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Diffraction and 'In-Visible Light': a case study of vertical dance

Introduction:

Diffractions dynamism proposes a shift of optical metaphors for new critical modes of thought and practice. Barad (2014:168) stated that the idea of diffraction ‘owes much to feminist theorists and physicists’ and Thiele (2014:202) questioned ‘how to live a world of difference(s), a world in/as ongoing differentiation, in such ways that the outcome is not ever more separation and antagonism, exclusion and the fear of others, but so that new senses of commonality are envisioned’. This paper explores diffraction from the perspective of the dancing and performing body, using as a case study Vertical Dance Kate Lawrence’s *Yn y Golau/In-visible Light*. This project began in 2016 as a collaboration between Photonics scientist Ray Davies of the Photonics Academy of Wales Bangor (PAWB) and Kate Lawrence, director of Vertical Dance Kate Lawrence, in response to the Synthesis initiative at Pontio, that brings together scientists and artists. Photonics is the science of light, and Lawrence and Davies’ primary concern was to discover how the invisible aspects of light might be made visible to the observer – making the invisible visible. Lawrence and Davies used vertical dance, which suspends the dancer above the ground using climbing equipment, as the vehicle for *Yn y Golau/In-visible Light*. In 2019 Lawrence received Research and Development funding from Arts Council Wales to develop the ideas in collaboration with science adviser, Cordelia Molloy. One of the guiding questions for Lawrence was how to make a highly visual performance interesting and available to people with visual impairments. Working with a visually impaired aerialist, Amelia Cavallo as a mentor, the company considered how to make light ‘visible’, through music, spoken word, sounds made by the dancers and by using sensory props. The audience were given diffraction grating glasses through which they could choose to watch the performance. These glasses allow the wearer to see the colour spectrum present in ‘white’ light which is
invisible to the naked eye. In this sense, diffraction (the slight bending of light as it passes round the edge of an object) is visible when the audience member wears the glasses. Visually impaired audience members had varying experiences of these depending on the nature of their impairment, ranging from very effective to headache inducing.

We will put forward the argument that metaphorical diffraction occurs as the piece explores how to make meaningful correspondences between phenomena in different mediums: dance/objects/scientific ideas/spoken word/music in order to create new ‘senses of commonality’ amongst diverse audience members. Barad (2003: 802) says ‘the move toward performative alternatives to representationalism shifts the focus from questions of correspondence between descriptions and reality (e.g., do they mirror nature or culture?) to matters of practices/doings/actions.’ Barad’s notion of ‘correspondences’ is crucial - as the work was not focused on accurately representing one thing in another medium, but about evoking something to those experiencing the work and prompting them to ask questions about the world around us. One of the main preoccupations in the creative process was how much we needed to describe in words. Where would the breath of the dancer or the vibrations of the dancer felt through the floor, or the breeze created by a dancer flying past create a visceral impression of the performance? If this were coupled with an opportunity for a non-sighted person to ‘fly’ in a harness prior to a performance, the bodily understanding of what was on display could be ‘harnessed’, meaning there would be less need to represent the dance in words. Indeed, feedback from visually impaired audience members proved that it was possible to achieve a ‘common’ experience of the work through a variety of sensory means, disrupting the primacy of the visual.

We argue that Yn y Golau/In-visible Light was able to enact ‘new senses of commonality’ (Thiele 2014: 202) using diffraction to ‘topologically reconfigure[e] connections’ (Barad 2007: 381) between things experienced in diverse mediums. The desire was to bring together sighted and non-sighted audiences without the muffling separation that audio description headphones can introduce for the unsighted person and to disrupt the primacy of the visual means of reception amongst seeing
Our focus on how to make the visual elements available through different senses (touch, sound primarily) enabled us and audiences to find new senses of commonality as we searched for new ways to communicate and be together in a large darkened space with the aim of appreciating and understanding a bit more about how light works.

**Vertical Dance:**

Dance is a diversifying art form that is always in a state of flux. There are a number of dance styles that are pushing the boundaries and questioning what is possible within creative, artistic and pedagogic and even medical and scientific environments. Vertical dance is an emerging form of dance that typically uses rock climbing and industrial access equipment (ropes, harnesses and abseil devices) to suspend dancers off the ground on a range of vertical surfaces. It takes place in a variety of locations, from theatres and their foyers to the outside of buildings and rock faces (Lawrence 2017). Vertical Dance Kate Lawrence (VDKL) are one of a limited, but growing number of companies worldwide specialising in this new dance genre. Artistic Director, Kate Lawrence has thirty years of experience as a dance artist and eighteen years specialising in Vertical Dance (VD). The company was constituted in December 2014 for the promotion of arts activities and builds on Lawrence’s collaboration with rigger Simon Edwards. Vertical Dance is a style of dance that depends on a partner or a team of people to support its execution. The style relies on a codependence of dancing bodies and rigging systems which results in an embodied understanding of equipment among dancers and a particular choreographic lens. Thus, the dancer, rigging equipment and the surfaces, or dance ‘floors’, are inextricably bound to one another in vertical dance choreography. As Moretti and Lawrence (2019) write, “vertical dance movers come from diverse backgrounds with a shared motive to fly and a very human desire to escape the pull of gravity and experience weightlessness” (11). The two reference how historically, dance has in some circumstances attempted to defy gravity and worked to create illusions.
Historically, the desire to escape gravity was explored in dance in a range of ways. Classical ballet developed pointe shoes to elevate the dancers, and in the romantic era, flew dancers through the air on wires. In the ritual of the Mexican Voladores de Papantla to appeal to the gods of rain, begun around 450 years ago, dancers descended upside down from a high pole attached to ropes. The exploration of the space of the body is evident in Loie Fuller’s use of light and fabric, Oscar Schlemmer’s unique spatial forms and Rudolf Laban’s dance in outdoor spaces and explorations of geometry and kinesphere. (Moretti and Lawrence 2019: 11)

The above examples highlight the fascination with flying. Vertical dance pushes boundaries of what is possible and uses creative explorations to investigate spatial disorientation. This vertical spatial exploration requires that a dancer reconsider space and time and challenges their body’s innate understanding of gravity. Through pushing off of a wall or suspending one’s body in gravity-defying manners, VD challenges how dance is experienced, both as a doer and viewer. At this juncture, we would like to pause and reflect on this notion of viewing dance. The traditional understanding of experiencing dance is that it must be seen, and while dance for a performer is an embodied practice, for the audience, it remains traditionally a visual experience. However, how does this affect and pertain to people with disabilities? Hossny et al. (2015) suggest that “people who are deafblind, blind or vision impaired are restricted from fully experiencing art because most art forms, including dance, are primarily perceived through vision” (446). This reality poses a question for the dance and disabled community as to how to make dance works accessible to a heterogeneous community? How can the dance world alleviate this tension and be inclusive of and welcome polyvocal audiences?

Haptic technologies is an area of research that has considered this question, and while not the focus of this paper, deserves some space in this writing. The term haptics is defined as the use of technology that stimulates the senses of touch and motion and allows the user to feel the material object. Haptic technologies are central to the
discussion of providing audio and visually impaired people an opportunity to experience dance. Haptic technologies can provide three-dimensional movement of dance and support an experiential as well as an aesthetic experience that is accessible to all. Hossny et al. (2015) “replace the term deaf, blind, deafblind, and audiovisually challenged with the term “deafblind-folded” to cover the possibility of promoting a new fashion of artistic renderings to sighted audience and artists” (446). And their study came up with a framework to convey performing arts to the audiovisually challenged audiences and used digital technologies such as motion capture, haptic translations, and haptic display devices to conclude that tactile feedback can be conveyed to deafblind-folded audiences. For the deafblind-folded performers that participated in the work portability devices were critical and proximity sensors important to ensure that dancers kept from crashing into one another. There are some digital tactile devices that assist the visually impaired to negotiate, understand and explore their surroundings. Such devices can encourage its users, particularly, visually impaired individuals to engage through different senses. Such technology is slowly being explored within a choreographic-dance environment but is still under-researched. These multimodal environments are one alternative for visually impaired and blind audiences to access dance. Yet what we are concerned with here is exploring alternative methods by which an audience may experience a performance piece that are not reliant on a device but rather through engaging and raising the importance of other senses beyond the visual, so that all members of an audience might have access to a richer sensory performance experience. From this standpoint, we aim to reflect on and challenge the standardised ways of viewing and experiencing dance. With this work, VDKL have explored affirmative ways of dealing with difference, diversity and diffraction.

Diffraction within performance contexts:

The term diffraction comes from the Latin term of diffringere, which means to break apart. In classical Physics, diffraction is the spreading of waves as they pass through or around objects in space. This bending of light around an object is dependent on the size of the object. For instance, if the wave and the object are close in size, the amount of bending is larger making the object appear bigger to the naked eye.
Diffraction can be witnessed in everyday encounters and environments, such as light sources in the atmosphere, for example, the sun and the moon. The Italian physicist and mathematician, Francesco Maria Grimaldi was the first to coin the term, although Leonardo DaVinci had also observed these effects. The notion of diffraction does not only lend itself to physics but also, education and feminism. A feminist and physicist Karen Barad used the concept of diffraction in a metaphorical manner, and it was then picked up by other academic disciplines, such as the art and literary world. Another theorist that was instrumental in developing the metaphorical use of the term diffraction is Donna Haraway whose 1988 article “Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective” was written as a commentary and sheds light on her perspective of diffraction and feminist science. Since then, Barad and Haraway have pushed the diffractive analysis discourse and propose that diffraction can serve as a reading or an embodied engagement of a situation to gain insight into the materiality or object being read. Specifically, Barad (2007) suggests that there is interconnectedness and that the two objects are not separate but rather intertwined material practices.

my aim is to disrupt the widespread reliance on an existing optical metaphor – namely reflection – that is set up to look for homologies and analogies between separate entities. By contrast, diffraction, as I argue, does not concern homologies but attends to specific material entanglements. (Barad 2007: 88)

These entanglements are not separate and rather than something being disclosed to the reader, it is the reader’s engagement with or in that situation that something new emerges because the two materials are engaging. Barad called this interaction an intra-action and she defines this process as not “an inherent property of an individual or human to be exercised, but as a dynamism of forces” (Barad 2007: 141) where there are a series of exchanges and diffractions that are interconnected.

Such intra-actions can exist in various practices from art to education and may initiate a reflection process that can instigate change. Educator Cher M. Hill (2017) has
explored reflective practices within the field of education and claims that “reflective practice is grounded in Dewey’s conceptualization of experiential learning and reflective thinking, which assumes a pre-existing and independent subject and object, and involves a logical analysis regarding cause and effect relationships. “ (Hill 2017: 1). Hill draws on Schön who likens the reflective practitioner to:

a scientist engaged in on-the-spot experimentation, in which action is undertaken with the intentional goal of transforming the situation. Tentative hypotheses are formed, enacted and revised as the “situation talks back” (131). Within reflection-in-action, boundaries between thinking and acting are collapsed, with each becoming an extension of the other (Schön 1983: 280). Reflection-on-action occurs outside of the realm of immediate action when there is extended opportunity for reflection. [...] Diffraction, within the context of physics, involves the bending and spreading of waves when they encounter a barrier or an opening. Diffraction therefore, as a metaphor for inquiry involves attending to difference, to patterns of interference, and the effects of difference-making practices. “ (Hill 2017: 2)

Later in this writing we will see how Yn y Golau/In-visible Light encouraged opportunities for reflection-on-action where the boundaries of what was possible to see and experience as audience members developed their individual readings of the dance work. Diffractive reading is similar to reflection-on-action, in which the practitioner engages in diffractive methods after an educative event has occurred in order to uncover new realities, which may then inform practice. However, this notion of diffraction informing practice and using experiences as a basis for thinking about artistic process is not always seen to be interconnected. Amba Sayal-Bennett in Diffractive Analysis: Embodied Encounters in Contemporary Artistic Video Practice (2018) outlined their experimentation with diffraction as a method in their own artistic practice. Sayal-Bennett delineates how contemporary artists’ video work challenges ‘representational’ understandings of film and video and this,
Unlike reflection, diffraction is a critical practice of engagement. Diffractive practices aim to understand the world from within. They place the emphasis on material experience, which means understanding that material objects and encounters are produced and reshaped through what Barad calls ‘intra-action’ – their relation to one another. (Sayal-Bennett 2018: online)

This intra-action may blur the beginning and the end of a process and the messiness can allow different readings that forge and sustain multiple tensions and reveal new insights. Art practices can challenge traditional approaches to research through their emphasis on collaboration and the integration of theory and practice. Yn y Golau/In-visible Light is an artistic experiment between a scientist and an artist that offers a framework for questioning diffraction and the manner in which sighted and non-sighted audiences read a work. At this point in the writing we will look closer at the dance work by VDKL and explore the manner in which the production of knowledge and research aimed not to happen in isolation but rather with invited members from the blind and non-blind communities.

**Case Study: Yn y Golau/In-visible Light:**

Yn y Golau is an interdisciplinary work in development using vertical dance, light, spoken word, live music, projection, object and costume design and found sound to investigate various light phenomena such as sun, moon and starlight, diffraction and bioluminescence. The work in progress performances took place on 11 May 2019 at Pontio Studio Theatre in Bangor, North Wales and were attended by families and visually impaired people with their working dogs. The objective was to create a performance that interlaced different art forms (dance, bilingual spoken text, music, design) to create a multi-sensory experience of light for diverse audiences with an underlying assumption that the experience of each audience member would be different as they construct their own ‘correspondences’ (Barad) between the elements. The text was heard by all audience members and was constructed to tell another story, rather than reflect the visual action directly. There was no desire to represent or reflect one genre exactly in another, but to present and explore light phenomena as diffractions.
across a range of art forms. For example, the visual projection of the sun onto a floorcloth was counter-pointed by two dancers counterbalancing each other, connected to the same rope through a pulley, a see-saw effect, playing ‘keepie-uppie’ with a balloon filled with quinoa, creating a sonic and visceral evocation of the explosive energy of the sun. This approach to audio description/access is different from the conventional live audio description into the ears of a visually impaired person wearing headphones. It involves the ‘creative integration of access tools such as audio description’ (Cavallo 2015: 125) into performance, a recent practice developed by companies such as Extant and Graeae theatre companies.

Prior to the performance, visually impaired audience members were invited for a ‘touch tour’ during which they were able to hear about the themes and a description of the show, ask questions and touch the costumes, instruments and props. Feedback from these audience members was very positive about this element, which is a common offer to visually impaired audiences prior to shows. At the beginning of the performance, audience members entered a darkened space and sat on the floor, around a circle marked out by electroluminescent wire, framing a circular floorcloth onto which images were projected. As they entered the space, they were handed diffraction glasses which they were encouraged to use at will during the performance. The show began with a description of the performance, the sections and the elements in each. This was designed for the visually impaired audience members and responding to feedback we have decided to eliminate this in future and to include it in the touch tour.

The performance was in five sections: Big Bang, The Moon, The Sun, The Earth and Undersea. Big Bang opened with a Big Bang simulation projected onto the floor and then narration in Welsh and English that described creation of the stars at the beginning of the universe. The only light came from LED torches on the wrists and ankles of the dancers and through the diffraction glasses they created dancing rainbows of diffracted light as they spun through the darkened space to the sound of improvised flute. The folded floorcloth (black on the back and white on the inside) was unfolded to simulate the waxing moon, and revealing a projected image of the moon. The dancers
rolled across the moon and then rose into the air, floating above as if moving in diminished gravity. Improvised flute music, audio excerpts from the first moon landing and narration create the aural environment. Sound in the Sun episode is created by the game played by the dancers with a balloon described above and the narration announces the life supporting properties of the sun to humans but suggests we have a cavalier attitude to our planet: ‘we toss it about our fragile earth’ (excerpt from performance text). The audience was then offered a model of the earth textured with mountains, deserts and cold polar regions, to pass around the circle with care. At the same time, the dancers used a hand held projector to take the spinning earth on a journey around the space and onto their own bodies. Following this, a larger projection of the spinning earth appeared on the floorcloth, and the dancers jumped from continent to continent. Finally, we journey to the undersea. The white of the dancers' costumes and their jellyfish like props is picked up by ultraviolet lights. The improvised flute music evokes the song of whales and we hear the sound of the dancers bodies as they move across the floor as well as their breathing. We feel the rush of air as they swing past us. Towards the end all lights disappear, and in the darkness we hear only the sound of the dancers bodies as they sweep and pitter patter across the floor like creatures on the deep sea bed.

After the show, we offered a very popular ‘have a go’ experience for all audience members during which they could have an experience of ‘flying’ in a harness. On this occasion, some of the visually impaired audience members participated. On reflection we decided that in future performances we would offer this experience to visually impaired audiences prior to the show, so that they could experience the show with an embodied knowledge of what the dancers were doing, and an ability to connect the sense of the air moving and the sound of the dancers bodies on the floor with their own experience of flying in a harness off the ground.

The process of developing *Yn y Golau/In-visible Light*:
Yn y Golau was developed over three years and will undergo a further stage of development to become a touring show in 2021. It began as a creative exploration of light and vertical dance and evolved into a journey through light phenomena we experience. The desire to create a performance that was accessible to both sighted and non-sighted audiences enabled us to find some innovative ways to express the scientific concepts through the senses of touch and sound. Narrative was added later as we wanted to see how much information could be conveyed through sound and touch. The input of our mentor, Amelia Cavallo, was invaluable in enabling us to understand the effect of the work for visually impaired audiences and this resulted in the development of the narrative. Exactly how much description of visual elements is required and indeed possible within time constraints is a complex question. We found that very little description was required in the sun section because the sounds made by the dancers located them and painted a clear picture of where they were in space and the energy they were expending. Similarly, visually impaired audiences responded very positively to hearing the sound of the dancers breathing and of their bodies sliding across the floor, to feeling the floor vibrating as the dancers moved.

After the performance feedback was gathered from sighted audience members through questionnaires and interviews were conducted with visually impaired audience members. The general audience were asked to comment on the following aspects of the performance; personal reaction; thematic content; the different elements (lights, dance, spoken word, music, projection, props) and how it might be developed into a show. Responses such as 'I felt immersed in the space, like I was part of it' reveal that the audience responded very positively to the sensory aspects of the show. The 'touchy feely earth' was a favourite and many picked up on the smells (rose and cedar) that were embedded in the earth model. The comment - 'A clever combination of all of these things that held you' suggests that the 'material entanglements' created between the diverse elements 'intra-acted' to create 'correspondences' (Barad 2003:82) that 'brought me to another world' (audience member comment). Many felt they wanted more interactive and participatory elements (such as the earth prop that was passed...
around) and this suggests a desire from audiences for more ‘senses of commonality’ (Thiele 2014: 202).

**Conclusion:**

Thiele’s (2014) search for ways to live in a world of differences and proposal that the idea of diffraction might enable us to find new ‘senses of commonality’ resonates strongly with reflections on the process of creating and performing Yn y Golau. The process of creating audio description is commonly undertaken after a new work has been made and is designed to be as faithful to the work being described as possible, ie the aim is to reflect the work as accurately as possible. This ambition is clearly unachieveable on two counts: first, translation of meaning in one medium - for example, dance - into language requires a degree of adaptation; second, the will always be from the subject position of the describer. There is a well rehearsed debate on faithfulness in audio description that has been outlined in recent work by advocates of new, creative approaches (Margolies, 2015; Carter, 2018; Cavallo, 2015); the aim here was not to undermine the excellent work undertaken by audio describers, but to look for a different way to address issues of accessibility, by including them from the beginning of a creative process. Furthermore, we were keen to discover new ways of reaching audiences through other senses beyond the visual. Dance is usually performed with music, but it is rare that particular attention is drawn to the sounds made by the dancers (breath and contact with surfaces such as the floor and objects) and the displacement of the air as they move through space.

The desire to bring together families (already diverse in age) and visually impaired audiences is a drive towards finding collective experiences for people with different sensory capacities. Yn y Golau can be effectively described as a series of exchanges and diffractions that are interconnected (Barad, 2007); the connections that were created in the space by the all the artists involved in the project were received through a range of sensory organs and reconstructed by each audience member in individual and unique ways.
References


