of light as body adornment required a dark light environment these settings heightened the sense focus and concentration.

The decision-making process in these sessions was not recorded separately as this would have hindered the creative flow of the session and would have required the sessions to continue for a considerably longer time. Particularly in outdoor locations there are time limits posed by environmental factors such as light conditions or weather. However, during the editing process the practitioner was able to reconstruct the decision-making from memory due to the chronology of images as these represented records of the positioning of light features on the performers and the choreographic instructions.

---

[86] Polanyi (1997) discussed tacit knowledge first in 1966 in relationship to scientific research. The introduction of this chapter briefly discusses knowledge implicit in art and design practice.

[87] Some of the efforts within the research process have been directed towards making these criteria more explicit and developing a framework for the description of wearable light. See chapter 5, 6.

The editing of still images was a reflective process based largely on the selection of images and their grouping in slide shows. Apart from some cropping of frames the images were not manipulated through software. The process began with a quick overview of the images and a selection of the images to which the practitioner was intuitively drawn. These images were then compared to the rest in order to describe what made them stand out. This process of comparing and describing allowed the practitioner to reflect on the criteria underlying the intuitive aesthetic decision making process and make these explicit.[88] The editing was an iterative process that reduced the numbers of pictures selected until the selection showed images that typified certain approaches within the work and opened a dialogue between image groups.

The editing process for moving images involved both reflective and creative elements. As video is a time-based medium the challenge of selecting relevant sections of video was the sheer bulk of information. The selection process was based on an intuitive approach similar to the selection of still images refined by further iterative processes of comparing, describing and selecting that led to a final collection of clips. Similar to still images this reflective process contributed to the emergence of criteria for the description and assessment of light as body adornment.

The recording and editing process became a cumulative learning process where knowledge about the creative potential and limits of these media was transferred over a range of projects. Over time this reflective process became more explicit and verbal supporting the emergence of explicit parameters that described and assessed wearable light. These parameters contributed to the development of a descriptive analysis framework.[89]

[88] See Chapter 5 for a discussion of these criteria.

[89] See chapter 5.

3.2 Research Process

At the outset of the research, the process was envisaged as a series of larger sub-projects that deliberately gave the research the freedom to evolve within the framework of the initial research map as a result of insights gained within prior sub-projects. This 'fixed process, emerging content' structure was adopted in order to accommodate the fact that the research is exploratory in nature as it opens a fairly new field of practice within art and design.[90]

The protean quality process and outcomes within this research led to a rather larger number of projects than originally anticipated. These projects were instigated by the outcomes of earlier projects in the PhD as well as opportunities that arose around these activities. The projects differed in scope, time scale and their contributions to the research process. Although the larger projects were conducted as planned in a serial manner with periods of evaluation in between, a lot of the smaller projects ran parallel to these projects and contributed directly or indirectly to the outcomes of these larger endeavours in the form of feedback or support. Figure 3.4 shows an overview of all projects in a timeline.[91]

[90] The structure of the research process and its relationship to the research approach is covered in the introduction to this chapter.

[91] The appendix, 8.2, contains a brief description of all projects and the aspects they addressed.

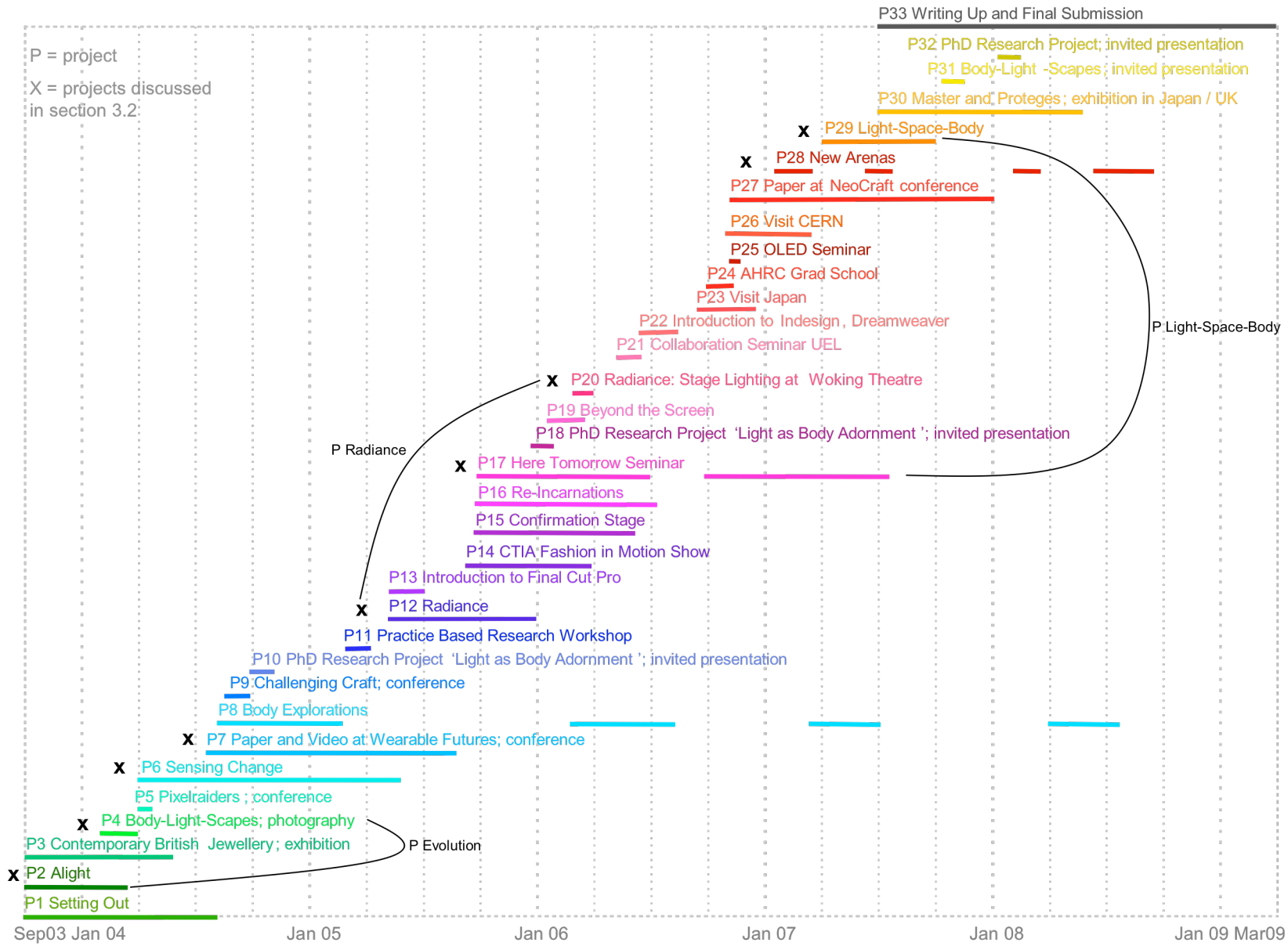

Fig. 3.4 Research Projects Timeline (source Oberlack, 2009, primary research for this thesis)

Projects ranged from collaborations with multiple participants to projects in which the author worked alone. Their role and impact on the research process will be described in the following account of selected projects that have been chosen because they typify different approaches, processes and outcomes in the research and because they had a significant impact.[92] The projects will be presented first in brief as a 'story of the project' focusing on the how the research process unfolded with learning outcomes from sub-projects impacting on subsequent key decisions. Subsequently the projects will be described in more detail in their own sections.

The project *Evolution* moved the wearable light features from jewellery into a performance context as a means to explore the body as a dynamic three-dimensional projection surface for light as body adornment with professional dancers. The performance *Alight*[93] was captured in lens-based media and the choreography further investigated in time-elapsed photography. The edit of this imagery provided the author with an insight into the reflective potential of the editing process in lens-based media. The performance and video of *Alight* as well as the imagery of *Body-Light-Scapes* proved pivotal for the further development of the research as they demonstrated the potential of wearable light for performance and lens-based media.

In response to *Evolution* the author decided to focus on the exploration of wearable light for performance with video documentation. This decision was driven by the opportunity to extend the working relationship with *Union Dance*[94] into collaboration for a dance production and to advance the technological development of the wearable light features due to the specific requirements of a professional large-scale stage environment.

Sensing Change developed the next generation of wearable light features that were geared towards application in a large multimedia dance production with its demands for high visibility, wearability and robustness. The author investigated the choreographic potential of these light features with a variety of collaborators such as the costume designer, multimedia artist, choreographers and performers. This contributed to the learning experience for the author, but the complexities of large-scale collaborations with multiple

---

92 The following sections focus on an overview of the research process. Outcomes are discussed in detail in chapters 5 and 6.

93 *Alight*, performance with dancers from *Union Dance* at the Victoria & Albert Museum, London, 28 February 2004. See video *Alight* on DVD.

94 The author worked with dancers from *Union Dance* in *Evolution*. For *Union Dance* see Union Dance (2009 [Internet]).

creative agendas limited the author's impact on the final choreography for the dance production *Sensing Change*.[95]

After the delivery of the first two major projects the author took the opportunity to present a paper and video at *Wearable Futures*[96] in order to reflect on the processes and outcomes of the practice-based research. The reflective processes of writing the paper and editing the video informed each other and established a process for projects that focused on editing, publication and feedback within the research.[97] The edit of still and moving imagery revealed the reflective and creative potential of recording and editing processes in lens-based media; the impact of the outcomes was confirmed by feedback at the conference.

The key decisions in response to *Wearable Futures* were to pursue the exploration of the performance context only through collaborations in which the exploration of wearable light was central to the performance; to ensure that collaborations were driven by equal impact from all partners; and to record wearable light performances with a view to exploring their creative potential in lens-based media.

Radiance presented the opportunity to explore choreography that focused on wearable light in specific environments. The author, the choreographer and the performers developed the choreography in a process of co-evolution over several months. Feedback from performers, audience and external experts led the author to consider the potential of these light features as product for therapeutic applications such as the rehabilitation of movement. The success of *Radiance Topos*[98] in a site-specific outdoor location instigated a variation of the performance for a contemporary dance stage that allowed the author to experiment with stage lighting in relationship to wearable light features.[99] Both performances demonstrated the creative potential of the interaction between light as body adornment and the surrounding (light) environment in 'live situations' as well as in lens-based media. Editing the video material revealed

---

95 *Sensing Change* premiered at the Queen Elizabeth Hall, London on 11 May 2005, the production toured nationally and internationally. See video *Sensing Change: Outcome* on DVD.

96 The paper (Oberlack, 2005; primary source) and video (Oberlack, 2005; primary source) were presented at *Wearable Futures: Hybrid Culture in the Design and Development of Soft Technology*. Conference. Newport: University of Wales. September 2005. See video on DVD.

97 For a more detailed categorization of projects within the research process see section 8.2.

98 *Radiance Topos,* performance for the 'laying the foundation stone' ceremony of *Lightbox*, Woking on 21st Sep 2005. See video *Radiance: Outcomes* on DVD. For *The Lightbox* see The Lightbox (2009 [Internet]).

99 *Radiance White Christmas*, performance, was shown as part of the White Christmas Season at *The Place*, London, 8th December 2005. See video *Radiance: Outcomes* on DVD. For *The Place* see The Place (2001 [Internet]).

the creative potential of digital techniques for the construction of a new set of moving images based on wearable light.

In response to *Radiance* the research moved to investigate the effect of different types of light environments on wearable light in lens-based media. The author decided to practice these investigations first in small-scale projects that allowed the author maximum control and made their pursuit possible with an affordable amount of logistical effort.

For *New Arenas* the author returned to the medium of time-elapsed photography in a series of projects that investigated the potential of wearable light in a variety of outdoor arenas with reflective elements such as snow and water. These natural features heightened the interaction between light, body and the environment; the photographs captured this interaction and revealed a previously undetected connection with the surrounding landscape. The project was conceived as a series of sessions in which the author either took on all roles simultaneously or retained overall artistic control with a single camera operator. This set up facilitated an intense and un-distracted dialogue between the practitioner and the emerging practice outcomes that provided a model for future projects.[100]

Key decisions in response to *New Arenas* were to focus on choreographies for lens-based media - video and photography - and to control all elements of the interaction of light-body-space, in particular the light environment. In order to explore the light effects of interactions between multiple performers and multiple cameras the author decided to initiate collaboration with professional dancers and videographers that was driven by the investigative parameters set out above while overall artistic control rested with the author.

The research process therefore culminated in the project *Light-Space-Body* that was part of a larger, fine art based venture where several artists worked on PhD research projects in the *Lethaby Gallery*, London over a period of four weeks. The author created a series of different light environments and investigated the interaction between wearable light features and multiple performers in these environments. In this project the author was able to fulfil the role of an 'auteur'[101] becoming the focus and conduit for creative action in the collaborative project with control of all aspects of choreographing and

[100] See section 3.1 for a discussion of the role of feedback in solo sessions.

[101] In the auteur theory of filmmaking the director is viewed as the major creative force in a motion picture who oversees all audio and visual elements of the film. Visual elements such as camera placement, blocking, lighting and scene length rather than plot line, convey the message of the film. The most successful examples will bear the unmistakable personal stamp of the director (Encyclopedia Britannica Online, 2009 [Internet]).

recording light on the body in still and moving images. The outcomes were light choreographies that were geared towards capture in lens-based media and resulted in a collection of time-elapsed photography and video that created new vantage points for wearable light from which abstract narratives with emotional impact emerged.

Following this 'story of the research process' the six projects driving the research process are described in more detail in the subsequent sections:

3.2.1 Evolution; Performance and Time-Elapsed Photography
3.2.2 *Sensing Change*; Multimedia Dance Production
3.2.3 *Wearable Futures;* Reflecting, Editing, Publishing, Feedback
3.2.4 *Radiance;* Co-Evolution of Choreography and Creative Editing
3.2.5 *New Arenas;* Wearable Light in Outdoor Environments
3.2.6 *Light-Space-Body*; Light Choreography & Design for Lens-Based Media

A corresponding video for each project is enclosed on DVD referencing still images and video clips of process and outcomes.

3.2.1 *Evolution;* Performance and Time-Elapsed Photography

Please reference the videos *Alight* and *Body-Light-Scapes* on DVD.

Evolution was the first practice-based project of the PhD research. It picked up on insights from the prior Masters (MA) research project on light as body adornment and explored the initial application of wearable light features produced during the MA in performance and lens-based media. *Evolution* ran parallel to the *Setting Up* stage of the PhD in which the remit, context and methodology for the research was clarified and developed from September 2003 to March 2004. Both projects mutually informed each other.

Evolution arose from opportunities that were developed in the wake of the MA research with a view to continuing the project on PhD level and culminated in culminated in an invitation to showcase wearable light features at the Victoria & Albert Museum, London as part of the *V&A Friday Late* on 28th February 2004 held in conjunction with *Brilliant*, an exhibition on light design.[102]

As the potential of the body as a dynamic, three-dimensional projection surface had become evident in the MA research, the author was interested in the choreography and performance of light on the moving body and initiated a

[102] *Brilliant*, exhibition on light design at the Victoria and Albert Museum, London, February – April 2004, see Pavitt (2004).

collaboration with professional dance company Union Dance[103] in order to develop *Alight*[104]*,* a series of three short performances for the V&A *Friday Late*. The author developed the loosely structured choreography with the dancers in a in a single workshop session drawing on the formal dance training of the performers and leaving room for improvisation by the dancers.

The performances on a small stage in the main entrance hall of the Victoria & Albert Museum highlighted the challenges of controlling the light environment in this type of setting. Despite the strong ambient light the wearable light features[105] were highly visible across the hall though they had not been designed for stage application.

The performance was documented on digital video with two stationary and one handheld camera for close-ups. The author collaborated with a professional video television editor in order to gain experience of film editing. The process resulted in a five-minute video of the event (figure 3.5).[106]

[103] Union Dance (2009 [Internet]).

[104] *Alight*, performance with dancers from *Union Dance* at the Victoria & Albert Museum, London, 28 February 2004. See video *Alight* on DVD.

[105] The wearable light features were equipped with light emitting diodes (LED).

[106] See video *Alight* on DVD.

Fig. 3.5 ***Alight* with wearable light features (clockwise from top left): *Travelling Light, Feuerrrad, Sous Vêtements, Body-Light-Wrap and Sous Vêtement*.**[107]

Alight drew audiences of several hundred people at a time. They responded enthusiastically to the performance with a large amount of flash photography. Asked for feedback after shows, members of the audience cited the novelty of a performance with wearable light features and the variety of the light effects on the body as well as their seductive quality as reasons for watching the performances.[108] The enthusiastic reaction from the public as well the feedback from member of the art and design community validated the practice for the first time on a wider base.

[107] Source *Alight* (2004) still image taken from video recording of the performance (Oberlack, 2004, primary source).

[108] See video *Alight* for some audience responses.

In order to create photographic material the author collaborated for with two *Union Dance* performers and a professional photographer.[109] Informed by *Alight* this session took place in the controlled light environment of a large photography studio.[110] The session focused on exploring the impact of different types of choreographed movement on the outcomes of light as body adornment in photography. The author took the role of artistic director and led a collaborative effort in which all partners contributed their expertise. This process led to the discovery of the creative potential of time-elapsed photography as a medium for recording light as body adornment.

The result was a large collection of images in which the performers and the light seems to mould together to form *Body-Light-Scapes*. These ranged from stationary interactions (figure 3.6) to dynamic traces of movement (figure 3.7) and became pivotal for the development of further research.[111]

Fig. 3.6 Stationary *Body-Light-Scape.*[112]

[109] The photography session was in part funded by the jewellery network organization *Sonar Project* that also introduced the author to the professional photographer (Sonar Project, 2009 [Internet]).

[110] The photography session took place in the main photography studio at Southampton Row, Central Saint Martins College of Art and Design, London.

[111] For a detailed discussion of the visual effects of *Body-Light-Scapes* see chapter 5.

[112] Source Oberlack (2005) primary research. For a collection of *Body-Light-Scapes* images see video *Body-Light-Scapes* on the DVD.

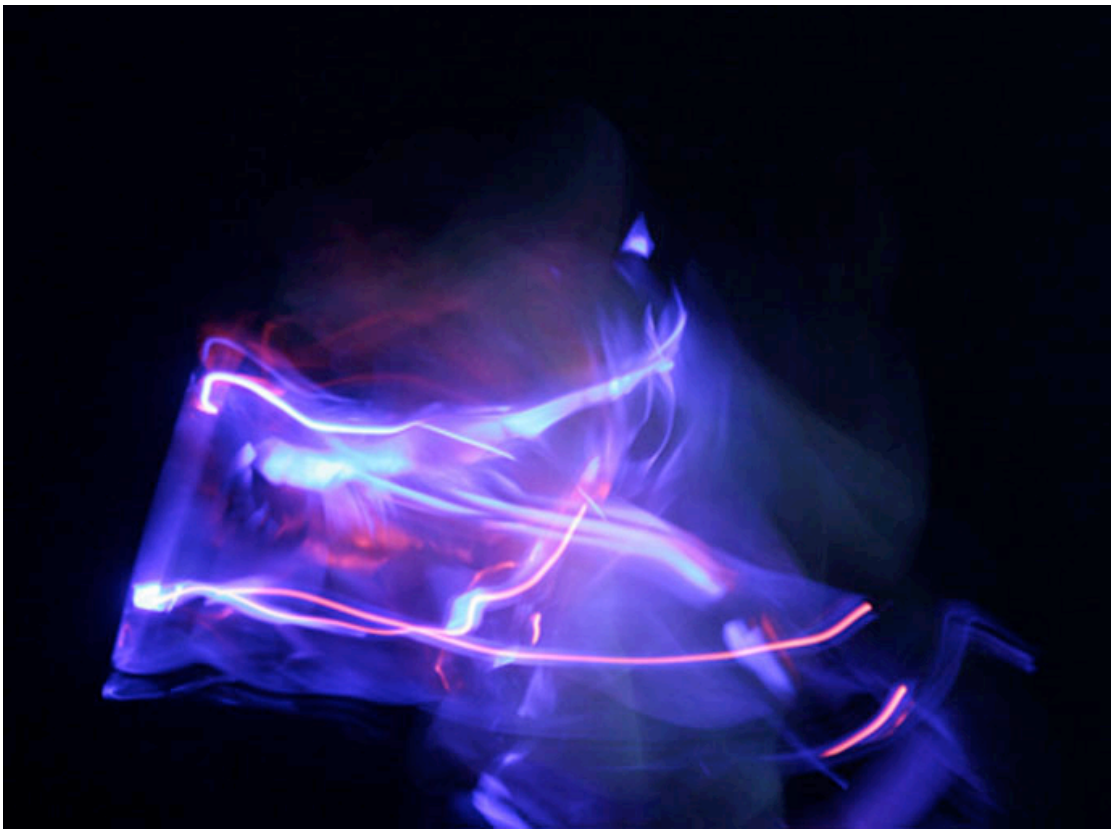

Fig. 3.7 Dynamic *Body-Light-Scape*.[113]

The project *Evolution* explored the choreography of light on the body and its recording and editing in still and moving images. The feedback to the performance and the recordings were positive. The role of the author in this project was to initiate collaborations and give artistic direction while relying strongly on the expertise on the collaborators as choreography, performance and recording where not yet part of the author's creative practice. The project also gave a first insight into the complexities of managing collaborations with a multitude of practitioners from different backgrounds as well as the liaison with institutions such as the V&A Museum.

The outcomes of *Evolution* demonstrated the scope of light as body adornment within a performance context and the creative potential of recording in lens-based media. In response to the process and outcomes of evolution the author decided to focus on the exploration of light as body adornment in a performance context while keeping the documentation in lens-based media as an essential part of the process.

[113] Source Oberlack (2005) primary research.

3.2.2 *Sensing Change*; Multimedia Dance Production

Please reference videos *Sensing Change: Process* and *Sensing Change: Outcome* on DVD.

As a result of *Evolution* the author participated in *Sensing Change*, a collaboration project initiated by *Union Dance*[114] in order to develop a dance production that explored the interaction of choreography, wearable light and costume design in a multimedia environment focusing on light in relation to the body. This dance production was to be premiered at the Queen Elizabeth Hall in London in May 2005 with subsequent national and international touring. In this context the author aimed to develop a next generation of wearable light features for application in a multimedia dance production and explore their choreographic potential in this setting.[115]

After an initial meeting with all collaborators; *Union Dance*, choreographers Rafael Bonachela and Mavin Khoo, fashion designer Jessica Bugg, multimedia artist Derek Richards[116] in May 2004, the author investigated specific aspects such as the multimedia stage setting and costume in meetings with the respective collaborators in order to research initial designs for a new generation of wearable light features (figure 3.8).

The author also attended rehearsals and workshops with the performers to investigate choreographed movement and explore the work process among the performers. In response to the evaluation of these meetings the author designed and built a collection of experimental, custom-built prototypes that met the demands of high light output and wearability with multiple light emitting diodes, a miniature battery case and elastic attachment straps and presented these at a research workshop with all collaborators in October 2004.

[114] Union Dance (2009 [Internet]).

[115] The agreement between the author and Union Dance was that the author funded development of the prototypes of these wearable light feature and Union Dance paid for the production of the actual number of light features required for the dance production.16 light features were produced.

[116] Bonachela (2009 [Internet]); Khoo (2009 [Internet]); Jessica Bugg (2009 [Internet]); Richards (2009 [Internet]); Oberlack (2010 [Internet]).

Fig. 3.8 Light design experiments in response to exploratory meetings with regard to the interaction of lights and costume.[117]

In the workshop two different directions emerged for the application of the wearable light features. Mavin Khoo's choreography was informed by the experimentation between the fashion designer Jess Bugg and the author and exploited the interaction between light features and costume. Rafael Bonachela's choreography focused on the interaction of the body and light in a multimedia setting. Multimedia techniques were used to track the wearable light features live during the performance. This trace of the light choreography was captured in photographs and projected back onto two screens on stage. The recording of this live light painting[118] became the backdrop for the ongoing performance.

This research workshop with multiple collaborators presented a significant learning experience for the author. It became evident that the focal points of the collaboration were the choreographers for whom this session represented input into their thinking about choreography and the setting thus did not encourage the open experimentation of previous meetings. The author also discovered that the decision making process of choreographers and performers was mainly driven by kinaesthetic perception[119] and that they found it challenging to visualize the effect that light experiments undertaken in the workshop might have on choreography.

---

[117] Source Oberlack (2005) primary research.

[118] Light painting has become a field of practice in lens-based media as websites such as Lightpainting Photography (2011 [Internet]) show. For a technical introduction see Greenspun (2007 [Internet]).

[119] Kinaesthetic perception is based on an "awareness of the position and movement of the parts of the body by means of sensory organs (proprioceptors) in the muscles and joints" (Oxford English Dictionary Online, 2010 [Internet]).

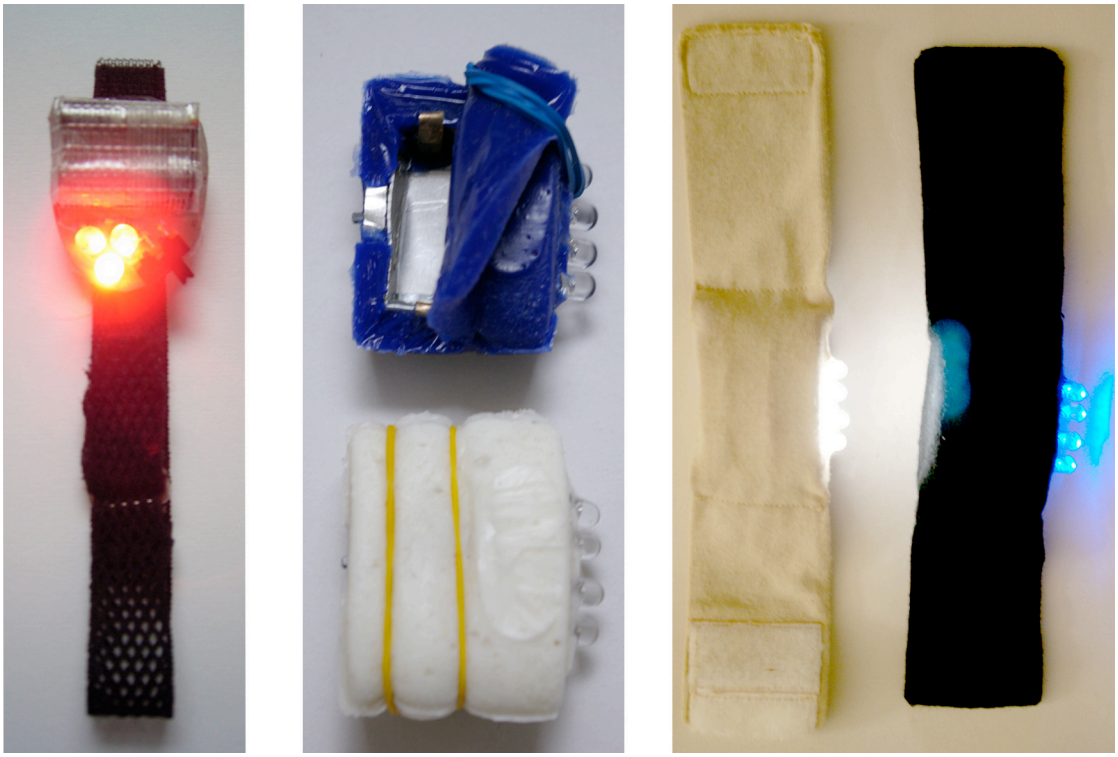

Fig. 3.9 Left: experimental prototype. Middle: final prototypes, revealing the battery compartment. Right: LED production pieces in elastic attachments.[120]

After the positive response from the workshop the prototypes were refined and put into production. All light features including electronics were custom-built, as commercial electronics solutions did not meet the brief. Silicon casings improved the robustness of the light features and helped to avoid injuries for the performers. Elastic textile band with *Velcro* tabs encased the light features and attached them to the body, varying in length, layout and colour depending on the position of the light feature on the body and the skin tone of the performer (figure 3.9).

[120] Source Oberlack (2005) primary research.

Fig. 3.10 Images from the dance workshops: costume for Bonachela's choreography *Silence Disrupted* (left), costume for Khoo's choreography *Pure C* (right).[121]

The details of the choreography evolved during an intense period of rehearsals just before the premiere in Spring 2005 (figure 3.10). By this time the choreographers had established a general choreographic direction for their performances and this limited further input from other collaborators. The production was premiered on the 11th May 2005 at the Queen Elizabeth Hall and toured nationally and internationally. The author received positive informal feedback on the use of wearable light features from peers and the wider audience. The performance was recorded with multiple cameras on digital video by the cinematographer and video editor from *Evolution* under the supervision the author. This video provided part of the material for the editing process in the subsequent project *Wearable Futures*.[122]

Sensing Change opened the fields of performance and choreography for this research project and provided a vital learning experience for the researcher in terms of subject matter and collaboration processes. The exploration of light on the body for multimedia stage environment pushed the technological development of wearable light features with its demands for visibility, wearability and robustness. In terms of process the project provided the opportunity to engage in methods of initiation and management of collaborations and to gather insight into the complexity of large collaborations with multiple creative practices and agendas. These experiences informed the

[121] Source Oberlack (2005) primary research.

[122] See section 3.2.3.

decision to engage in *Radiance*[123], a subsequent collaboration with choreographer Carol Brown that focused on the co-evolution of choreography between all collaborators.

After the completion of the first two major practice-based projects, *Evolution* and *Sensing Change*, the author decided to take a step back from collaborative practices in order to reflect on the outcomes and processes of these projects and draw conclusions for subsequent projects.

3.2.3 Wearable Futures; Reflecting, Editing, Publishing, Feedback

Please reference the video *I+E Illumination and Emanation – Light as Body Adornment* on DVD.

Wearable Futures provided the author took with an opportunity for reflection on prior practice-based projects through writing and through editing photographic and video material into a new presentation of *I+E*.

The author was invited to present a paper and video for at the international conference *Wearable Futures: Hybrid Culture in the Design and Development of Soft Technology* University of Wales, Newport in September 2005.[124] The main research process for the paper and the video took place in parallel in summer 2005 and incorporated the outcomes of the project *Sensing Change*.

The aim of the video was to provide an overview of practice-based outcomes and was composed of clips from *Evolution* and *Sensing Change* and still images of *Body-Light-Scapes.* The editing process presented a major learning experience as the author edited video for the first time without professional assistance.[125] In the first instance the author relied on intuitive reflective processes to select relevant sections of recording and establish a rhythm in the final video by determining position, scene length and transitions of these clips. During this process the author started to describe the criteria by which the selection of still and moving images were made.

These fairly loose descriptions were reflected upon and formalized while writing the paper and again informed the video editing in an iterative process. During this reflective process elements of a visual language of light on the body started to emerge such as ‘the sculpting the body with light’, ‘tracing and

[123] See section 3.2.4.

[124] Paper (Oberlack, 2005; primary source) and video (Oberlack, 2005; primary source); the video can be viewed on the enclosed DVD.

[125] The author used the widely available video editing software *iMovie* (Apple, 2010 [Internet]).

choreographing body movement', 'the body as carrier and propulsion mechanism for light' and 'the body as a projection surface'.[126]

As *Wearable Futures* was conceived as a 'solo' project the author was able to develop reflective and critical thinking at her own pace and without the presence of collaborative agendas. Presenting the paper and exhibiting the video at the *Wearable Futures* conference provided the first opportunity to introduce the project to an international forum of researchers and practitioners from a wide range of backgrounds in art and design as well as technology. The feedback was overwhelmingly positive and provided the author with a network of contacts within the *wearable tech*[127] community.

The iterative process of reflective thinking in the writing of the paper and the video edit established a model for subsequent projects[128] that focused on editing, publishing and gathering feedback for the research. The emergence of elements of a visual language for wearable light guided further research.[129]

In response the reflections of Wearable Futures the author decided to focus in future on collaborations in which the exploration of light and the body was the centre of explorations and in which the collaboration was driven by an equal impact of all collaborators.

[126] See chapter 5 and 6 for further discussion of these themes.

[127] See chapter 2.2 for a description of *wearable tech* or *wearables*.

[128] See appendix 8.2 for an overview and categorization of all sub-projects of this research.

[129] See chapter 5 for a detailed discussion of an emerging visual language for wearable light.

3.2.4 *Radiance;* Co-Evolution of Choreography and Creative Editing

Please reference the videos Radiance: Process and Radiance: Outcomes on DVD.

The project *Radiance* presented three opportunities: investigating and expanding the choreographic potential of light on the body in close cooperation with the choreographer; taking light on the body into a new, site-specific outdoor environment while working with a new set of professional performers and amateur dancers; and to explore the recording and editing potential of these performances in lens-based media.

Choreographer Carol Brown was commissioned by *Woking Dance Festival*[130] to create *Radiance Topos*, a performance based on the theme of light, space and memory as a site-specific outdoor performance that involved the community for the ceremony of laying the foundation of *Lightbox*[131], the new Woking Galleries.[132] Brown invited the author to take part in order to choreograph the performance of light on the body having seen *Sensing Change*.

Fig. 3.11 *Radiance Topos* research workshop.[133]

[130] Woking Dance Festival (2011 [Internet]).

[131] The main feature of the *Lightbox*, a light sculpture integrated into the fabric of the building, inspired the theme of the commission (Brown, 2009 [Internet]). For *The Lightbox*, Woking see The Lightbox (2009 [Internet]).

[132] *Radiance Topos* took place on 21 September 2005 in Woking and was part-funded by a grant from the Arts Council England (Brown, 2009 [Internet]). The funding allowed Woking *Dance Festival* to commission the author to produce wearable light features for the performance.

[133] Source project *Radiance*, still image from video recordings of the workshops (Oberlack, 2005, primary research).

The choreography of *Radiance Topos* emerged through a series of workshops with the performers in summer 2005 (figure 3.11). The majority of the performers were keen amateurs from a local dance group who had extensive prior experience of engaging with professional choreographers and performers. Initially using wearable light features from *Sensing Change*[134] the collaborators explored what these light features might do on the body, and emerging choreographic patterns were documented on camera.[135] As an outcome of early workshops it was decided that the red prototypes were most appropriate and all light features should be uniform in colour. In response to this feedback the author developed a new set of red LED light features.

Each dancer worked with a single light feature on their wrists in order to concentrate on the effects of movements on the light effects. Descriptions of movement patterns materialised such as 'holding/cradling light', 'light skimming the body', 'light forming connections between the performers' and became early elements of an emerging critical language. The choreographer and the author led the development of these patterns into a choreographic score over the course of the research workshops. The choreographer and the author detailed the final choreography on site in the immediate run-up to the event.[136]

The performance was shown in the afternoon as well as in the evening. The afternoon performance demonstrated the challenges of controlling an outdoor light environment as the sudden appearance of sunlight rendered the light effects nearly invisible. Both performances were documented with multiple cameras by the team established for the recording of *Sensing Change*. These recordings provided the material for creative explorations in the subsequent editing process.

---

134 *Union Dance* kindly agreed to provide the wearable light features during their summer break.

135 All choreographers and performers that the author encountered in the course of the research used video recordings to document choreographies and their development. Some additionally used graphic notations to highlight parts of the choreography. These notations were informal and largely developed for their own use. Formal systems of choreographic notation such as Labanotation and Benesh notation are complex graphic systems that detail timing, direction, impulse and dynamics. Their complexity makes them the province of specialists. (Sulcas, 2007) The author followed the example of the choreographers and relied mainly of video and photographic recordings to document choreographic patterns.

136 Carol Brown commented on the positive experience of sharing the development of the choreography with the author. See video *Radiance: Process*.

The success of *Radiance Topos* initiated *Radiance White Christmas*,[137] performed at contemporary dance venue *The Place*, London as part of their *White Christmas* season. This setting allowed the author to engage wearable light with stage lighting.

Fig. 3.12 *Radiance White Christmas*; research workshop with professional dancers.[138]

Carol Brown and the author developed the *Radiance White Christmas* choreography with the three professional dancers for the contemporary dance stage setting at *The Place* (figure 3.12). The project enabled the author to engage in the choreography process with professional performers and to experiment with stage lighting in relationship to wearable light features. The recording of these experimental sessions and of the performance allowed the practitioner to extend the creative exploration of wearable light in lens-based media through the interaction with stage lighting (figure 3.13).

In the video editing process the author started to explore the creative potential of digital editing techniques such as the manipulation of speed, transparent overlays and filter effects (figure 3.13). This creative editing process led to the extension of light effects and constructed a new set of moving images. These images presented a new layer in the creation of images derived from wearable light and instigated explorations of speed and scale of movement in future projects.

---

[137] *Radiance White Christmas*, performance, The Place, London, 8th December 2005. See video *Radiance: Outcomes* on DVD. See also The Place (2001 [Internet]).

[138] Source project *Radiance*, still image from video documentation of the workshops (Oberlack, 2005, primary research).

Fig. 3.13 Interaction of wearable light and stage lighting, overlay in the video editing.[139]

Feedback from the research process with the amateur dancers, from peers and from professional performers led the author to consider the potential of wearable light features for therapeutic and educational applications such as rehabilitation, therapy for elderly people or dance training.[140]

Working with amateur dancers extended the author's understanding of how the general public might respond to engaging with wearable light features. The interaction with professional performers gave the author an insight into their role in developing choreographies and provided the author with a network of professional dancers interested in the exploration of light as body adornment.

The author's engagement in the development of the choreographies presented a learning experience with regards to methods and processes of choreography, and it expanded choreographic concepts of wearable light. These insights underpinned the development of the author's own choreographic initiatives.

The site-specific outdoor location supplied a new context for wearable light and gave an insight into the potential and challenges of outdoor arenas for wearable light. The author recognized this potential and chose to further investigate the effect of outdoor arenas with reflective features in relationship to wearable light through lens-based media. Having completed several collaborative projects the author decided to pursue this investigation through 'solo' projects in order to take full control over practice, process and outcomes.

---

[139] Source project *Radiance,* still image constructed from video recordings of the stage lighting workshop (Oberlack, 2005, primary research).

[140] Feedback to this project came amongst others from an invited presentation to staff and students of MA Dance, University of Surrey, Guildford in January 2006 (Oberlack, 2006a; primary source).

3.2.5 *New Arenas*; Wearable Light in Outdoor Environments

Please reference the video *New Arenas: Snow and Water* on DVD.

In *New Arenas* the author explored outdoor environments for wearable light in a series of small-scale projects from February 2007 to August 2008. These resulted in a collection of photographic work that investigates the interaction of these natural environments with wearable light features and the body. Environments containing light reflective features such as snow and water became of particular interest because of the effects that this reflective environment can contribute to light on the body. The author set herself a loose brief to explore light as body adornment in these settings whenever opportunities arose.[141] The projects of *New Arenas* were spaced over a period of 18 months with engagement in other projects such as *Light-Space-Body*[142] between sessions. This led to an iterative process in which outcomes were reflected upon in the light of parallel sub-projects and informed the next set of sessions.

The first sessions took place in the mountains near Verbier, Switzerland in February 2007. The scope of daylight sessions turned out to be limited as the strong reflections of sunlight vastly diminished the visibility of artificial light effects on and off the body. However, at dusk and at night the snow provided a backdrop that reflected ambient and artificial light.

Working with a photographer the author simultaneously assumed the roles of performer and artistic director. These sessions were recorded on digital camera and instant feedback from the digital camera allowed the author to direct in response to the emerging imagery.[143]

[141] The author coincided all of these projects with holiday travel in order to make the logistics affordable.

[142] See 3.2.6.

[143] However, due to the subzero temperatures the sessions had to be kept relatively short as equipment, in particular batteries suffered in the cold.

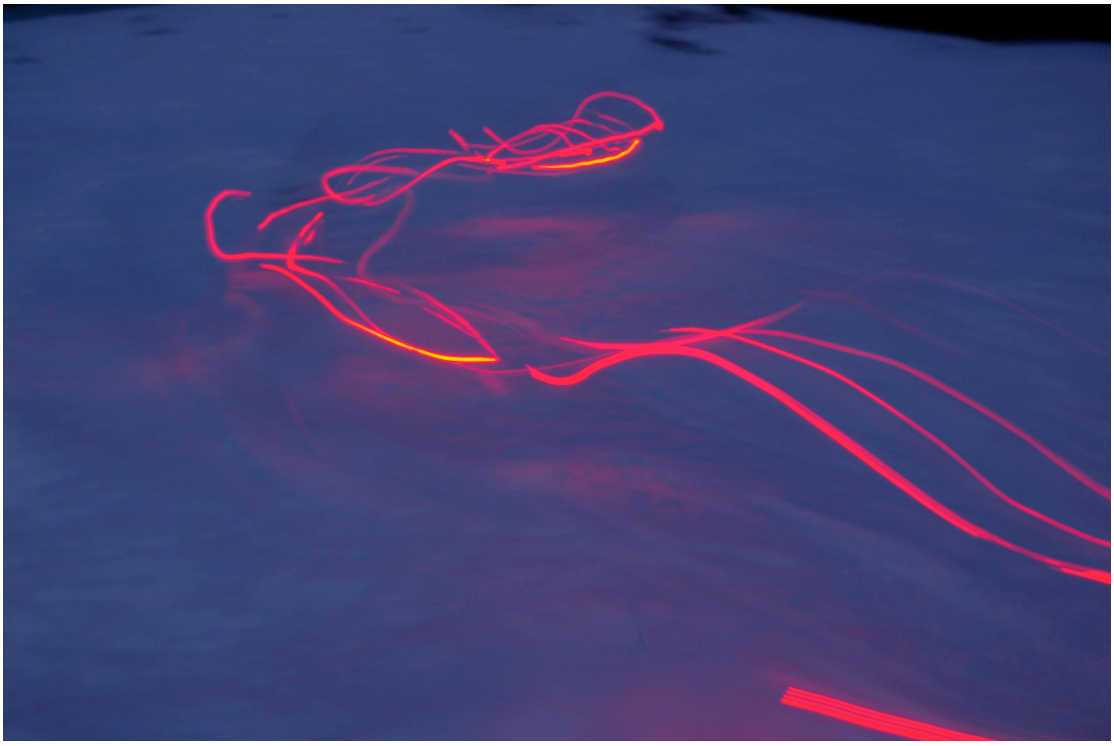

Fig. 3.14 ***Light Landscape*** **shows the reflective qualities of snow in interaction with wearable light features.**[144]

Skiing while wearing light features gave a new spatial dimension to the interaction of light and body with the environment (figure 3.14). The camera captured the movement of lights down a ski slope and their trace in the surrounding landscape, but hardly tracked the skier's body because the skier was moving fast and not wearing reflective clothing. Having created the light effects by carrying and propelling the wearable light features, the performer is marked by absence in the emerging *Light Landscapes.*

The author followed up these sessions with explorations of water as a light environment (fig. 3.15).[145] Water provides a much darker backdrop than snow but its smooth surface reflected light more strongly than the crystalline surface of snow.

Informed by the outcomes of the snow sessions, the author worked at night locating the performances in shallow water.[146] Water thus surrounded the performer at ankle level and provided a mirror-like reflective surface.

[144] Source Oberlack (2007) primary research.

[145] Sessions took place in the Maledives in summer 2007 and Thailand summer 2008. The author returned to Verbier for a 'solo' project in March 2008.

[146] As these sessions took place in warm climates the author was able to sustain long sessions in water.

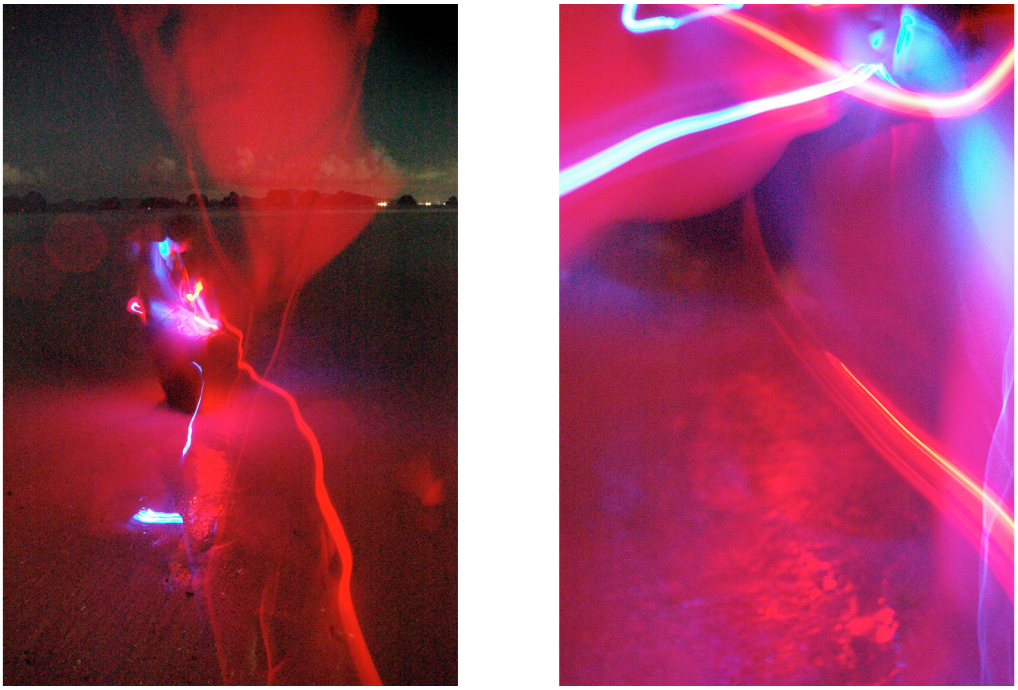

Fig. 3.15 Reflective effects of water on the interaction of light, body and environment within a landscape setting (left) and close up (right).[147]

The process of these sessions followed the same logic as the snow sessions. However, working on her own allowed the author to establish an intensive reflective dialogue with the outcomes without being distracted by the presence of collaborators. The author investigated choreographies that evolved around the body as well as choreographies that explored spatial relationships.

Simultaneously assuming or controlling the roles of performer, artistic director and camera operator required the author to control a multitude of factors that had an impact on the photographic outcomes. The author directed the type of light features used, their position on the body and the choreography of movement in relationship to the camera frame and to the environment, and at the same time controlled the settings of the camera recording. However, gauging the space for choreographies within the camera frame proved challenging without external feedback.

In particular camera frame and shutter speed impacted on the outcomes as images were composed of different layers of light effects recorded over the time of exposure. In general longer exposure time and more varied movement patterns and tempos resulted in a more complex visual effect. The choice of camera frame determined the relationship of light choreography, body and the environment.

[147] Source Oberlack (2007) primary research.

The editing process evolved around the selection of images according to themes that emerged from reflecting upon the recorded photographs. In general these themes corresponded with the chronological order of the photo shoot. This suggests that the author was intuitively exploring along the lines of these themes during the sessions.

Emerging themes evolved mostly around the visual characteristics of the images such as 'Trails and Fields', 'Purple Circle', 'Trails to Veils', 'Overlay', 'Dynamic Body Contour' and 'Kinetic Sculpture'.[148] This provided a further expansion of the critical-descriptive vocabulary while narrative links emerged in the imagery. Due to feedback from peers the author considered also sports as a future arena for wearable light and sportswear as a potential product application.

An unexpected outcome of the research was the discovery of 'accidental' or inadvertent performance. Because the author was exploring light on the body in a public setting, the light choreographies drew attention from audiences who accidentally happened upon the performances. The author had no other indication of the presence of an audience, though the choreography of light in public settings suggested that the potential audience was large.[149] These 'accidental' performances constituted a social intervention and raised questions about their potential audience, how the audience experienced the performance and what kind of meaning they might have constructed from the encounter.[150]

The *Light Landscapes* created by the *New Arenas* established photographic work as a creative output in its own right and suggested the investigation of scale in relationship to wearable light. The investigation of these light environments also informed future thinking about the manipulation of the light environment as a method of designing the interaction between body, light features and environment.

In response to *New Arenas* the author determined to pursue the exploration of the three-way interaction between wearable light, the body and the light environment in which the author controls all elements of the interaction. These investigations were to focus on choreographies for lens-based media with a particular interest in the effects of manipulating the light environment on the outcomes.

---

[148] See section 5.1 for a detailed description.

[149] As figure 3.15 (left) shows, the coastline of the main land with harbour lights was visible from the location of the session suggesting that the light choreography might have been noticed from there.

[150] See section 4.3 for a further discussion of accidental performances.

The author also decided to return to larger collaborative practice with professional dancers and videographers in order to explore light effects of interactions between multiple performers and capture these interactions from multiple camera viewpoints. However, the author determined to keep overall artistic control of the collaboration.

3.2.6 *Light-Space-Body*; Light Choreography & Design for Lens-Based Media

Please reference the videos *Light-Space-Body: Process* and *Light-Space-Body: Outcomes* on DVD.

Light-Space-Body presented a culmination of the research process and investigated the interaction of light and body in especially designed light environments through choreographies for lens-based media.

Light-Space-Body took place within a larger, fine art based project that provided the opportunity for a number of practice-based PhD researchers to develop new work in the *Lethaby Gallery*[151] at Central Saint Martins College of Art and Design in August 2007.

This 'residency' project evolved as part of *Here Tomorrow*, a seminar that facilitated feedback and reflection on practice-based research through a series of peer presentations. All participants shared a common interest of practice in time-based media and most of them had a fine art background. The discussion of the author's work within this context provided a widened feedback and validation for the research project.

During the *Lethaby Gallery* project participants produced practice-based research in relationship to specific aspects of their PhD projects. These projects ranged from animation characters to architectural interventions. The interaction with other practitioners over the course of the project led to a stimulating atmosphere of continuous discourse and feedback. Working alongside peers involved with different media provided a new context of practice within which to locate and to evaluate the author's practice.

The aim of *Light-Space-Body* was to explore the interaction of light on the body with specially designed light environment and take full control of all aspects of the production, informed by the outcomes of the research to date.

[151] For *Lethaby Gallery* see Central Saint Martins College of Art and Design (2011 [Internet]).

A four-month design and planning phase prepared the author for the three-week period of research and production in the gallery in August 2007. The outcomes of this period were reflected upon and edited into a video. The author presented this video as part of a 'show and tell' exhibition event at the gallery in October 2007 attended by peers, research and academic staff of the University of the Arts London, and members of the wider art and design community. This event provided a vital feedback mechanism for the author's research project.

During the preparation period the author researched and designed the light environment and sought advice on its realisation from theatre design experts such as Michael Sainte Croix.[152] Different options for the recording of the light effects such as 16mm film and video were considered, however, the author settled on high definition digital video due to its recording capability in low light conditions and relative ease of use. The author engaged performers and videographers from her network and covered all logistics such as sourcing materials for the light environment, costumes for performers etc.

Central to the project was a light environment that was flexible enough to allow explorations in different types of settings. The author decided to build an architectural structure inside the gallery that evolved in four iterations of four-week period of the project and that allowed light manipulations within these iterations.

Figure 3.16 shows initial design sketches for the light environment and 3.17 demonstrates their development in response to research meetings with theatre design experts. The actual designs of iterations three and four of the light environment still changed in response to the research process in the Lethaby Gallery.

[152] Michael Sainte Croix is Theatre Design Technical Manager at Central Saint Martins College of Art and Design.

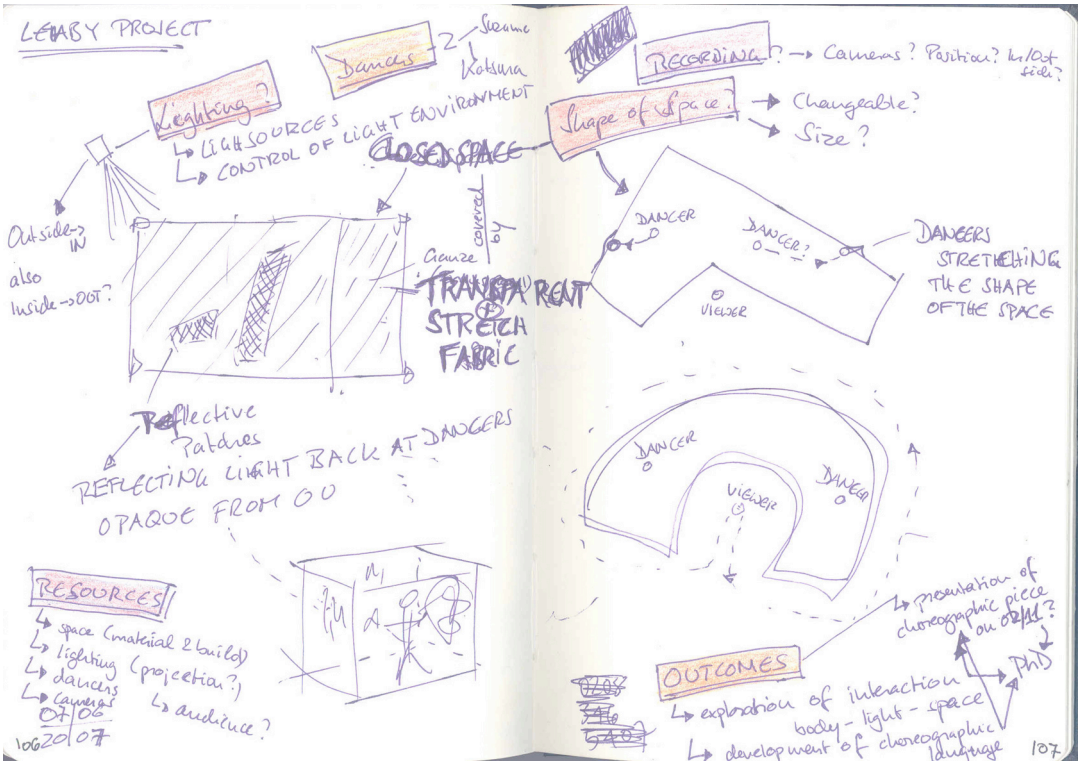

Fig. 3.16 Sketches for initial design development of light environments.[153]

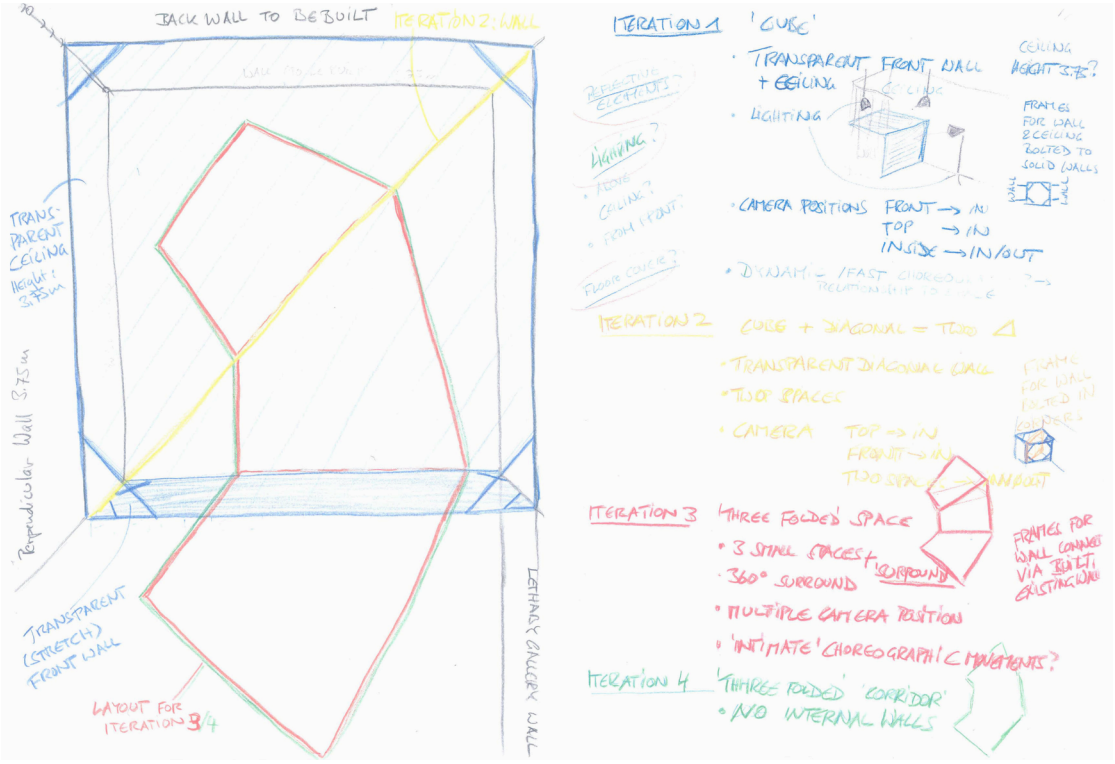

Fig. 3.17 Sketches of the iterations of the light environments.[154]

[153] Source Oberlack (2007) primary research: research diary p. 106/7.

[154] The four iterations of the layout are marked in colours blue for iteration 1 *cube*, yellow for iteration 2 *diagonal*, red for iteration 3 *three-folded space* and green for iteration 4 *inside-out:outside-in* (source Oberlack, 2007, primary research: research diary p.107a/b).

During the research period the author built these architectural light environments inside the gallery. The spatial features of these light environments evolved in four iterations from a cube shape into a sculptural space with the potential for multiple interactions between light, space, performers and cameras. The 'walls' of this space were made of translucent, elastic sharkstooth gauze[155] used in theatre. Light sources available in the gallery were manipulated with professional colour gels[156] for stage applications in order to explore a variety of light situations (figure 3.18).

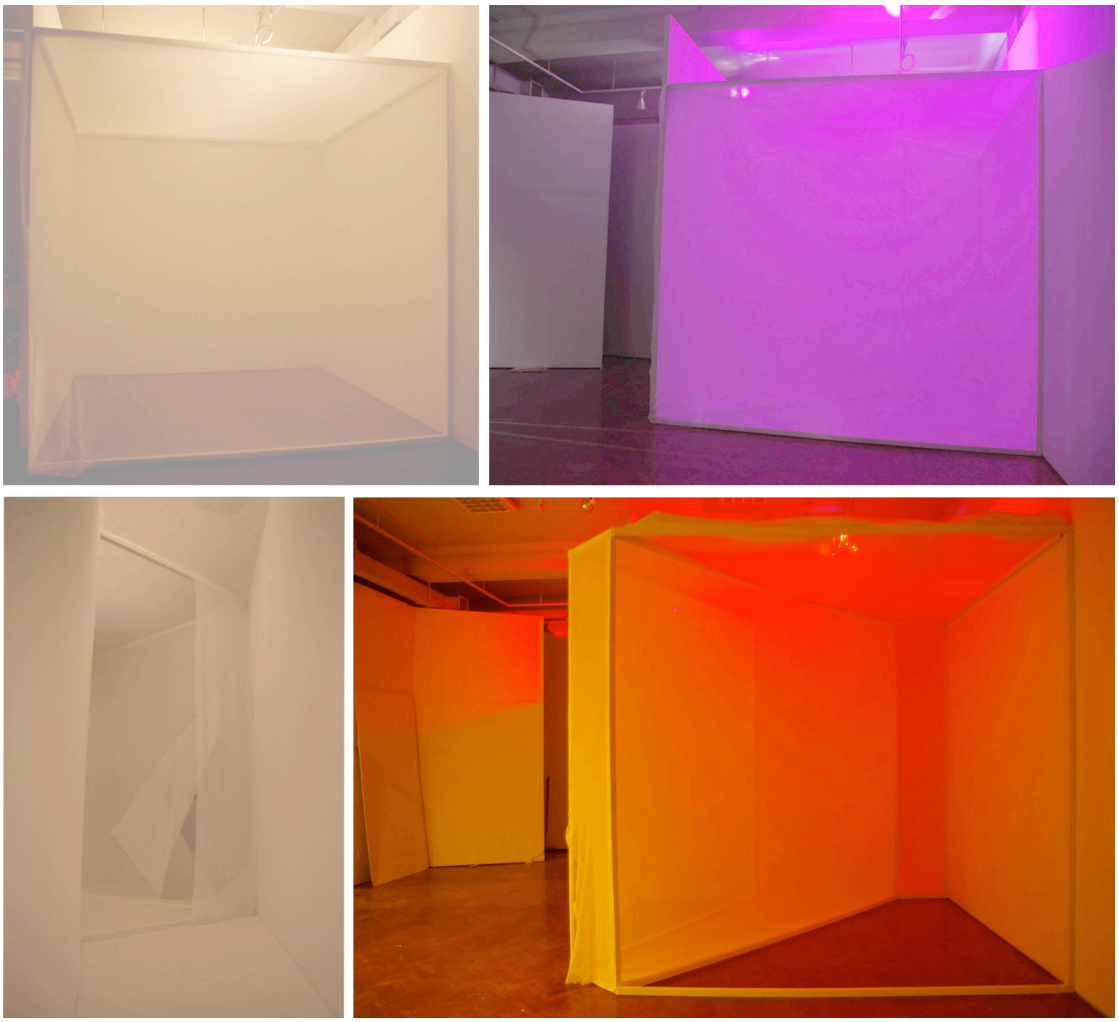

Fig. 3.18 The light environment evolved in four iterations. Clockwise from top left: it. 1 *cube*, it. 2 *diagonal*, it. 3 *three-folded space*, it. 4 *inside-out:outside-in*.[157]

The potential of each light environment was investigated with multiple performers over three to four days depending on its complexity. The author worked with a core of two performers who were joined by up to three more performers over the period of the project. This facilitated a balance of

[155] For sharkstooth gauze see for example British Theatre Guide (2011 [Internet]).

[156] For *Rosco* colour gels see *Rosco* (2011 [Internet]).

[157] Source Oberlack (2007) primary research.

continuity and fresh presences and allowed the author explore complex light environments with a multitude of performers in the latter stages of the project.

Each investigation of the light environments started with a period of free exploration and development of light choreographies that were recorded with time-elapsed photography and a digital video camera in order to record the workshop process and reference choreographies (figure 3.19). During this phase the author took on the roles of artistic director and camera operator simultaneously using the reflective methods described in section 3.1.

Fig. 3.19 Explorative research in two iterations of the light environment.[158]

These explorations culminated in the recording of light choreographies on high definition digital video on the last day of each investigative period. Working with two camerawomen from prior research projects[159] the author focused on the development of high definition moving images and drew on light choreographies that had been developed in response to the light environment during the exploration phase.

The light environment provided important features for the creation and manipulation of light effects on and off the body. Translucent walls provided a foil for capturing light effects and dispersed light around the bodies of

[158] Source Oberlack (2007) primary research: still images taken from video documentation of the research process. Left: performer inside the funnel of the *three-folded space* (iteration 3), right: performer inside the cube with mirror as reflective element (iteration 1).

[159] Projects *Sensing Change* (3.2.2) and *Radiance* (3.2.4).

performers. They extended the light effects surrounding the body and made connection between light, space and body visible. Mirrors reflected and distributed light emissions in unexpected ways, creating spatial connections between the performers and the light environment that explored the sculptural qualities of the space.

Multiple camera perspectives contributed to the rich recordings of light effects within the environments. These camera perspectives included: Filming from the outside into the light arena, from the inside out, through or along the translucent and elastic walls as well as positioning the camera among the performers in the arena.

Light-Space-Body continued the investigation of interactions between multiple performers from earlier collaborative projects adding the interaction with the light environment into the mix. The project delivered the prior personal knowledge into a contribution to knowledge learning curve with suggestions for future research.[160]

Creative outcomes in the form of still and moving images investigated the interactions of wearable light features with multiple performers in specifically designed light environments. These outcomes informed the last session of the project *New Arenas*[161] in August 2008, formed the base for future publications and exhibitions and led to invited presentations in the art and design community.[162]

In *Light-Space-Body* the author expanded her role to becoming the 'auteur'[163] who had full control of research process and creative outcomes in still and moving images. Besides overseeing the collaborative effort, the author assumed multiple other roles such as constructing the light environments, photographing, support and logistic as funding for the project was limited.

---

[160] For a discussion of contributions to knowledge and suggestions for further research see chapter 6.

[161] See section 3.2.5.

[162] This included the presentation of a paper at an international conference in Canada (Oberlack, 2007; primary source), an invited presentation to MA Fine Art at Central Saint Martins College of Art and Design (Oberlack, 2008; primary source) and the participation in an exhibition on contemporary British jewellery in Japan (Birmingham City University; School of Jewellery, 2008).

[163] In the auteur theory of filmmaking the director is viewed as the major creative force in a motion picture and oversees all audio and visual elements of the film. Visual elements such as camera placement, blocking, lighting and scene length rather than plot line, convey the message of the film. The most successful examples will bear the unmistakable personal stamp of the director. Examples are directors François Truffaut and Jean-Luc Godard (Encyclopedia Britannica Online, 2009 [Internet]). For further reference see Tudor (1974).

This proved exhausting leaving little time for the reflection on outcomes during the research period.[164]

Discourse with other practitioners over the period of the project and feedback from a wider art and design community in the final exhibition event gave valuable insights and validation to the project. These informed the reflection and writing process of the thesis.

3.3 Conclusion; PhD Methodology and Research Process

As wearable light has not been extensively investigated in art and design a critical discourse has yet to be established, so practice-based research into wearable light is exploratory in nature. It is practice-based with practice as the main vehicle of research and practice-led in that it is concerned with issues of practice and research outcomes are practical.[165]

The research adopted a multiple methods approach to drive a reflective cycle between practice and critical context. These methods complemented each other and fulfilled specific functions in the generation, documentation and reflection of practice and critical context.

The methodology emerged in response to outcomes from the exploratory and reflective research process that is a feature in this protean project. This process was designed to allow the research to develop through a sequence of projects whose outcomes were evaluated and reflected upon and then informed the conception of future projects in the research. This process led to the discovery of creative and research outcomes that were not envisaged in the original research remit. Research methods accordingly developed alongside the extension of the research remit.

As noted earlier, at the outset the practice-based research was expected to be driven by the design of different collections of wearable light features in response to specific research questions. However, in the course of the research the application of these light pieces in performances and the potential of recording these light effects as creative output in their own right began to drive the creative practice.

---

[164] The assumption of multiple roles was mainly due to funding issues as the project was privately funded with some support from the research fund for PhD students at Central Saint Martins College of Art and Design.

[165] See the introduction to chapter three and chapter one for a discussion of the practice-based and practice-led aspects of this research.

Over the course of the research process the author's creative practice expanded from the design and production of wearable light features to choreographing the interaction of wearable light features and performers for live performances and the choreography and recording of wearable light in time-elapsed photography and video.

Creative outcomes correspondingly extended from three-dimensional objects to include two-dimensional images, the time-based medium of video and the choreography for live performances. At the beginning of the research still and moving images mainly functioned as means of documenting the ephemeral qualities of wearable light and their application in live performances. In the course of the research, however, the author discovered the creative potential of time-elapsed photography and digital video. Still and moving images thus became a creative output in their own right.

Recording and editing practices became a cumulative learning process that spanned a range of different projects and transferred knowledge between collaborations and 'solo' projects working with still and moving images and live events.

Hand in hand with this extension of creative practice, the author's role grew from the designer of wearable light features to the role of choreographer for live performances and thus 'auteur' of still and moving images of light on the body in space. The iterative and reflective nature of this practice suggests an extension of Schoen's (1991) thoughts on the iterative and combined creative process.

The expansion of practice and corresponding extension of practice and methods as well as the expanding role of the practitioner were a result of the reflective research process set up by the experimental, practice-based research methodology. In turn these fed back into the reflective research process and the research methodology.

Collaborative and 'solo' projects played an important role in the research process with their distinct potentials and challenges. They complemented each other and allowed the author to switch between periods of engagement in collaborative input and periods of introspection in 'solo' projects.

In 'solo' projects the practitioner assumed all roles in the artistic process, often simultaneously. This allowed full control of practice, process and outcomes, and facilitated the logistic of projects. However, often the strain of fulfilling multiple roles impacted on the practitioner's ability to fully realise the creative potential of a project. As by their very nature 'solo' projects do not encourage

the exchange with other practitioners, they set boundaries to accessing outside expertise.

Collaborative efforts facilitated this exchange with choreographers, performers, photographers and film editors amongst others. In some projects such as *Radiance* and *Sensing Change* the collaborations also facilitated funding and logistics. Challenges lay in the coordination and the communication between multiple practitioners from a wide range of backgrounds who had different creative languages and agendas. Who initiated the collaboration and what kind of role they took in the process impacted on contributions to and control of the collaborative process and therefore the creative outcomes as much as the expertise, agendas and prior experiences of all contributors. The most successful collaborations were based on the co-evolution of creative outcomes between the author and the choreographer or saw the author take the role of 'auteur' with full control of the creative process and outcomes.

The experimental, practice-based research methodology developed for this project led to an expansion of practice and outcomes that widened the original research remit.

The outcomes of this extended research remit will inform post-doctoral research into the developing new generations of wearable light features and exploring their application in different genres of artistic and design practice.

The reflection and evaluation process built into the research led to the emergence of elements of an as yet immature language for the description and evaluation of wearable light that shows potential for further investigation in post-doctoral research.[166]

The outcome of a number of projects pointed towards future beneficial product applications in areas such as health, personal safety and sportswear. Informal exploratory research of these applications suggested that there is indeed scope for more formal investigations in post-doctoral research.

[166] See chapter 5.

4 Wearable Light; Wearability and Time-Based Boundaries

This research explores the effects that light can generate as a non-material creative medium in interaction with the body. Light can come from natural sources such as the sun or from a wide array of artificial light sources. These sources range from conventional tungsten light bulbs and halogen lights in domestic interiors to specialized architectural and stage lighting, many of which are now based on light emitting diode (LED) technology.

These media have in common that they project light on the body from light sources in an environment. Indeed the author used these media in the MA research preceding the PhD and explored light on the body through images projected from fixed projectors (figure 4.1).

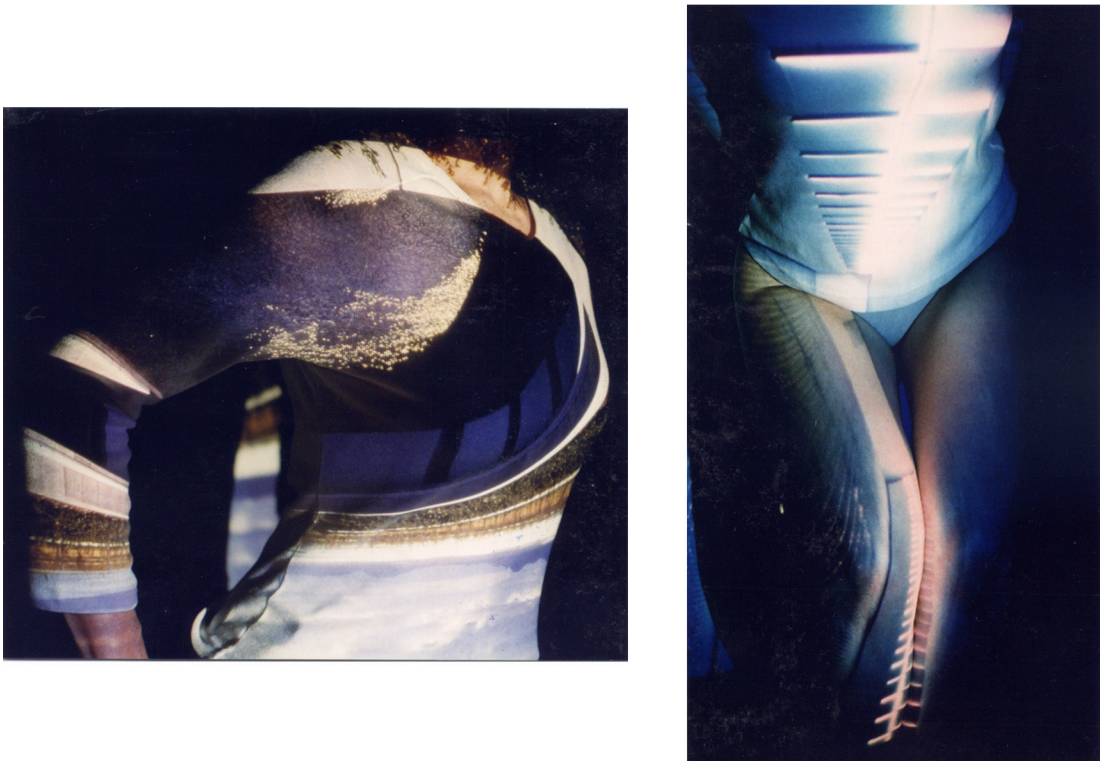

Fig. 4.1 Projections of images on the body; MA research preceding the PhD.[167]

Wearability emerged as key concept from the MA research to be taken forward to the PhD. As the conclusions in chapter two point out, the rationale was twofold: wearable light has not yet been explored in any depth within an art and design context and recent advancements in technologies such as light

[167] Source Oberlack (2002).

emitting diodes and miniature batteries facilitated their use in light as body adornment.

However, in the course of the PhD the control and manipulation of light environments re-emerged as a concept of the research and led to the investigation of interactions between wearable light features, performers and specially designed light environments in *Light-Space-Body.*[168]

Characteristics of wearability and time-based boundaries of light as body adornment emerged through the research and as such they represent research outcomes. Time-based boundaries originally arose from the concept of wearability, but have wider implications in terms of the ephemeral qualities of light as body adornment.

Wearability and time-based boundaries can therefore be conceptualized as research outcomes as well as underlying factors that drove the investigations of the research process.

The nature of wearability and its implications for the development of practice are described in section 4.1 ‘Wearability’; time-based boundaries are covered in 4.2; section 4.3 discusses the impact on visual Perception and social interaction and section 4.4 presents conclusions with reference to the dual nature of wearability and time-based boundaries.

In this chapter sections reference specific still or moving images in order to support their arguments. More examples of still and moving imagery can be found throughout the visual material of various projects.

4.1 Wearability

Wearability of light can be conceptualized in two ways: the body as the site of light projections i.e. ‘wearing’ light as a non-material layer, or the body as a carrier of light features. As a carrier the body can manipulate light effects through movement and propel them through the surrounding environment. In this case the body acts as a propulsion mechanism for light features that project light into the surrounding space or on the body. These two approaches combine to create dynamic light effects on the body and/or in the space surrounding the body. The interaction of multiple protagonists of wearable light creates complex, layered light effects on their bodies and in their environment.

[168] See section 3.2.6.

Initially this research was concerned with investigating across the field of combining wearable light and the body. This stage was followed by a narrowing of the focus onto the body as a carrier and site of light. Latterly the research centred on recording this creatively on video so that the record of a performance over time and within a space of a body(ies) carrying light becomes an artwork.

The body as a site of light (4.1.1) and the body as carrier of light (4.1.2) are combined in a 'light choreography' that on the effect of movement phrases on wearable light (4.1.3). This has impliction for the scale of outcomes (4.1.4) consequences for the publication and exhibition of this type of practice (4.1.5).

4.1.1 Wearing Light; the Body as a Site of Light

Please reference videos *Body-Light-Scapes*, *Radiance: Outcomes* and *Light-Space-Body: Outcomes* for further examples.

Empirical research has produced the following observations: light effects on the body as a site of light are determined by three factors: characteristics of the projection surface, qualities of emissions from (wearable) light sources and attributes of the (light) environment.

When the body is 'wearing' light i.e. is the site of projected light, then its characteristics as projection surface impact on the light effects. The body is a three-dimensional projection surface as opposed to conventional two-dimensional screens. The surface of the body twists and warps according to the shape of the body. This combination of curvature and angularity defines the contour and the three-dimensional profile of the body.

When light is projected on the body it follows and highlights its contour and profile (figure 4.2). These light effects will change depth, detail and textural perspectives of the body and can lead to physical and visual illusions. This view of local light effects on the body is in most cases unfamiliar to the viewer as we are accustomed to overhead illumination of the body from natural or artificial light sources in our domestic or public environment (Rossing, Chiaverina, 1999). This confrontation with an unfamiliar view of the body can alter the perception of the body and contribute to its understanding.

Due to the complexity of the spatial features the outcomes of light projections on the body can only be anticipated in general terms. Even fractional changes of the projection angle can lead to radical changes in the light effect.

The lowering of the head in figure 4.4 (right) for example incorporates features of the face into a light effect that is focused on the neck and décolleté.[169]

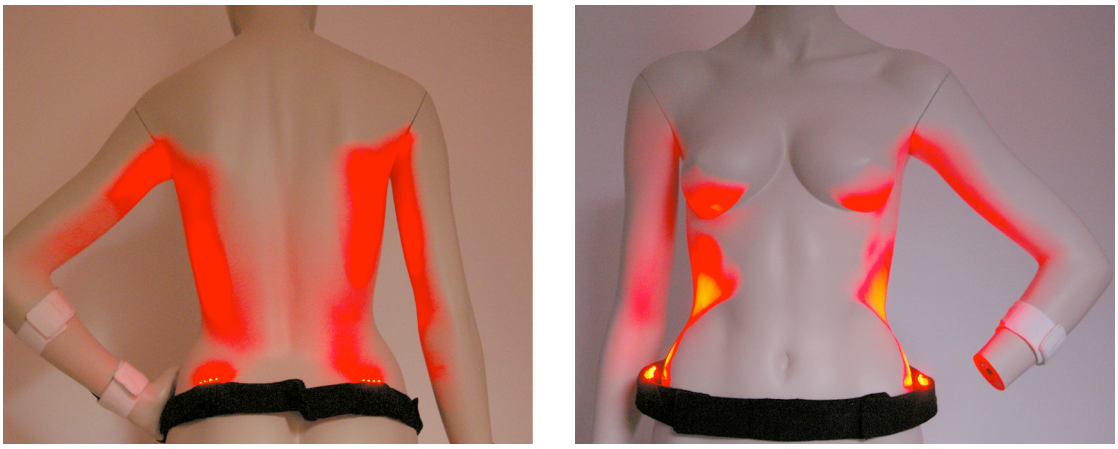

Fig. 4.2 Light projections follow and highlight contour and three-dimensional profile of the body.[170]

One can argue with Drutt English, Dormer (1995, p.32) that light constitutes a non-material layer on the body that only comes into existence when light emissions meet the body. This layer of light merges with the body and accentuates its boundary.

Depending on the strength of the projection, light might be projected back into the immediate space around the body that is part private and part public. In this case the layer of light heightens and makes explicit the connection between the body and the intimate space in its immediate vicinity. In this sense the light projection extends and redefines the boundary of the body.

[169] Chapter 5 describes visual effects in more detail as part of the emergent visual language of wearable light.

[170] Source project *Radiance* (Oberlack, 2006, primary research), for the project see section 3.2.4.

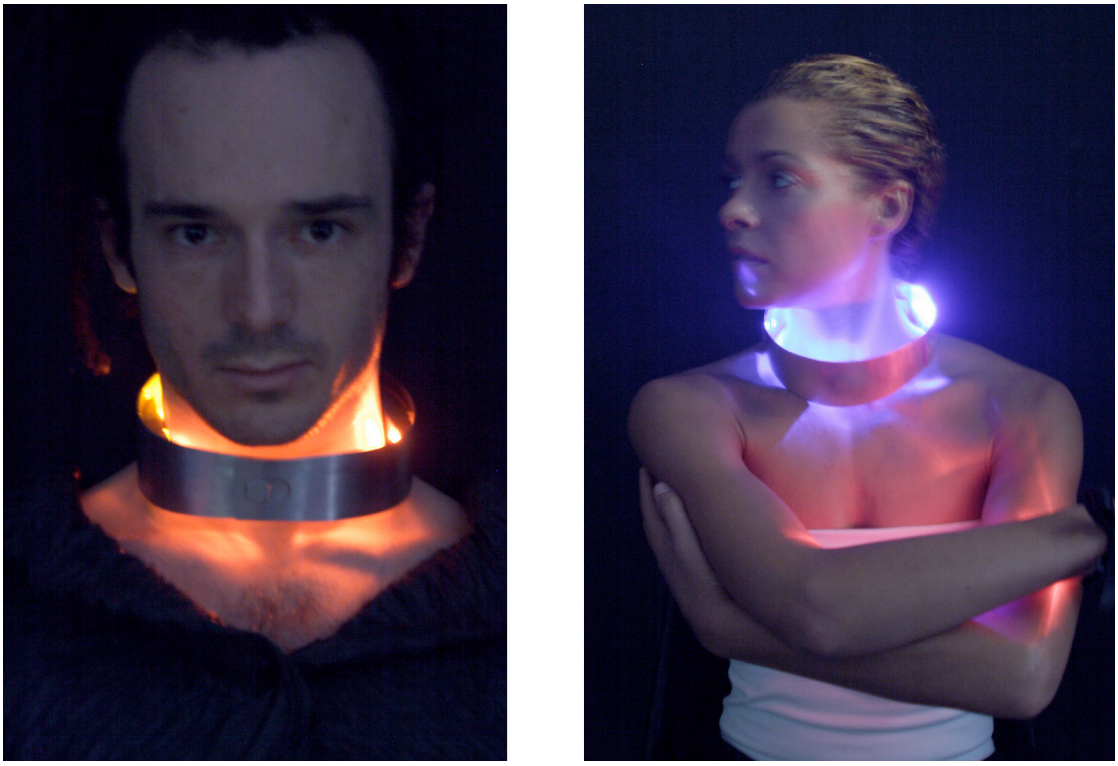

Fig. 4.3 Light fills the intimate space around the body extending and redefining its boundaries. Reflective qualities of surfaces impact on this effect.[171]

The strength and character of the light effect will depend on the reflective and absorptive qualities of the projection surface, i.e. skin or fabric that covers the body. Experiments throughout this research project have shown that shiny or oily skin will be more reflective than matte skin and fair skin tones will reflect light stronger than dark ones. In general the shine of skin will outweigh its tone in terms of defining the reflective or absorptive qualities of the surface. The reflection of light can be enhanced by applying skin treatments such as oil, metallic powders or reflective skin paint whereas treatments like matte and dark skin powders or paints increase absorption. Fabrics worn on the body will alter reflective and absorptive qualities of the projection surface in a similar manner.

Gender specification plays a role for the body as a site of light as it impacts on the shape, size and posture of the body. This has an effect on the shape, size and profile of the projection surface and therefore the corresponding light effects. In imagery and outcomes where the protagonist is still present as a character, gender also raises questions with regards to what is associated with male and female in the context of wearable light.

[171] Source *Body-Light-Scapes* in project *Evolution* (Oberlack, 2004, primary research), for the project see section 3.2.1.

The characteristics of light sources contribute to the overall light effect on the body. This research employed light emitting diodes in wearable light features as this technology provides miniature sources with strong light output and low energy consumption. This entailed a specific colour palette limited to a small range of mainly primary colours.[172]

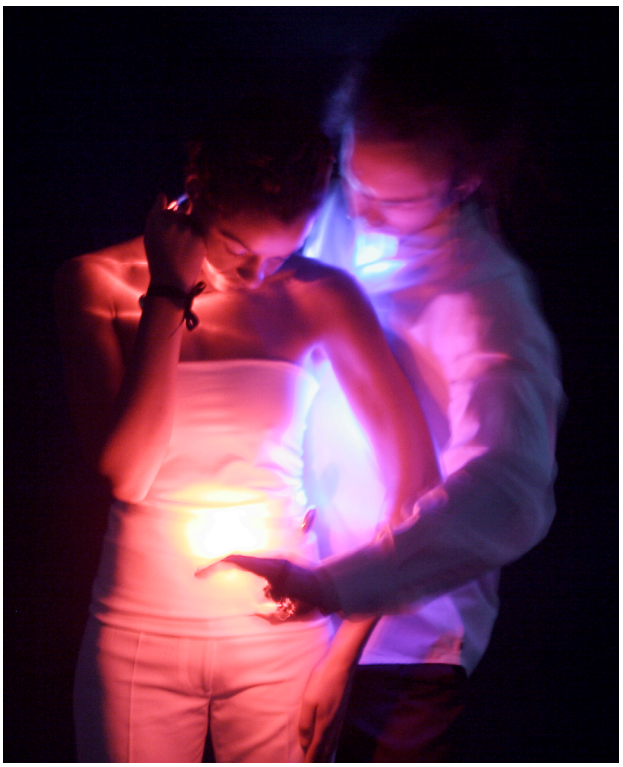

Fig. 4.4 Multiple performers trap light emissions to create *Body-Light-Scapes*.[173]

Figure 4.4 illustrates how red and yellow coloured light features give the performer on the left a much warmer glow than the mix of blue, red and white light on the right performer. The wide angle distribution of light emissions from the yellow light feature creates a wide, even light field on the left performer, whereas the pinpoint distribution of the small red light feature on the performer's wrist creates radiating streaks of light. The further away the light features are positioned from the body, the larger and the fuzzier their light projections.

For multiple performers the interactions between the different factors multiply as light gets trapped and mixes between and around the performers. This interaction generates images in which the bodies of the performers and the light intertwine to create new *Body-Light-Scapes* that extend and redefine the

[172] For light emitting diode (LED) technology see Schubert (2003).

[173] Source *Body-Light-Scapes* in project *Evolution* (Oberlack, 2004, primary research), for the project see section 3.2.4.

boundaries of the body. These B*ody-Light-Scapes* can be static as shown in figure 4.4 or dynamic when the wearable light features are propelled.[174]

The light environment will impact on the body as a site of light. As demonstrated in figure 4.5 ambient light mediates the light effects on the body produced by the wearable light feature *Feuerrad*.[175] In the left image, the light effect on the neck is less visible than the light effects on the dark background of the right image where light effects register much more strongly in the recording. Experiments in the research show that in full sunlight light effects on the body can become almost invisible.

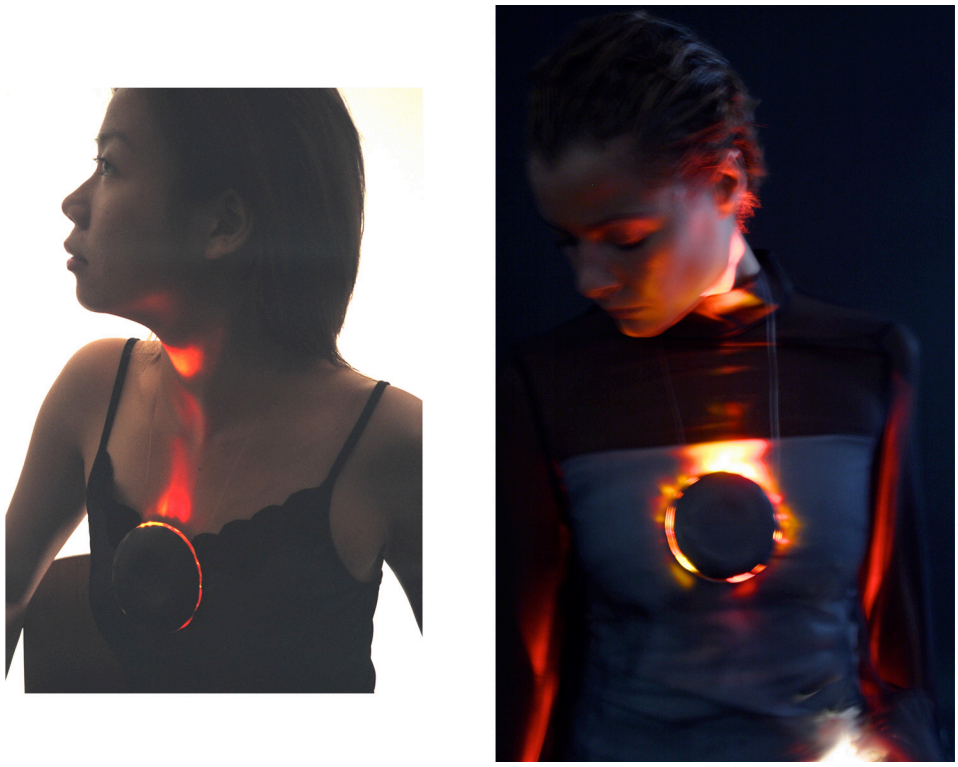

Fig. 4.5 Impact of the light environment on light effects on the body.[176]

Controlling the light environment means managing the physical features of the environment and the light situation produced by ambient light sources. In formal arenas such as a photographic studio or a stage only architectural features and the available light equipment limit control of the light environment. Informal arenas such as an outdoor performance setting or

[174] The effect of movement and positioning of wearable light features is discussed in the following section 4.1.2.

[175] *Feuerrad* was part of the author's 2003 MA collection, based on investigating the application of light technologies for light jewellery.

[176] Source (left) image from MA collection (Oberlack, 2002), source (right) *Body-Light-Scapes* in project *Evolution* (Oberlack, 2004, primary research). As with all photographic recording, camera settings such as aperture and shutter speed impact on the outcome of the recording.

'everyday arenas'[177] afford much less control. [178] The protagonist can only choose the time and place of the arena and their own position in the light environment. This might lead to accidental interactions with ambient light sources or physical features of the arena. The potential of these interactions was demonstrated in *New Arenas.*[179]

For the recording of still or moving images the characteristics of the light environment and their control become vital as cameras have much less capacity for subtle light reception than the human eye. The impact of the environment therefore increases in images.

In summary, light effects on the body are determined by the interaction of characteristics of the projection surface and characteristics of light emissions mediated by the light environment. The projection surface is characterized by its contour, three-dimensional profile and reflective quality. Colour and colour mix, distribution angles and position of the light source determine the light emission in relationship to the body. Physical and ambient light features constitute the light environment.

Gender impacts on the body as a site of light through shape, size and posture of the body and has an effect on shape, size and profile of the projection.

The body as a site of light contributes to the definition and understanding of the body as light projections on the body can emphasize corporeality and three-dimensionality of the body. They also connect the body to the intimate space in its immediate vicinity thus extending and redefining its boundaries.

Feedback from the research suggests that light on the body has an emotional impact on the viewer/audience and the wearer/performer. This raises the questions about the body as an experiential site.

---

[177] 'Everyday Arena' is a term the author coined during MA research and indicates informal settings and events that protagonists of wearable light might operate in. These can range from leisure to office to special occasions.

[178] The afternoon performance of *Radiance Topos* gave a startling example of how difficult it is to control an outdoor light environment. The sun came out just as the performance started and made light effects nearly invisible. For *Radiance Topos* see section 3.2.4.

[179] See 3.2.5 for the project and chapter 5 for a description of visual effects.

4.1.2 Wearing Light Features; the Body as a Carrier of Light

Please reference videos *Body-Light-Scapes*, *Radiance: Outcomes* and *Light-Space-Body: Outcomes.*

Research in this project has shown that the body as a carrier of light refers to the position of light features on the body and their movement by the body. Position and motion contribute to the type of light effects generated on the body as a site of light, and have implications for the focus of interaction between the protagonist and his environment.

Experimental research has shown that the type of light effect generated and their site on the body depend on the position of the light-emitting feature. Two factors impact on this position: the location of the light feature on the body and the direction of its light emissions.

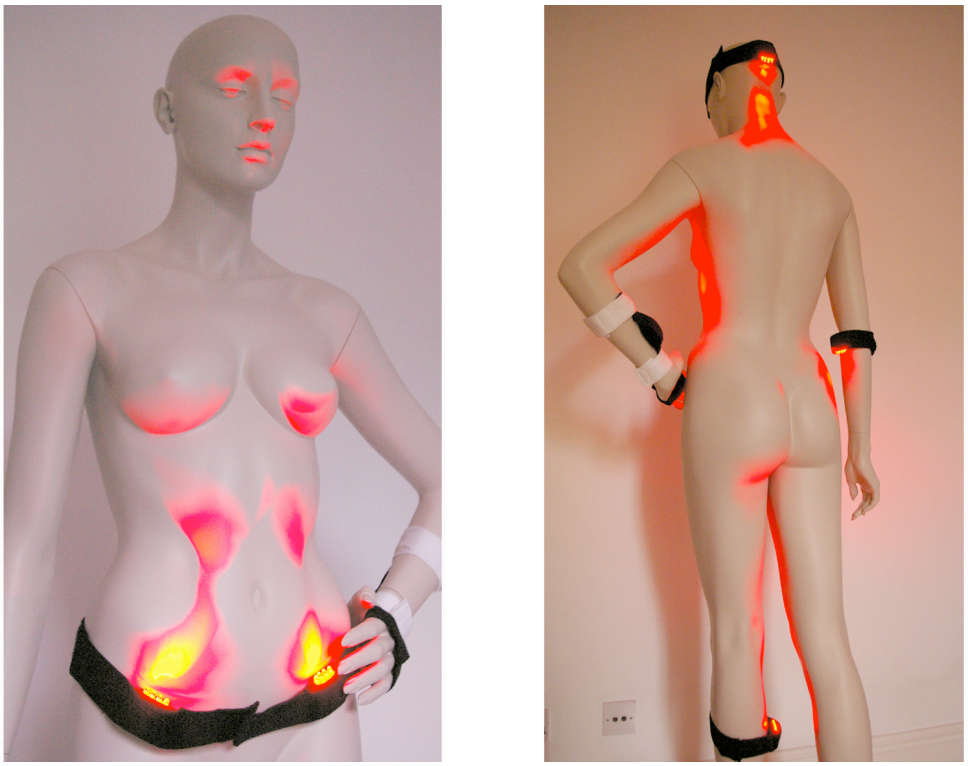

Fig. 4.6 Locations of light features on the body: torso versus extremities.[180]

As figure 4.6 shows the light features create a focused effect around their location on the body, then the light travels further and projects onto other sites that cross its path. Locations on the body that have the most impact are head, neck, torso and limbs as they can leverage light effects. This enables the

[180] Source project *Radiance* (Oberlack, 2005, primary research), for the project see section 3.2.4.

protagonist to increase or decrease the intensity and spread of light effects, and to alter the impact on adjacent body surface or surroundings. Locations on wrists or hands and ankles or feet have proved particularly versatile as they allow the marking of various sites on and off the body and can propel light around the body. These locations also facilitate the alteration of the distance between light feature and projection site. The change in distance in turn leads to a change in scale of the projection. In general, the further outward the location is from the centre of the body, the more variety of movement and therefore the more diverse and dynamic the light effects and their sites.

As figure 4.7 shows there are three directions that light emissions can take in relationship to the body. They can face towards the body, skim along the body on an aligned or angled trajectory or point outwards into space. Facing towards the body the light emission will focus on the body as its projection site as discussed in section 4.1. These projections are by their nature close to the body and in general have a more intimate feel (figure 4.4 top left).

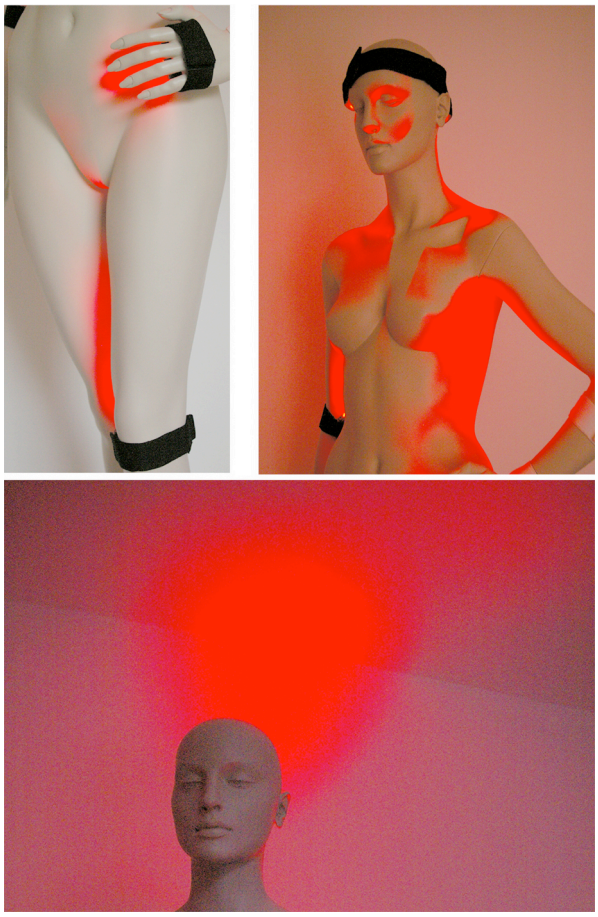

Fig. 4.7 Directions of light emissions. Clockwise from top left: facing towards the body, aligned or angled trajectory to the body and pointing into space.[181]

[181] Source project *Radiance* (Oberlack, 2005, primary research), for the project see section 3.2.4.

If the light feature is directed along an angled or parallel trajectory to the body, then the light skims along the surface of the body and projects into the immediate vicinity of the body. This creates a connection between the body as a site and the surrounding space and negotiates the physical boundaries of the body (figure 4.7 top right).

Aiming the beam away from the body projects light near or far into space and bounces it off features in the environment (figure 4.7 bottom). This extrapolates the body into the surrounding environment, marks the space around the body and can extend the reach of the body. The trajectory of these light emissions is difficult to predict with any accuracy. They often do not show as light beams, only to reappear when the path of the light crosses physical features in the environment and in the air. Lighting the body has erotic implications: light facing towards the body tends to emphasise physical characteristics, skimming tends to model planes and profiles, and pointing away profiles and locates the body.

Positioning light features on the extremities allows the alteration of projection angles in one movement and a swift change in the direction of light emissions.

Effects created by wearable light features will be dynamic by nature, as protagonists usually do not stay still for extended periods of time. This leads to a transient and ephemeral quality of light effects on an off the body. The faster the motion and the more complex the interactions of body, light and environment the more dynamic and transient the outcome will be. Often effects pass so quickly or are so subtle that the eye can hardly catch them.[182]

Movements such as locomotors,[183] gestures and even involuntary twitches all impact on the dynamic display of wearable light. The stronger the body moves in terms of direction, tempo and distance, the more the light features are propelled forward along the path of the movement. The body becomes a propulsion mechanism for wearable light. This light traces and amplifies its movement as it travels through space and time.

Gender specification affects the body as carrier and propulsion mechanism in so far as the shape and size of the body as well as its posture, reach and movement patterns will impact on the dynamic of light effects. Gender specific movement patterns have not been researched in this project, but are well

---

[182] The transient effects are discussed in section 4.2.1 as part of time-based boundaries of wearable light.

[183] "**Locomotor.** Movement progressing through space from one spot to another. Basic locomotor movements include walking, running, galloping, jumping, hopping, skipping, sliding, leaping." (Californian State Board of Education, 2009 [Internet]).

documented.[184] Gender influences shape, size and posture of the body and thus affects the 'reach' of the body and its movement patterns. This in turn has an effect on the dynamic of wearable light.

Fig. 4.8 Light effects created by body motion. Clockwise from top left: movement of light on the body, around the body and passage through space.[185]

As figure 4.8 shows three different types of movement can be conceptualized in relationship to the body: movements on the body, around the body and through space. These movements trace, mark, define and choreograph the body and its relationship to the surrounding space and the space itself. The choreography of moving light is a key concept and is discussed in more detail in the following section 4.1.3.

[184] Research into gender specific movement patterns is the domain of biomechanics, for example *USC; ACL Project Prevent* (2009 [Internet]).

[185] Source (top) *Boy-Light-Scapes* in project *Evolution* (Oberlack, 2004, primary research), source (bottom) project *New Arenas* (Oberlack, 2007, primary research); see 3.2 for both projects.

The body as a carrier of light features has implications for the relationship between the body and its environment as it changes the focus of interaction between body and environment through light emanating from the body.

The body becomes part of the light environment into which it enters; it reflects light and casts shadows in response to light sources in the space surrounding it. The body is therefore a medium for the reflection of ambient light. Without wearable light sources the only way protagonists can interact with this environment is by positioning themselves in relationship to the ambient light sources.[186]

The focus shifts to the body as a medium of light emission when the protagonist is emanating light. With this shift the direction of light in relationship to the body changes from a one-way 'outside in' to a two-way 'outside in / inside out'. The protagonist is still part of the light environment, but he can now interact by casting light as well as shadow. This opens a wider and more versatile range of options in terms of impacting on the 'light-scape' in interaction with the environment.

One can argue that the potential impact of the protagonist through his or her presence will be much higher when wearing light. The protagonist of wearable light becomes an unfamiliar view in the environment as in general humans are used to widespread overhead illumination of their environment and the protagonists within it (Rossing, Chiaverina, 1999 p. 322). This impact can be investigated more formally in performances, but also applies to wearing light informally in public or private spaces. As yet these investigations are exploratory and experimental, but have the potential to form a new sub-discipline in light art, which may subsequently feed into light jewellery.

In summary, the body acts as a carrier and propulsion mechanism for the light sources when wearable light features are positioned on the body. Movement of the light emissions creates transient and ephemeral light effects that can take place on the body, the area surrounding the body or point into the environment beyond the reach of the body. The light effects can trace movements of the body and track and amplify its motion in and through space.

Gender impacts on the dynamic of wearable light through shape, size, posture and gait as these affect the movement patterns and reach of the body.

Wearable light sources can extend the reach of the body beyond its immediate vicinity; redefine the body's relationship with its environment and

[186] An example for a light situation in a public space that plays with the idea of pedestrians casting coloured shadows by passing underneath seemingly white flood lights can be found in front of the Waterloo entrance to the Southbank Centre, London.

trace movement of the body through space. This contributes not only to the definition and understanding of the body, but to its passage and re-passage through space, and of the nature and features of the space itself.

Light emanation from the body changes the focus of interaction between protagonist and the light environment as the protagonist can cast light as well as shadow into the environment. The performer therefore does not only impact on the light environment, but also on the perception and understanding of the relationship between protagonist and environment.

4.1.3 Choreography of Light

Please reference videos *Body-Light-Scapes*, *Radiance: Outcomes* and *Light-Space-Body: Outcomes* for further examples.

Body motion can be choreographed to devise light effects**.** This 'light choreography' designs the way in which light effects mark and define the body, its connection to the surrounding space and the space itself.

'Light choreography' is inherently time-based[187] and determines the type and quality of the mark making through type, tempo, rhythm, and phrasing of body movements.[188] In this research phrases were developed from locomotors, gestures and twitches of the body. Facial expressions played a minor part as the light features and their choreographing were geared towards larger scale.

These phrases are put into a sequence within a dance structure for live performances or recording in lens-based media. In this research the development of choreographies for live performance mainly happened in collaborative projects. A notable exception was the short performance *Re-Incarnations: Light Wear*[189] where the author developed the choreography by directing three performers.

The performance of the 'light choreography' can be documented through time-elapsed photography or video.[190] 'Light choreography' can be geared solely towards creating still or moving images of light on the body as explored in projects *New Arenas* and *Light-Space-Body*. In this case the instant (digital)

---

[187] For implications of time-based boundaries of the work see section 4.2.

[188] "**Choreography ('dance writing').** The creation and composition of dances by arranging or inventing steps, movements, and patterns of movements. **Dance phrase.** A partial dance idea composed of a series of connecting movements and similar to a sentence in the written form. **Dance sequence**. The order in which a series of movements and shapes occurs. **Dance structures**. The way in which a dance is constructed or organized; a supporting framework or the essential parts of a dance." (Californian State Board of Education, 2009 [Internet]), for further reference see Minton (2007).

[189] Oberlack (2006; primary source).

[190] The fundamental difference between the experience of light choreography in a live performance and its recording is discussed in section 4.2.2.

feedback from the recording devices drives the creative decision-making and therefore the development of choreographic phrases.

Tempo of movement is a key concept for the creation of lights effect on and off the body. Static images of light on the body are only produced if light sources and projection site stay still as figures 4.3 to 4.7 have shown. If light sources and projection site move at the same time they can create a multi-layered interaction at different tempos. Simultaneous movement of light source and projection site is particularly relevant to the choreography of light on the body as a projection site.

Light movements and therefore choreographic potential can be conceptualized in three different ways in relationship to the body: choreography on the body, marking space around the body and passage through space.[191]

Choreography on the body relates to the body as a site of light.[192] Light moves over the surface of the body and traces its contour and three-dimensional profile. The effect created will depend on gestures made in relationship to the body and on whether the body as a site stays still or moves. This includes motion of the core and the extremities of the body as well as locomotors. The tempo of these movements in relationship to each other is key for the light effect created on the body. Slow movements create blurring effects, light fields and veils of light on the body and in its immediate vicinity (figure 4.9 left). Fast movements create increased blurring and trails of light (figure 4.9 right).

Light effects cause dynamic changes in depth, detail and textural perspectives on the body, they modulate from moment to moment the appearance and thus our understanding of the body, distorting it by emphasising separate parts. The light effects also contribute to our understanding of the dynamic connection between the body and the intimate space in its immediate vicinity.

[191] See section 4.1.2, figure 4.8.

[192] See section 4.1.1.

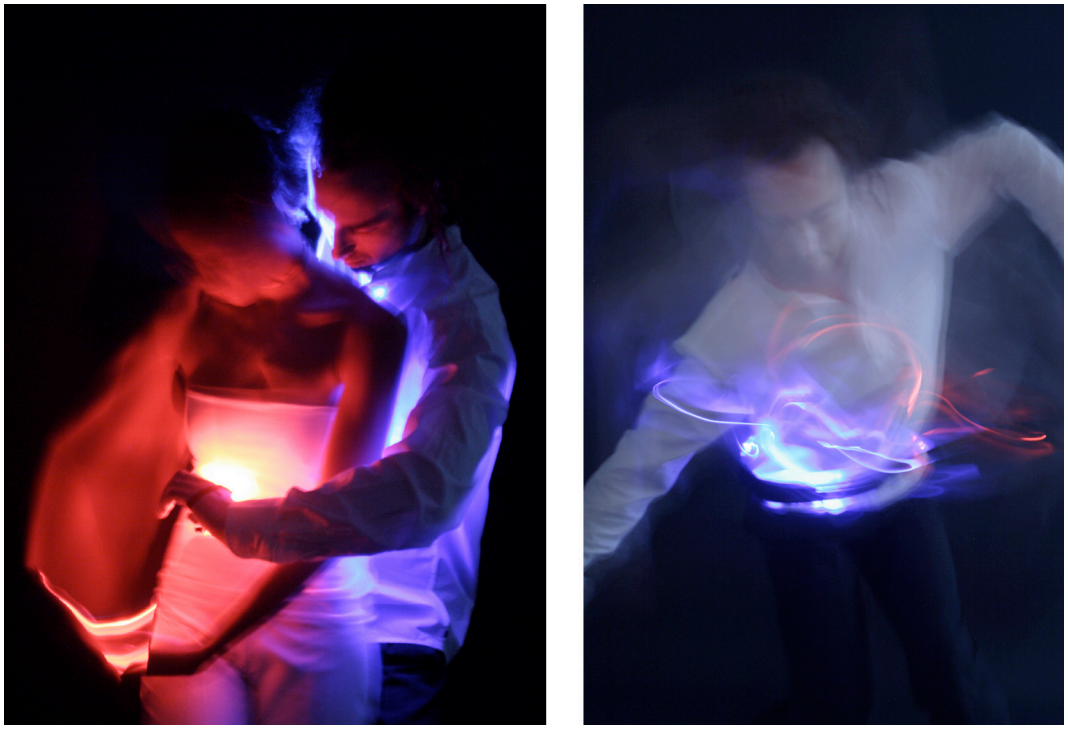

Fig. 4.9 Choreography of light on the body: (left) slow and (right) fast motion.[193]

Fig. 4.10 Choreography of light around the body: curved and linear movements.[194]

[193] Source *Boy-Light-Scapes* in project *Evolution* (Oberlack, 2004, primary research) see section 3.2.1 for the project.

[194] Source *Boy-Light-Scapes* in project *Evolution* (Oberlack, 2004, primary research) see section 3.2.1 for the project.

Marking space around the body relates to the extension of the body into its vicinity. Movements of light features on arms and legs mark the space around the body and explore its reach as figure 4.10 shows. Due to the proximity of the body to the light sources it does not only propel the light features, but also can also be 'hit' by the light emissions and become a projection surface. This connection between body and its surrounding area can be explored through the 'light choreography'.

Pace, rhythm and direction of movements as well as changes in these attributes impact on the outcome of the mark making. Axial movements[195] can create curved, flowing effects or linear and angular outcomes.[196] The images in figures 4.8 (top right) and 4.10 show a combination of curved and linear movements combined with sharp angles where the direction of movement changes abruptly.

A light source at an extremity emphasises the trajectory of the wrist or ankle, locomotor movements describe the limits or lack of limits of a space, and the interaction of the body with space and within it.

These light effects map out the space in reach of the body and its relationship to this space. This contributes to the understanding of how the body relates to space in dynamic movement. It also adds to the knowledge of how the body is connected to its surrounding area by making its reach visible and extending its boundaries.

The choreography of the passage through space relates to the movement of light beyond the immediate vicinity of the body. The body travels through space and acts as a propulsion mechanism for the light features attached to it. The light marks and maps out the layout and features of the space, and traces the course of the body through space. By their very nature these light effects are dynamic (figure 4.11 top).

If the body stays still the light projections into space remain static. The light features can then trace features of the environment and their spatial relationship to the body, but cannot mark the passage through space. In project *Light-Space-Body* this static display was used to make the architectural complexity of the light environment visible and heighten its sculptural quality (figure 4.11 bottom).

---

[195] "**Axial movement**. Movement anchored to one spot by a body part. Only the available space in any direction is used while the initial body contact is being maintained. Movement is organized around the axis of the body and is not designed for travel from one location to another. Also known as non-locomotor movement. Examples include stretching, bending, turning in place, gesturing." (Californian State Board of Education, 2009 [Internet]), for further reference see Minton (2007).

[196] The visual effects created by choreographed movement are further discussed in chapter 5.

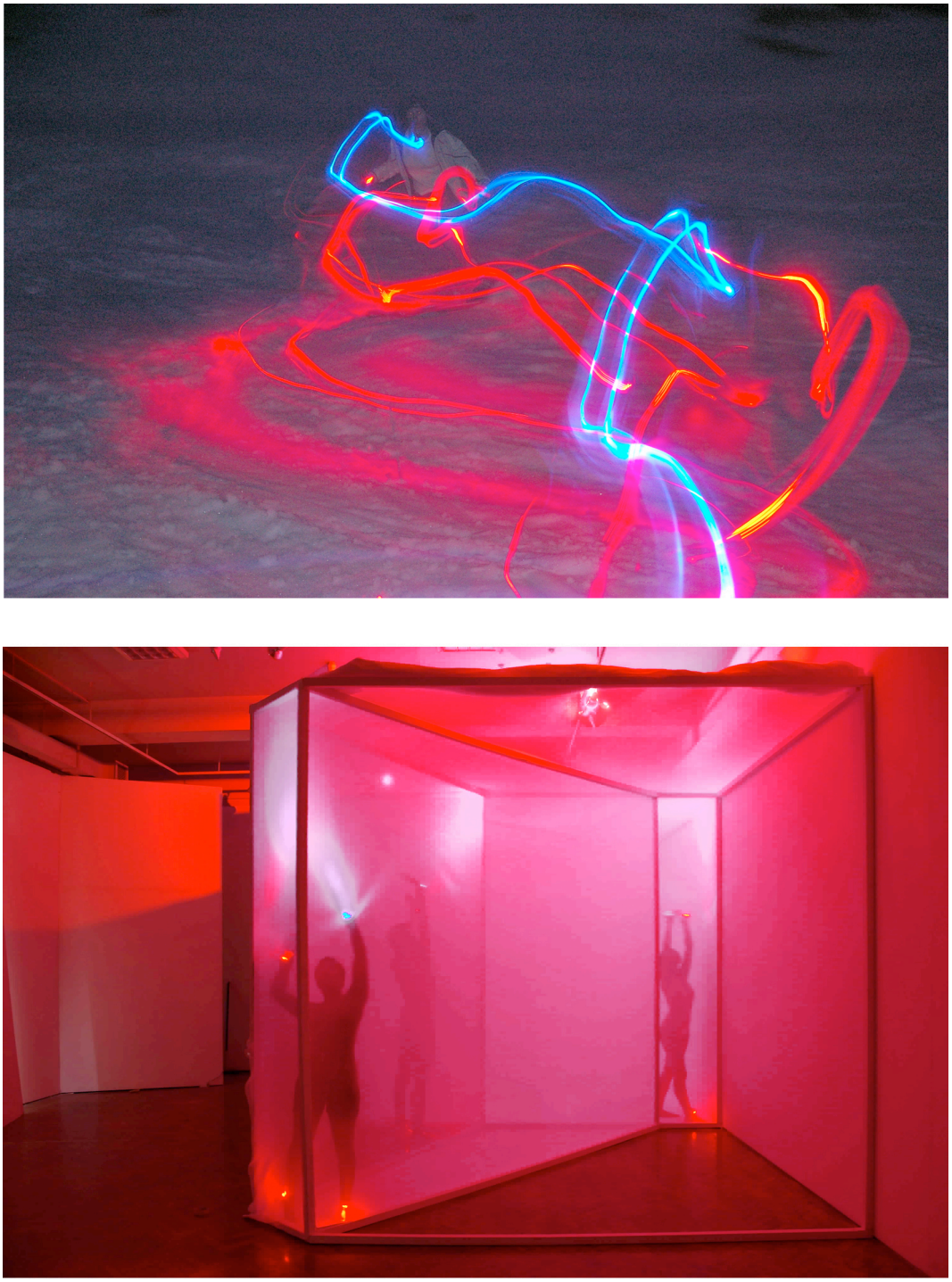

Fig. 4.11 Choreography of passage through space (top) versus 'static' marking of space (bottom).[197]

Choreographies that explore the spatial relationships between body and environment therefore contribute to understanding of the passage and re-passage of the body through space and of the space itself.

[197] Source (top) project *New Arenas* (Oberlack, 2007, primary research), source (bottom) project *Light-Space-Body* (Oberlack, 2007, primary research). See section 3.2 for both projects.

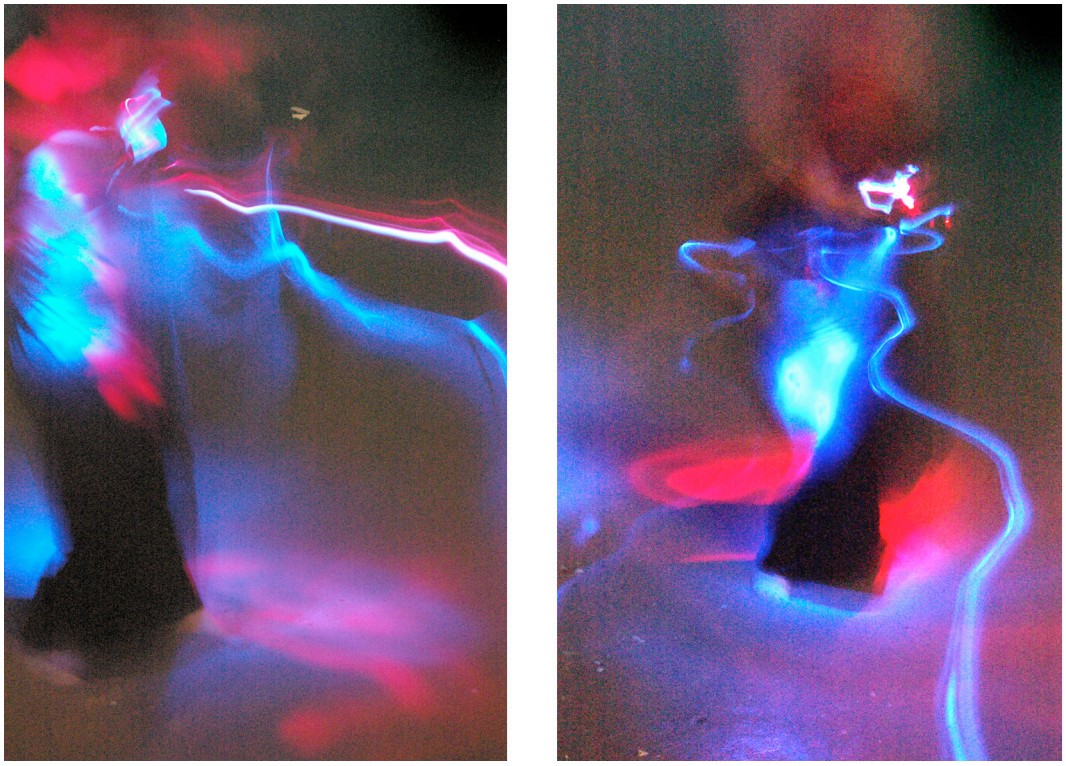

Fig. 4.12 Combination of mark making around the body and passage through space.[198]

Different types of choreographies can be combined in sequence as figure 4.12 shows. These images trace the passage of light through space. The light marks features of the environment such as sand, water surface and the slightly misty air. The light then leads up to the body and creates dynamic light effects around and on the body.

Tempo does not only affect the dynamics of the light choreography, but also the presence of the performer in the final outcome. In figure 4.12 the performer's body is present as a site of light, but the performer as a character is absent. This degree of presence and absence of the performer depends on choreographic and recording decisions.

In static images such as in figure 4.5 or images with slow movement (figure 4.9 left), the performers' physical features are still visible and the protagonists are present as characters. With increasing dynamic the performer's body is only present as projection site or carrier but is hardly recognisable (figure 4.9 right, 4.11). If the tempo escalates further, the performer generates light effects, but disappears in their visual outcome (figure 4.10). In this case the performer is present only by the light traces his or her body has left in the performance or in its recording (4.8 top right, bottom).

[198] Source project *New Arenas* (Oberlack, 2008, primary research), for the project see section 3.2.5.

In general static positions or slow movements lead to a stronger presence of the performers than full, fast motion. In the same way higher light levels from wearable light features and/or ambient sources lead to a stronger presence of the performer than dark environments. This applies to live performance and recorded images. It is possible for the performer to be bodily present in the live performance of wearable light, but largely invisible and absent from the visual experience of the performance. The accidental performances of project *New Arenas* demonstrated the mysterious effect this can have for the audience.[199]

The phenomenon of presence/absence of the performer becomes pronounced in still and moving images because recording tools such as digital still or video cameras cannot detect light as subtly as the human eye. These records can show the body as ghostly apparition among the light effects or not at all. Parameters of the recording such as ISO speed, aperture, shutter speed and camera frame will strongly impact on the visual outcome and therefore on the presence or absence of the performer in the image. Recordings of time elapsed photography are the strongest proponent of this phenomenon of 'presence through absence'.[200]

'Light choreography' arranges the movement of light over time and in space and therefore strongly relates to the environment in which its performance takes place.

In the first instance controlling the light environment is important for choreography of light in order to ensure its visibility. Beyond this control, however, a creative inclusion of the light environment into the choreography is possible by exploiting features of the environment such as the mirror-like water table in project *New Arenas*.[201]

In controlled arenas such as stage with professional theatre lighting or a gallery setting the light environment can be specially designed to interact with the light choreography. This design includes architectural features, the materials used to build the features and the lighting. Lighting design includes light sources, their position and their manipulation with colour filters or stencils.

In project *Light-Space-Body*[202] the newly built light environment took on sculptural qualities in a gallery setting. These qualities and their interaction

[199] See project *New Arenas*, section 3.2.5 and the discussion of 'accidental performance' in section 4.3.

[200] For further discussion of 'presence through absence' see 5.1.6.

[201] See section 3.2.5.

[202] See section 3.2.6.

with light on the body were explored through light choreographies. In figure 4.13 the choreography traces the translucent and the solid walls of the light environment thereby marking its spatial relationships through wearable light.

The characteristic of the walls in this environment was particularly important. Translucent sharkstooth gauze made light effects visible through the walls thus creating different layers of spatial relations between wearable light and environment. The gauze had, however, enough 'body' to reflect light emission. Light therefore bounced off these walls, was distributed in a wider area and created large light effects around the performers thus connecting their bodies more visibly to the surrounding space.

If the light was trapped between translucent walls with relatively small distances between them, then the light effects filled this space and took on a spatial quality. Figure 4.11 (bottom) shows examples where the light is trapped in the narrow funnel in the foreground and in the corners of the light environment in the back. The image also demonstrates the translucency of the walls. Walls and ceiling of the light environment capture emissions from wearable light features, and a smaller amount of radiation spills over onto walls and ceiling of the gallery.

Fig. 4.13 Choreography exploring specifically designed light environments.[203]

[203] Source project *Light-Space-Body* (Oberlack, 2007, primary research) see section 3.2.6 for the project.

In summary, the interaction of the body as a site of light, the body as a carrier and propulsion mechanism for wearable light features and the light environment can be choreographed to design and explore light effect in a ‘light choreography’. This choreography creates movement phrases and sequences that relate to the body as a site of light, mark the space around it or its passage through space.

‘Light choreography’ therefore contributes to the definition and understanding of the body and its dynamic connection to the intimate space in its immediate vicinity. In marking the space around the body it contributes to the understanding of how the body relates both to it and to the surrounding space in dynamic movement by making its reach evident and extending its boundaries. Choreographies that explore the spatial relationships between body and environment contribute to understanding of the body moving through space, its impact on space and of the nature of space itself.

Tempo of movement is a key concept of light choreography. Characteristics of movement range from static to frenzied, gently flowing, syncopated or rhythmic or staccato and light effects will vary accordingly. Together with the light level of the environment this has an effect on the presence or absence of performers in the visual experience of live performances and in the recording of wearable light, in particular in time-elapse photography.

Light emanation from the body changes the focus of interaction between protagonist and the light environment as the protagonist can cast light as well as shadow into the environment. Through its impact on the light environment the light emanating from the protagonist can change the perception and understanding of the relationship between protagonist and environment.

Beyond mere control ‘light choreography’ can make creative use of the light environment or explore wearable light in especially designed environments.

4.1.4 Scaling of Light Effects

Please reference videos *Body-Light-Scapes*, *Radiance: Outcomes and Light-Space-Body: Outcomes*.

The body as a carrier of wearable light positions light features in spatial relationship to projection surfaces. This spatial relationship impact on the scale of the projections: the distance between the light source and the projection surfaces on and off the body determines the size of the projection and can vary from small and intimate to large-scale.

Fig. 4.14 Scaling of Light Effects: Multi-layered interaction of light features on the body and projected images of light effects created by these light features.[204]

Figure 4.14 shows a combination of small, medium and large-scale projections on and off the body. The blue lights on the two performers in the front are very close to their bodies and generate localized light effects. The light feature of the left performer's wrist projects light on her upper body and creates a much more encompassing effect. The scale of the projection is limited by the size of the body as a site and the distance to the light source.

In the case of a single performer, the length of the limbs determines the maximum distance between light source and the body as projection site. Multiple performers can increase the distance to the body of other performers and therefore the scale of projections on the body. In the image the performer in the front right is projecting light onto the performer in the back, covering her body with a red glow. The red glow connects the performer to the images of wearable light on the back of the stage. This screen projection is based on choreography of light around the body and takes the work up to its largest scale. This screen projection touches upon issues of scale and output media in the publication and exhibition of work that will be discussed in 4.1.5.

Light effects on and around the body can be seamlessly scaled up or down by moving the body parts on which light sources are located. A small, localized, more intimate effect can be transformed into a large-scale projection far away from the body, its size only limited by the shape and the visibility of the light emission. This seamless scaling and control can be achieved particularly well

[204] Source *Re-Incarnation; Light Wear*, performance at *Carry the Can*, international bi-annual conference of the Association of Contemporary Jewellery (ACJ) London, 8 July 2006 (Oberlack, 2006, primary source).

when light features are located on the limbs as their range of motion is most versatile.

In summary, the spatial relationship between the position of wearable light features and the projection surface on or off the body will impact on the scale of light projections. These can range from small-scale, localized effects on the body to large-scale projections in the environment. Seamless scaling up or down is facilitated by the positioning of wearable light features on the limbs on the body. Multiple performers increase the range and complexity of scale that can be achieved. A repertoire is emerging which embodies the position of lights upon the body, their colour, intensity, spread and direction, and the movement of single dancers and multiples.

4.1.5 Implications for the Publication and Exhibition of Transient, Body-Related Practice

The dynamic nature of wearable light with its transient effects and ephemeral quality has implication for the publication and exhibition of this type of body-related practice.

This became apparent early on in the research process when practice outcomes were shown in an exhibition on contemporary jewellery running over two months.[205] Exhibiting in this framework raised questions of how to showcase this project in terms of context, the relationship of wearable light to the body and the nature of wearability.

Contemporary jewellery is conceptualized as independent objects in close relationship to and dialogue with the body (Astfalck, 2005). These objects are typically exhibited on their own, the body only being implied by the jewellery. Unlike traditional and contemporary jewellery, however, light jewellery has to be seen on the body and in motion to be fully understood. The transient effects of wearable light need the body to be completed and are in this sense ‘jewellery to be’ (Cheung, 2006).

For a static exhibition these requirements posed challenges in terms of spatial and light arrangements as well as logistical difficulties as bodies in motion are difficult to support over a period of two months. For the *Jewellery Unlimited* exhibition the work was displayed in a specially designed wall cabinet that integrated stylised body shapes of the neck and upper body. This largely

[205] *Jewellery Unlimited: An exhibition of Original and Challenging Contemporary Jewellery.* Curated by the *Association for Contemporary Jewellery ACJ* in collaboration with *Bristol City Museum and Art Gallery*, 2004. Catalogue Bristol City Museum and Art Gallery (2004), also Jewellery Unlimited (2009 [Internet]).

resolved issues of space and control of the light environment. However, the body shapes were static and only displayed a fragmented view of the body and thus of wearable light.

Even the best case scenario, displaying the light features on motorized mannequins with a range of body motions, could not have addressed a fundamental switch in logic: In order to be displayed over the period of the exhibition, wearable light features had to be connected to mains electrics. They became non-wearable for the time of the exhibition – in technical terms exactly what the research is not about.

As a consequence of this learning experience the author in future showcased the outcomes of practice through performance and recordings of still and moving images.

The exhibition of recorded work brings with it its own issues. Calibration of the outputs for different media such as print and projections has proved challenging as the colour range of this type of imagery is usually outside typical print or projection ranges. Projections seem particularly suited for the display as their luminosity brings out the full range of colour and subtleties of light modulation in the imagery.

The original calibration of still and moving images is geared towards projections, as the imagery is recorded in digital technology and reviewed on LCD screen during the recording. While LCD screens and projectors each have their own output ranges they all work on the basis of additive colour mixing. Output in print media requires major alterations in the calibration of the original material in order to adjust for subtractive colour mixing.[206] Outputs are re-calibrated for iterations of print or projection.

Following feedback from peers and the author's own experience, the scale of output media has become a point of interest, as scale is an important factor in experiencing the outcomes of this practice. In general large scale suits this type of work better than small scale. This raises questions about the intimacy of the work in relationship to the body. It works in an intimate relationship with the body and its surrounding area. The outcomes, however, suggest a large scale even for images that focus on the body as projection site. A point in case is imagery that focuses on fragmentary views of body(ies) that are transformed by light and shown in a new light, and therefore might be seen and understood differently.

[206] For additive and subtractive colour mix and its implications see Rossing, Chiaverina (1999) pp. 9-10, 178-196.

In summary, 'light jewellery' and wearable light in general has to be seen on the body and in motion to be fully understood. This has consequences for the publication and exhibition for this type of work. Performances and recordings in still and moving images have proven to give a better understanding of wearable light than static exhibitions. Scale becomes an important point of reference in relationship to exhibiting recorded media.

The fact that light jewellery needs the body and movement to be fully understood also raises the question whether the light jewellery is of little intrinsic monetary value and not of great aesthetic value until it is used in performance: i.e. not like jewellery as we know it.

The light features can have aesthetic value of their own and feedback to light jewellery suggest that it is indeed the combination of sensuous light effects and beautiful objects that attracts people to this type of work. For light features geared towards performance, however, qualities such as high light output, ease of wear and robustness outweigh aesthetic criteria; they become tools to create light effects. Technological and aesthetic learning experiences in terms of light effects can in turn inform future generations of light jewellery.

4.1.6 Implications for the Design of Wearable Light Features

The following paragraph gives a short and selective overview of implications that wearability has for the design of light features and draws some conclusions with regards to wearable technology.[207]

The design of wearable light features shapes the form, colour and light intensity of their emissions. This design can integrate media that reflect and distribute the light such as metal shields. Alternatively the features can be combined with reflective and absorptive devices or costumes that manipulate light reflection on the body.

Wearable light features are controlled by electronics that are powered by miniature batteries[208]. Housing electronics and batteries inside wearable light features has implication for their design as well as safety implications. All electronics for this research were designed and custom-built by the author with commercially available components such as light emitting diodes,

[207] Descriptions of some designs have been included in sections 3.2 as part of the practice process. As the research focused on the artistic exploration of wearable light, a technical discussion of design exceeds the boundaries of this thesis.

[208] For a discussion of the time-based implications of using batteries see 4.2.3.

resistors, switches, et cetera. Specific battery compartments had to be developed, as commercially available solutions did not fit requirements in terms of compactness.

In the course of the research the design of the light features developed from beautifully crafted objects of 'light jewellery' to 'performance pieces': small machines for the production of light effects on the body.

This development came with the technological development of light features for stage performances in the project *Sensing Change*.[209] The development for stage required highest possible light output in the smallest possible design in order to avoid infringing on the potential for movement in the choreography. It also required the light features to be robust in order to withstand the impact of performers' movements and to have a soft surface in order to avoid injuries.

The ultimate aim for these performance pieces was to produce highly visible light effects while reducing their presence on the performers' bodies as far as possible in order to allow the exploration of light as a non-material medium on the body. The functional design of the light features achieved this and allowed batch production of light features for a multitude of performers. This was the base for expanding practice into the fields of performance and recording and editing wearable light in lens-based media.

The development of this 'performance wear' raised the question of the intrinsic value of light features. The design of the features for performance and recording was based on functionalities, not on their appearance as an object. Their value lay in the production of light effects. This was opposed to the earlier collection of 'light jewellery' discussed in section 4.1.5.

Coming from a jewellery background it was important for the 'light jewellery' to be beautifully crafted objects. This suggests an intrinsic monetary value, aesthetic quality and emotional content in the objects that exists independent from the light effects they produce. As jewellery these objects also imply a high level of personal involvement and investment with meaning beyond the designer's intent (Sackville, Broadhead eds., 2006 p. 9).

Feedback to this light jewellery from peers and the general public suggested that it had a sensuous and seductive appeal and that the light effects did not have technological connotations for the audience. The aesthetic impression of the object and the light effect it generated obscured the fact that it constituted technology worn on the body. Being beautiful objects in their own right the

[209] See Section 3.2.2.

objects complemented the light effects and contributed to the appeal of the light jewellery. The audience could imagine themselves wearing these pieces.

This raises questions for the wearability of technology in general: What is acceptable or appealing as technology on the body? Responses range from surgical implants to textile and garment solutions to technology worn as object on the body.

Surgical implants appear mainly in the context of fine art and neuroscience. Artists such as Stelarc (2009 [Internet]) and cybernetic and neuroscientists such as the Cybernetic Intelligence Research Group CIRG (2009 [Internet]) explore the effects of implanting transmitters into the body.

Mass-market applications currently employ textile-based technologies for sports wear, therapeutic applications and personal safety. Textile solutions are geared towards the integration of technology in fabrics and garments. Wearable technology becomes a thin, flat, flexible and largely invisible layer that could be called 'soft hardware'. One of the main issues for this development is the integration of batteries into fabric and garments.[210]

Weblogs such as ClickZ (2009 [Internet]) show that object based applications of wearable technology such as MP3 players are often deemed to leave unsightly bulges on the body even by a public interested in technology. Wearing these objects does not seem very appealing. This might caused by the fact that a lot of object-based explorations centre on human interface technology and are technology-driven rather than aesthetically design-driven.[211]

Feedback from the public to 'light jewellery' in this research suggests that wearable technology must have an element of sensuousness and charm both in its effects and in the quality of the object. This suggests that the context of jewellery with its intrinsic relationship to the body (Cheung, 2006) could contribute concepts and expertise that have as yet not been prevalent in the development of wearable technology.[212]

The author's research has focused on applying miniature lighting technologies in objects that are active on the boundary of the body – a definition of jewellery in the widest sense (Broadhead, 2005 p.25). The appropriate

---

[210] For an example see the website of the *Wearable Technologies Conference* (2009 [Internet]). See also the work of Joanna Berzowska (8.1.2) and Lisa Stead (8.1.3).

[211] For examples see *Human Interface Technology Lab (HITL)* (2009 [Internet]) where projects such as a wearable low vision aid are explored.

[212] The work of Sompit Moi Fusakul (2.2) and Nicole Gratiot-Stöber (8.1.2) are examples of an application of jewellery expertise to wearable technology. For an overview of jewellery concepts see Broadhead (2005), Drutt English, Dormer (1995).

relationship of the light feature to the body and the different viewpoints for object and light effects was therefore always at the centre of design considerations. The visual character and the aesthetic qualities of the objects depended, however, on the context of their use in the author's practice. Where the emphasis of the design of wearable light features lay was essentially determined by the focus of practice in the research projects.

4.2 Characteristics and Qualities of Time-Based Practice

Time-based characteristics and qualities of wearable light drove the creative practice and at the same time they are part of the research outcomes. This section identifies these qualities and characteristics and investigates their influence on the development of the creative practice.

The author first became interested in time-based characteristics of light as body adornment during the MA research into energy supply for wearable light features and then realised the essentially dynamic and therefore time-based nature of light as body adornment. This time-based component of the work has gone on to define the practice in a more central manner in that the author explored wearable light through time-based art forms and media such as live performances, time-elapsed photography and video. For the purposes of research within the PhD the time-based component became the drive motor of practice together with the concept of wearability.[213]

The first time-based characteristic refers to the transient nature of wearable light (4.2.1). Documenting the light effects in still or moving images can extend this very short timeline. There are however, fundamental differences between the experience of light effects in a live situation and their recording. These are charted in section 4.2.2. Lastly, the energy supply for wearable light features requires the use of batteries. Section 4.2.3 investigates how the performance and life span of these batteries impact on the light effects.

[213] For a discussion of characteristics of wearability see section 4.1.

4.2.1 Blink and You Might Miss It; Light as a Medium on the Body

Light waves or photons[214] of the light beam register on the retina of the eye only for a moment at a time. This means the eye can follow the current light effect one moment at a time, but it cannot record the effect and physiologically only hold on to it for a short period of time. The brain processes electrical signals from the retina, i.e. visually perceives the light effects and can keep a memory of the light effect (Rossing, Chiaverina, 1999).[215]

While this is true for all visual perception of light and art (Weibel, Jansen, 2006a), it is particularly relevant for this practice for three reasons. Firstly, the visual perception of light on the body is at the heart of this practice. Secondly, the body is a complex projection surface. Therefore light effects on the body will be complex and require a high level of information processing for their visual perception. Thirdly, the body is mobile and that implies dynamic light effects on the body that are in constant flux.

The complex and dynamic nature of light as body adornment makes it difficult to process and keep a memory of the multitude of light effects over any longer period of time. Unless the protagonist stays absolutely still, wearable light will continuously produce subtle and/or radical changes of light effects. The perception and understanding of wearable light is therefore inherently time-based.

The visual perception of wearable light might very well lead to ‘information overload’ for the viewer. While the brain is still processing the receptions from one moment before, the eye is already confronted with a new, possibly radically different, but equally complex light effect. ‘Blink and you might miss it’ refers to the fact that the eye cannot necessarily see all the light effects unfolding on the body in and over time; particularly when it is in full, fast motion.

Early on in the research it became apparent that the transient, complex and dynamic nature of light on the body offered opportunities for exploration through performance. As ‘light jewellery’ that turns the body into a dynamic projection surface is still an unfamiliar view, it draws attention and can instigate social interaction; the line between ‘wearing light’ and ‘performing

---

[214] For a reference to the dual nature of light as wave and particle and its implications see Rossing, Chiaverina (1999) pp. 23-41.

[215] Indeed this ‘persistence of vision’ is key to the illusion of movement produced by video and film (Rossing, Chiaverina, 1999). The impact of wearable light on the (visual) perception of the body is further discussed in section 4.3.

light on the body' can easily become blurred.[216] These informal performances inspired the formal investigations of wearable light through performances in professional settings.

4.2.2 Extending the Time Line; Live versus Recorded Reality

Time-elapsed photography and video were originally employed in order to document complex and evolving light effects on the body. These records were either images or video footage that could be played back, in slow motion if necessary, in order to see complex light effects taking place and reflect upon them. Beyond the reflective potential of documentation these recording mechanism offered creative possibilities for the exploration of light as body adornment and the construction of still and moving images of wearable light.[217] While traces of wearable light can be recorded in still and moving images, there is a distinct difference between the visual experience of wearable light as a live event and its recording. The issues of documenting live performances through moving images have been well documented. Rye (2003)[218] argues that

> "…there are fundamental differences between 'the live' and 'the recorded' which means that there is no simple way of translating between the two. These differences stem from the different relationships these two phenomena have with time and space. Performance frames time and space as singular and unrecoverable and this is in direct contradiction to a record in which time and space are constructed as fixed and reproductive. Therefore the record is predicated on the idea of a control of time and space: that time and space can be captured, recovered and repeated, which in turn provides the document with a type of convenience and accessibility." (Rye, 2003 [Internet] p.1)

Beyond these fundamental differences lens-based media are restricted in the view they can capture through the lens; therefore camera angle and frame become of immediate importance. For the documentation of live performances this presents limitations that become particularly apparent if there are multiple and complex events taking place simultaneously in a performance.

> "Early on, in documenting my own practice in multi-media performance, I became frustrated by the inability of the video medium to handle the

[216] See sections 4.3 and 2.2 for *Studio5050*.

[217] The chronology of projects in section 3.2 charts this development.

[218] Rye is associated with *PARIP; Practice as Research in Performance* (2009 [Internet]) at Bristol University. This *Arts and Humanities Research Council* funded project researched practice as research in performance and the implications of documenting and disseminating performance practice in moving images.

> multiplicity and simultaneity of live events designed (as they were) to fragment and overload an audience point of view. The camera, and its co-dependent screen image, for all its illusion of plentitude and completeness passed on by the conventions of mainstream film and television, could capture only a small part of what was going on in the original show."
> (Rye, 2003 [Internet] p.1)

Recordings in moving images such as film, digital video or time-elapsed photography capture the movement of wearable light as it evolves over time. However, as pointed out above, the choice of camera viewpoint will affect the re-construction of the live event reality in the recording. As wearable light requires low lighting levels, recording parameters such as exposure time strongly impact on the outcome.[219] The (visual) experience of the live performance and the recording of wearable light are quite distinctly different.

John Berger (2008) pointed out that an image is a sight which has been recreated or reproduced. The camera shows that what you see is relative to your position in time and space at any given time. In the author's experience this means that the viewpoint of a camera can never capture all parts of the live experience of reality, only parts of it that are framed by the viewpoint of the camera. This can be considered a limitation, but also gives the practitioner choice with regards to how to frame a shot (of wearable light) and points to two aspects in the recording of wearable light.

Firstly, recording as extension of the timeline or documentation of a live event and secondly, the recording as an interpretation of the event. This implies that live event and recorded reality constitute multiple layers of meaning constructed from the same set of events. The limitations of recordings as documentation have been pointed out above. However, as the exploration of wearable light is not limited to its practice as live performance, recordings as interpretations of live events reveal their reflective and creative potential.

In the process of this the research, recording live events of wearable light made it possible to 'make real' phenomena that otherwise only existed as ideas in the author's head. In this sense recordings presented a reflective means to develop understanding and practice of wearable light. This raises the questions of what it means to be able to trace expressions of wearable light in recorded media that cannot or only ambiguously be detected with the naked eye. There is a parallel to photographic explorations of human and animal motion by Eadweard Muybridge (Muybridge, 1955; Hill, 2001) and Etienne-Jules Marey (Dagognet, 1992) in the late nineteenth century. Their invention and use of instantaneous motion picture capture contributed to

understanding of motion sequences that could not be detected in live events. The creative potential of recordings as an interpretation of wearable light lies in their aesthetic quality as artworks in their own right. The production of these artworks has taken the practice of wearable light into new areas such as film and photography and expanded the range of outcomes across disciplines in art and design.

Digital video and time-elapsed photography produce recordings that are distinctly different in terms of the visual characteristics and qualities of wearable light. Video records the light effects frame by frame over time and is therefore in its character closer to the live experience of wearable light than time-elapsed photography. Time-elapsed photography captures wearable light in one image that is constructed of a sequence of light effects overlaying each other in the recording. The visual effect is composed of the layering of different light effects over the time of the exposure. The difference between digital video and time-elapsed photography is demonstrated in figures 4.15 and 4.16. They show the same event recorded in still images from video and time-elapsed photography. Video traces the light sources mainly as light points whereas time-elapsed photography traces them as trails of light.

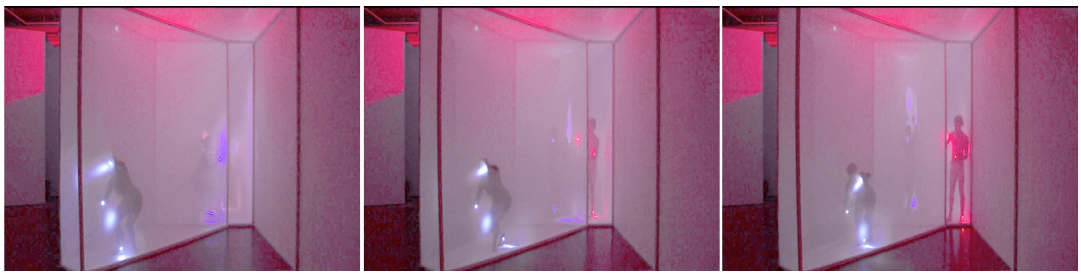

Fig. 4.15 Video charting the movement of wearable light along the boundaries of the environment (left to right).[220]

Fig. 4.16 Time-elapsed photograph of the movement displayed in figure 4.15[221]

[220] Source project *Light-Space-Body* (Oberlack, 2007; primary research). The still images represent a selection of frames that refer to the beginning, middle and end of the movement. Please refer to video *Light-Space-Body: Outcomes*. For the project see section 3.2.6.

The visual experience of still and moving images of wearable light depends on type and scale of the output medium and will have an effect on the interpretation of wearable in these images**.**

4.2.3 Time to Recharge; Energy Supply of Wearable Light Features

Wearability of light features requires a mobile energy supply located on the body.[222] At this point in time only miniature battery technology meets this requirement. The advent of mobile telephones and digital cameras[223] has led to rechargeable miniature batteries with significantly improved life spans and facilitated the design of wearable light features. However, all batteries are inherently time-based, whether rechargeable or conventional, miniature or not. Their energy supply runs out after a period of time that is determined by their capacity and the amount of energy required by the electronic unit they are powering. This means there is a time-based component to wearable light driven by the hardware of the light features.

Before it is time to recharge, the diminishing capacity of batteries shows in the performance of wearable light features. Lights start to dim and their light output decreases subtly over time. As light effects become weaker, their definition as well as their visibility diminishes. The decrease is so gradual that it is possible for the performer or wearer not to notice for quite a period of time.

In recordings diminishing lights do no register their full range of intensity from hotspot to hardly visible. Outlines of light effects soften and graduation of tone and colour mix is limited to mid-range. While this can be construed as a limitation of the technology, the gradual decrease of light output offers also creative possibilities: the exploration of different expressions and moods of wearable light with the same set of light features.

Rapid technological advances are extending the lifespan of miniature batteries and the creative combination of battery and lighting technologies can expand the duration of wearable light. Indeed technological research in this project was geared towards extending the light output and lifetime of light effects on the body.

---

[221] Source project *Light-Space-Body* (Oberlack, 2007, primary research), for the project see section 3.2.6.

[222] There are examples of light features on the body that are connected to mains electricity such as Tanaka, 1956; see section 2.4. These features, however, severely limit the radius of motion for the protagonist and in some cases present a risk for their safety.

[223] For examples see CNET UK (2009 [Internet]) among others.

4.3 Impact on Perception and Social Interaction

Expressions of wearable light have an impact on the visual perception[224] of the body and contribute to its definition and understanding. Wearable light therefore contributes to the perception of body in a wider sense that takes into account notions of the body and the person as part of a cultural and social context.

Cognitive processes in the brain transform the visual information from the eye and lead to a construction of meaning and understanding of wearable light for the person processing this information. This procedure can lead to physiological or cognitive illusions (Rossing, Chiaverina, 1999) that can add to the perception of the body and contribute to its understanding.

In 'live situations' such as informal encounters or formal performances where the protagonist wears or performs light on the body, his perception of themselves can change as well as the perception of the audience.

Placing an object close to the body brings a sense of touch and intimacy and engages complex sensibilities in the wearer and the audience as Broadhead (2005) points out in relationship to contemporary jewellery. This is particularly the case for wearable light with its twin engagements of positioning light features on the body and wearing light as a non-material medium on the body. Light has the potential to focus the gaze of the audience and to re-focus the gaze of the protagonist. As the visual effects show the body in a new light, its perception in the eye of the protagonist and the spectator can be altered and lead to a new awareness of the body. This can give an insight into corporeality, the relationship of the body with its surrounding space and its engagement with its context,[225] raising in particular questions about

[224] "**Perception** - in psychology, mental organization and interpretation of sensory information. The Gestalt psychologists studied extensively the ways in which people organize and select from the vast array of stimuli that are presented to them, concentrating particularly on visual stimuli. Perception is influenced by a variety of factors, including the intensity and physical dimensions of the stimulus; such activities of the sense organs as effects of preceding stimulation; the subject's past experience; attention factors such as readiness to respond to a stimulus; and motivation and emotional state of the subject. Stimulus elements in visual organization form perceived patterns according to their nearness to each other, their similarity, the tendency for the subject to perceive complete figures, and the ability of the subject to distinguish important figures from background. Perceptual constancy is the tendency of a subject to interpret one object in the same manner, regardless of such variations as distance, angle of sight, or brightness. Through selective attention, the subject focuses on a limited number of stimuli, and ignores those that are considered less important. ... Recent studies have shown that stimuli are actually perceived in the brain, while sensory organs merely gather the signals." (The Columbia Encyclopedia, 2004 [Internet]).

[225] For an overview of visual perception see Caelli (1981), perception in relationship to the creative process see Arnheim (1974) and on the impact of images Wright (2008).

boundaries of the body, their extension and their relationship to the boundaries of a person.

Protagonists of wearable light regularly reported an altered and heightened awareness of their body and its movements in the course of this research. This consciousness was based on a sensual and emotional response rather than on a rational inquiry. Audiences similarly showed a reaction based on emotions, describing performances as well as still and moving images of wearable light with attributes such as seductive, mysterious and magical.

This response seems to be related to the complex, dynamic and transient nature of light effects created by the rhythm and phrases of the underlying choreography.[226] These rhythms, phrases and modulations of light were identified as emerging narratives in an emerging visual language of wearable light.[227] If these emerging 'light narratives' are interpreted as elements of an emergent critical language, then the emotional response that this language effects can be described as 'poetic'.

The term 'poetic' refers here to the poetic qualities of writing or other works of art rather than to 'poetics' as it is used in cultural critique.[228] 'Poetic' or 'poetical' describes evocative and imaginative qualities of a work of art that elicit an emotional response from its audience (Merriam Webster Online, 2010 [Internet]; Oxford English Dictionary, 2010 [Internet]). This originates from poetry being characterized as "literature that evokes a concentrated imaginative awareness of experience or a specific emotional response through language chosen and arranged for its meaning, sound, rhythm" (Encyclopaedia Britannica, 2010 [Internet]). In this sense the question of what kind of emotional response the choreography of wearable light can achieve can be construed as its poetic impact.

Wearable light can also change the visual perception of the body in relationship to the surrounding space. This is particularly relevant in informal public outdoor settings. In these settings the light environment is mainly

---

[226] For the choreography of wearable light see section 4.1.3.

[227] See chapter 5.1.7.

[228] Poetics as a term covers the study of linguistic techniques in poetry and literature (Oxford English Dictionary Online, 2011 [Internet]). 'Poetics' as a term has been adopted into a wider context of contemporary cultural theory and critique and its use ranges from the study of literature and communication (for example the journal *Poetics Today,* Sternberg ed.) to research into culture, media and the arts (for example *Poetics*, Van Rees ed.). Particularly disciplines such as architecture have taken up the term poetics, in part because the meaning of the Greek root poesis ('making' or 'fabricating') seemed ideal for describing non-linguistic compositional strategies related to construction and materials (Kleinman, 2009 p.9). Michael Renov states that it is the fundamental aim of poetics "to submit aesthetic forms to rigorous investigation as to their composition, function and effect" (Renov, 1993 p.20) in his investigations of a poetics of documentary film.

defined by static, large-scale, wide-angle overhead illumination from sun or moonlight and/or street and architectural lighting. Moving lights from cars potentially complement the overhead light sources and provide illumination from a side angle. The protagonist of wearable light can actively influence this environment by casting light as well as shadow. Light emanating from protagonists does not only alter the light environment in terms of scale, rhythm and pace of the new light sources, but also changes the perception of the protagonists as an actor in relationship to this environment. In a parallel to the multiplicity of camera viewpoints (Berger, 2008), the focus of perception changes from the large-scale overhead illumination of the light environment to the multitude of light emanations from the person(s) travelling through the environment. This leads to light on different scales in the environment. The change in the role of the protagonist shows potential for the application of wearable light in new arenas.

Alterations in the perception of the body due to wearable light can lead to changes in the readings of the protagonist and the viewer as a person and instigate social exchanges. Events in the course of this research have demonstrated that wearable light can instigate social interactions. This evidence is supported by the outcome of projects such as *Moi* by interaction designers *Studio 5050*.[229] As Broadhead (2005) points out in relationship to jewellery:

> "Objects that are used in close relationship to an individual can indicate a personal history, declare a relationship to others, and raise issues of identity and status. What is worn is a source of constant fascination and curiosity, demonstrating the continual two-way process of expression by one person and the impression it makes on others." (Broadhead, 2005 p. 25)

In the author's experience the fascination and curiosity of observers can be significant, particularly in informal encounters. The unfamiliar sight of wearable light can spark spontaneous enquiries and conversations about the experience. In some cases observers even became protagonists by trying out the wearable light features.

When wearing light the protagonist can provoke spontaneous social interaction and the boundaries between wearing and performing light can become blurred. Feedback from practitioners in fine art contexts showed a particular interest in how wearable light might influence or shape social interaction.

[229] *Studio5050* have designed small wearable light features to playfully explore social exchanges. See section 2.2.

In the course of the research 'accidental performances' in the sense of an inadvertent social intervention emerged as an unexpected outcome of the research. They first happened during the project *New Arenas*[230] that explored wearable lights in new and public environments. While the choreography of light in a public setting was intentional, the author did not expect an audience as the sessions took place at night in quiet, sparsely populated areas.[231] However, because of their public setting these explorations acquired an 'accidental' audience who happened upon them. Some of the audience members came to investigate the phenomenon and were clearly curious, but kept their distance once they had established what was happening.

These encounters turned the explorations into 'accidental performances' in the sense of an inadvertent social intervention where neither the audience nor the protagonist expected the event. While the author was not able to establish what effect the 'accidental performance' had on the audience due to language barriers, the encounter raises questions about its impact. What were the characteristics and qualities of the experience for the audience and what might effect might this experience have had?

There is a poetic sense about the accidental involvement of the public and the moment of public revelation this encounter entailed.[232] One has to assume that their prior experiences of performances have an effect on the how the audiences experienced and understood the performance of wearable light. Did the audience recognize the light display as such? Was there a moment of magic or charm involved or was the experience disturbing, or indeed indifferent? Who else might have seen the performance without the knowledge of the performer?

These accidental performances also raised questions of the potential of this type of performance in different social contexts. The author's hypothesis is that the effects of accidental performances will be framed by the social context they are taking place in. The potential for social interaction and different forms of experience will vary between, for example, loosely populated areas of natural landscape and densely populated cities where neon lighting is part of the night time experience for every inhabitant. These questions point towards potential for future research.

---

[230] See section 3.2.5.

[231] Explorations of choreographies were geared towards recording wearable light in naturally reflective landscapes. The choice of settings and the time of night for the sessions reflected this aim. See section 3.2.5.

[232] As pointed out earlier in this section the term poetic is here used in relationship to evocative and imaginative qualities that raise an emotional response from the audience.

4.4 Dual Nature of Wearability and Time-Based Boundaries

This section comments on the dual nature of wearability and time-based boundaries of wearable light as central drive motors of the research and as research outcomes, and their implications for the development of this research.

Wearability was established as the central tenet of the research at the outset of the project.[233] This led to a wide review of the field exploring what wearability means in relationship to light and the body. The distinction between the body as a site of light and as a carrier of light features was the outcome of this review and led to a narrowing of the focus of the research to investigate the choreography of light. These choreographies directed the motion of the body as a site and as a carrier in movement phrases that focused on the development of light effects in relationship to the light environment. Wearability also had implications for the publication of this type of transient, body-related practice and the design of light features. These investigations led to the identification of the mechanics of placing light on the body: a 'Know How' of how wearable light interacts with the body and what kind of effects can be achieved as well as their impact on the perception and understanding of the body in spatial contexts.

In tandem with the increasing focus on the choreography of light for live performances and recordings in still and moving images, wearable light features developed from 'light jewellery' to 'performance pieces'. The nature of wearable light features changed with this development. They evolved from objects with intrinsic value, aesthetic qualities and emotional content in their own right to functional objects whose sole purpose was to produce light effects on the body. The value of these 'performance pieces' lay in their capacity to light the body in a variety of ways. The light effect on the body became the 'non-material object' with intrinsic value, aesthetic qualities and emotional content. In this process the traditional jewellery qualities of a finely crafted object with intrinsic value have been replaced by functionally driven objects generating a 'new aesthetic experience' that is of high value.

[233] See chapter 1 and conclusions to the context review in section 2.6.

A time-based component was implicit in this research in two aspects. Firstly, wearable light features require a mobile energy supply on the body and these are inherently time-limited. Secondly and more fundamentally, wearable light is by its very nature dynamic and time-based as the body is mobile and movement occurs over time. This suggested the exploration of wearable light through performance.

The transient nature of wearable light was documented in the inherently time-based media of still and moving images. The practice of recording and editing this imagery triggered the discovery of the reflective and creative potential of recording wearable light in lens-based media as a practice in its own right.

The exploration of choreographies of light in performance and lens-based media led to the discovery emerging narratives such as 'light ciphers' and more abstract rhythms and modulations as of elements of an visual language of wearable light. The emotional response to the narratives suggests the potential for poetic qualities in wearable light.

The research outcomes contributed to the identification and development of a complex performance art based on wearable light with two modes of expression: live performance and lens-based media.[234] The outcomes also feed back into new generations of 'light jewellery' and 'performance wear' that both have their own place in the practice of wearable light.

As empirical research has shown, wearable light impacts on the visual perception of the body in the eye of the protagonist and the viewer. It therefore contributes to our awareness and understanding of the body. The altered visual perception of the body can lead to changes in the perception of the person(a) of the protagonist 'wearing' light in his view and/or that of the audience in the sense that the protagonist seems dramatized by the light. This drama can instigate social interaction as work by *Studio5050* and this research has shown.

'Accidental performance' refers to the exploration of wearable light in public settings that turn into opportunistic performances as the public happens upon the 'light choreographies'. These inadvertent social interventions raised questions about their potential audience, the poetic quality of the encounter and what kind of meaning might have been constructed from the experience.

[234] See chapter 6.

5 Emerging Visual Language of Wearable Light

This chapter describes characteristics and qualities of visual effects achieved by wearable light on and off the body. These descriptions have emerged from reflections of practice and outcomes taking place “in action” and “on action” (Schoen, 1991) after ‘solo’ or collaborative work sessions. Early narrative accounts of wearable light were formalized into elements of an emerging visual language in response to a lack of criteria for the assessment of wearable light that came to light in reviews of literature on light and body.

These descriptive elements are charted in section 5.1 and classified in a typology of this emerging language, the *Descriptive Analysis Framework*, in section 5.2. The potential of this framework to describe and assess wearable light in different contexts and its implications for future development are discussed in conclusions, 5.3.

5.1 Elements of an Emerging Visual Language

The choreography of wearable light determines the kind of ‘light marks’ that are created on and off the body and the characteristics of the mark making therefore become important for the outcome.[235] The variety of these marks is particularly pronounced in the recording of wearable light in moving and still images that are composed of layers of mark making over time. The viewpoint of the camera or that of the spectator in a live performance has a strong impact on the visual effects they register or experience.

The descriptions in the following sections will focus on still images as these represent the most complex compositions. The images were selected because they typify emerging elements of a visual language for wearable light and open a discourse between images over the course of the sub-sections, with continuing dialogues and the advent of new parameters. More examples of still and moving imagery can be found throughout the visual material.

The following themes are by no means comprehensive, as elements of a visual language of wearable light are only emerging. They represent an overview of typical building blocks that such a language can entail. These building blocks have emerged in response to the practice-based research in this project and the terminology is the author’s own.

[235] See section 4.1.3.

Trails, veils, fields, washes, patches and vapours have emerged as basic elements in the composition of visual effects (5.1.1). These elements are combined through layering and overlay techniques to form expressions of wearable light (5.1.2). ‘Sculpting the Body’ addresses an emerging theme in relationship to the body as a site of light (5.1.3), ‘Kinetic Light Sculptures’ mark the space around the body (5.1.4) and ‘Abstract Light-Scapes’ refer to the passage of wearable light through space (5.1.5). Overriding themes are varying degrees of ’Presence and Absence’ of the human figure in the imagery (5.1.6) and ‘Emerging Narratives’ (section 5.1.7).

5.1.1 Trails, Veils, Fields, Washes, Patches & Vapours

Please reference videos *Body-Light-Scapes* and *New Arenas*. *Radiance: Outcomes* and *Light-Space-Body: Outcomes* provide examples in moving images.

This section describes the types of marks that form the base for the composition of visual effects created by wearable light. The characteristics of these elements relate back to the way they have been achieved and can thus be categorized.

Trails & Veils stem from light emissions in motion that register on the camera, or the in the eyes of the audience in a live performance. The dynamic of movement is still apparent in the trail or veil. Speed, direction and distance covered by the movement will determine their characteristics. The viewpoint of the camera or spectator plays a particular role for these effects as the track on which the light sources move through space will appear different from various viewing angles.

The dynamic of movements is still apparent in the trail or veil. In figure 5.1 (left) trails seem to travel through midair while veils mostly evolve dynamically within a defined area. Accordingly, light trails are created through fast movement that covers distance whereas veils are produced by movement covering a smaller territory, in most cases at a slower pace.

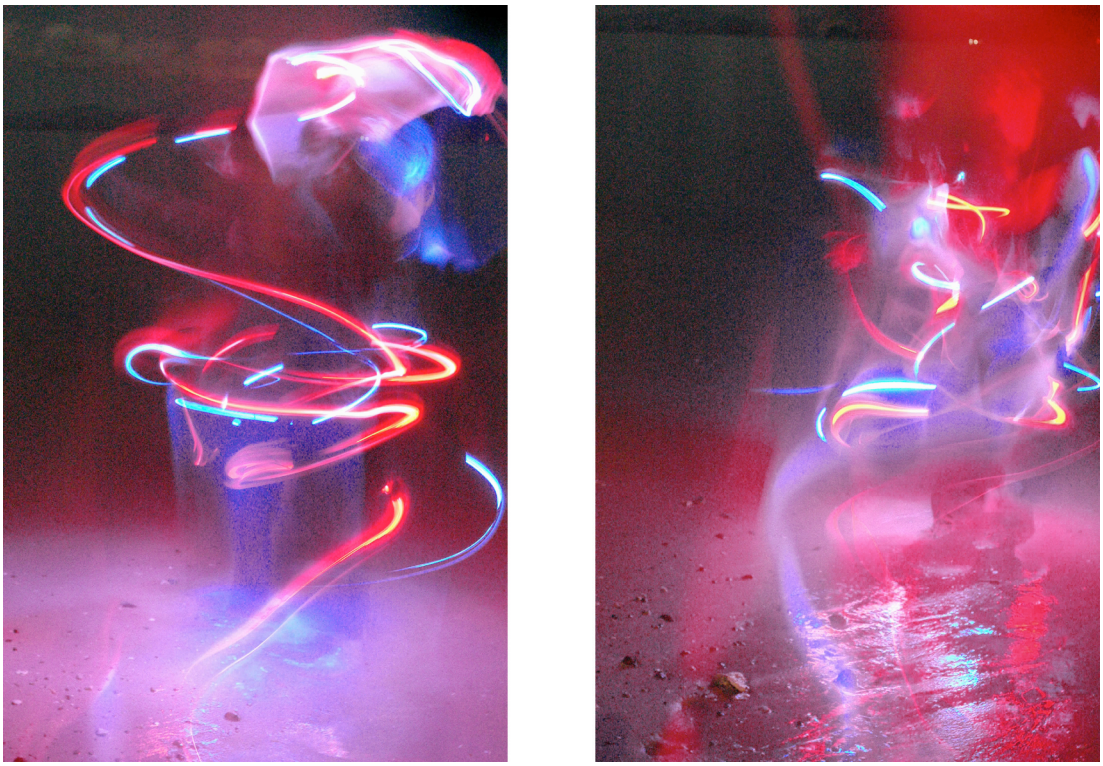

Fig. 5.1 Trails, Veils, Fields, Washes, Patches and Vapours.[236]

Trails can be sharply defined or have blurred boundaries, be opaque or translucent and turn into veils as figure 5.1 (right) shows. Trails typically draw patterns around the body or reach from the body into space thereby extending its boundaries. In this case the environment acts as a backdrop but is not directly referenced (figure 5.1 left). Trails and veils can show sweeping curves or straight lines with angular or jagged changes in direction depending on the movement phrases. They can also travel through space, mark its dimensions and define the depth of field (figure 5.1 right).

Trails and veils leave a dynamic pattern where the body often is only present through the light tracing its movement and are typically more apparent in time-elapsed photography than in video as the light effects in video are recorded frame by frame over time.[237]

In both images of figure 5.1 sharply defined, multicoloured light trails dissolve into light veils enveloping the body or extending into space. The wide spectrum and clear separation of colours in these trails and veils is a distinct feature. Colours range from white to turquoise and yellow to red in the light trails and multiple shades of red, pink and purple in the light veils.

[236] Source project *New Arenas* (Oberlack, 2007, primary research) for the project see section 3.2.5.

[237] See section 4.2.2.

While covering the same colour range as trails and veils, **fields, washes, patches and vapours** are more monochrome and more static in character with different degrees of size, translucency, definition and iridescence. They provide a backdrop for the trails and veils, but also define the body as an obscured presence and characterize dimensions and material quality of the space around the body.

Slow movements and the reflection of light from water or even air produce light fields or washes. The light emissions are distributed by reflective or partly absorptive surfaces such as water and the black dress in figure 5.1. Intensity and colour spectrum varies depending on the angle at which the light is reflected.

Fields and **Washes** both suggest a certain expanse of the light effect. Light fields, however, are more opaque in appearance such as the red fields in the top right corner of figure 5.1 (right) and display a sort of luminous solidity. Washes seem like translucent, soft and diaphanous layers of light that can merge with the surface they are reflected off. In figure 5.1 (left) the pink-purple wash on the water seems to merge with it and dissolve its material properties.

Patches are typically smaller in size than fields or washes and are areas of either intense light or complete darkness. The dark patches provide contrast in the visual effects whereas the highlight patches are often pools of light that display iridescence, such as the patches reflected on the water surface in figure 5.1 (right). As opposed to the washes, these patches make the material properties of the water apparent by showing its ripples.

Vapours are coloured hazes that seemingly hover in the air as in figure 5.1 (right) top right. Vapours materialize through reflection of light in the air. This is be caused by particles dissolved in the air like, for example water. They are highly translucent and monochrome with an immaterial quality.

All of the visual effects have luminosity in common. In combination with the colour palette derived from light emitting diodes they seem to glow and almost ‘jump off the page’. This is not surprising given the additive mix of coloured light bouncing off reflective surfaces at different angles. The combination of luminosity and colour range draws obvious parallels to light art genres such as Neon Art.[238] Colour effects in live performance and recordings are dissimilar as light registers differently on the retina of the eye and on the camera.[239]

[238] For an overview see Elger (2006).

[239] The reception of light in recordings is impacted upon by the recording medium as well as its parameters, particularly concerning exposure time.

Trails, veils, fields, washes, patches and vapours have emerged as basic elements in the composition of visual effects. Trails and veils result directly from the emissions of moving light sources and show the dynamic of motion in their appearance. Fields, washes, patches and vapours are caused indirectly by light reflection. They are more static in character and differ in their size, translucency and light intensity. Luminosity and a specific colour palette derived from their origin in light emitting diodes are common to all of these light effects.

The blurring of boundaries between the foreground, the background and the figure of the body through the overlaying of visual effects points to the importance of layering in the construction of these images. The implications of 'Layering and Overlay' are the subject of the following section 5.1.2.

5.1.2 Layering and Overlay

Please reference videos *Body-Light-Scapes* and *New Arenas*. *Radiance: Outcomes* and *Light-Space-Body: Outcomes* provide examples in moving images.

The overall visual effect of wearable light in still and moving images is composed of different layers of light effects as they are recorded over the time of the exposure in lens-based media. Generally the longer the exposure time and the more varied the movement pattern and speeds, the more complex the overall visual effect. Different types of marks such as light trails, veils, fields, washes, patches and vapours can be combined in this layering process. Indeed, it is the mix of various types of mark making that draws interest in the images.

'Overlay' refers to techniques of overlaying images that can be employed in the recording of time-elapsed photography and in the editing of video material.[240]

[240] 'Overlay' techniques can also be used in the editing of still images, but will not be covered here.

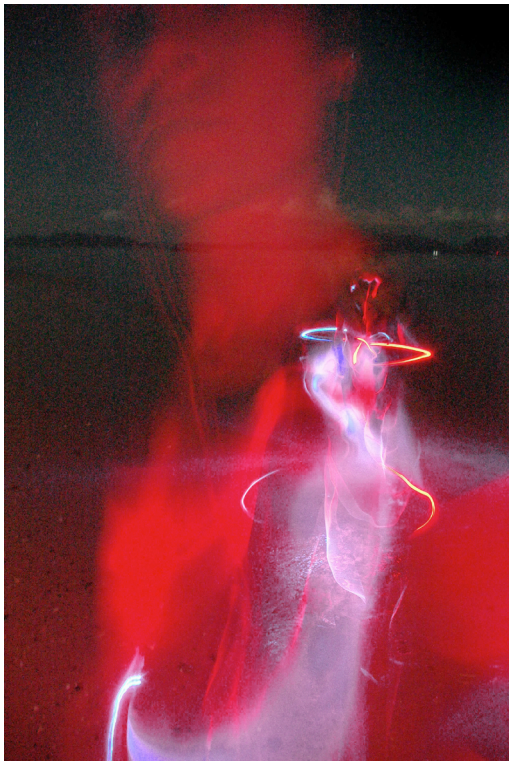

Fig. 5.2 Layering and Scale; *Ghosted Figures.*[241]

The author discovered the effects of overlays in the recording of time-elapsed photography during the 'solo' sessions of project *New Arenas*.[242] These effects were caused by long exposure times during which the practitioner performed in varying distances to the camera. In the resulting imagery, the body is overlaid on the landscape in different scales.

In figure 5.2 a translucent torso lit in soft red fills the foreground of the image, overlaying and miniaturizing the obscure landscape in the background. The effect of the torso is similar to the technique of ghosting used in graphic design.[243] Overlaid onto the torso is the recording of the light choreography that is in scale with the landscape. This light choreography appears like a piece of jewellery on the shoulder and décolleté of the ghosted torso because of its position in the image and seems disconnected from the landscape in the background. The multiple overlays of light and shadow create subtle differences in tonal qualities that add to the ghosting effect.

The image plays with the scale of the body in relationship to the landscape and itself, as the body is present in this image as figure in varying scales. This raises questions about the relationship of the body to the space surrounding it

[241] Source project *New Arenas* (Oberlack, 2007, primary research), for the project see section 3.2.5.

[242] See section 3.2.5.

[243] For discussion of ghosting see for example Graphic Design Forum (2009 [Internet]).

and to itself. It also raises questions about the deliberate composition of such images in the recording process.

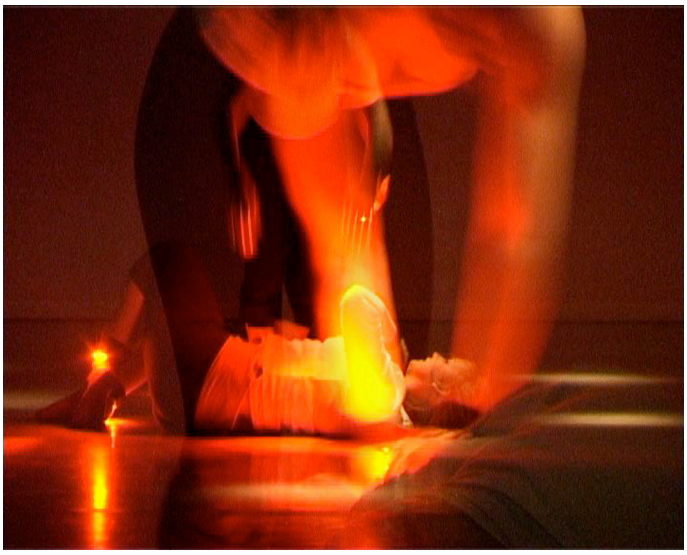

Fig. 5.3 Video Overlay.[244]

Overlay is also a standard procedure of manipulating video or film material in the digital editing process where two sets of footage are assembled as layers with varying degrees of translucency.[245] The variation of translucency impacts upon the outcome: the construction of a new set of moving images based on footage of wearable light. This new material can amplify the effects of light on the body and play with different sets of scale in the imagery. The time-based component allows the juxtaposition of light choreographies at different tempos in a single image, giving rise to questions of rhythm and modulation across the screen and over time. Slowing down the speed of footage in the edit adds to this effect as it enhances the visibility of ephemeral light effects better in the footage.

Despite being digitally constructed these images did not look artificial among the rest of the footage. This raises questions about the creation of wearable light in the three-dimensional reality of performing and recording, its invention in the two-dimensional reality of video editing or indeed in an entirely computer generated virtual reality.

---

[244] Source project *Radiance* (Oberlack, 2006, primary research) still image from video documentation of stage lighting workshop. For the project see section 3.2.4.

[245] Overlay techniques are a feature of almost all video editing software. *Imovie* (Apple, 2010 [Internet]) and *Final Cut Pro Express* (Apple, 2009 [Internet]) were used in this research.

5.1.3 Sculpting the Body

Please reference videos *Body-Light-Scapes* and *New Arenas*. *Radiance: Outcomes* and *Light-Space-Body: Outcomes* provide examples in moving images.

*'*Sculpting the Body' refers to ways in which wearable light can shape the visual perception of the body as a site of light.

The light emitted by the *Body Light Wrap* (figure 5.4) rakes the surface of the body, accentuates the relief of the skin and highlights the shape of the body in the projected areas. The reflective shields distribute the light, frame the projection and provide a contrasting shadow to it. Size and visibility of the shields also contribute to a stronger 'object character' of this light feature.

Body Light Wrap exploits the juxtaposition of red and blue light emission on the shoulders to model the muscle and bone structure of the upper body in a *chiaroscuro*[246] effect. Indeed one could speak of the body being sculpted by light.

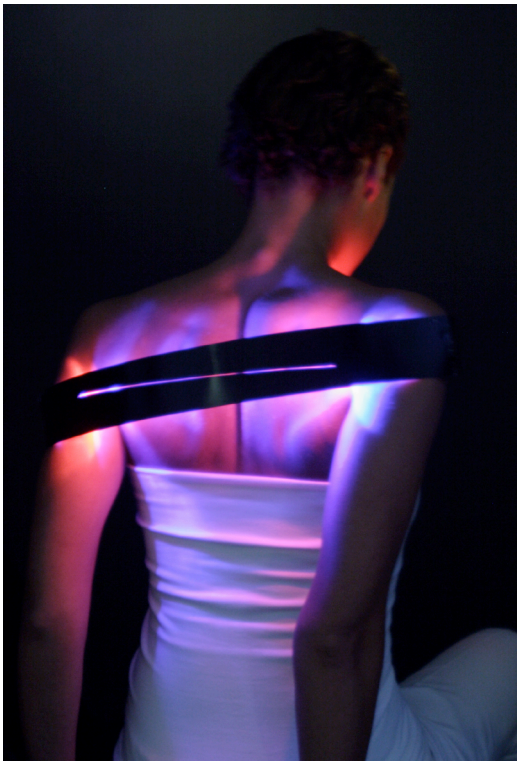

Fig. 5.4 Sculpting the Body; *Body Light Wrap.*[247]

Despite its size the *Body Light Wrap* has an intimate and emotive quality. It invites the wearer to play with light on their body and engage with the evolving

[246] For *chiaroscuro* see Rossing, Chiaverina (1999) p. 322.

[247] Source *Body-Light-Scapes*, part of project *Evolution* (Oberlack, 2004, primary research), for the project see section 3.2.6.

visual effects. As the body seems immediately more present, this raises questions about changes in awareness and perception of the body.[248]

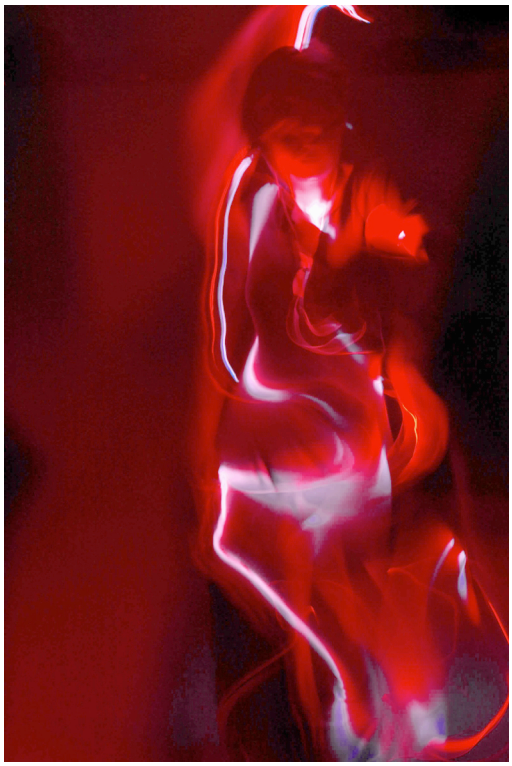

Fig. 5.5 Sculpting the Body; *Dynamic Body Contour.*[249]

Dynamic Body Contour sculpts the contours of the body in dynamic motion. Red and blue light trails contour the body in a wide S-shape from the veils around the ankle and lower legs, along the upper thighs and across the upper body ending in a sharp hook-shaped trail above the head. The dynamic movement of the light covers the whole body in a veil and highlights only few details such as the profile of the head. Instead, it creates a rhythm of shadow and light on the body combining clear outlines with blurring and dissolving of the body contours.

Despite the blurring there is a clear sense of the shape and volume of the body. The light effects re-define its contours and amplify the tempo and extension of the actual movements. The figure seems to rise at speed from veils of light materializing out of the darkness. One could argue that the figure becomes a 'Body-Light-Cipher'.

'Sculpting the Body' with stable or dynamic effects of wearable light refers to the body as a site of light. In both cases the visual effects augment the presence of the body. Stable effects can pick up on details of the skin relief

[248] See section 4.3.

[249] Source project *New Arenas* (Oberlack, 2007, primary research), for the project see section 3.2.5.

and model the muscle and bone structures whereas dynamic effects amplify and re-define contours and volume of the body as well as its motion.

5.1.4 Kinetic Light Sculpture

Please reference videos *Body-Light-Scapes* and *New Arenas*. *Radiance: Outcomes* and *Light-Space-Body: Outcomes* provide examples in moving images.

'Kinetic Light Sculpture' refers to images created by light choreographies that mark the space around the body thus shaping its connection to the surrounding area and extending its boundaries into this space. The visual effects in this theme take on the character of kinetic sculptures.[250]

Fig. 5.6 Kinetic Light Sculpture; *Light Cage*.[251]

In figure 5.6 light trails form an elliptical cage around the body. Only a fragment of the head is visible and the rest of the body is largely indistinguishable. This fragment locates the body in the cage and focuses the eye on the human figure as the originator of the light cage. The reach of the body is clearly marked by the sharply defined, opaque light trails.

This marking of the potential of 'motion space' around the body creates a parallel to Noam Ben Jacov's[252] performance work with collapsible metal

[250] For kinetic sculptures see Museu d'Art Contemporani (2000), Popper (2006).

[251] Source project *New Arenas* (Oberlack, 2007, primary research), for the project see section 3.2.5.

[252] Ben-Jacov (2009 [Internet]), see also Derrez (2005).

frames that unfold into three dimensions when moved around the body. The body becomes encased in dynamic cages that unfold according to the choreography of its movements. This shapes and extends the range of spatial movements.

Light Cages can mark space in a similar manner. Their immaterial quality, however, provides no resistance in the form of weight and fixed structure. Instead, the light traces the shape and rhythm of movement and dramatizes its presence.

Fig. 5.7 Kinetic Light Sculpture; *Purple Circle*.[253]

The *Purple Circle* in figure 5.7 is focused on wide, intensely coloured light fields filling and defining the space between the body and the water surface. These light fields take on a defined, luminous shape: the eponymous *Purple Circle* and a wider pink field that both seem to be hovering on the water. The purple circle and its pink fringe are reflections of the light trails revolving in wide circles above them. The silhouette of a lower body connects the base of the circles and the trails but disappears in the light trails. This body shape is vague and hardly as such present, similar to ghosting techniques in graphic design. Its reflection in the water seemingly has the same substance as the actual body. This leads to the illusion of the body being elongated into deep water and contributes to the hovering effect of the purple circle.

[253] Source project *New Arenas* (Oberlack, 2007, primary research), for the project see section 3.2.5.

The overall visual effect is mysterious and difficult to read, as there is no clear cue how the visual effect has been produced. A point in case is the purple circle and its pink fringe. They provide the base of the kinetic light sculpture by anchoring the connecting figure and defining the expanse of the water surface. On the other hand they seem to have a gel-like consistency reminiscent of the ectoplasm of jellyfish.[254] At the same time the ripples on the surface of the water are clearly visible in the pink light field and indicate its material properties. The water environment is central to this image in a way that does not apply to a lot of the other image groups.

'Kinetic Light Sculptures' evolve out of marking of space around the body. They can trace the shape and rhythm of movement around the whole body and dramatize its presence such as for example *Light Cages*, or create visual illusions by marking the space around the body in a highly reflective environment such as for example *Purple Circle*.

These images raise questions with regards to shaping the connection of the body to its surrounding area, extending its boundaries into this space and envisaging the full potential of the 'motion space' around the body. They also raise questions with regards to the creation of visual illusions through wearable light.

[254] "The outer side of jellyfish is lined with a jelly-like material called ectoplasm ("outer plasma"). It typically contains a smaller amount of protein granules and other organic compounds than inner cytoplasm, also referred to as endoplasm." (Animal Pictures Archive, 2009 [Internet]).

5.1.5 Abstract ‘Light-Scapes’

Please reference videos *Body-Light-Scapes* and *New Arenas*. *Radiance: Outcomes* and *Light-Space-Body: Outcomes* provide examples in moving images.

‘Abstract Light-Scapes’ relates to the passage and re-passage of the body through space. Wearable light marks not only this passage, but also dimensions and features of the space. The qualities of the outcome depend on the material characteristics of the environment, in particular its reflective and absorptive properties. Snow and water environments have been explored in this respect in the project *New Arenas*.[255]

Fig. 5.8 Abstract ‘Light-Scapes’; Snow.[256]

On a snowy ground red, blue and yellow light trails emanate from a hardly visible figure in the background and pass through the image in sweeping serpentine movements. Blue and yellow trails are sharply defined and end abruptly in mid-ground whereas red trials have a soft, wide and blurred appearance. The red trails run the full length of the serpentines and out of the picture in the foreground. They provide expanse and volume to the visual effect and mark the crystalline surface of the snow-covered ground through their reflection. The blue and yellow trails give definition and a sense of the

[255] See section 3.2.5.

[256] Source project *New Arenas* (Oberlack, 2007, primary research), for the project see section 3.2.5.

depth of field. The tempo and movement pattern of skiing is the base of this visual effect, similar to a motorized vehicle in its smooth motion.[257]

Wearable light marks the spatial expansion of the environment and its material properties, i.e. the snow covered ground. At the same time the layering of the light trails seems to create a space of its own in which the depth of field is ambiguous and can be read in number of ways. If the viewer focuses on the vast red light field in the fore and middle ground, then the sense of depth in the overall visual effect collapses and it can be read as a light cipher or a form of calligraphic script.

Fig. 5.9 Abstract 'Light-Scapes'; Water.[258]

The red light field rising out of the water fills the mid-ground of the image almost entirely in figure 5.9 while taking on a three-dimensional quality; it seems to solidify into an abstract sculptural form that fills the frame and dwarfs the landscape around it. The red volume almost blocks out the slightly angled ghost line of the horizon. This leads to ambiguity in terms of the scale and setting of the environment.

---

[257] Walking, running or skating on the ski slope would have produced more jagged light effects. This is demonstrated by one of the images in the video *New Arenas* where the author was climbing up the ski slope.

[258] Source project *New Arenas* (Oberlack, 2007, primary research), for the project see section 3.2.5.

The water appears almost saturated with luminous colour, its surface distributing, softening and mixing the light in concentric rings of magenta and red. These circles show as segments in the image giving a sense of depth and horizontal expanse in juxtaposition to the vertical elevation of the red sculptural light mass. Elliptical and curved light trails in the foreground connect the two.

The body as the originator of this ‘light-scape’ is not visible as the performer is positioned just out of frame to the right, and material properties of the environment are only recognisable in the lower part of the foreground. The image therefore seems to be composed mainly of light with different characteristics. It is an abstract ‘light-scape’ with an ambiguous sense of depth, scale and dimensional properties of the shapes and volumes that define it. This raises questions as to the presence or absence of the performer in the imagery that is further discussed in the following section 5.1.6.

Abstract ‘Light-Scapes’ relate to the passage and re-passage of the body through space and it’s marking of spatial dimensions and material properties of the environment. This leads to a transformation of the landscape into a ‘light-scape’ with abstract qualities that defines and re-defines spatial expansion and material characteristics of the environment. Scale and depth of field are often ambiguous and provide a potential for multiple interpretations of the relationship between the visual effects and their environment. This raises questions with regard to the relationship of the body to the wider environment and how an observer will re-construct this reality.

5.1.6 Presence/Absence

Please reference videos *Body-Light-Scapes* and *New Arenas*. *Radiance: Outcomes* and *Light-Space-Body: Outcomes* provide examples in moving images.

Wearable light features and the body can be present to varying degrees in expressions of wearable light such as performance, still or moving images. This 'Presence/Absence' effect takes place in live performance, though it is particularly pronounced in recordings of wearable light.

Most light features in this research are designed to be absent from outcomes, their presence only implied by their light emissions. Still and moving images represent a record of these light features in action. A notable exception is the *Body Light Wrap*, figure 5.4, whose reflective shield is a feature of the visual effect. In this image the body of the performer is fully present and instrumental for the outcome.

While the light trails and veils in figure 5.5 obscure the actual body, their play of light and shadow enhances its presence by amplifying and re-defining contours and volume of the body. The fragmentation of the body through wearable light in figure 5.11 is a variation in that the light effects draw the focus on the body and enhance its presence. At the same time they separate the body into different zones and fragment its appearance into a less familiar shape.

Figure 5.10 shows different degrees of an obscured presence of the body.[259] In the right image the protagonist is largely indistinct, but the head and upper body are still recognisable through their illumination in red light. In the left image the light veils obscure the body of the performer entirely. However, there is still a sense of a more solid human form behind the veils. In both cases the presence is achieved through the illumination of the body by wearable light; i.e. they are only present because the body is a site of wearable light, not because of background illumination.

[259] Section 4.1.3 discussed how varying degrees of presence of the body were achieved.

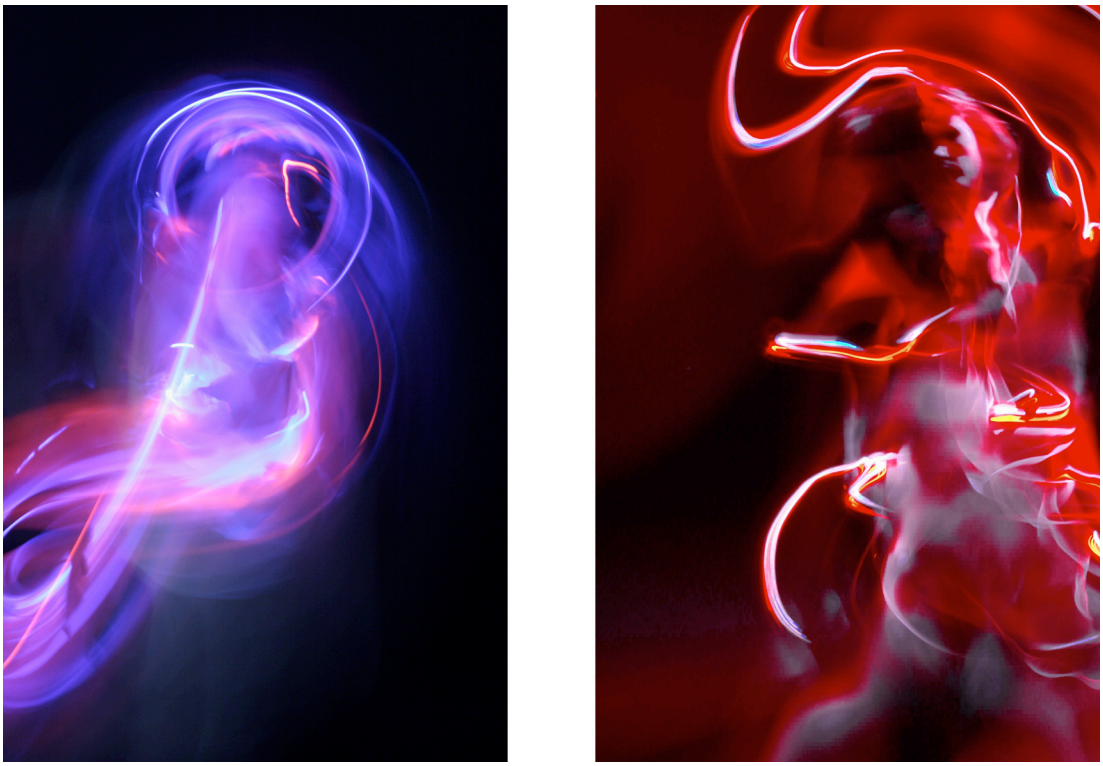

Fig. 5.10 Presence/Absence.[260]

Figure 5.2 shows a variation of this obscured presence: the torso is ghosted in a similar manner to graphic design techniques, leaving a translucent trace that is overlaid on the background. The overall effect is one of a figure being an immaterial presence that amalgamates with the land/waterscape. A similar effect is taking place in figure 5.7, but with an entirely different visual outcome. The lower part of the body seems ghosted as well, but still shows as a reflection in the water whereas the upper part of the body disappears entirely among the light trails. This creates the impression of the body dissolving as a presence into a shadow on the water.

The least degree of presence of the performer is achieved when their body is a carrier and propulsion for the light features, but is not visible in relationship to the visual presence of wearable light in the outcome. For example figure 5.9 where the protagonist is entirely absent from the image having generated the light effects from a position just to the right of the camera frame. The resulting imagery has painterly qualities and some of them are entirely abstract with no visual reference to the body as a shape. In live performance the light appears evanescent and the display will seem protean if there is no visual reference to the body as a figure.

[260] Source (left) project *Body-Light-Scapes* (Oberlack, 2007, primary research), (right) project *New Arenas* (Oberlack, 2007, primary research) see section 3.2 for both projects.

This raises questions of whether and how there is a sense of human presence in the outcomes and has implications for the body as a carrier of light as the human body is still present in the movement patterns of wearable light.

These patterns are impacted on and determined by characteristics such as spatial reach, posture, gait and pace of the body. One can argue that this is a case of 'presence through absence' where the movement patterns of the wearable light imply the human body.[261] This points towards potential future research such as exploring the impact that movement patterns of different types of bodies can have on wearable light. It also raises questions with regard to whether these records of human activity can be construed as *memento mori.*[262]

5.1.7 Emerging Narratives

Please reference videos *Body-Light-Scapes* and *New Arenas*. *Radiance: Outcomes* and *Light-Space-Body: Outcomes* provide examples in moving images.

This section addresses a range of wider themes coming into view: a sense of narrative emerging from still and video imagery. These narratives can take the form of theatrical associations or evolve around more abstract and musical themes such as rhythm, mood and modulation, particularly in moving images.

The light effects in figure 5.11 are almost unreadable in the sense that the viewer does not know what is happening or how they have been created. White light marks appear out of a red haze over a pool of intense white light that is at the centre of expanding rings of magenta, pink and red. A human figure might be emerging through the light, but is only suggested. This visual effect creates a mysterious or magical atmosphere in which multiple interpretations of the phenomenon are possible.

[261] Attaching light features to animals would hypothetically produce entirely different light patterns.

[262] "**Memento mori.** Latin phrase meaning remember you must die. A memento mori painting or sculpture is one designed to remind the viewer of their mortality and of the brevity and fragility of human life in the face of God and nature." (Collection Tate, 2009 [Internet]).

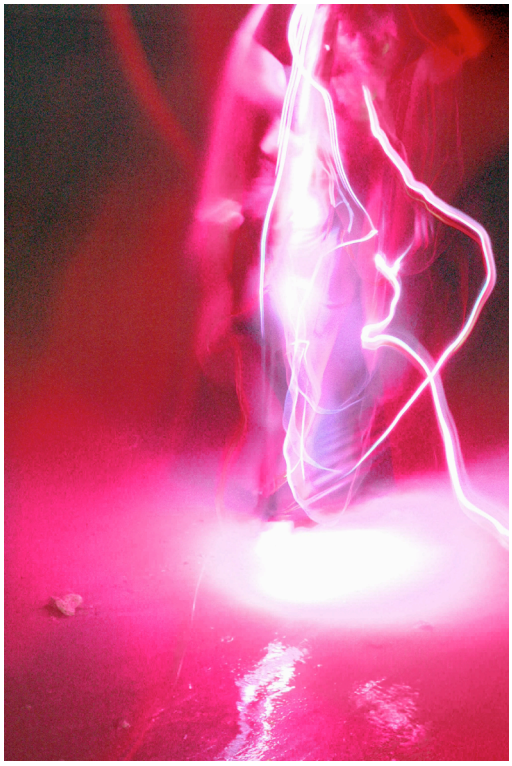

Fig. 5.11 Emerging Narratives; Light Cipher.[263]

If the eyes focus on the white and magenta light, then the visual effect takes on the appearance of a calligraphic script and the light could be a code or cipher. If the viewer focuses on the red haze, then the human figure at the heart of this apparition becomes more obvious and the light seems to envelope the body like a form of ectoplasm.[264]

The narrative associations and structures emerging here are loosely coupled; the viewer responds intuitively identifying half-recognized imagery that suggest that they have validity beyond the author's personal experience.

The sense of narrative in performance and video is more abstract and evolves along the lines of musical themes such as the development of rhythm, phrases, modulation, chords, shifts, moods, riffs and solos.[265] They can be experienced in the videos of project outcomes such as *Radiance: Outcome* and *Light-Space-Body: Outcome* though they are as yet immature. The sense

[263] Source project *New Arenas* (Oberlack, 2007, primary research), for the project see section 3.2.5.

[264] "Ectoplasm **1** *Biology, dated* the more viscous, clear outer layer of the cytoplasm in amoeboid cells. Compare with endoplasm **2** a supernatural viscous substance that supposedly exudes from the body of a medium during a spiritualistic trance and forms the material for the manifestation of spirits." (Oxford English Dictionary Online, 2009 [Internet]). Ectoplasm is here used in its relationship to the paranormal. In popular culture ectoplasm denotes a gauze-like substance excreted from orifices on a medium's body that drapes itself over their non-physical body (Wikipedia, 2009 [Internet]).

[265] For musical terms see Classical Works (2010 [Internet]) and A Passion for Jazz (2010 [Internet]).

of rhythm and mood relates to the poetic qualities of wearable light discussed in section 4.3.

A sense of narratives is emerging across performances, video and still imagery. In still imagery these can take the form of light ciphers or theatrical characters with their associated storylines. In video and performance the emerging narratives are more abstract or impressionistic and evolve along the lines of musical terms such as moods, shifts and development of phrases.

These elements of an emergent visual language are not comprehensive, but provide an insight into building blocks of such a language as far as they have thus emerged. This language is as yet immature, but shows potential for application in other practices and contexts.[266]

The images were selected for use here because they typify emerging elements of a visual language for wearable light and continue a dialogue over the subsections. At the same time they can provide new or alternative sets of parameters or new aesthetic in comparison to previous sections. This sets up a discourse between the images and image groups.

5.2 Descriptive Analysis Framework for Wearable Light

The *Descriptive Analysis Framework (DAF)* presents a taxonomy[267] of wearable light that summarizes and systemizes elements of an emergent visual language as discussed in section 5.1.

The *DAF* presents partly technological knowledge; the author and her collaborators know how certain effects are achieved and thus can replicate or vary them, or put them into different juxtapositions.

The *DAF* is also based on the author's authority as 'auteur' in assembling, controlling, i.e. directing, and recording the complex activity. The characteristics and aesthetic quality of the outcome can be manipulated by the author and may be used in a different way by another practitioner.

A third aspect is the poetic impact upon the emotions of a spectator who is not involved in the realization of the piece.

The typology materialized out of the author's reflection on the practice of wearable light. In this respect it is an overview that integrates the elements of an emergent visual language as well as bringing together knowledge from all

[266] See sections 5.2 and conclusions in section 5.3.

[267] For the purpose of this thesis 'typology' and 'taxonomy' are used as synonyms.

areas of the practice. The author developed this taxonomy through mind mapping techniques (Buzan, 2000) in an iterative process that involved the application of the classification to different areas of practice within the research.

The *DAF* has six main categories that cover firstly, the **constituent parts of wearable light** i.e. the interaction of light, body and space and secondly, their combination in **movement phrases and choreography**. The third category, **focus of practice**, concerns the application of wearable light in various types of practice. The applications lead to **visual effects** in their outcomes that are described as elements of a visual language. **Emerging narratives** evolve out of the interpretation of the visual effects. The last grouping addresses the **impact of wearable light** on spectators and protagonists.

Constituent parts of wearable light are light, body and space. Their complex and dynamic interactions shape the visual outcomes of wearable light in all contexts.

This category refers to the body as a site and a carrier of light and concerns the design of light effects as well as light features. This is 'technical' knowledge about how certain effects are achieved and thus can be replicated, varied or put into different juxtapositions.

Replication of effects is possible within a range in the sense that the set up of light, body and space is repeatable, but outcomes will not be exactly identical due to the complex and dynamic interactions taking place.

Movement phrases and choreography combine the constituent parts light, body and space and shape their complex and dynamic interactions in sequence. This leads to a 'light choreography' that determines or impacts upon the visual effects of wearable light in all contexts.

The dynamic and complex nature of wearable light leads to elements of improvisation and 'accidental performance' in the outcome. The balance between choreography and improvised interpretation will have an effect on the poetic impact of the outcomes.

Focus of practice deals with the application of wearable light in different disciplines: The first two categories can be applied to a range of practices such as light jewellery, performance and the recording of wearable light in still and moving images. Time-elapsed photography and digital video have been the recording methods for still and moving images respectively in this practice.

The focus of practice will impact upon wearable light as for example recording parameters have an effect on the outcome.

The applications were derived from the authors practice and other practitioner might apply them differently. Areas such as product applications of wearable light come to mind.

The application of categories one and two leads to a range of **visual effects** in the outcomes. These outcomes will vary for different forms of practice, but elements of a visual language emerge across disciplines. Section 5.1 charted a selection of these themes: (a) basic elements of visual effects; (b) the composition of imagery through layering and overlay; (c) effects on the body such as 'Sculpting the body'; (d) effects around the body such as 'Kinetic Light Sculptures'; (e) effects of passage through space such as 'Abstract Light-Scapes'.

Themes emerging from earlier chapters relate to the scale of outcomes. The quality of the light emission is an overarching factor in terms of is luminosity, translucency, colour palette and iridescence.

Dynamic 'actions' of light emerged in visual effects such as 'Kinetic Light Sculptures' and are described in this category. The concept of light 'acting' evolved from a review of stage lighting where the terms 'bounce' and 'spill' are central concepts (Reid, 2001; Shelley, 2009).

From these visual effects emerges a sense of **narrative** and more abstract **themes**. Narratives cover associations that emerge from still and moving images. Themes relate to more abstract topics in the imagery such as presence/absence, memento mori, light as metaphor and fragmentation.

The last category relates to the **impact of wearable light** on spectators and protagonists. This concerns their engagement in process and outcomes as well as the poetic impact on the spectator and possibly the protagonist.[268] The following table provides an overview of the typology with main categories on the left and subsequent categories and elements of language following to the right.

[268] Poetic qualities and impact have been discussed in 4.3.

Category	Subcategory	Further Subcategory or Elements of Language
(1) Constituent Parts	Light	role (as medium or support) design light effects (contrast, brightness, colour)[269] design light features (characteristics, intrinsic aesthetic value)
	body	role in relationship to light (site, carrier, propulsion, medium of reception, medium of perception)
	space (environment)	spatial dimension, natural or architectural features, material properties
(2) Movement Phrases and Choreography	movement	in relationship to light source (holding, cradling, throwing, turning…) in relationship to the body (on body, around body, through space) rhythm, tempo, direction, pattern
	performers	physical attributes (size, gender etc.) performance background, movement repertoire, professional or amateur, single or multiple performers
	choreography	sequencing of movement phrases in overall structure (developments) balance of choreographic score and elements of improvisation
(3) Focus of Practice	artefacts	light jewellery, performance wear, light environment
	live event	formal, informal or accidental performance
	recording	still images (digital or analogue time-elapsed photography) moving images (digital video, analogue film)

[269] All subcategories in 'constituent parts' could be taken further in terms of detailing language. These details are not covered in this overview, but are present in the original mind maps.

Category	Subcategory	Further Subcategory or Elements of Language
(4) Visual Effects	quality of light	luminosity, translucency, colour palette, iridescence
	scale	from small, localized effects on the body to large scale projection at a distance from the body scale of output medium for recordings
	basic elements of visual effects	trail, veil, field, wash, patch, vapour [270]
	composition of imagery through layering and overlay	layering, overlay (in recording or editing), ghosting
	'sculpting the body' (effects on the body)	contouring (dynamic, static) tonal modulation of muscle and bone structure (chiaroscuro)
	'kinetic light sculptures' (effects around the body)	'actions' of light effects: raking, framing, hovering, filling, enveloping, blending, blurring, curving, sweeping, swerving, extending, expanding, spilling, bouncing[271]

[270] For a description of characteristics of trails, veils, etcetera see section 5.1.1.

[271] The terms 'spilling and bouncing' have been borrowed from stage lighting terms. For 'spill' see Reid (2001) pp. 15, 116 and Shelley (2009) p. 8. For 'bounce' see Reid (2001) p. 116 and Shelley (2009) pp. 5, 351.

Category	Subcategory	Further Subcategory or Elements of Language
		light effects: tangential, elliptic, concentric, serpentine, jagged, angular, linear)
	‘abstract light-scapes’ (effects of passage through space)	‘light-scape’: scale, spatial dimensions, features, material properties, ambiguity of 2D/3D expansion of space in ‘light-scapes’
(5) Narratives & Themes	themes	presence / absence, presence through absence, memento mori, fragmentation of the body, light as a metaphor
	narratives	light ciphers, theatrical characters abstract or musical sense of narrative (shifts, developments, moods, riffs…)
(6) Impact of Wearable Light	engagement of spectator or protagonist	participation of audience: instrumental, encouraged, discouraged protagonist: observer, actor, simultaneous roles
	poetic impact	intimate, emotive, playful, engaging, atmospheric, magical, mysterious, ambiguous, disturbing, overwhelming

The typology is still emerging from the reflection on practice of wearable light and is as yet immature. However, the author proposes that this taxonomy has the potential to be applied to other practices concerned with wearable light and facilitate the description and development of such practice. This raises the question whether there is a potential to develop the typology with regards to transferability and relevance to wider contexts in arts and design such as light art.

For example Erina Kashihara's work (2.1) is centred on the interaction of wearable light structures and the body. As her practice focuses on the design of object, it does not indicate or explore 'light choreography' on the body. Movement phrases will however impact upon the interactions of the light structures with the body and its surrounding space. Despite the light structures surrounding the body, the light effects are clearly focused on the body and heighten its contours. One can argue that there is an element of 'sculpting' of features of the body. Due to their object character the light features are very much present as part of the overall visual effect as is the body. In many ways there are parallels to the *Body Light Wrap* to be noted here. In terms of poetic impact the light structures certainly changes perceptions and raises awareness of the body for the spectator. The impact of the structure on the protagonist is not known.

5.3 Conclusions for the Emergent Critical Language

Elements of a visual language of wearable light have emerged through the practice-based research of this project and have been made explicit through reflective cycles between practice and critical context in the research process.[272] This emerging terminology constitutes the foundation of an as yet immature vocabulary of wearable light that describes wearable light effects according to their visual characteristics, the way they can be combined, how they relate to the body and what kind of narratives are emerging from the imagery. This terminology has been codified into a taxonomy that also takes into account technical and practice-based aspects of wearable light as well as its impact.

[272] For a discussion of the reflective research methodology see chapter 3.

This section comments on how this emerging visual language can contribute to knowledge. There are several aspects to this contribution: the evaluative component of visual language as 'rich descriptions', their role in building theory and the transferability of the visual language to other practices and contexts.

The elements of a visual language of wearable light were originally developed as a response to the lack of approaches to describing and assessing wearable light. In order to describe and assess outcomes, 'rich descriptions' had to be derived from process and outcomes of the practice in a self-referential manner. This iterative process of development and application to different areas and projects of practice informed and framed the research process as a whole. Therefore the identification and framing of terms within this emerging vocabulary derived entirely from the author's practice.

In the latter parts of the research these descriptions were formalized in the taxonomy by using mind mapping techniques (Buzan, 2000) in an iterative process that applied the classification to different areas of practice within the research.

'Rich descriptions' refers to the way ethnographic research and comparative case study theory use 'rich' or 'deep description' as a method of generating knowledge.[273] Phenomena in the research arena – in this case the practice of wearable light - are described in detailed accounts that rely amongst others on narratives to give an impression of the complex interactions of the local context. Rich descriptions have an element of assessment and evaluation as they usually include the description of decision-making processes and their outcomes. This applies in particular to the description of the practice and outcomes of wearable light as regular feedback and assessment of research process and outcomes were a building block its methodology.[274] As such these rich descriptions can contribute towards 'building of theory' by providing the first building blocks (Gibb Dyer, Wilkins, 1991). The rich descriptions of phenomena of wearable light derived from this research are in this respect stepping stones towards the development of a visual language of wearable light.

[273] For rich descriptions in ethnographic research see *Valsiner (2002)* and Atkinson et.al. eds. (2001). For comparative case studies in organizational science see Gibb Dyer, Wilkins (1991). For examples of case study research and its relationship to action research in industrial and product design see Yen, Woolley, Hsieh (2002).

[274] See chapter 3.

Section 5.2 demonstrated the potential of applying the current taxonomy to other of practices of wearable light than the author's own through the example of Kashihara's work (2006).[275] This application of the critical language to practice other than the author's can be interpreted as an external validation of the framework and demonstrated that the current typology contributes to knowledge by facilitating the description and assessment of different practices of wearable light. This raises the question whether this taxonomy can be expanded to describe and assess practices of light in the wider context of art and design. This question will have to be answered by future research and include conversations with experts in other contexts to evaluate the validity of the methodology for that context.

[275] See section 2.1.

6 Conclusions; Contributions to Knowledge and Implications for Further Research

As stated in chapter 1, the original research aim was to explore the potential of light as body adornment with a main interest in artificial light using advances in lighting technology and to evaluate the implications of this research for a range of applications. The objectives were firstly, to establish the conceptual and technological dimensions of light as body adornment through a practice-based research. Secondly, to critically review the potential of new technologies in lighting and energy supply with regards to the research. Thirdly, to contextualise the project by critically reviewing the use of light in relationship to the body in contemporary art and design practice. Fourthly, to explore implications of this research for applications in related disciplines and lastly, to seek and integrate external feedback on practice as part of the research project (Oberlack, 2004a; primary source).

The experimental, practice-based research methodology centred on a sequence of projects that investigated different aspects of light as body adornment. These projects were planned to evolve by evaluating process and outcomes of previous projects in the sequence and given boundaries by a research map[276]. Expected outcomes were collections of light features responding to the specific facet of research examined in each project of the sequence.

Early outcomes of this reflective research process led to an adjustment of the research objectives in 2006, at confirmation/transfer stage, with an added emphasis on collaborations and the development of a critical framework for the description and evaluation of light as body adornment. As a clarification the research objectives included a focus on wearable light features and the regular integration of external feedback (Oberlack, 2006b; primary source).[277]

Driven by the reflective, experimental methodology, the research has since evolved to applying and exploring wearable light in different contexts rather than developing numerous collections of light features. This has led to a more complex practice with a wide range of outcomes across disciplines in art and design and accordingly to an adaptation of the methods within the research

[276] See chapter 3, figure 3.1.

[277] A revised research map took account of the widened research remit. See chapter 3, figure 3.2.

process. Methods employed related to the new areas of practice such as choreography, scenography, time-elapsed photography, digital video recording and editing. Short courses and collaborations with experts in their fields provided training for the practitioner. The expansion of practice and extension of methods and outcomes in turn fed back into the research process closing a reflective cycle.

This research methodology allowed the author to achieve the original research objectives, although it developed research practice and outcomes far beyond the original remit. The change in the title of the research reflects this wider research remit: *I+E Illumination and Emanation; Light As Body Adornment and Implications for Wearable Light*.[278]

Discussed in section one was the use of practice within this research with a note of how the terms practice-based and practice-led research are used, observing that studies of light might be expected to be framed scientifically but that this research is framed in the discipline of art practice. However, the researcher's background in science has informed and facilitated this study.

The following sections each present conclusions and their contributions to knowledge, put these contributions into context and point out implications for future research. The contributions are listed as a sequence of interrelated outcomes according to their reference to chapters in the thesis.

The experimental, practice-based research methodology represents a central original contribution to knowledge and is discussed in section 6.1 with reference to the role of collaboration and 'solo' projects in the research.

This research methodology led to a 'scaling' of practice with a corresponding extension of methods, expansion of the role of the practitioner and extension of outcomes culminating in the identification and development of a performance art based on wearable light that represents an original contribution to knowledge with a large scope for future research (6.2).

Conclusions in sections 6.3 and 6.4 refer to characteristics and qualities of wearability and time-based boundaries of wearable light examined in chapter 4 and discuss their contributions to knowledge and implications for further research.

Drawing on discussions in chapter 5, section 6.5 comments on the state of the development of a critical language of wearable light as an original contribution to knowledge and points out potential for future research.

---

[278] For the original title and a discussion of the rationale for changing the title of the research see chapter 1, p. 2.

Section 6.6 summarizes the implications for further research discussed in prior sections indicating the author's future research interests.

6.1 Experimental, Practice-Based Research Methodology

The research methodology set up a reflective research process based on a sequence of projects in which selected aspects of practice and critical context were investigated in a reflective heuristic cycle. The evaluation of process and outcomes of each project informed the selection and initiation of subsequent projects in the sequence. External feedback was paramount and integrated throughout the process from a wide range of audiences including peers, expert and the general public. A balance of collaborations and 'solo' projects characterized the process, granting access to expert knowledge and creative practice from other disciplines in collaborative projects while providing opportunities for small-scale speculative experimentation in 'solo' projects.

This research process led to a 'scaling' effect. Practice expanded from designing wearable light features in a jewellery context to the developing light features for performances to choreographing wearable light for performance, recording and editing these performances and exploring wearable light in relationship to specific light environments in lens-based media. In the course of the research these practices were identified as constituent parts of a complex performance art based on wearable light and developed with two modes of expression: live performance and recording in lens-based media. Corresponding to the expansion of practice outcomes extended across disciplines: from jewellery to choreography, performance, lens-based media and scenography.

This 'scaling' of practice and outcomes had consequences for the research methodology, as it required methods appropriate to the new areas of practice and therefore the acquisition of new sets of skills through expert advice, formal training and experimental learning 'on the job'. Collaborative projects in particular provided access to expert knowledge and invaluable 'training on the job'.

Hand in hand with the expansion of practice the role of the practitioner was 'scaled up' from designer and experimenter to the 'auteur' as the authority at the heart of collaborative projects, directing the creative process and controlling its outcomes.

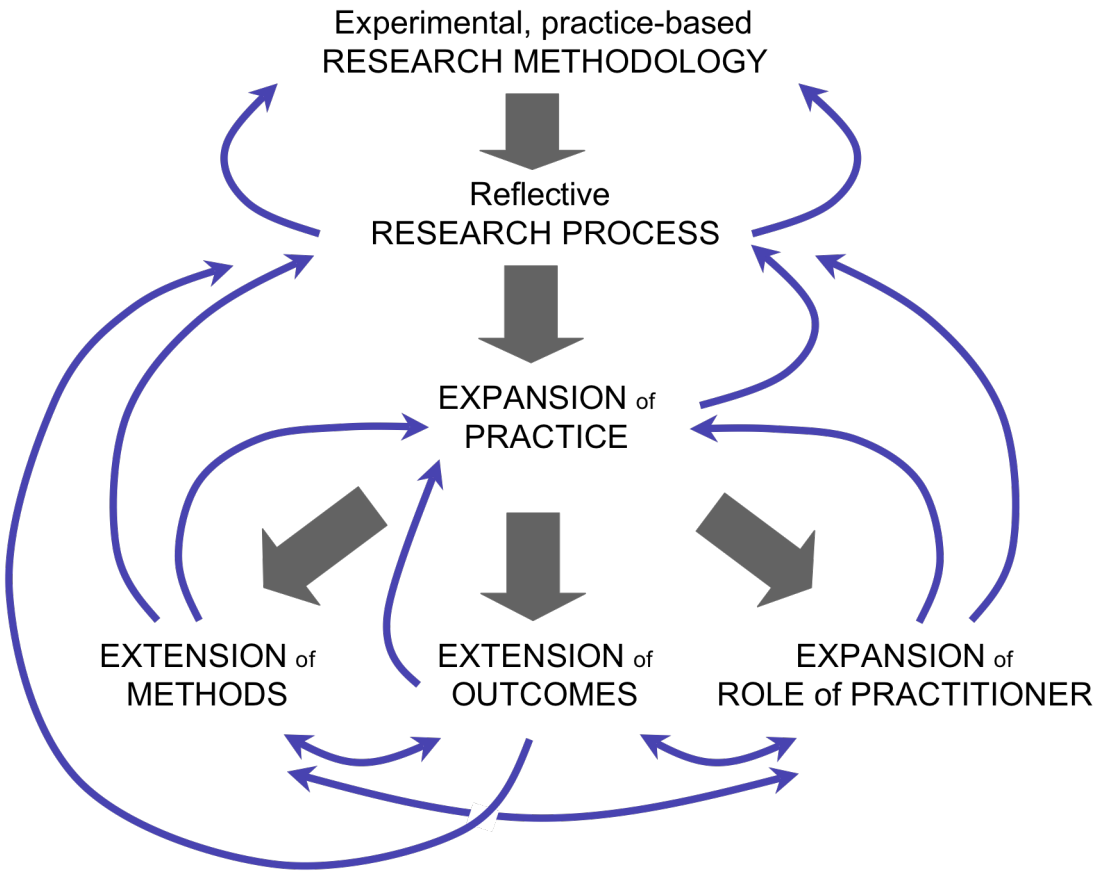

Fig. 6.1 Feedback loops drive reflective cycles in the research methodology.[279]

The experimental practice-based research methodology set up the reflective research process that drove the 'scaling' of practice, outcomes, methods and role of the practitioner. At the same time the research process facilitated the cross-reflections between expanded practice, extended outcomes, methods and the expanded role of the practitioner. These stimulated the reflective research process with feedback. Reflections on the consequences of the 'scaling' effect in the research process in turn fed back into reflections on the experimental, practice-based research methodology (figure 6.1).

The research methodology developed for this research represents a central original contribution to knowledge in terms of the understanding and development of practice-based and practice-led research in art and design. The iterative and reflective nature of this practice-based research suggests an

[279] Source Oberlack (2010) primary research.

extension of Schoen's (1991) thoughts on the iterative and combined creative process.

Practitioners and researchers can employ this methodology across a wide range of practices in art and design. It has particular relevance for practice-based research that operates at the intersection of disciplines or pursues an investigation that is exploratory in nature.

Its significance for the author's and other practitioner's research and practice lies in the fact that it allows the simultaneous development of practice-based research outcomes and practice outcomes contributing to knowledge for research and practice in art and design.

The application across a variety of contexts can contribute to the validation, review, refinement and extension of the research methodology. This points towards a potential for future research that compares and contrasts this research methodology with other approaches in the growing body of practice-based research in art and design.[280]

A balance of collaborative and 'solo' projects characterized the research process. Switching between these types of projects enabled the author to combine periods of engagement in collaborative input and introspection in 'solo' projects.

Due to the cross-disciplinary nature of wearable light, collaborations were of paramount importance: with technological experts and with practitioners such as choreographers, performers, photographers and film editors amongst others. Collaborative efforts facilitated the exchange and creative engagement with highly skilled partners across who brought a wide range of creative mindsets and agendas to the collaborations. These projects also provided access to expert knowledge and training on the job in new areas of practice for the practitioner. Challenges lay in the coordination of and the communication between multiple practitioners from a wide range of artistic backgrounds who had different creative languages and agendas. Contributions to and control of the collaborative process and therefore the creative outcomes depended on who initiated the collaboration, what role they took in the process as well as the expertise, agendas and prior experiences of all collaborators. The most successful collaborations were based on the co-

[280] For an overview of practice-based research in art and design see Biggs (2000 [Internet]), also Scrivener (2004 [Internet]) and Barrett, Bolt (2007).

evolution of creative outcomes or saw the author take the role of ‘auteur’ with overall control of the creative process and outcomes.

‘Solo’ projects played an equally important role in the research process as they afforded the practitioner full control of practice, process and outcomes and ran on a smaller scale than collaborations. The less complex logistics allowed flexible and affordable development of new avenues of enquiry, facilitated work that was more experimental and speculative in nature and often provided a first step towards the initiation of larger collaborative projects. In ‘solo’ projects the practitioner assumed all roles in the artistic process, often simultaneously. This offered the opportunity to develop an intense dialogue between the practitioner and the emerging practice un-distracted by outside influences. Challenges lay in the strain of multiple roles that at times limited the full realisation of the creative potential in a project. ‘Solo’ projects can also set boundaries for the access to outside expertise and creative external engagement as by their nature do not encourage the exchange with other practitioners.

The exploration of the role and management of collaborations and ‘solo’ projects in the research process presents a contribution to knowledge of the research process in practice-based and practice-led research. The research also contributed to an understanding how collaborations, co-operation with external experts and short course training can facilitate the rapid extension of methods across disciplines for the researcher. Practitioners across a wide range of disciplines in art and design may employ and extend this ‘process knowledge’.

6.2 ‘Scaling’ leading to Complex Performance Art Based on Wearable Light

As pointed out in section 6.1, ‘scaling’ refers to the expansion of practice and corresponding extension of outcomes across disciplines in art and design from jewellery to wearables, choreography, performance and lens-based media. This development was a result of the research project and had implications for the methods employed as well as for the role of the practitioner.

The expansion of practice and matching extension of outcomes culminated in the identification and development of a complex performance art based on wearable light that is ‘new’ and comparable to that achieved by other artists. This inherently transient and body-related performance art has two modes of expression and outcome, live performance and recording in lens-based

media, and unites different strands of the expanded practise into a 'Gesamtkunstwerk'. [281]

This represents an original contribution to knowledge in the practice of performance and lens-based media and provides the base for further explorations by the author and practitioners from disciplines such as performance, lens-based media and installation art. In particular the exploration of the body simultaneously being a site, a carrier and a perceptive medium of light contributes a new dimension to the practice of performance and installation work based on light.

Practitioners in these fields might investigate this area in ways different from the author's and therefore extend its scope.

Recording and editing of wearable light in lens-based media, developed as a practice in the course of this research, hold potential for further investigation. Digital editing techniques allowing the construction of new sets of imagery in post-production raise the question of how 'real' light effects might be and how that impacts on the relationship of light and the body, in particular in virtual reality. This research contributed to a detailed understanding of how (wearable) light and the body interact 'live' and in different lens-based media.[282] This knowledge can be applied and further developed across a wide range of practices in art and design and in particular inform the creation of virtual reality scenarios.

Implicit in the expansion of practice was the technological development of new generations of light features. This required a critical review of the potential of technologies in lighting and energy supply for their application in wearable light as well as a critical review of the use of light in relationship to the body in contemporary art and design practice.[283] Combined with practice-based investigations of characteristics and qualities of wearable light,[284] this research points to future generations of wearable light features that capitalize on outcomes of current investigations. These can take the form of experimental light features that provide fresh potential for application and exploration.

---

[281] "**Gesamtkunstwerk** (German: 'total work of art'). A term used to describe the cooperation of several arts in a single expressive aim. The term was coined by the composer Richard Wagner in his book *Das Kunstwerk der Zukunft* (The Artwork of the Future, 1849), although the idea of uniting music, poetry, the visual arts, and dance is as old as opera. Subsequently the term has been applied (often retrospectively) to various ensembles embracing painting, sculpture, and architecture or other combinations of arts (see Baroque, for example)." (The Oxford Dictionary of Art, 2004 [Internet]).

[282] See also 6.3 and 6.4.

[283] For a presentation of the context review in brief see chapter 2.

[284] These characteristics and qualities are examined in chapter 4 and contributions to knowledge discussed in sections 6.3 and 6.4.

The research outcomes can also be applied to create collections of light jewellery for general consumption and, in a wider sense, indicate potential future product applications in therapeutic rehabilitation, personal safety or sportswear.

The course of the research also reflected upon different roles of the practitioner as the practice expanded. Coming from a jewellery background, the traditional role of a jeweller is that of a designer/maker or of a designer who works in close co-operation with craftsmen and technical experts. Working with light jewellery, however, implies the reliance on the supply of discreet technology for its realisation as technologies such as light emitting diodes and miniature batteries are creatively assembled in wearable light features.

With the expansion of practice into disciplines such as performance and lens-based media the role of the practitioner expanded accordingly from designer and experimenter to the 'auteur' as the conduit of collaborative projects, directing the creative process and controlling its outcomes. The expansion of the role of the practitioner to 'auteur' who is the focus and conduit of action in the creative process had wider implications: working in collaboration with highly skilled and creative contributors. The author has learned through experience to assimilate their contributions into her own practice. This practice is quite usual in many artistic disciplines such as, for example, in filmmaking where the theory and practice of the 'auteur' originated.[285] This process requires the 'auteur' to have an understanding of and in many cases take on multiple roles in the process, and at the same time engage with highly skilled and creative collaborators.

The research contributed to the understanding of how the role of the practitioner/researcher can expand through practice and what the underlying requirements are. Other practitioners from various disciplines in art and design may draw on these contributions to knowledge to expand their role as practitioners and researchers. The contributions point to future research into further development of reflective practice that encourages and supports simultaneous multiple roles as part of the future development of this research methodology.

[285] "In the auteur theory of filmmaking the director is viewed as the major creative force in a motion picture and oversees all audio and visual elements of the film. Visual elements such as camera placement, blocking, lighting and scene length rather than plot line, convey the message of the film. The most successful examples will bear the unmistakable personal stamp of the director. Examples are directors François Truffaut and Jean-Luc Godard." (Encyclopedia Britannica Online, 2009 [Internet]). For further reference see Tudor (1974).

6.3 Implications of Wearability

The research provided an original contribution to knowledge in the mechanics of placing light on the body: how it works and what effects can be achieved as well as its implications for the perception and understanding of the body in relationship to spatial and social contexts.

The body as a site and carrier are constituent parts of creating wearable light on the body. The complex interaction between the body as a site, the body as a carrier and the environment is brought together in movement patterns that are choreographed in a 'light choreography'. This 'light choreography' can focus on the body as a site, mark the area around the body or explore spatial relationships through the movement of the 'light emanating' body through space. This has implications for the scale of outcomes that range from localized, intimate light effects on the body to large-scale projections of wearable light in the environment that can explore spatial dimensions and features of the environment. Due to the wearability of light, scale can be seamlessly altered by moving the body as a carrier of light towards or away from the projection area.

These factors contribute to the definition and understanding of the body and its dynamic connection to the intimate space in its immediate vicinity. They contribute to the understanding of how the body relates to its surrounding area by making its reach evident and extending its boundaries. Explorations of the spatial relationships between body and environment contribute to understanding of the passage and re-passage of body through space and of the space itself.

These contributions to knowledge provide the base for the creation of new practice outcomes such as generations of wearable light features that can take the form of experimental light features, collections of jewellery for the general public and future product applications.

Implications for the publication and exhibition of wearable light revolve around the fact that wearable light cannot be understood without the body in motion; therefore wearable light features cannot be exhibited without the body. This is a fundamental departure from the way in which jewellery is generally exhibited: as objects that just imply the body, and presents a contribution to the way jewellery can be understood.

As a consequence, the researcher only published and exhibited wearable light through performances and recordings in lens-based media. The scale of the output medium took on an important role as it impacted on the experience of

wearable light. This represents a contribution to knowledge with respect to publication and exhibition of inherently transient, body-related practice and suggests future research into new forms of output media that go beyond the two-dimensionality of conventional output media such as projection screens.[286]

There is a pedagogical dimension to these outcomes: the research has developed and made explicit a 'how to' knowledge that can be the base for learning, teaching and assessment of the practice of wearable light. This directly supports the original research question and represents an original contribution to knowledge for various disciplines such as jewellery and performance.

Investigations of wearability as a central tenet of the practice of wearable light contributed to the identification and development of the complex performance art based on wearable light discussed in section 6.2.

6.4 Time-based Boundaries of Wearable Light

The research contributed to the understanding of the limitations posed and the potential offered by the characteristics and qualities of time-based work. This relates to performance and recording practices in general with some characteristics such as mobile energy supply specific to wearable light.

The research contributed more specifically to understanding the transient nature of interactions between light, body and environment in live situations, and its implications for the perception by protagonist and spectator. Performances can only be fully experienced in live situations and a memory of the performance taken away from it. These memories represent an otherwise absent experience as typically only fragments of the performance can be remembered, and contribute to the quality of 'presence though absence' in live performances. The more complex the performance experience, the more fragmentary memories of it will be, as feedback to performances of wearable light demonstrated.

Recording of live performances as documentation and extension of the timeline have limitations as they address time and space in a fundamentally different manner. Differences in the visual perception of wearable light in performance and its recordings did not only confirm the relevance of this

[286] Dr. Jane Harris, reader at Central Saint Martins College of Art and Design, was awarded a NESTA award for the exploration of new forms of media for the presentation of projection-based work. Central Saint Martins College of Art and Design research fellow Naomi Filmer has investigated lenticular lenses as a step towards three-dimensional representation; see Britton Newell (2007) for images.

fundamental rift, but also demonstrated the influence of the camera viewpoint and recording parameters on the outcome of the documentation. The issue of documenting performances is compounded by the fact that recordings can take on a life of their own and come to represent the practice.

However, if recordings are deliberately conceptualized as alternative interpretations of reality derived from the same set of events as the live performance or developed in their own right, then the creative potential of the recording and editing process becomes apparent, as recordings of wearable light have shown. In these recordings the human body can be present or absent to different degrees. Even if the body is absent in the recording, there is a sense of human presence in the imagery as the movement patterns typical for human beings imply their presence. In this sense one can speak of 'presence through absence' in recordings of wearable light.

The research contributed to the understanding of this difference between the experience of live performances and their recording in lens-based media as well as to the understanding of the creative potential of recordings as alternative as alternative interpretations of the same set of events and expressions of wearable light in their own right. Future research into alternative means of documentations such as three-dimensional representations might be undertaken, but currently the author does not see how the fundamental difference between the singularity of time-space experience in live performance versus the sequential and repeatable nature of time-space in recordings (Rye, 2003) can be overcome.

Even though recordings of wearable light can be construed as independent art works in their own right, three-dimensional representation is relevant for the practice of wearable light because it offers different viewing angles of the same event in one artefact. This is of importance to recordings of wearable light as the visual effects that can be perceived very much depend on the viewing point and angle.

The research also contributes to the understanding of limitations and possibilities posed by wearable energy sources such as miniature battery technologies by researching and applying them in new generations of wearable light features. The research suggests a potential for future technological developments that extend timelines for wearable energy supply and therefore provide the base for future generation of wearable light features.

Investigations of the implications of time-based boundaries to the practice of wearable light contributed to the identification and development of a complex performance art based on wearable light discussed in section 6.2.

6.5 Emergent Visual Language of Wearable Light

The research identified and developed a critical vocabulary of wearable light in response to the lack of criteria for the description and assessment of wearable light in the context of light and body.

While the review of literature such as the comprehensive overview of light art in Weibel, Jansen eds. (2006) and technical terms of stage lighting (Reid, 2001; Shelley, 2009) provided some insight into the description and evaluation of light and the body, the critical vocabulary evolved entirely in response to the practice-based research of this project. Consequently the terms of the emergent language and their classification are the author's own.

The elements of this vocabulary take the form of 'rich description' similar to those employed in ethnography. The elements therefore constitute building blocks of an as yet immature critical language of wearable light. The expansion and refinement of this vocabulary will be subject to future research.

While the 'rich descriptions' provide an element of assessment by drawing on reflective processes, their descriptive value outweighs their evaluative component. The development from a descriptive to a more critical language is thus still to be completed.

The elements of the emergent language were codified into a taxonomy that took into account technical and practice-based aspects as well as the impact of wearable light. This classification requires review, refinement and expansion in response to further practice-based research by the author and other practitioners. Investigations of wider contexts such as semiotics[287] might provide insights into the refinement of the taxonomy and move it towards a 'grammar' of wearable light.

While the author has reviewed and validated the critical vocabulary by applying it to practice case studies in the context review, the external review and validation will need to be taken forward for the current state of the critical language as well as for future iterations.

Although this emergent visual language is as yet immature, it contributes to knowledge for the practice of wearable light in jewellery as it facilitates the description and assessment of such practices. It also shows potential to be

[287] "Semiotics; the study of signs and symbols and their use or interpretation." (Oxford English Dictionary Online, 2011a [Internet])

transferred to other practices of wearable light that employ different media, such as performance, photography or filmmaking.

This original contribution to knowledge suggests future research in order to move to a more mature critical vocabulary. Once further developed this framework can be used by practitioners from a wide range of disciplines working with light and body as well as art and design historians and cultural critics. The researcher's practice will continue to use the emergent language for the description and evaluation of practice and develop it in response to future practice-based research.

6.6 Future Research

This research is characterized by its contributions to knowledge that can be applied and further developed by researchers and practitioners across a wide range of different disciplines in art and design such as jewellery, fashion, wearables, performance, fine art and lens-based media. The large scope for future research in relation to working with light and the body across these disciplines has been mapped out in sections 6.1 to 6.5. This section summarizes implications for future research and states intentions for the development of the author's future research within this context.

The development of the experimental, practice-based research methodology discussed as a central contribution to knowledge in 6.1 shows scope for future research in terms of review, refinement and validation through application to projects from a wide range of practice. However, in order to build this body of research a significant number of researchers will have to adopt the methodology developed in this project and extend it to their practice.

The significance of the methodology lies in the fact that it allows the development of practice-based research outcomes as well as practice outcomes that all contribute to knowledge for research and practice in art and design.

A specific aspect of the methodology was the role and management of collaborations and 'solo' projects in the research and their contribution to the extension of methods in the research process. This points towards future research into reflective practice that encourages and supports simultaneous multiple roles and facilitates the adaptation and extension of methodologies available to the researcher.

The research methodology developed in this project will form the foundation of all further research and practice by the author and indeed become a ‘drive motor’ for the development of future projects. Given the multiple reflective cycles built onto the research, the author expects the methodology to evolve over time in response to future projects and will publish these learning outcomes as future contribution to knowledge.

The research led to the identification and development of a complex performance art based on wearable light with two main modes: live performance and recordings in lens- based media. This original contribution to knowledge provides the foundation for further explorations by the author and by practitioners from various disciplines who might investigate this area in ways different from the author’s and therefore extend its scope.

For example, wearable light contributes a new dimension to the practice of installation work based on light as it simultaneously references the body as a site and as a carrier of light, and as an experiential medium. This outcome points to further research with regard to its impact in installation work and might be explored by other practitioners in different ways from the author’s.

The author’s own interest lies in the exploration of new environments and contexts for this complex performance art; this includes the design and manipulation of light environments. Future research will focus on the three-way interaction of ‘light-body-environment’ and explore their wider implications.

The practice of this performance art based in public settings can lead to ‘accidental performances’ as inadvertent social interventions. There is a moment of revelation when the audience happens upon the performance that raises questions about the characteristics of the experience for audience and protagonist alike. This contribution to the understanding of performance suggests future research into the effects of these ‘accidental performances’ on social interactions. While this area of research will not be a main focus of the author’s future research, it is relevant when taking wearable light into new public arenas and thereby creating social interventions.

Specific aspects of this performance art based on wearable light hold particular potential for the development of future research.

The recording and editing of wearable light in lens-based media offer opportunities for further investigation, for example (analogue) film-based media such as 16mm film hold potential with regard to the capture of colour and low light effects. Due to the technical complexity of film-based media,

long-term collaboration with a cinematographer would be required to investigate this area.

Digital editing techniques that allow the creation of new sets of imagery based on wearable light in post-production raise questions about differences in the characteristics and qualities of wearable light depending on the method of conception. This points to future research into the use of light on the body in virtual reality, which does not only represent a new medium, but a new context for wearable light. The author is currently exploring possibilities for future research projects in this context.

Research outcomes with regard to publication and exhibition of inherently transient, body-related practice suggest future research into new forms of output media that go beyond the two-dimensionality of conventional output media such as projection screens. Three-dimensional representation in is relevant for the author's practice because it offers different viewing angles of the same event in one artefact. This is of importance to recordings of wearable light as the visual effects that can be perceived very much depend on the viewing point and angle. In the first instance the author will draw on research of other practitioners already working in this area to develop an understanding of implications of new media for the publication of her own practice.

The research contributed to the definition and understanding of the body and its dynamic connection to the intimate space in its immediate vicinity; to the understanding of how the body relates to its surrounding area; to understanding of the passage and re-passage of body through space and of the space itself. These contributions to knowledge provide the foundation for the development of new generations of wearable light features.

These can take the form of experimental light features that provide fresh potential for their application and exploration in different contexts and media. The research outcomes can also be applied to create collections of 'light jewellery' for general consumption. The research contributed to a change in the understanding of what jewellery may be and how it can be used. This is a base for future generations of 'performance wear' employing wearable light to explore scope and increased capabilities of jewellery for the instigation and framing of perceptions and social interaction. Jewellers and/or performance artists might further explore this area of work.

The author's interest lies in developing future 'performance wear' for application and exploration in the performance art based on wearable light referred to above.

The research also contributes to the understanding of limitations and possibilities posed by wearable energy sources such as miniature battery technologies. The research suggests a potential for future technological developments that extend timelines for wearable energy supply and therefore provide the base for future generation of wearable light features.

Research outcomes indicate potential future product applications in therapeutic rehabilitation, personal safety or sportswear. Each of these applications requires collaborations with commercial partners in respective industries.

The research identified and developed a critical vocabulary to describe and evaluate wearable light in response to the lack of existing frameworks. These formed elements of an emerging visual language of wearable light that was codified a typology of characteristics and qualities of wearable light, *Descriptive Analysis Framework (DAF).*

This original contribution to knowledge suggests future research in order to develop a more mature critical language that includes evaluative components as well as expanding the current descriptive elements.

The author plans to investigate potential contributions from a wider context such as semiotics towards a 'grammar' of this critical language. Art and design practices that focus on light in a wider context might offer insights into expanding and developing the 'rich descriptions'. Also being considered is research into lighting in architectural environments and stage lighting. The former provides a large body of work and extensive commentary on light environments,[288] while the latter can contribute a wider reference to technical terminology as well as a critical component.[289]

The emerging critical language will need further external validation through application to a wide range of practices concerned with light and the body in art and design in order to review and refine the vocabulary. A mature language of wearable light will not only be valuable to art and design practices revolving around light and the body, but might also be of interest to art and design historians and cultural critics.

The author will continue to use this vocabulary for the description and evaluation of her practice and develop it in response to future research. The reflective cycles of the research methodology developed in this project will

[288] For example Steffy (2008) and Yee (2007).

[289] For example Reid (2001) and Cadena (2006).

facilitate the future emergence and refinement of elements of a critical language of wearable light from a practice-based perspective.

In summary, the experimental, practice-based research methodology developed in this research will form the foundation for the author's future practice; i.e. subsequent research will be conducted using this approach. Due to its reflective cycles the methodology can be expected to develop over time according to the content and nature of future projects. The author will publish developments of the methodology as future contributions to knowledge.

In terms of content, future research will develop the performance art based on wearable light established in this project. Projects will focus on specific aspects of this performance art and investigate how they impact on live performances of wearable light and on recordings in lens-based media. Of particular interest are the following aspects: new environments, contexts and media, new generations of wearable light features and new options for publication and exhibition of such inherently transient, body-related practice.

These projects will also contribute to the future development of the emerging visual language of wearable light. This practice-based research perspective will be complemented by investigations of critical context that might contribute to the review, refinement and validation of the critical vocabulary.

7 References and Bibliography

Chapter seven is divided in four sections. Primary sources in 7.1 present research material that has been produced in the course of the PhD project in terms of papers (7.1.1) and audio-visual media (7.1.2). Publications in 7.2 show all text-based material relevant to the research in print and online except primary sources. Audio-visual sources (7.3) refer to images, video and film material in print and online that are relevant to this research except primary sources. Other internet sources (7.4) indicate websites with information on artists, collaborators and organizations relevant to this thesis. Section (7.5) covers exhibitions, performances, lectures, conferences and symposia attended by the author that have had particular impact on the PhD research.

7.1 Primary Sources

7.1.1 Primary Sources: Papers

Oberlack, U. (2004a) I+E illumination + emanation; light as body adornment. Paper for the registration of the PhD thesis. Unpublished. London: University of the Arts London

Oberlack, U. (2004b) I+E illumination + emanation; light as body adornment. Application for a doctoral award by the Arts and Humanities Research Board. Unpublished. London: University of the Arts London

Oberlack, U. (2005) I+E illumination + emanation; light as body adornment. Paper presented at Wearable Futures; hybrid culture in the design and development of soft technology. Conference. Newport: University of Wales. September 2005

Oberlack, U. (2006a) Light / body / memory; wearable light in the context of Radiance Topos. Invited presentation to MA Dance, University of Surrey. Unpublished. Guildford: University of Surrey. January 2006

Oberlack, U. (2006b) I+E illumination + emanation; light as body adornment. Paper for the confirmation the PhD project. Unpublished. London: University of the Arts London

Oberlack, U. (2007) Investigating light as body adornment; creating new forms of aesthetic expression?. Paper presented at NeoCraft; international conference on the crafts and modernity. Conference. Halifax, CA: Nova Scotia College of Art and Design. November 2007

Oberlack, U. (2008) Investigating wearable light. Invited presentation to MA Fine Art, Central Saint Martins College of Art and Design. Unpublished. London: Central Saint Martins College of Art and Design. January 2008

7.1.2 Primary Sources: Audio-Visual Media

Alight. (2004) Video of performance at the Victoria & Albert Museum, London. 28 February 2004. Directed by Ulrike Oberlack. London. 5 min.

I+E illumination + emanation; light as body adornment. (2005) Video. Directed, edited by Ulrike Oberlack. London. 5 min.

Body-Light-Scapes. (2006) Video. Directed, edited by Ulrike Oberlack with images by Rob Popper. London. 3min.

Re-Incarnations: Light Wear. (2006) Video of performance at Carry the Can, international bi-annual conference of the Association of Contemporary Jewellery (ACJ), London. 8 July 2006. Directed, edited by Ulrike Oberlack with images by Frank Leopold. London. 3min.

Light-Space-Body: Outcomes. (2007) Video. Directed, edited by Ulrike Oberlack. London. 5min.

Light-Space-Body: Process. (2007) Video. Directed, edited by Ulrike Oberlack. London. 15min.

New Arenas: Snow and Water. (2008) Video. Directed, edited by Ulrike Oberlack. London. 4min.

Radiance: Outcomes. (2009) Video. Directed, edited by Ulrike Oberlack. London. 20min.

Radiance: Process. (2009) Video. Directed, edited by Ulrike Oberlack. London. 10min.

Sensing Change: Outcomes. (2009) Directed, edited by Ulrike Oberlack. London. 4min.

Sensing Change: Process. (2009) Directed, edited by Ulrike Oberlack. London. 3min.

I+E illumination + emanation; light as body adornment and the implications of wearable light. (2009) Video. Directed, edited by Ulrike Oberlack. London. 8min.

7.2 Publications

Alvesson, M., Sköldberg, K. (2000) Reflexive methodology. London: Thousand Oaks, New Delhi: Sage

Animal Pictures Archive (2009) Ectoplasm jellyfish. [Internet] Available from <http://www.animalpicturesarchive.com/view.php?tid=3&did=27282&lang=kr> [Accessed 30 Mar 2009]

Antoniades, A. C. (1992) Poetics of architecture: theory of design. New York: John Wiley & Sons

A Passion for Jazz (2010) Glossary of jazz terms. [Internet] Available from <http://www.apassion4jazz.net/glossary4.html> [Accessed 21 October 2010]

Apple (2009) Final Cut Pro Express. [Internet] Available from <http://www.apple.com/finalcutexpress/> [Accessed 10 May 2009]

Apple (2010) iMovie. [Internet] Available from <http://www.apple.com/ilife/imovie> [Accessed 20 May 2010]

Arnheim, R. (1974) Art and visual perception; a psychology of the creative eye. Berkeley, CA: University of California Press

Artnet (2009) Gesamtkunstwerk. [Internet] Available from <http://www.artnet.com/library/03/0317/T031798.asp> [Accessed 20 Jun 2009]

Astfalck, J. (2005) Jewellery as a fine art practice. In Grant, C. ed. (2005) New directions in jewellery; essays by Jivan Astfalck, Caroline Broadhead and Paul Derrez. London: Black Dog Publishing, pp. 18-24

Atkinson, P. et. al. eds. (2001) Handbook of ethnography. London: Sage

Bailey, M.J. (1988) Those glorious glamour years; classic Hollywood costumes of the 1930's. London: Columbus

Bachelard, G. (1971) The poetics of reverie; childhood, language and the cosmos. Boston, MA: Beacon Press. Translation of: La poétique de la rêverie (1960) Paris: Presses Universitaire de France

Bachelard, G. (1994) The poetics of space. Boston, MA: Beacon Press. First published (1964) NewYork: Orion Press. Translation of: La poétique de l'espace (1958) Paris: Presses Universitaire de France

Barrett, E., Bolt, B. (2007) Practice as research; approaches to creative arts enquiry. London: I.B.Tauris

Bauhaus (2010) Bühne. [Internet] Available from <http://www.bauhaus.de/bauhaus1919/buehne1919.html> [Accessed 13 June 2010]

Berger, J. (2008) Ways of seeing. London: Penguin. First published (1972) London: British Broadcasting Corporation

Biggs, M. (2000) Editorial: the foundations of practice-based research. Working papers in art and design, vol.1. [Internet] Available from <http://sitem.herts.ac.uk/artdes_research/papers/wpades/vol1/vol1intro.html> [Accessed 25 April 2011]

Biggs, M. (2004) Learning from experience: approaches to the experiential component of practice-based research. In Forskning, Reflektion,Utveckling. (2004) Stockholm: Vetenskapsrådet, pp. 6-21. [Internet] Available from <http://www.herts.ac.uk/artdes/research/tvad/mb/2004a.pdf> [Accessed 12 April 2006]

Birmingham City University; School of Jewellery (2008) Masters and protégés; contemporary British jewellery. Exhibition Catalogue. Birmingham: Birmingham City University

Bishop, C. (2008) Installation art; a critical history. London: Tate Publishing. First published (2005) London: Tate Publishing

Black Light Theatre (2010a) Black light theatre; history. [Internet] Available from <http://blacklight-theatre.com/a_history.html> [Accessed 13 June 2010]

Black Light Theatre (2010b) Black light theatre; know how. [Internet] Available from <http://blacklight-theatre.com/a_know_how.html> [Accessed 13 June 2010]

Brett, D. (1992) C.R. Mackintosh; the poetics of workmanship. London: Reaktion Books

Brett, G. et al. eds. (2000) Force fields; phases of the kinetic. Exhibition Catalogue. Barcelona: Museu d'Art Contemporani (MACBA)

Bristol City Museum and Art Gallery (2004) Jewellery unlimited; an exhibition of original and challenging contemporary jewellery. Bristol: Bristol City Museum and Art Gallery, in association with Bristol: Association of Contemporary Jewellery

British Theatre Guide (2011) Sharkstooth gauze. [Internet] Available from <http://www.britishtheatreguide.info/otherresources/glossary/glossgi.htm> [Accessed 20 April 2011]

Britton Newell, L. (2007) Out of the ordinary; spectacular craft. London: V&A Publications

Broadhead, C. (2005) A part / apart. In Grant, C. ed. (2005) New directions in jewellery; essays by Jivan Astfalck, Caroline Broadhead and Paul Derrez. London: Black Dog Publishing, pp. 25-35

Brown, B. et al. (2004) Types of research in the creative arts and design. [Internet] Available from <http://www.brighton.ac.uk/arts/research/5_0_scholarly_infrastructure/5_6_0_epapers/4_research.pdf> [Accessed 29 April 2006]

Bugg, F. (1997) Researching the crafts; initial approaches to historical, critical and theoretical studies. Crafts Council research guide. London: Crafts Council

Bunnell, K. (1998) Re:presenting making; the integration of new technology into ceramic designer-maker practice. Aberdeen: The Robert Gordon University

Buzan, T. (1974) Use your head. London: BBC Publications

Buzan, T., Buzan, B. (2003) The mind map book. Revised edition. First published (1993) London: BBC Worldwide Ltd

Cadena, R. (2006) Automated lighting; the art and science of moving light in theatre, live performance, broadcast and entertainment. Amsterdam, London: Focal Press

Caelli, T. (1981) Visual perception; theory and practice. Oxford: Pergamon

Californian Board of State Education (2009) Visual and performing arts; dance content standards, glossary. [Internet] Available from <http://www.cde.ca.gov/BE/ST/SS/daglossary.asp> [Accessed 10 June 2009]

Central Saint Martins College of Art and Design (2011) Lethaby Gallery London. [Internet] Available from <http://www.csm.arts.ac.uk/csm_lethaby.htm> [Accessed 20 April 2011]

Cheung, L. (2006) Wear, wearing, worn; the transition of jewels to jewellery. In Sackville, A., Broadhead, M. eds. (2006) New directions in jewellery II. London: Black Dog Publishing, pp. 12-23

Classical Works (2010) Glossary of musical terms. [Internet] Available from <http://www.classicalworks.com/html/glossary.html> [Accessed 21 October 2010]

ClickZ (2009) Geek Chic. [Internet] Available from <http://www.clickz.com/837221> [Accessed 10 Jun 2009]

CNET UK (2009) CNET UK Expert Tech Reviews. [Internet] Available from <http://www.cnet.co.uk> [Accessed 10 Jun 2009]

Collection Tate (2009) Memento Mori. [Internet] Available from <http://www.tate.org.uk/collections/glossary/definition.jsp?entryId=162> [Accessed 03 June 2009]

Cowan, J. (1998) On becoming an innovative university teacher; reflection in action. Maidenhead: SRHE/Open University Press

Crafts Council Gallery (1980) Susanna Heron; bodywork exhibition. Exhibition catalogue. London: Crafts Council Gallery

Cunningham, P. A., Voso Lab, S. eds. (1991) Dress and popular culture. Bowling Green, Ohio: Bowling Green State University Popular Press

Current, R. N. / Current, M. E. (1997) Loie Fuller; goddess of light. Boston: Northeastern University Press

Dagognet, F. (1992) Etienne-Jules Marey; a Passion for the Trace. New York: Zone Books. Translated edition by Robert Galeta. Cambridge, MA: MIT Press

Dormer, P., Turner, R. (1985) The new jewelry; trends and traditions. London: Thames & Hudson

Derrez, P. (2005) Jewellery? What jewellery are we actually talking about? In Grant, C. ed. (2005) New directions in jewellery; essays by Jivan Astfalck, Caroline Broadhead and Paul Derrez. London: Black Dog Publishing, pp.11-17

Drutt English, H., Dormer, P. (1995) Jewelry of our time; art, ornament, obsession. London: Thames & Hudson

DukeMedNews (2005) Light therapy may combat fungal infections, new evidence suggests. [Internet] Available from <http://www.dukemednews.duke.edu/news/article.php?id=8455> [Accessed 10 December 2008]

Elger, D. (2006) Light as metaphor: art with neon. In Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz, pp. 490-525

Encyclopedia Britannica Online (2009) Auteur theory. [Internet] Available from <http://www.britannica.com/EBchecked/topic/44609/auteur-theory> [Accessed 9 July 2009]

Encyclopedia Britannica Online (2010) Poetry. [Internet] Available from < http://www.britannica.com/EBchecked/topic/466108/poetry> [Accessed 12 December 2010]

Erlandson, D.A. et.al (1993) Doing naturalistic inquiry; a guide to methods. Newbury Park, London, New Delhi: Sage

Fahey, D., Klein Devlin, R. (2005) Bill Brandt. [Internet] Available from <http://http.www.faheykleingallery.com/featured_artists/brandt/brandt_frames.htm> [Accessed 20 December 2008]

Frampton, K. (1995) Studies in tectonic culture; the poetics of construction in nineteenth and twentieth century architecture. Chicago, IL: Graham Foundation for Advanced Studies in the Fine Arts, Cambridge, MA, London: MIT Press

Getty Museum (2006a) Getty Museum Online Guide. [Internet] Available from <http://www.getty.edu/art/gettyguide/artMakerDetails?maker=3793&page=2> [Accessed 20 Feb 2006]

Getty Museum (2006b) Lucas Samaras. [Internet] Available from <http://www.getty.edu/art/gettyguide/artMakerDetails?maker=3793&page=2> [Accessed 23 Feb 2006]

Gibb Dyer, W., Wilkins, A.L. (1991) Better Stories, Not Better Constructs, to Generate Better Theory; A Rejoinder to Eisenhardt. In The Academy of Management Review, vol. 16 no. 3 pp. 613-619

Govan, M., Bell, T. (2005) Dan Flavin: the complete lights 1961-1996. New York: Dia Art Foundation in association with New Haven, London: Yale University Press

Grant,C. ed. (2005) New directions in jewellery; essays by Jivan Astfalck, Caroline Broadhead and Paul Derrez. London: Black Dog Publishing

Gray, C., Malins, J. (2004) Visualizing research; a guide to the research process in art and design. Aldershot, UK, Burlington, USA: Ashgate Publishing Ltd.

Greenhalgh, P. ed. (2000) Art Nouveau 1890 – 1914. London: V&A Publications

Greenhalgh, P. ed. (2002) The persistence of craft; the applied arts today. London: A&C Black

Greenspun, P. (2007) Studio photography. [Internet] Available from <http://photo.net/learn/studio/primer> Accessed [20 April 2011]

Grindon, L. (2007) Q&A; poetics of the documentary film interview. The Velvet Light Trap no. 60 Fall 2007 pp. 11-12

Gropius, W. ed. (1961) The theatre of the Bauhaus. Middletown: Wesley University Press

Hackley, C. (2003) Doing research projects in marketing, management and consumer research. London; New York: Routledge

Hayward Gallery (2005) Dan Flavin; a retrospective. Exhibition leaflet. London: Hayward Gallery

Hedley, G. (1995) Julia Manheim; the shifting emphasis. Exhibition catalogue. London: Bellew Publishing Co. in collaboration with Bury St. Edmunds: Bury St. Edmunds Art Gallery

Heron, S., Ward, D. (1983) The jewellery project; new departures in British and European jewellery 1980-83. Exhibition catalogue. London: Crafts Council Gallery

Hill, P. (2001) Eadweard Muybridge. London: Phaidon

Howard, P. (2002) What is scenography?. London: Routledge

Jansen, G., Beitin, A. (2006) The stuff of which luminaries are made; the fluorescent tube as minimalist principle in light art. In Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz, pp. 526-553

Joris, Y.G.J.M. ed. (2005) Gijs Bakker and jewellery. Stuttgart: Arnoldsche Art Publishers

Kader, A. (2000) The concentrated essence of a wiggle; Art Nouveau sculpture. In Greenhalgh, P. ed. (2000) Art Nouveau 1890 – 1914. London: V&A Publications, pp. 250-263

Kearney, R. (1998) Poetics of imagining; modern to postmodern. Edinburgh: Edinburgh University Press

Kleinman, K. (2009) Introduction. In Turnovsky, J. (2009) The poetics of a wall projection. London: Architecture Association London, pp. 3-15

Kolb, D. (1984) Experiential learning; experience as the source of learning and development. Englewood Cliffs, NJ: Prentice Hall

Laurence, R. (2005) Electrifying art; Atsuko Tanaka 1954-1968. [Internet] Available from <http://www.straight.com/content.cfm?id=8508> [Accessed 10 December 2008]

Lee, S. (2005) Fashioning the future; tomorrow's wardrobe. Images by Warren du Preez, Nick Thornton Jones. London: Thames & Hudson

Lindberg Slayter Reconstructions (2007) Loie Fuller. [Internet] Available from <http://lsreconstructions.org/bio/loie-fuller> [Accessed 10 October 2010]

Lifson, B., Samaras, L. (1988) Samaras. New York: Aperture

Lundberg, A. (2008) Material poetics of a Malay house. The Australian Journal of Anthropology, vol. 19 issue 1 pp. 1-16

Malins, J., Gray, C. (1995) Appropriate research methodologies for artists, designers & craftspersons: research as a learning process. Aberdeen: The Centre for Research in Art & Design, Faculty of Design, Gray's School of Art, The Robert Gordon University

Merriam Webster Online (2011) Poetic. [Internet] Available from < http://www.merriam-webster.com/dictionary/poetic> [Accessed 12 December 2010]

Miller, N. K., ed. (1986) The poetics of gender. Conference proceedings. New York, Guildford: Columbia University Press

Ming, T. (2005) Electrifying painting. Essay accompanying: Electrifying art; Atsuko Tanaka 1954-1968. Exhibition. Vancouver: The Morris and Helen Belkin Gallery [Internet] Available from <http://www.belkin-gallery.ubc.ca/webpage/pastex/tanaka/ ming.html> [Accessed 27 April 2006]

Minton, S.C. (2007) Choreography; a basic approach using improvisation. 3rd ed. Champaign, IL: HumanKinetics

Mitoma, J. ed. (2003) Envisioning dance on film and video. New York, London: Routledge

Moon, J. (2003) Learning journals. Presentation at Reflective Writing workshop, The London Institute. Unpublished. Available via Exeter University email <j.moon@exeter.ac.uk> London: The London Insitute. 27 November 2003

Musée Départemental d'Art Contemporain Rochechouart (2007) Anthony McCall; elements for a retrospective, 1972-1979, 2003-. Exhibition catalogue in association with London: Serpentine Gallery. Blou: Monografik Editions

Museu d'Art Contemporani (2000) Force Fields: phases of the kinetic. Exhibition catalogue. Barcelona: Museu d'Art Contemporani (MACBA) in association with London: Hayward Gallery

Museum Het Kruithuis ed. (1993) Gebroken lijnen / broken lines; Emmy van Leersum, 1930-1984. 's Hertogenbosch: Museum Het Kruithuis, in association with Ghent: Snoeck-Ducaju & Zoon

Muthesius, S. (2009) The poetic home; designing the 19th century domestic interior. London: Thames & Hudson

Muybridge, E. (1955) The human figure in motion. New York: Dover Publications

Ober, J. ed. (1982) The recurring theme; Susanna Heron. Exhibition catalogue. Apeldoorn: Gem. Reekummuseum

Oberlack, U. (2002) I+E illumination + emanation; light as body adornment. MA Thesis. London: Central Saint Martins College of Art and Design

Oberlack, U. (2010) PhD research. In Fraser, S., Oberlack, U. (2010) intimatearchitecture.org. [Internet] Available from <http://www.intimatearchitecture.org/?page_id=6> [Accessed 20 April 2011]

Obermaier, K. (2006) Exile. [Internet] Available from <http://www.exile.at> [Accessed 29 Mar 2006]

Olver, L. (2002) The art of jewellery design; from idea to reality. London: A&C Black

Orna, E., Stevens, G. (1995) Managing information for research. Buckingham, UK; Bristol, UK: Open University Press

Oxford English Dictionary Online (2009) Ectoplasm. [Internet] Available from <http://www.oxforddictionaries.com/view/entry/m_en_gb0255610#m_en_gb0255610> [Accessed 30 March 2009]

Oxford English Dictionary Online (2010) Kinaesthesia. [Internet] Available from <http://oxforddictionaries.com/view/entry/m_en_gb0443660#m_en_gb0443660.003> [Accessed 12 December 2010]

Oxford English Dictionary Online (2011) Poetic. [Internet] Available from <http://www.oxforddictionaries.com/view/entry/m_en_gb0642830#m_en_gb0642830> [Accessed 20 April 2011]

Oxford English Dictionary Online (2011a) Semiotics. [Internet] Available from < http://oxforddictionaries.com/view/entry/m_en_gb0754040#m_en_gb0754040> [Accessed 22 April 2011]

Palmer, A. (1991) Paper clothes; not just a fad. In Cunningham, P. A., Voso Lab, S. eds. (1991) Dress and popular culture. Bowling Green, Ohio: Bowling Green State University Popular Press, pp. 85-105

Pavitt, J. (2004) Brilliant; lights & lighting. London: V&A Publications

Polanyi, M. (1997) The tacit dimension. In Prusak, L. (1997) Knowledge in organizations. Oxford: Butterworth-Heinemann, pp. 135-147

Popper, F. (2006) Light Kinetics. In Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz, pp. 424-447

Preston-Dunlop, V. M. (2002) Dance and the performative; a choreographical perspective; Laban and beyond. London: Verve

Prusak, L. (1997) Knowledge in organizations. Oxford: Butterworth-Heinemann

Rancière, J. The names of history; on the poetics of knowledge. Minneapolis: University of Minnesota Press

Reid, F. (2001) The stage lighting handbook. 6th edition. London: A&C Black

Renov, M. (1993) Towards a poetics of documentary. In: Renov, M. ed. Theorizing Documentary. New York: Routledge, pp.12-35

Renov, M. ed. (1993) Theorizing Documentary. New York: Routledge

Rhodes, B. (2011) A brief history of wearable computing. [Internet] Avaliable from: <www.media.mit.edu/wearables/lizzy/timeline.html> [Accessed 20 April 2011]

Riklin-Schilbert, A. (1999) Schmuckzeichen Schweiz 20. Jahrhundert; 20th century Swiss art jewelry. St.Gallen: VGS Verlagsgemeinschaft St.Gallen

Robson, C. (1993) Real world research. Oxford, UK, Cambridge, USA: Blackwell

Rosco (2011) Rosco colour gel. [Internet] Available from <http://www.rosco.com/uk/technotes/filters/perma_rlux_crc.cfm> [Accessed 20 April 2011]

Rossing, T.D., Chiaverina, C.J. (1999) Light science; physics and the visual arts. New York: Springer

Rust, C. et al. (2005) Research review; practice-led research in art, design and architecture; project overview. [Internet] Available from <http://aces.shu.ac.uk/ahrc/ahrcreview/projectinfo/overview.html> [Accessed 12 April 2006]

Rye, C. (2003) Incorporating Practice: A multi-viewpoint approach to performance documentation. [Internet] Available from < http://www.bristol.ac.uk/parip/s_cr.htm> [Accessed 12 June 2009] Reproduced with permission from Journal of Media Practice, vol. 3 no. 2 pp. 115-123

Sackville, A., Broadhead, M. eds. (2006) New directions in jewellery II. London: Black Dog Publishing

Sanderson, A. (2002) Night photography. New York: Amphoto. First published (2001) London: Argentum

Sandino, L. (2002) Studio jewellery; mapping the absent body. In Greenhalgh, P. ed. The persistence of craft; the applied arts today. London: A&C Black, pp. 107-117

Schlemmer, O. (2003) Mensch und Kunstfigur. In Schlemmer, O., Moholy-Nagy, L., Molnar, F. (2003) Die Bühne im Bauhaus. Berlin: Gebr. Mann Verlag, pp. 7-43

Schlemmer, O., Moholy-Nagy, L., Molnar, F. (2003) Die Bühne im Bauhaus. Neue Bauhausbücher. Berlin: Gebr. Mann Verlag. First published (1925) Munich: A. Langen

Schoen, D. (1991) The reflective practitioner; how professionals think in action. Aldershot, UK, Burlington, USA: Ashgate Publishing Ltd.

Schubert, E. F. (2003) Light-emitting diodes. Cambridge: Cambridge University Press

Scrivener, S. (2004) The practical implications of applying a theory of practice based research: a case study. Working papers in art and design, vol. 3. [Internet] Available from <http://sitem.herts.ac.uk/artdes_research/papers/wpades/vol3/ssabs.html> [Accessed 25 April 2011]

Sennett, T. (1981) Hollywood musicals. New York: Harry N. Abrams, Inc.

Serpentine Gallery (2007) Anthony McCall 30 November 2007 – 3 February 2008 London. [Internet] Available from <http://www.serpentinegallery.org/2007/04/anthony_mccall december_2007_ja.html> [Accessed 29 August 2008]

Shelley, S. L. (2009) A practical guide to stage lighting. Amsterdam, Burlington, MA: Focal Press

Shorr, M. ed. (1968) Body covering. Exhibition catalogue. New York: Museum of Contemporary Crafts

Sulcas, R. (2007) All the right moves. New York Times, 30 Aug 2007 [Internet] Available from <http://www.nytimes.com/2007/08/30/arts/dance/30nota.html> [Accessed 20 May 2009]

Stead, L. J. (2005) The emotional wardrobe; a fashion perspective on the integration of technology and computing. PhD thesis. London: Central Saint Martin's College of Art and Design

Steffy, G. (2008) Architectural lighting design. New York: John Wiley & Sons, Inc.

Sternberg, M. ed. Poetics Today; international journal for theory and analysis of literature and communication. Journal. Durham, NC: Duke University Press

Taylor, R., Eikhenbaum, B. M. (1982) The poetics of cinema. Oxford: RPT Publications

The Columbia Encyclopedia (2004) Perception. Excerpt from sixth edition. New York: Columbia University Press. [Internet] Available from <http://www.questia.com/library/ psychology/visual-perception.jsp> [Accessed 20 May 2009]

The Creators Project (2010) Original creators; Diana Dew. [Internet] Available from <http://www.thecreatorsproject.com/en-uk/blog/original-creators-diana-dew> [Accessed 13 June 2010]

The Oxford Dictionary of Art (2004) Gesamtkunstwerk. Oxford: Oxford University Press. [Internet] Online version available from eNotes.com (2006) <http://www.enotes.com/oxford-art-encyclopedia/ gesamtkunstwerk> [Accessed 20 April 2011]

Tudor, A. (1974) Theories of film. New York: Viking Press

Turnovsky, J. (2009) The poetics of a wall projection. London: Architecture Association London. Translation of: Die Poetik eines Mauervorsprungs (1985) Braunschweig, Wiesbaden: Friedr. Vieweg und Sohn

Tzonis, A. (1986) Classical architecture; the poetics of order. Cambridge, MA: MIT Press

Valsiner, J. (2002) Ethnography lost and found; qualitative methodology between science, art, and social powers. In FQS Forum; Qualitative Social Research; Sozialforschung, vol. 3 no. 2 art. 29. [Internet] Available from <http://www.qualitative-research.net/index.php/fqs/ article/view/875/1902> [Accessed 12 June 2009]

Van Rees, K. ed. Poetics; journal of empirical research on culture, the media and the art. Journal. Amsterdam: Elsevier

Von Graevenitz, A. (1993) Instruments of radical thinking. In Museum Het Kruithuis ed. (1993) Gebroken lijnen / Broken lines; Emmy van Leersum, 1930-1984. 's Hertogenbosch: Museum Het Kruithuis, in association with Ghent: Snoeck-Ducaju & Zoon pp. 13-26

Ward, D. (1983) Work in the collection; a broader context and related activities. In Heron, S., Ward, D. (1983) The jewellery project; new departures in British and European jewellery 1980-83. Exhibition catalogue. London: Crafts Council Gallery pp. 7-13

Watkins, D. (1999) Jewellery design sourcebook. London: New Holland Publishers (UK) Ltd.

Weibel, P. (2006) The development of light art. In Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz pp. 86-223

Weibel, P. (2006a) Ars Lucis Lichtkunst aus Kunstlicht; Ars Lucis light art from artificial light. In Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz pp. 224-407

Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz

Weibel, P., Janssen, G. (2006a) Light as a medium of art; preface. In Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz pp. 26-43

Wikipedia (2009) Ectoplasm (paranormal). [Internet] Available from <http://en.wikipedia.org/wiki/Ectoplasm_(paranormal)> [Accessed 30 March 2009]

Williams, M. (2003) Making sense of social research. London et al.: Sage

Wright, T. (2008) Visual impact: culture and the meaning of images. Oxford: Berg

Wosk, J.(2001) Women and the Machine. Baltimore, London: The John Hopkins University Press

Woolley, M. (2000) Distinction between practice-based and practice-led research. In Research into Practice. Conference proceedings. Hertford UK: University of Hertfordshire

Yee, R. (2007) Lighting spaces; the art and science of architectural lighting. New York: Visual Reference Books

Yen, C-C., Woolley, M., Hsieh, K-J. (2002) Action case research; a method for the accumulation of design theory/practice knowledge in practice. In Working Papers in Art and Design, vol. 2. [Internet] Available from <http://www.herts.ac.uk/artdes/research/ papers/wpades/vol2/yenfull.html> [Accessed 30 Mar 2009]

ZKM Zentrum fuer Kunst und Medien (2005) Lichtkunst aus Kunstlicht; curatorial concept of the exhibition. [Internet] Available from <http://hosting.zkm.de/lichtkunst/stories/storyReader$7> [Accessed 10 December 2008]

Zyman, D. (2006) On 'making-room' or how seeing takes place in a light space. In Weibel, P., Jansen, G. eds. (2006) Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. ZKM Publikationen. Ostfildern: Hatje Canz pp. 466-489

7.3 Audio-Visual Sources

Apparition (2004) Obermaier, K. [Online Image] Available from <http://www.exile.at/apparition> [Accessed 29 Mar 2006]

The Changing Room (2008) Brown, C. [Online image] Available from <http://www.carolbrowndances.com/archive.php> [Accessed 10 December 2008]

Chromalive (2006) Chroma Light Therapy. [Online Image] Available from <http://www.chromalighttherapy.com/applications.html> [Accessed 26 Apr 2006]

Communicating Rings (2002) Gratiot-Stoeber, N. [Online Image] Available from <http://www.kishku.com/projects/images/kishku_wp_explorations.jpg> [Accessed 28 Mar 2006]

Dave (2000) Obermaier, K., Haring, C. [Online Image] Available from <http://www.exile.at/dave> [Accessed 29 Mar 2006]

Electric Dress (1956) Tanaka, A. [Online Image] Available from <http://www.belkin-gallery.ubc.ca/webpage/pastex/tanaka/fig.html> [Accessed 27 April 2006]

Fire Dance (1901) Film. Directed by Loie Fuller. USA. 5 min. Hand-coloured. [Internet] Available from <http://www.imdb.com/name/nm0298291/filmotype> [Accessed 10 December 2008]

Imagine. Let there be light. (2008) Presented by Alan Yentob. London: BBC. 11 November 2008. 80 min. [Internet] Available from <http://www.bbc.co.uk/iplayer> [Accessed 08 December 2008] Information about the series and the episode [Internet] Available from <http://www.bbc.co.uk/imagine/let_there_be _light.shtml> [Accessed 10 December 2008]

In Daylight and Cool White (1979) Documentary film. Directed by Michael Marton. New York: Artist Rights Society. 29 min. Colour.

LED Safety Light (2006) Battery Shed. [Online Image] Available from <http//:www.battery-shed.co.uk/acatalog/trcy-headsprint.jpg> [Accessed 22 April 2006]

Le lys de la vie (1920) Film. Directed by Loie Fuller, Georgette Sorrèrre. France. 6 min. Black & white. [Internet] Available from <http://www.imdb.com/name/nm0298291/filmotype> [Accessed 10 December 2008]

Lichtkunst aus Kunstlicht (2005) Video documentation of Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. Exhibition. Karlsruhe: ZKM Museum fuer Neue Kunst. 50 min.

Nude (1951) Brandt, B. [Online Image] Avaliable from <http.www.faheykleingallery.com/ images/photographs/brandt_b/brandt_22_bg.jpg> [Accessed 20 Mar 2006]

Nude (1952) Brandt, B. [Online Image] Avaliable from <http.www.vam.ac.uk/images/image/5039-large.jpg> [Accessed 20 Mar 2006]

Readings collection SS 2008 (2008) Chalayan, H. [Online Image] Avaliable from <http://www.husseinchalayan.com/#/past_collections.2008.2008_s_s_readings.34> [Accessed 15 Dec 2008]

Reflective Clothing (2006) Webbikeworld. [Online Image] Available from <http://www.webbikeworld.com/women- motorcycle-clothing/g-line/reflective.jpg> [Accessed 22 April 2006]

Samaras (1988) Samaras, L. [Online Image] Available from <http://www.amazon.com/gp/product/images/0893812412/ref=dp_image_0/002-90298.htm> [Accessed 22 April 2006]

Seasonal Affective Disorder (2006) Bio-Light. [Online Image] Available from <http://www.bio-light.com/images/LighttherapySBeditPS92cropHP400.jpg> [Accessed 26 April 2006]

Vein2 (2002) Fusakul, S. M. [Online image] Available from <http://beverlytang.com/photos/moi_fusakul.jgp> [Accessed 24 Mar 2006]

7.4 Other Internet Sources

Ben-Jacov, N. (2009) Noam Ben Jacov. [Internet] Netherlands. Available from <http://www.noamben-jacov.nl> [Accessed 10 June 2009]

Bonachela, R. (2009) Rafael Bonachela. [Internet] United Kingdom. Available from <http://www.rafaelbonachela.com> [Accessed 29 Apr 2009]

Brown, C. (2008) Carol Brown. [Internet] United Kingdom. Available from <http://www.carolbrowndances.com> [Accessed 10 December 2008]

Bugg, J. (2009) Jessica Bugg. [Internet] United Kingdom. Available from <http://www.ucreative.ac.uk/index.cfm?articleid=9728> [Accessed 29 Apr 2009]

Chalayan, H. (2011) Hussein Chalayan. [Internet] United Kingdom. Available from <http://www.husseinchalayan.com> [Accessed 20 April 2011]

Chroma Light Therapy Chroma light therapy. [Internet] Germany. Available from <http://www.chromalighttherapy.com/applications.html> [Accessed 10 December 2008]

Cybernetic Intelligence Research Group CIRG (2009) Cybernetic Intelligence Research Group CIRG. [Internet] United Kingdom. Available from <http://www.reading.ac.uk/cirg/cirg-manmachine.asp> [Accessed 10 Jun 2009]

Fraser, S., Oberlack, U. (2010) Intimate architecture. [Internet] United Kingdom. Available from <http://www.intimatearchitecture.org> Accessed [20 April 2011]

Graphic Design Forum (2009) Graphic design forum. [Internet] USA. Available from <http://www.graphicdesignforum.com> [Accessed 14 Jun 2009]

Heron, S. (2011) Susanna Heron. [Internet] United Kingdom. Available from <http://www.susannaheron.com> [Accessed 20 April 2011]

Human Interface Technology Lab (HITL) (2009) Human Interface Technology Lab (HITL). [Internet] USA. Available from <http://www.hitl.washington.edu/home> [Accessed 10 Jun 2009]

Jewellery Unlimited (2009) Jewellery Unlimited. [Internet] United Kingdom. Available from <http://www.jewellery-unlimited.org.uk> [Accessed 29 Apr 2009]

Kashihara, E. (2006) Erina Kashihara. [Internet] Japan. Available from <http://www. ne.jp/asahi/k-one/space/englisherina1.htm> [Accessed 20 Feb 2006]

Khoo, M. (2009) Mavin Khoo. [Internet] United Kingdom. Available from <http://www.mavinkhoodance.co.uk> [Accessed 29 Apr 2009]

Lightpainting Photography (2011) Lightpainting photography. [Internet] USA. Available from <http://lightpaintingphotography.com> Accessed [20 April 2011]

PARIP Practice as Research in Performance (2009) PARIP Practice as Research in Performance. [Internet] United Kingdom. Available from <http://www.bris.ac.uk/parip/faq.htm> [Accessed 12 Jun 2009]

Ramsgard Thomsen, M. (2006) Mette Ramsgard Thomsen. [Internet] Danmark. Available from <http://www.esc-design.info> [Accessed 22 Feb 2006]

Richards, D. (2009) Derek Richards. [Internet] United Kingdom. Available from <http://archive.futuresonic.com/sensesonic /archive/DEREK/msg-0001.html> [Accessed 29 Apr 2009]

Riskin, S. (2011) Seth Riskin. [Internet] USA. Available from <http://www.sethriskin.com> [Accessed 20 April 2011]

SAD Lighting (2006) Seasonal Affective Disorder Treatment. [Internet] United Kingdom. Available from <http://www.sad-lighting.co.uk/treatment> [Accessed 26 April 2006]

Sonar Project (2009) Sonar Project UK. [Internet] United Kingdom. Available from <http://www.sonarproject.org.uk> [Accessed 03 Jun 2009]

Stelarc (2009) Stelarc. [Internet] Australia. Available from <http://www.stelarc.va.com.au> [Accessed 10 Jun 2009]

Studio5050 (2011) Studio5050. [Internet] USA. Available from <http://www.5050ltd.com> [Accessed 20 April 2011]

The Lightbox (2009) The Lightbox. [Internet] United Kingdom. Available from <http://www.thelightbox.org.uk> [Accessed 05 May 2009]

The Place (2011) The Place. [Internet] United Kingdom. Available from <http://www.theplace.org.uk> [Accessed 20 April 2011]

Union Dance (2009) Union Dance. [Internet] United Kingdom. Available from <http://www.uniondance.co.uk> [Accessed 29 Apr 2009]

USC; ACL Project Prevent (2009) USC; ACL Project Prevent: working to reduce ACL injuries. [Internet] USA. Available from <http://pt.usc.edu/ACLprojectprevent/project_oview.htm> [Accessed 10 Jun 2009]

Woking Dance Festival (2011) Woking Dance Festival. [Internet] United Kingdom. Available from <http://www.wokingdancefestival.co.uk> [Accessed 20 April 2011]

Wearable Technologies Conference (2009) WT Conference; the fusion of innovative technologies for mass-market products '09. [Internet] USA. Available from <http://www.wearable-technologies-conference.com> [Accessed 10 Jun 2009]

7.5 Exhibitions, Performances, Lectures, Conferences and Symposia

Abstract: sea, unsea. Performance/lecture. Brown, C., Ramsgard Thomsen, M. Presented at Finding Fluid Form. Symposium. Sally Bennis Theatre. Brighton: University of Brighton, School of Architecture. December 2005

Apparition. Performance. Obermaier, K. London: Queen Elizabeth Hall. November 2004

Carry the Can. International bi-annual conference of the Association of Contemporary Jewellery (ACJ). London: Central Saint Martins College of Art and Design. July 2006

Changing room. Performance. Brown, C., Ramsgard Thomsen, M. London: Greenwich Dance Agency. October 2004

Challenging Craft; international conference on the new craft. Conference. Aberdeen: Gray's Scool of Art, The Robert Gordon University. July 2004

Dan Flavin; a retrospective. Exhibition. London: Hayward Gallery. January – April 2006

Dan Flavin. Exhibition. Munich: Kunstbau Lenbachhaus. April – June 1994, reprised June – August 2004

Force Fields; phases of the kinetic. Exhibition. London: Hayward Gallery in association with Barcelona: Museu d'Art Contemporani (MACBA). July – September 2000

Jewellery Unlimited; exhibition of original and challenging contemporary jewellery. Exhibition. Curated by Association of Contemporary Jewellery (ACJ) in collaboration with Bristol City Museum and Art Gallery. Bristol: Bristol City Museum and Art Gallery. April-June 2004

Lichtkunst aus Kunstlicht; light art from artificial light; light as a medium in 20th and 21st century art. Exhibition. Karlsruhe: ZKM Zentrum fűr Kunst und Medientechnology. October 2005 – May 2006

NeoCraft; international conference on the crafts and modernity. Conference. Halifax, CA: Nova Scotia College of Art and Design. November 2007

Perspectives in practice-based research. Series of 4 workshops. Coventry: Coventry University, Leeds: Leeds University, Hertford: University of Hertfordshire, London: University of the Arts London, London: Wimbledon School of Arts. October 2005 - July 2006

Pixelraiders 2. Conference. Sheffield: Sheffield Hallam University. April 2004

Spring research symposium. Symposium. London: University of the Arts London. February 2006

Wearable Futures; hybrid culture in the design and development of soft technology. Conference. Newport: University of Wales. September 2005

8 Appendix

8.1 Broad Context of Wearable Light; Additional Case Studies

The following case studies give further insight into the research that identified the broad context of wearable light referenced in chapter two. While this material is valuable to establish this wide context, it was not included in the main body of text in order to focus the argument on case studies that relate directly to light in interaction with the body.

8.1.1 Adam Paxton; Harnessing Colour in Acrylic Jewellery

The manipulation of light through reflective and refractive materials is relevant to the harnessing and distribution of both artificial and natural light.

Adam Paxton's acrylic jewellery captures natural light and channels it to create luminous colour patterns on the surface and in the depth of the objects. The luminosity and subtle patterning of the colours is reminiscent of the underwater world of coral reefs. Reflective elements create distorted mirror effects and add contrast to the sensual, animated quality of these 'creatures to wear'.

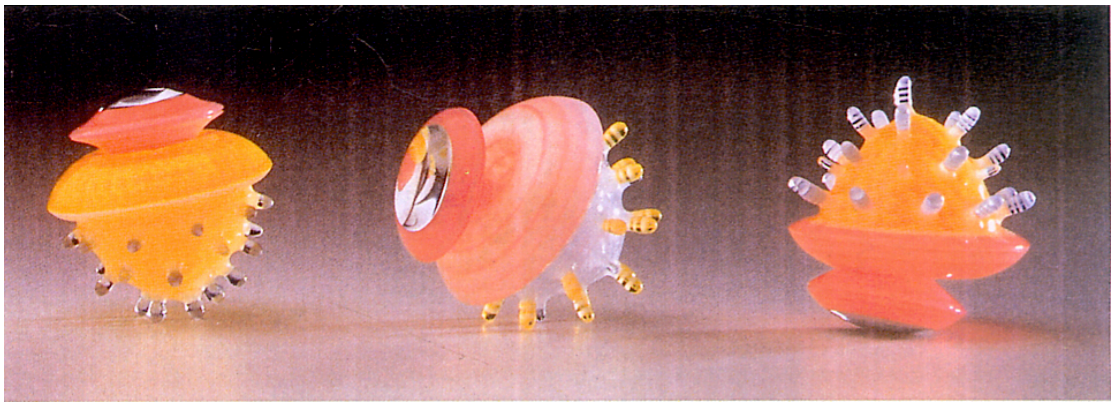

Fig. 8.1 Adam Paxton; *Squirming Brooches*, 2000.[290]

Paxton's expertise lies in the mixing and blending of materials that manipulate light to create localised light and colour effects. These complex light effects take place mainly within the objects but some light is channelled back outwards and projected onto surrounding surfaces, as the subtle pink

[290] Source Olver (2002) p. 147.

reflections beneath the objects in the image show. However, it is difficult for the viewer to reconstruct how these effects are achieved, which lends the objects a mysterious and precious quality.

Contemporary jewellers such as Paxon exploit the refractive and reflective characteristics of acrylic to achieve a sophisticated palette of luminous, yet subtle colour and light patterns in jewellery. This jewellery is a receptacle for natural light and captures the imagination through the aesthetic qualities of its light display rather than its technological complexity.

8.1.2 Joanna Berzowska, Nicole Gratiot-Stöber; Tracing Human Interaction with Wearables

Joanna Berzowska's memory rich garments and Nicole Gratiot-Stoeber's rings both use light as a signal or trace of human interaction.

Fig. 8.2 **Joanna Berzowska** ***Intimate Memory*****, 2004.**[291] **Nicole Gratiot-Stöber** ***Communicating Rings*****, 1995.**[292]

The *Intimate Memory* shirt aims to sense and display the trace of intimate whispering in the ear of the wearer. A sensitive microphone built into the collar of the shirt records the whispers and triggers a light display of the LEDs in the shirt according to the intensity and the time elapsed since the last whisper. It holds and displays a memory of the last whisper. The skirt has integrated touch sensors that record acts of touching and gradually change the colour

[291] Source Lee (2005) p. 168.

[292] Source Communicating Rings, 2002 [Online Image].

display of the LEDs on the skirt to show how often it has come into contact with people or objects (Lee, 2005 p. 168).

Gratiot-Stöber's interactive jewellery displays and draws attention to deliberate acts of intimate human touch: the holding of hands. LEDs integrated into the two rings only light up when the rings meet in the clasp of two hands (Watkins, 1999 p. 45-6). In terms of displaying different states of interaction Gratiot-Stöber's rings are far simpler than the *Intimate Memory* garment. Her rings are much more driven by aesthetic considerations than Berzowska's technologically driven garments.[293] By capturing the light in the Perspex tips of the rings the light effect itself is shaped three-dimensionally and seems more deliberate than the simple pattern of LED bulbs on the Berzowska's garment.

In both works light has the function of a signifier that traces past events or draws attention to an otherwise not or less visible act of intimacy. The light effect is located on the body and triggered by interaction of the body with other bodies or objects. The body, however, does not feature in the physical constitution of the light effect. The light effect is contained in a garment or ring and does not need the body as a projection surface.

Despite their different aesthetics, Berzowska's practice and Gratiot-Stoeber's works typify an approach in wearables that combines light and sensor technology to trace human interaction. The light display is triggered by acts of human interaction on the body and acts as a highlight or signifier for these interactions, but is otherwise independent of the body.

[293] At the 'Wearable Futures' conference Berzowska commented in the final discussion that her work had been driven by technological considerations and the design of garments had the function of 'proof of concept' in the past. She was, however, becoming more interested in the design of garments from a fashion point of view and was starting a collaboration with fashion designer Di Mainstone.

8.1.3 Lisa Stead; Communicating Emotional States with Wearables

Lisa Stead uses light to visualize and express the physiological and emotional state of the wearer.

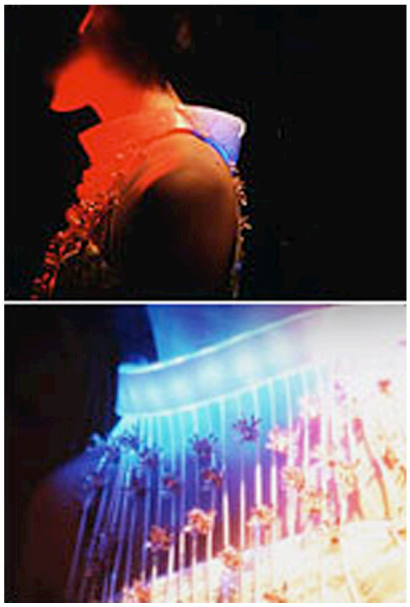

Fig. 8.3 **Lisa Stead; *Emovere*, 2005.[294]** **Sompit Moi Fusakul; *Vein2*, 2002.[295]**

While Stead's *Emovere* project has a similar aim as Sompit Moi Fusakul's *Vein2* [296], its prototype is far more complex and aims to show different light displays according to emotional states such as surprise, fear, joy etcetera. The emotional state of the wearer is recorded through a network of sensors integrated into the garment. A wireless link relays the information from the sensors to a computer that estimates the emotional state of the wearer according to pre-tested models and feeds this information back to light display in the garment (Stead, 2005).

In both works the body essentially triggers different light displays through physiological changes in heart rate, body temperature or skin electricity. The light display is shaped around the body, but the physical interaction of the body and the light sources is not the focus of investigation.

---

[294] Source Stead (2005) p. 166. Shown here is a first prototype of the garment.

[295] Source Vein2, 2002 [Online Image].

[296] Sompit Moi Fusakul's project *Vein2* is described in chapter 2.2.

Emovere and *Vein2* typify approaches in wearables that combine different types of biometric sensors to create works that try to communicate something from the world inside the wearer – their emotional state. *Emovere* can be conceived and developed as a communication tool for people who find it difficult to relate emotionally to others and has potential as a therapeutic device (Stead, 2005 pp. 218-20).

8.1.4 Light Features as Functional Wearables

Light as functional wearables covers an area where the functional aspect rather than the aesthetic qualities of light on the body are of importance. The two main categories here are light as a personal safety feature and light as a therapeutic measure.

Wearable light for personal safety follows mainly two routes: wearable light emitting diode (LED) torches and reflective strips or patches attached to outer garments.

Wearable LED torches work like accessories and can be clipped on to headgear, backpacks, handbags or any outer garment. They were mainly developed as bicycle lights and their major application is still to increase visibility in traffic. The goal is to increase the wearer's ability to see in the dark as well as and to increase his/her visibility for others.

These torches are very versatile as they can be attached to the body in a multitude of positions. However, the size and light intensity of the torches is relative small in comparison to other light sources in traffic like headlights of cars. They can therefore easily be overlooked, particularly as their light distribution is not specific to the human shape. So far, there has been no development of torches that address these issues.

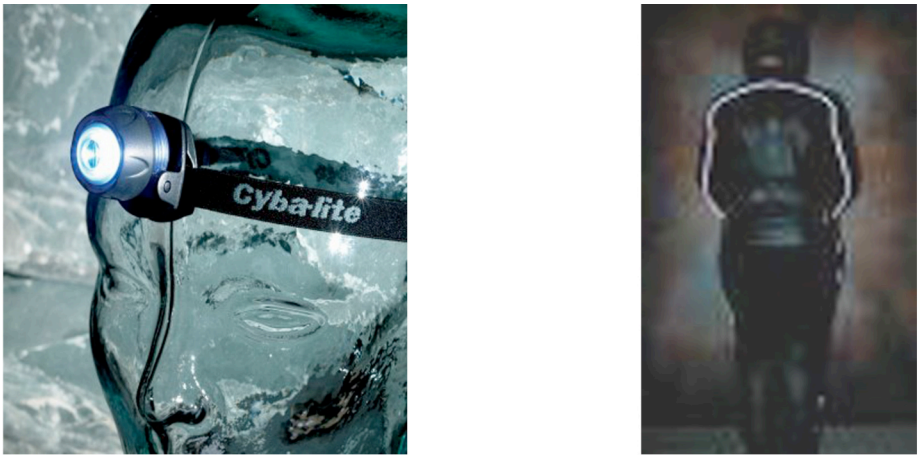

Fig. 8.4 LED Safety light for cyclists[297] (left), reflectors of motorcycle gear (right).[298]

[297] Source LED Safety Light, 2006 [Online Image].

Reflective gear typically is integrated as strips or patches into vests or other outer garments and reflects external light beams strongly if light is shining on it within a narrowly defined viewing angle. Reflective gear only increases the visibility of the wearer for others; it does not help the wearer to see well in the dark.

These strips or patches can follow the body silhouette and can therefore create a specific human shape that catches the attention of the viewer. However, it is a passive measure, meaning it depends on strong external light sources and a fairly narrow viewing angle to create visible effects.

The design of this safety gear is led by a functional aesthetic derived from sportswear. The appeal of light as a safety measure might be increased if its aesthetic incorporated wider influences and explored different types of illuminations on the body. The focus on light emissions specific to the shape of the human body might also help to achieve the aim of better visibility of the wearer.

Light has a profound physiological impact on the body and has been used in various therapeutic functions. Medical applications range from local hot lamps for the treatment of fungal infections to bright light boxes for people suffering from Seasonal Affective Disorder SAD.[299] These applications are based on the varied effects that light has on the biochemistry of the body and on microorganisms that invade its immune defences (DukeMedNews, 2005 [Internet]).

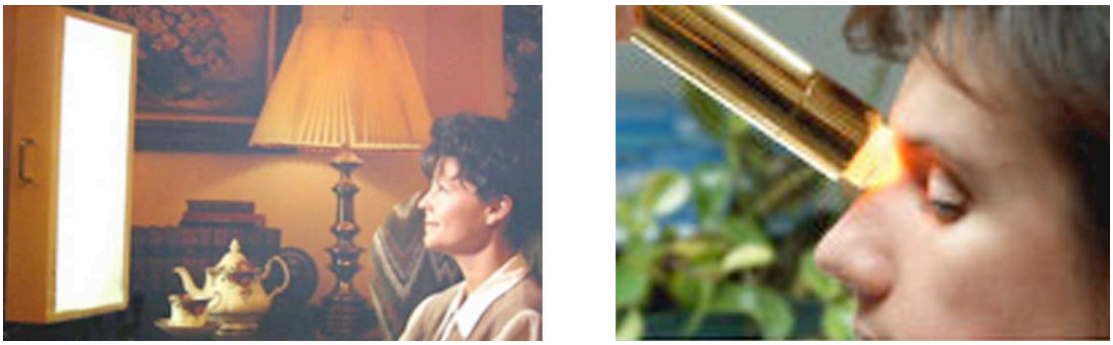

Fig. 8.5 Lightbox for *SAD* (left), *Chromalive* penlight (right).[300]

In alternative medicine, light and colour therapy are used to complement therapies like acupuncture by stimulating nerve points and meridians with energy transmitted by the different wavelengths of coloured light. This

[298] Source Reflective Clothing, 2006 [Online Image].

[299] See SAD Lighting (2006 [Internet]).

[300] Source (left) Seasonal Affective Disorder, 2006 [Online Image], source (right) Chromalive, 2006 [Online Image].

stimulation is claimed to have a range of positive health effects that can lead to a slowing of the ageing of body cells.[301]

None of these therapeutic functions are so far wearable. Wearability might, however, allow a constant application of light effects and therefore a more rigorous stimulation of positive health effects.

Light as 'functional wearable' has main applications in personal safety, is built into sportswear and has potential for future therapeutic applications. Design of safety gear is led by a functional aesthetic derived from sportswear. The appeal of light as safety measure might be increased if its aesthetic incorporated wider influences and explored different types of illuminations on the body. The focus on light emissions specific to the shape of the human body might also help to achieve the aim of better visibility of the wearer.

Therapeutic functions centre on the effect that light has on the human physiology. Apart from some 'light pens' for alternative therapy, light applications are so far hardly wearable. Wearability might, however, allow a constant application of light effects and therefore a more rigorous stimulation of positive health effects.

8.1.5 Lucas Samaras; Dramatizing the Body with Saturated Colours in Lens-Based Media

Lucas Samaras' work typifies an approach that uses coloured light to modulate the body in saturate colour in lens-based media. Echoes of his work can be traced into the world of advertising photography.

[301] An example of such an application is the *Chromalive* Colour Therapy. See Chroma Light Therapy (2006 [Internet]).

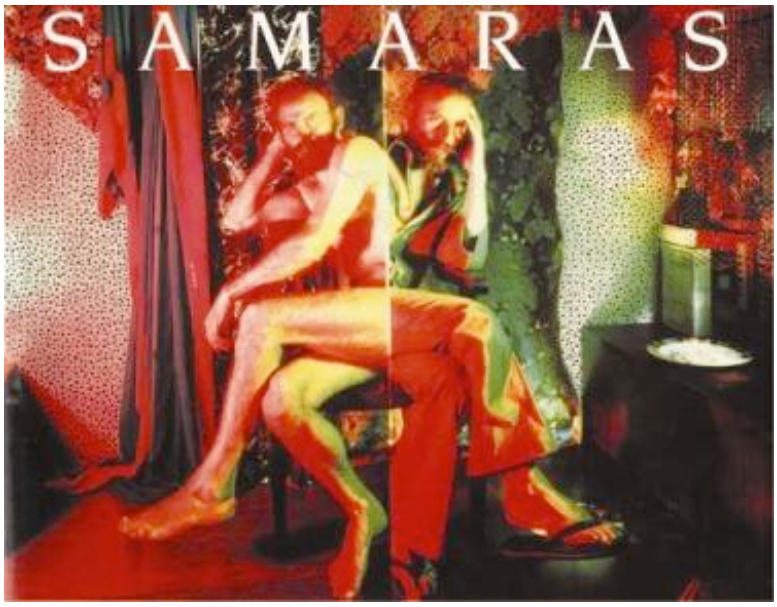

Fig. 8.6 Lucas Samaras; *Self Portrait*, book jacket for *Samaras*.[302]

In 1973 photographer Lucas Samaras discovered that the wet dyes of Polaroid photos were highly malleable and started to create what he called "Photo-Transformations" (Getty Museum, 2006a [Internet]). The dramatic colour palette of the Polaroid photograph shows parallels to the luminous colours achieved by light emitting diodes (LED), an artificial light source widely used for wearable light features.

Varying hues of red illumination and contrasting yellow and green illumination accentuate and exaggerate the silhouette of the body as well tracing the relief of the bone and muscle structure on the left side of the portrait and folds of garments on the right. It is however, not possible to tell how much of the light effect in Samaras' photograph is due to the actual illumination of the portrait and how much is due to colour manipulation in the printing process.

Due to the development process of photographs and film it is possible to create light effects through the manipulation of the film material without creating these light effects in reality.

Samaras' work exemplifies an approach that uses the luminous contrast of colour and lighting angles to dramatise the landscape of the body. Due to the development process of photographs and film it is possible to create light effects through the manipulation of the photo or film material without creating these light effect in reality. In a similar way light effects can be achieved and manipulated in digital photography and film. This raises questions for the research of wearable light about the importance of the light effect vis-à-vis the

[302] Source Samaras, 1988 [Online Image]. See Lifson, Samaras (1988).

light source. Manipulating light effects of wearable light in film/ digital video can complement the creation of wearable light features and their exploration in three-dimensional reality.[303]

8.2 Research Project Timeline: Overview of all Projects

The following overview of projects undertaken as part of this research accompanies the research projects timeline in chapter 3.2. The projects can be categorised by their exploration of and contribution to different aspects of the research and creative practice of light as body adornment that have emerged in the course of the research process.

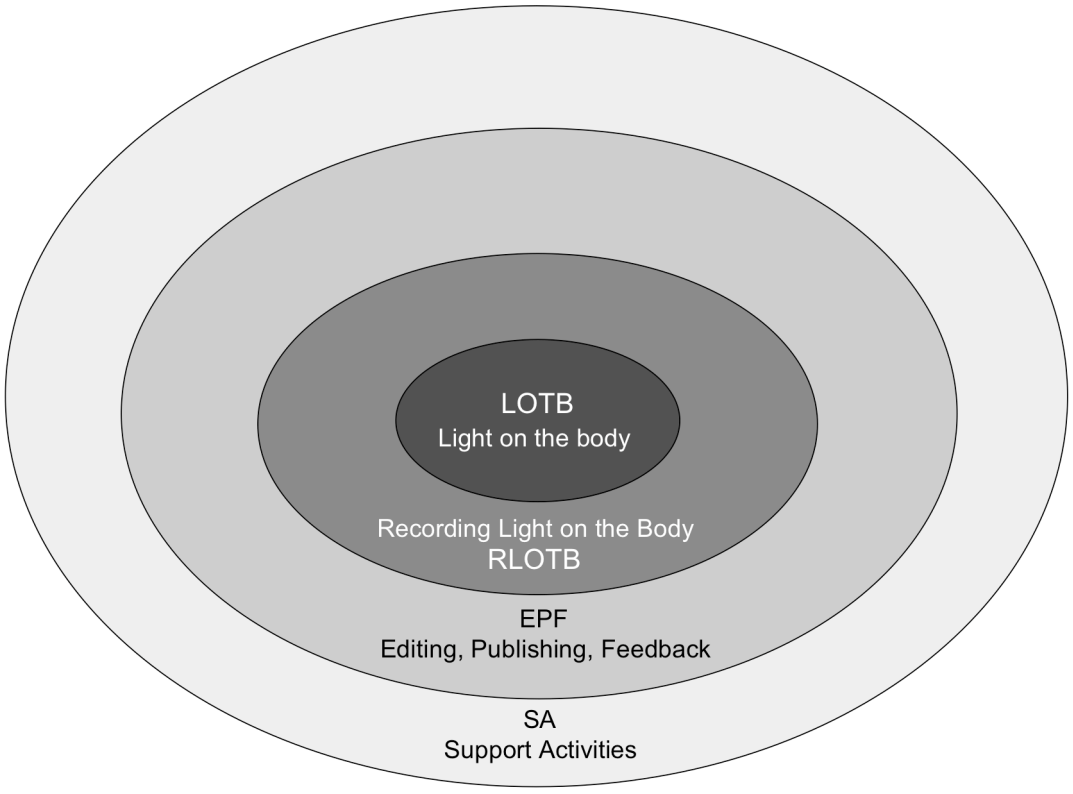

Fig. 8.7 Aspects of the research and creative practice of wearable light.[304]

[303] As filmmaker Will Raban pointed out there are two different routes to develop the practice-based research of wearable light: producing three-dimensional light features that create certain light effects on the body or using the medium of film to create light effects on the body through manipulation of film material (University of the Arts London Spring Research Symposium 2006). The second route possibly allows greater freedom in the development of light effects, but will loose the aspect of wearability. Both routes can complement each other.

[304] Source Oberlack (2009) primary research.

Light on the Body (LOTB) focuses on the investigation of the visual phenomena of light on the body, i.e. the physical reality of how light, body and space can interact through the mediation of wearable light features.
Recording of Light on the Body (RLOTB) describes the capturing of light effects created by light on the body through lens-based media such as time-elapsed photography, video or film. These recordings can become creative outputs in their own right and drive research and creative practice.

Editing, publishing, feedback (EPF) addresses the reflective process of editing the outcomes of LOTB and RLOTB in such a way that they can be published and become subject of external feedback. This includes the integration of the feedback into the research process.
Supporting activities (SA) covers research activities that support and facilitate projects without direct research outcomes. Typical examples are the acquisition of new skills or the exploration of technical innovations through seminars and workshops.

These aspects are not mutually exclusive and were present in all larger sub-projects to some degree. The following table describes the projects in more detail.

No.	Name of Project	Date		Type of Project				Comment
		From	To	LOTB	RLOTB	EPF	SA	
1	Setting Out	Jul-03	Jul-04	x		x	x	Acceptance and registration process for PhD project successful in Spring 04; Arts and Humanities Research Council (AHRC) doctoral award granted July 04
2	Evolution	Jul-03	Feb-04	x	x	x		Performance *Alight* 28 Feb 04
3	Jewellery Unlimited; Contemporary British Jewellery, exhibition, Bristol City Museum and Art Gallery	Jul-03	Apr-04			x		Practice featured in exhibition of contemporary British Jewellery curated by the Association of Contemporary Jewellery (ACJ) in collaboration with Bristol City Museum and Art Gallery, see <http://www.jewellery-unlimited.org.uk>
4	BodyLightScapes	Mar-04	Mar-04		x			Collaboration with photographer Rob Popper and *Union Dance* members; outcome: Body-Light -Scapes (time-elapsed photography)
5	Pixelraiders Conference, Sheffield	Apr-04	Apr-04				x	Attended conference focusing on the use of digital technology in contemporary art and design practice including a workshop on *Processing* software to create interactive virtual media. Potential for parallel virtual practice exploring light in virtual spaces.
6	Sensing Change	Apr-04	May-05	x	x	x		Collaboration with Union Dance, produced first generation of performance light features *big reds / blues / whites*, Premiere Queen Elizabeth Hall, London 11 May 2005

No.	Name of Project	Date		Type of Project				Comment
7	Wearable Futures Conference	Jul-04	Sep-05			x		Call for abstracts Jul 04, submission full texts July 05, commissioning of video May 05 for conference Sep 05
8	Body Explorations	Aug-04	Jun-08	x	x			Series of experimental explorations of LOTB in lens-based media.
9	Challenging Craft Conference, Aberdeen	Sep-04	Sep-04				x	Attended conference focusing on the opportunities and challenges that arise from cutting edge technology for contemporary craft and design practices
10	Presentation of Light as Body Adornment as PhD Research Project, MADS at CSM	Nov-04	Nov-04			x		Invited presentation to staff and students of MA Design Studies at Central Saint Martins College of Art and Design
11	Practice-based Research Workshop	Mar-05	Jun-05			x	x	AHRC funded workshop series organized by the Art and Design Research Institutions in the UK, first session at London College of Fashion: poster contribution
12	Radiance	May-05	Dec-05	x	x	x		Commissioned by Lightbox, Woking and Woking Dance Festival to produce second generation of *big red;* development of choreography through workshops with the performers and the light features; site-specific performance September 2005; development of variation of the choreography for the White Christmas Season at the Place, London
13	Introduction to Final Cut Pro	May-05	Jun-05			x	x	Final Cut Pro Video Editing Course at CSM with Tim Harrison (Camberwell College of Art, London); The *Here Tomorrow* seminar grew out of this course.

No.	**Name of Project**	**Date**		**Type of Project**				**Comment**
14	CTIA - Fashion in Motion Show	Sep-05	Mar-06			**x**		Catwalk Show of future designs for technology on the body at the annual conference of the CTIA - The Wireless Association, Las Vegas, March 2006
15	Confirmation Stage	Oct-05	May-06	**x**		**x**	**x**	Context Review and Presentation at University of the Arts London Spring Research Symposium in Feb 06
16	Re-Incarnations	Oct-05	Jul-06	**x**	**x**	**x**		Performance at *Carry the Can,* international, bi-annual conference by the ACJ Association of Contemporary Jewellery, July 06
17	Here Tomorrow	Oct-05	Jun-07			**x**	**x**	Practice-based seminar in fine art context; interest in or relationship to time-based practice as common denominator; organized by CSM research fellow Susan Trangmar. Leading to a residency for the seminar participants at the Lethaby Gallery in August 07.
18	Light as Body Adornment as part of the Radiance project; presentation to MA Dance at Surrey University	Jan-06	Jan-06			**x**		Invited presentation to staff and students of MA Dance at the University of Surrey, Guildford as one outcome of the Radiance project.

No.	**Name of Project**	**Date**		**Type of Project**				**Comment**
19	Beyond the Screen	Feb-06	Feb-06	**x**			**x**	10-day intensive workshop on the exploration of building and programming sensor-led input-output devices that go beyond the conventions of conventional input-output devices such as keyboard and screen. Explored interaction of body motion sensor and light output devices. See <http:// www.mintymonkey.com/basel_p1.html> for more information.
20	Stage Lighting Workshop at Woking Theatre	Mar-06	Mar-06	**x**	**x**	**x**		Collaboration with Sarah Gillmartin, lighting designer and MA Dance, Surrey University students; exploration of video recording by Heidi Ahsmann and Jude Macfarlane; opportunity for this session at Woking Theatre arising from Woking Dance Festival; exploration of creative editing techniques in Final Cut Pro by Ulrike Oberlack.
21	Seminar at University of East London	May-06	May-06			**x**	**x**	Seminar convened by scientists from University of East London. Exploration of possibilities for collaborations with scientists. Presentation of my work in the seminar.
22	Introduction to Indesign, Dreamweaver	Jun-06	Jul-06				**x**	Introduction to desktop publishing and website programming at CSM
23	Visit Japan	Sep-06	Dec-06	**x**		**x**	**x**	Exploratory visit to Japan; meeting with practitioner Erina Kashihara; establishment of connections to UK Embassy Support Staff for Design Industry

No.	**Name of Project**	**Date**		**Type of Project**				**Comment**
24	AHRC Grad School	Oct-06	Oct-06				**x**	Intensive course for personal and professional development as part of the AHRC Doctoral Award
25	OLED Seminar	Nov-06	Nov-06				**x**	One day seminar exploring the application of Organic Light Emitting Diode Technology
26	Visit CERN (European Centre for Nuclear Research), Geneva	Nov-06	Feb-07	**x**	**x**		**x**	Exploratory visit to CERN with Dr. Jane Harris
27	Body-Light-Scapes for *Neocraft* Conference	Nov-06	Nov-07			**x**		Paper at *Neocraft*, international conference
28	New Arenas	Feb-07	Jul-08	**x**	**x**			Series of experimental explorations of LOTB in new arenas with specific reflective qualities; man made (nighttime cityscapes) and natural (snow- and waterscapes)
29	Light-Space-Body: Light Choreography and Light Environment	Apr-07	Oct-07	**x**	**x**	**x**		Participation in 4 week residency of fine art based seminar *Here Tomorrow* at Lethaby Gallery
30	Masters and Protégés	Jul-07	Oct-08			**x**		Curated Exhibition of Contemporary British Jewellery in Itami and Tokyo, Japan (Mar to May08), then Birmingham (Oct to Nov 08)
31	Body-Light-Scapes; presentation to MAD; CFJ at CSM	Nov-07	Nov-07			**x**		Invited presentation to staff and students of MA Design; Ceramics, Furniture or Jewellery (by Project) at Central Saint Martins College of Art and Design
32	Light as Body Adornment as PhD Research Project; presentation to MAFA at CSM	Jan-08	Jan-08			**x**		Invited presentation to staff and students of MA Fine Art at Central Saint Martins College of Art and Design
33	Writing up and Submission	Oct-07	Jun-09			**x**		Production of thesis and submission.