

Site Projects Presents:
NIGHT RAINBOW | GLOBAL RAINBOW NEW HAVEN
a temporary light installation by Yvette Mattern



EDUCATIONAL GUIDE
for teachers, parents and students

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NIGHT RAINBOW | GLOBAL RAINBOW NEW HAVEN

Site Projects, 2013

An Educational Guide for Teachers, Parents and Students

What is Night Rainbow | Global Rainbow New Haven?

Night Rainbow | Global Rainbow New Haven – a laser light sculpture by Yvette Mattern – uses specially-designed lasers to project the seven colors of the natural rainbow [ROYGBIV]. This innovative technology allows the artist to achieve vibrant colors, visible for over 30 miles (48 km). Ms Mattern said this temporary exhibition symbolizes “diversity and peace.”



Global Rainbow debuted for a single night with limited technology in New York City (2009). The fully-realized *Rainbow* has now traveled extensively, with recent exhibitions in the 2012 Cultural Olympiad, the prelude to the Olympic Games and in New York City as *Global Rainbow: After the Storm* in support of and to give hope to the victims of Hurricane Sandy.

Who is Site Projects?

Site Projects Inc. [www.siteprojects.org] commissions internationally-recognized artists to create temporary visual art in New Haven’s public spaces. Our work activates spaces not typically associated with art, (such as the Farmington Canal, New Haven Green and Temple Plaza), in order to engage the community and build a large audience. Site Projects’ exhibitions are free, open and accessible to all.

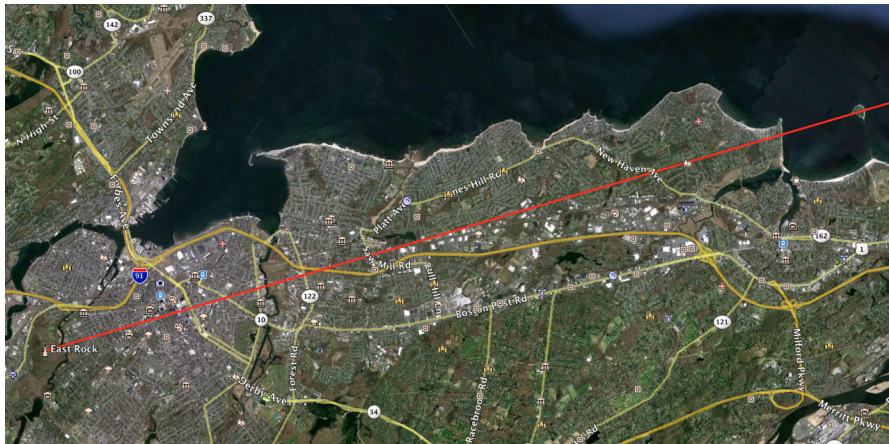
Established in 2004, Site Projects has commissioned four artists and exhibited seven artworks, making New Haven a thriving center for public art. Site Projects partners with numerous local agencies, institutions and other non-profit organizations. Our 2010 commission continues to draw admiring crowds:



Square with four circles, Felice Varini, downtown New Haven, Temple Plaza, 2010.

The Kick-Off

In celebration of the 375th Anniversary of New Haven, Site Projects will present *Night Rainbow | Global Rainbow New Haven* in April 2013. The exhibition will run for four consecutive nights and begin on April 24, 2013. Originating from the top of East Rock Park, *Night Rainbow | Global Rainbow* will paint the night sky over downtown New Haven, crossing above the Green, Interstate Highway 95, West Haven, diminishing into a colorful glow in Long Island Sound:



While each viewer sees the same artwork, *Night Rainbow | Global Rainbow* takes on a myriad of different forms depending on one's vantage point and atmospheric conditions.

Learning Opportunities

Night Rainbow | Global Rainbow New Haven presents rich learning opportunities for children and adults. To fully enjoy and understand the artwork, it is necessary to observe and

investigate this spectacular light installation. However, the experience of the artwork can be enhanced by knowledge about natural rainbows, laser technology, the history of rainbows in art and the history of New Haven.

It is our hope that teachers will weave the artwork into existing curriculums. Site Projects will be offering guided nighttime tours of the exhibition. Here you will find several examples of how Site Projects envisions one might integrate the artwork into a variety of subjects as well as additional resources you may find helpful in creating your own projects.



Global Rainbow, Preston, England, 2012

Remember! Seeing is Believing!

Don't miss *Night Rainbow | Global Rainbow New Haven*

www.nightrainbownewhaven.com

April 24 – 27, 2013

dusk – 1am nightly

contact: info@siteprojects.org

Science & Technology

Natural Rainbows - and - *Night Rainbow*

"... a rainbow is not something that has concrete existence occupying a specific space. Instead, a rainbow is an optical phenomenon so complex that each eye of any single observer receives light of a slightly differing wavelength from a given raindrop at any given moment -- so that each eye actually sees a different rainbow."

- Richard Whelan, The Book of Rainbows

Introduction

Like a natural rainbow, *Night Rainbow | Global Rainbow* will change depending on one's viewpoint. However, the optimum position for viewing each type of rainbow will be quite different. For example, the projection site of *Night Rainbow | Global Rainbow* will surely be one of the most beautiful places in New Haven to view the installation. However, what happens when one attempts to find the point of origin of a natural rainbow?

Attached you will find a series of suggested activities that: investigate natural rainbows by producing rainbow-like effects and laser technology, compare and contrast natural rainbows to the laser light installation and encourage you to develop theories about the impact such an artwork - in using technology to reproduce a natural phenomenon - has on our society.



New Haven Rainbow (photo: Jared Pitts)



Global Rainbow in Whitley Bay, England

Prior to the Exhibition: Understanding Natural Rainbows

Night Rainbow | Global Rainbow New Haven uses high specification lasers to project light across the range of the visible spectrum of the rainbow. Colored light is formed naturally when white light/sunlight hits raindrops in the atmosphere. Light from the sun is bent as it crosses from air into the water of a raindrop. This is called 'refraction.' Light of different colors is bent by a different amount. The light from one raindrop in the sky would be so weak that we could not see it and so it takes many raindrops to create a full rainbow. When you look at any one part of a rainbow, you are looking deep into the sky, collecting light from many, many raindrops that are in the direction you are looking: "The rainbow ... [is] created in the eye of the beholder by light coming from raindrops at differing distances from the eye." (Whelan)

Visit: http://www.ehow.com/way_5414891_prisms-experiments.html#ixzz2E2wsTcPr for some activities that you can easily do at home to begin an investigation into natural spectrums.

Discussion: "A rainbow can occur only when the sun is less than 42 degrees above the horizon -- in other words, before mid-morning or past mid-afternoon." (Whelan)

Prior to the Exhibition: Understanding *Night Rainbow | Global Rainbow New Haven*

LASER stands for: Light Amplification by Stimulated Emission of Radiation. A laser energizes electrons to a higher than normal state and as they return back to normal, this energy very quickly zaps out in a specific color. Electrons at different states emit different colors.

When this light passes another energized electron, the light stimulates the process and the second photon picks up the same path as the first. A laser has two parallel mirrors that keep this light bouncing back and forth, gaining more and more photons. This can be let out as a beam traveling in the same direction. Compare this to a light bulb or a candle flame, which emits radiation in all directions.

Lightwave International (<http://www.lasershows.net/>) is the laser production company that Yvette Mattern works with to create the *Rainbow*. For specific information on the high-specification lasers used in *Night Rainbow | Global Rainbow New Haven*, visit: <http://www.lasershows.net/index.php/laser-rentals> (see Additional Information).

For further information on lasers, check out these links: <http://www.laserfx.com/Works/Works2.html>, <http://www.laserfx.com/Science/IndexScience.html> and <http://photonlexicon.com/repairfaq/sam/laserfaq.htm#faqwil>

For activities, see Tyler Ibbotson's, Laser Lesson Plan (Expert Feedback, page 27) or visit the links below:

Create Your Own Laser Show:

<http://www.optics4kids.org/osa.ok4/media/optics4kids/teachersparents/classroomactivities/pdfs/create%20your%20own%20laser%20show.pdf>

Optic Games:

<http://www.optics4kids.org/osa.ok4/media/optics4kids/teachersparents/classroomactivities/pdfs/electro-optics%20games.pdf>

During the Exhibition: Experience *Night Rainbow | Global Rainbow*

To fully enjoy and understand the artwork, it is necessary to observe and investigate this spectacular light installation firsthand. The exhibition will be on view for four consecutive nights and will look quite different depending on your vantage point.

Activity: Finding Optimal Viewing Points

Site Projects recommends traveling around the city to discover the most stunning locations. How does the artwork look when standing directly underneath? Looking straight at the projection sight? From various angles and sides?

Make note of the best locations to view *Night Rainbow | Global Rainbow* and determine your direction. Does height make a difference as to the vibrancy of the lasers?

Take pictures! Upload your discoveries onto our website, Facebook and Flickr! page.

After the Exhibition: Discussion Topics

- 1) What are the similarities and differences between a natural rainbow and *Night Rainbow*? Of course, each type of rainbow is formed using different methods (natural rainbows are formed by white light passing through refraction devices; *Night Rainbow | Global Rainbow* is formed with high specification lasers). What is the best location, angle, height to view the laser rainbow vs. natural rainbow?
- 2) Given this information, what is the impact on society of such an artwork that uses technology to reproduce a natural phenomenon?

History & Social Studies

The History of our City: New Haven as a Beacon

Night Rainbow | Global Rainbow New Haven and the 375th Anniversary

“As New Haven approached the 340th anniversary of its birth, some positive and optimistic signs of faith in its regeneration were evident. Speeches and reports affirmed that the city was ‘turning around.’ ... It seemed now that the city could be revitalized by building on its social diversity, rather than on a decaying unity.”

Judith Schiff, “The Social History of New Haven,” New Haven: An Illustrated History

Introduction

For hundreds of years, people from diverse points of origin were drawn to New Haven in search of better lives and refuge. Not everyone found what they were looking for, but most stayed and made their lives better – sometimes despite harsh treatment and overwhelming odds. In the process, the people who came to New Haven established a richly diverse population – a population that today embraces a wide variety of ethnic and cultural traditions.

Site Projects presents *Night Rainbow | Global Rainbow New Haven* in celebration of an important milestone in the long history of our city: the 375th Anniversary of its founding. Projected from the top of East Rock Park, the artwork will become a beacon -- a symbol of New Haven’s history of beckoning people here to settle.

This birthday celebration can initiate a study of local history focusing on the peoples drawn to New Haven from the 1600s through the 20th century. In the suggested activities, you are encouraged to research New Haven history using a wide variety of sources, including the Ethnic Heritage Center’s online resource: http://www.criscoladesign.com/pdfs/ehc_census.pdf and visit the New Haven Museum as well as research one group of settlers in great detail. In addition, there are a series of questions to initiate a conversation about Public Art from a civic standpoint. Ultimately, ask yourself the question: How does the artwork celebrate New Haven’s 375 years as a beacon? Are there other ways the artwork symbolizes the history of our City?

Prior to the Exhibition: Understanding New Haven History

Native Americans (Quinnipiac and Pequot tribes) settled in the New Haven area more than 8,000 years ago. Other peoples came starting in the 1600s. Beginning with the Dutch, subsequent groups included: English Puritans, Africans (both slaves and free), Italians, Irish, Germans, Scots, French, Puerto Ricans, Swedes, Chinese, Japanese, and many many more.

Activity 1: Create a Timeline

Go to: http://www.criscoladesign.com/pdfs/ehc_census.pdf and visit the New Haven Museum. Create your own illustrated timeline that represents the diverse groups of settlers who came to New Haven over the past 375 years and give a brief description about why each group came.

Discussion: What did this site look like 375 years ago? Make some predictions and visit: <http://newhavenmuseum.org/> to view some of the oldest images of New Haven.



New Haven, present day

Activity 2: Focused Study

Many of us know our countries of origin. Maybe your grandmother is from Kenya or your great great grandfather is from Ireland. If you know your family's heritage, research your ancestors' history as they settled in New Haven. If you do not know your family's country of origin, research settlers that interest you.

Using the previously listed sources, as well as books from the New Haven Free Public Library, consider questions such as: What did the settlers hope to find in New Haven? Did they succeed? How were the settlers received by those already living in New Haven? How do you feel about what you have learned?

Make a presentation on your research. Create visual aids in such as illustrated posters, handouts or even a PowerPoint presentation.

Prior to the Exhibition: Public Art and Civic Engagement

Public Art is artwork mounted in public spaces. Site Projects' mission is to present artwork that is accessible and viewable by all. In today's economic climate, is it worth it?

Consider these discussion topics:

Why should time, effort, space and money be put into public art? Who will benefit? What is the value of art? Should taxpayer's money be used for art? What impact does public art have on the community? On Economics?

What considerations should be taken into account when presenting public art? Was Work Projects Administration (WPA) a good idea? Did it help the economic condition at the time?

What kind of artwork ought to be considered suitable for public art?

What is public space?

Who should be involved in deciding what art is exhibited in public spaces? Should the government be involved? Should a particular person or group of people decide?

During the Exhibition: Experience *Night Rainbow | Global Rainbow New Haven*

Night Rainbow | Global Rainbow New Haven will be projected for four nights beginning April 24, 2013.

Go outside, investigate the *Rainbow*, discover it from different locations and vantage points.

You might want to ask your neighbors and friends how they feel about the artwork and how they experience the piece. Post comments and reactions to our website and Facebook page.

Think about the impact this laser light installation has on you and the people you know. Think about how it symbolizes the long history of New Haven.

Take pictures! Upload your discoveries onto our website and Flickr! page.

After the Exhibition: Discussion Topics

- 1) Does *Night Rainbow | Global Rainbow New Haven* successfully symbolize New Haven's long history as a beacon?
- 2) Does the artwork symbolize our history in other ways?
- 3) How does this artwork speak to our City? To your community?

Art & Art History

Representations of Rainbows - and - *Night Rainbow | Global Rainbow*

"My heart leaps up when I behold/ A rainbow in the sky:/ So was it when my life began;/ So is it now I am a man;/ So be it when I shall grow old./ Or let me die!"

William Wordsworth, 1802

"And sometimes I remember days of old,/ When fellowship seemed not so far to seek,/ And all the world and I seemed much less cold,/ And at the rainbow's foot lay surely gold,/ And hope felt strong, and life itself not weak."

Christina Rossetti, *The Thread of Life*

Introduction

Artists have been representing rainbows for centuries. From works by Constable and Turner to Monet and Seurat to Kandinsky to modern photographers and now, Yvette Mattern, each artist's work represents the same natural phenomenon in a different way.

Through the suggested activities, you are encouraged to investigate how rainbows have been represented in the past, compare and contrast these works to *Night Rainbow | Global Rainbow New Haven* and develop theories about how using technology to represent a natural phenomenon influences the meaning of the artwork.

You are also encouraged to participate in *Sites.Camera.Action!*, *Film Shorts Festival, Fall 2013*.



John Constable, 1831

"Salisbury Cathedral from the Meadows"
The National Gallery, London



Prior to the Exhibition: Art History Survey of Rainbows

There are numerous examples of rainbows found in several collections such as the Yale Center for British Art (<http://britishart.yale.edu/collections/search>) and the Yale University Art Gallery (<http://ecatalogue.art.yale.edu/search.htm>). For instance, John Constable's, *Sky Study with a Rainbow*, 1827, is in the collection at the Yale Center for British Art.

How does Yvette Mattern's, *Night Rainbow | Global Rainbow New Haven*, fit into this history?

Activity: Create Your Own Gallery

Museum curators carefully choose works to include in each collection and rotating exhibition. Create your own digital collection -- a kind of digital museum -- with a curated exhibition of rainbow representations.

Use your best cyber-sleuthing skills and dig into museum databases. You may even be able to find some of these works in our very own museums right in downtown New Haven. However, not all are on public display.

Explain which works you like best and why. Consider comparing two works in detail. Collect a diverse range of mediums, including painting, photography, sculpture, printmaking, weavings, etc. Consider: How successful is each artist's representation of a rainbow? What mediums speak to you? Choose two artists and answer: What do you think the artist is trying to say with this piece?

You may use <http://www.googleartproject.com> to create your gallery or you may want to create a slideshow of images in another program. Once complete, title your exhibition.

During the Exhibition: Experience *Night Rainbow | Global Rainbow New Haven*

Night Rainbow will be projected for four nights beginning April 24, 2013. Go outside, investigate the *Rainbow*, discover it from different locations and vantage points.

Think about the impact this laser light installation has on you and the people you know. Think about how it changes the physical spaces in our community, the places we frequent daily. Think about how the artist's medium influences the meaning of the artwork and your experience of it.

Activity: Investigate Physical Landscape of New Haven

Move through the city under the trajectory of the *Rainbow* and take note of specific locations that seem to be changed by the light sculpture. In some places the *Rainbow* creates a sort of a ceiling, in some places it will create a backdrop. Think about the effect this sculpture has on the physical landscape of our city. Take pictures and upload them to our website or our Flickr! page.

During the Exhibition: Document *Night Rainbow | Global Rainbow New Haven*

Our first film festival in relation to Felice Varini's, *Square with four circles*, invited amateurs and professionals to submit videos, 2 minutes or less, in relation to the artwork. A panel of judges, including several celebrities, awarded cash and other prizes. You may read more and view winners @ <http://www.sitescameraaction.info/>.

In conjunction with *Night Rainbow | Global Rainbow*, Site Projects will host its second films shorts competition related to the artwork, *Sites.Camera.Action!, Fall 2013*.

To begin organizing your ideas for your film short, take photos and video the exhibition. You may even want to draw or paint the installation. A call for submissions will be announced in March 2013.

Additional Information

**Yvette Mattern, Lightwave International
and the laser light sculpture:
*Night Rainbow / Global Rainbow New Haven***

Yvette Mattern

www.yvettemattern.com

Yvette Mattern (b.1963) is an American artist now living in Berlin. Mattern's work has an emphasis on film and video, frequently intersecting performance, public art and sculpture, and has been exhibited in Berlin, Vienna, Dakar, New York, Venice, Rome, Chicago and Amsterdam as well as England, Northern Ireland and France.



Born in San Juan, Puerto Rico, Mattern studied film at Columbia University. Her video works include: "Race Mixers" (Haus der Kulturen der Welt, Berlin, 2001), "Masai" (Valencia Biennale, 2001), Video Art, Art Magazine, 01No52 (Berlin, St. Gallen, Lucerne, Vienna, 2000), "The Zanzibar Project" (Anthology Film Archives, New York, 1998). As a video designer for theater, she has collaborated with a variety of artists and directors, including Renate Ackermann ("Jacob Lenz," Karlsruhe, 2001), Shelley Hirsch ("For Jerry," Berlin, 1998) and Kyle De Camp ("Come to Life," Performance at P.S.1, New York, 1997).

Mattern was Assistant Professor of Art and Music at the University of Albany in New York and Visiting Professor of Art at Oberlin College in Ohio. Residencies of note include: BALTIC Center for Contemporary Art in Gateshead, England (2006); Center for Contemporary Art in Ujazdowski Castle in Warsaw (2007/2008), with two exhibitions in 2008: *Cinema Remixed and Reloaded*, Spelman Museum of Art, Atlanta, GA and *Black Light/White Noise*, Contemporary Arts Museum, Houston, TX. In 2009, Mattern's: *Mulatta* was shown in *Carnival Within – an Exhibition Made in America*, organized in both Berlin and New York.

Mattern began exhibiting *Global Rainbow* in 2009.

Lightwave International

www.lasershows.net

Yvette Mattern has been working with Lightwave International since 2010. Lightwave specializes in laser spectacles, producing work for countless sporting events, including the 2011 Fiesta Bowl, the NFL 2008 NFC Divisional Championship and the Stanley Cup Playoffs. In addition to sporting events, Lightwave provides laser installments for a number of films, civic and corporate events.

For specific information about Lightwave's laser equipment, please visit:
<http://www.lasershows.net/index.php/laser-rentals>.



Global Rainbow | Yvette Mattern



Global Rainbow is a large-scale public art light installation. The artwork beams seven rays of laser light representing the color spectrum of the natural rainbow: ROYGBIV. Theoretically and symbolically, its presentation encompasses geographical and social diversity. The artist intends the work to be a symbol of hope.



Exhibitions

2013

Night Rainbow | Global Rainbow New Haven, New Haven, Connecticut
www.NightRainbowNewHaven.com

2012

Global Rainbow: After the Storm,
Benefit for the Victims of Hurricane Sandy, New York City, New York



Global Rainbow, Cultural Olympiad, Arts Council of England, Legacy Trust UK and the Olympic Lottery Distributor. Three Locations: North Tyneside (February, UK Premiere); City of Preston (March 8, International Women's Day); Northern Ireland (March 14)



2011

Global Rainbow, Le Lieu Unique, Nantes, France



2010

Global Rainbow, La Novela Festival, Toulouse, France



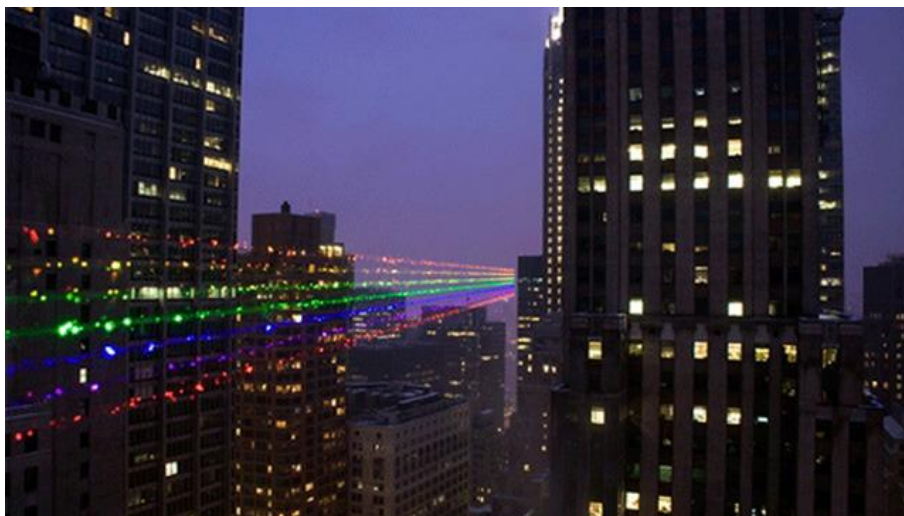
2010

From One to Many, Transmediale 10, Berlin, Germany



2009

Global Rainbow, 14 Wall Street, Trial Run on Martin Luther King Jr. Day, New York City



Press for the *Rainbow*

Not many artists need to get permission from air traffic control or the local harbormaster to exhibit their work, but then not many artists shine columns of light five miles along the North Sea coast. The American artist Yvette Mattern is showing Global Rainbow in two venues in the north of England and one in Northern Ireland over the next few weeks. ... Depending on where you were standing, you either saw the rainbow spectrum clearly arcing overhead, or, from a different angle, they fused together to form a blur of colour, turning into a white arc from further off. ... The combination of parallel lines of multi-coloured light apparently curving over the coastline was a delight for all the people who turned out to see the opening night. ... everybody I spoke to - people walking their dogs on the beach, parents out with their children and arty types from Tyneside and beyond - hugely enjoyed the spectacle.

"Giant rainbow lights up the night-time sky – and sea – at Whitley Bay," Alan Sykes, The Guardian, March 2012.
<http://www.guardian.co.uk/uk/the-northerner/2012/mar/01/art-newcastle-lightshow-rainbow-whitleybay-yvettemattern>

Each Olympics, there's a lesser-known cultural Olympics that runs parallel to the main event. Over the years, there hasn't been consistency as to how long it runs, or what the cultural Olympiads in various nations feature (artists, and artistic activities, mainly). This year's event in London is said to be the "largest cultural celebration in the history of the modern Olympic and Paralympic Movements" (according to their own website). As part of the festivities, earlier this week international artist Yvette Mattern's laser rainbow projection, Global Rainbow, was flipped on in Whitley Bay, England, to celebrate London's Cultural Olympiad in the north-east of England. According to the BBC, the rainbow, which stands for "diversity and peace," has previously been installed in Germany, France and the United States, and was first created in 2009 to celebrate Martin Luther King Day. This time around, the five colors are references to the Olympic rings. The projection will shine along the North Tyneside coastline until Sunday. From there, it will spread its light to other parts of the UK. Go [here](#) for more information on London's Cultural Olympiad, and look! Pretty pictures of light below.

"Global Rainbow Flipped On IN England for London's Cultural Olympiad," Huffington Post, March 2012
http://www.huffingtonpost.com/2012/03/03/global-rainbow-london-cultural-olympiad_n_1318440.html

American artist Yvette Mattern's Global Rainbow is lighting up miles of the North East, for the next five nights. It consists of seven parallel beams of coloured laser light designed to be projected across large open sites, particularly densely populated areas. Hundreds gathered to watch the first show being beamed from St Mary's Lighthouse, Whitley Bay at 18:00 GMT. ...

Global Rainbow is the first in a series of high profile Cultural Olympiad projects taking place across the North East during 2012. Allison Clark-Jenkins, regional director of Arts Council England, said: "Global Rainbow is the perfect way to mark the start of this year's cultural celebrations of the London 2012 Olympic and Paralympic Games in the North East. Not only is the project delivering art on a very large scale to many thousands of people, but it's welcoming an international artist to the region, and is the culmination of a great deal of careful planning and creative programming.

"London 2012 heralded by Whitley Bay laser light show," BBC, February 2012
<http://www.bbc.co.uk/news/uk-england-tyne-17204678>

Art is often said to have healing powers, and beginning tomorrow many people who live in the path of Hurricane Sandy — which struck a month ago — will have a chance to see a piece of art created for them. It's a "monumental" laser installation by Yvette Mattern called Global Rainbow, After the Storm, launched from the rooftop of the Standard Hotel at the Highline. Designed to illuminate the night sky and be visible for up to 35 miles (depending on atmospheric conditions), the work will aim seven beams of high power light lasers over communities hit by Sandy. It "aims to symbolize hope and act as a call to action to support the communities that were devastated by the storm
...

Judith Dobrzynski, "A New Light for Victims of Hurricane Sandy," Arts Journal, 11/2012
<http://www.artsjournal.com/realcleararts/2012/11/a-new-light-for-victims-of-hurricane-sandy.html>

In an interview with The Huffington Post, Mattern, while shivering in the freezing temperatures on the roof, looked out into the beams a few feet above. "The rainbow has its own power, you know?" The Berlin-based artist launched a version of "Global Rainbow" for the Cultural Olympiad in London in March, and has also installed the project in Germany, France, and the Netherlands since its 2009 inception on Wall Street for Martin Luther King Jr. Day. For the project's Chelsea launch, the artist wants the rainbow to serve as a reminder that "we are all in this together, regardless of divisions of class, race, religion and culture," she says in a news release. The project is to serve as a call to action to raise funds for Waves For Water and the New York Foundation for the Arts' Emergency Fund, which are taking donations [here](#).

Kathleen Massara, "'Global Rainbow' is Yvette Mattern's Amazing Light Installation At the Standard Hotel."
Huffington Post, 11/28/2012. http://www.huffingtonpost.com/2012/11/28/global-rainbow-new-york_n_2204177.html

Local Support for *Night Rainbow* / *Global Rainbow New Haven*

“As the Mayor of New Haven, I enthusiastically endorse Site Projects’ proposed exhibition ... This dramatic piece will illuminate the skies over New Haven ... [and] be a beacon, drawing crowds of spectators and tourists to the City. ... Site Projects has a history of bringing high quality art exhibitions and cultural events to New Haven and the City has been supporting their projects since 2004.”

John Destefano
Mayor of New Haven

“Thousands of Europeans have now experienced the power of this artwork, which has drawn huge crowds who quietly witness its beauty. This installation promises to be one of New Haven’s most visually stunning and compelling cultural events of 2013.”

Jock Reynolds
Director, Yale University Art Gallery

“[Yvette Mattern] promises to invite every member of our community to look up and contemplate just how far our light can shine. New Haven is a town of many languages ... Yvette’s project will speak to us all. To whom does a rainbow not speak? ... Yes. We have Turner’s rainbows at the Yale Center for British Art. But Yvette’s will become our rainbow, filling the air that we all breathe.”

Bill Brown
Director, Eli Whitney Museum

*“Market New Haven promotes the City as a unique and attractive destination with ‘something for everyone’ ... It is for this very reason that I endorse Site Projects’ commitment to host ... **Night Rainbow**. We hope to attract thousand of visitors to New Haven ... We have witnessed first-hand the quality of public art projects Site Projects has brought to our city since 2004 and we hope to add Ms. Mattern’s **Night Rainbow** to their impressive portfolio.”*

Anne Worcester
Chief Marketing Officer, Market New Haven, Inc.

Support from Previous Exhibitors

“Everybody loved the Rainbow for its extraordinary strength and beauty. ... Two people in quite the same place and they don’t see the same Rainbow.”

Didier Kimmoun, Director of Artistic Events, City of Toulouse France

“[The Rainbow] was a massive success! ... an artwork that is a simple concept, easily translatable to a mass audience but, equally, worth debating in more depth.”

Cian Smythe, Arts Council, Northern Ireland

Expert Feedback

Lessons + Ideas from Teachers

Educational Center for the Arts

Sabrina Marques
Drawing Instructor

Lesson Plan Inspired by:

Yvette Mattern- *Night Rainbow* | *Global Rainbow New Haven*

Yvette Mattern's artwork *Night Rainbow* | *Global Rainbow* is a laser light installation that will illuminate the night sky of New Haven for 5 nights. This piece will originate from the summit of East Rock Park and project the colors of ROYGBIV 30 miles outward over the landscape of New Haven and continue its trajectory out to the Long Island Sound.

Interested in the concept of line extending beyond flatness and into real space- as a class, we will have a field trip after school to experience the *Night Rainbow* | *Global Rainbow* as a means of metaphorical inspiration and use the book of Paul Jackson, From Sheet to Form, to literally create from folding paper, line and shape in actual space.

We will then compose the forms in a setting and draw them as a still life, i.e. suspend them from the ceiling, or cluster them in a pile in the corner of the room- addressing Yvette Mattern's piece where one's perspective changes one's perception. We will draw with the lights of the room off and only have controlled colored spotlights on the still life being drawn- creating a high contrast colored light and shadow relationship. The students will actualize their folded drawings/sculptures back into a two dimensional piece, creating illusionistic space keeping in mind they originally physically manifested the drawn lines and shapes in actual space.

Connecticut Arts Standards for Work inspired by:

Yvette Mattern's *Night Rainbow* | *Global Rainbow New Haven*

Students will:

- I. Select paper, techniques, and processes to communicate ideas. Reflect on their choices and analyze what makes them effective.
- II. Utilize elements and principles of design to solve visual problems.
- III. Use the elements of art and principles of design to improve communication of their ideas.
- IV. Describe and analyze characteristics of works of art- specifically the art installation *Night Rainbow* | *Global Rainbow New Haven*, using visual art terminology.
- V. Reflect on and evaluate the quality of and effectiveness of your design - using specific criteria.

Outcomes:

- I. Oral Presentation – describe their personal project to the class.
- II. Reflective Discussion:

What are the differences in the visual language of light and color when its trajectory is over the New Haven landscape, and when its trajectory is over the topography of folded paper?

Were you able to create artwork that effectively reflects your sense that perspective changes perception?

What have you learned about your own visual instincts?

Have you learned how to communicate your visual ideas using the elements and principles of design?

How did the sheet to form approach challenge you?

Laser Lesson Plan

Tyler Ibbotson, former High School Math teacher, current Finance professional

Section 1. Introduction to lasers

A. Discussion Questions:

1. Where do we see lasers in everyday life?

Answers: Laser pointers. CD and DVD readers and burners. Barcode reader at supermarket. Surgical equipment (e.g., to remove growths, for eye surgery). To measure distances in construction (even to measure the distance to the moon). To cut metals.

2. What makes lasers different from normal light? What makes a laser different from a flashlight? Brainstorm differences and similarities (bring in a laser pointer and a flashlight if possible).

Solutions:

- i. Important differences: Laser beam monochromatic light. Laser beam light focused in narrow beam.
- ii. Important similarities: Both use light. Both require energy input to create light. Both lights eventually diffuse and dissipate.

3. Comparing a laser beam to a flashlight beam. (materials: laser pointer, flashlight, glass prism)

- a. Starting six inches from a chalkboard or wall, shine a laser pointer and a flashlight at the chalkboard or a wall. Have a student measure the diameter of each beam. Next stand one foot from the wall and measure the diameter. Then: 2 ft, 5 ft, 10 ft and so on. Have all students record observations on a chart of distance and diameter. Compare the ways the radius of the laser beam expands in contrast to the flashlight.

Solution: The diameter of the laser increases linearly with distance. The diameter of the flashlight increases linearly at first, but quickly becomes too diffuse to actually measure.

- b. Ask students to predict what will happen when you shine the flashlight through the glass prism compared to the laser. Then, shine each through and see what actually happens.

Solution: Flashlight light is made up of all colors and thus should split into a rainbow of colors. In contrast, laser light will stay monochromatic even during diffraction.

B. How lasers works

A laser beam is a dense beam of light focused in a single direction. The laser has two key components which make it possible to focus light. The first is the gas or crystal used to produce laser light, and the second is the tube with mirrors used to focus the light. To understand how laser light is produced is it important to first understand how atoms can absorb and emit light. Atoms are made up of two primary components, a central part called the nucleus, and outer rings of electrons that orbit the nucleus. The electrons orbiting the nucleus are organized into rings around the nucleus. When the atom is hit with energy, the electrons can jump to a higher ring. If the electron then jumps back down to its original energy level, it will have to release some energy and it does this by releasing a photon, which is a particle of light. The amount of energy released when the electron jumps will determine the wavelength of the photon. Wavelengths appear to our eye as color. So, by picking a gas or crystal where only one electron

can jump back and forth, lasers are able to emit only a single wavelength of light, which translates into a single color of light. So now we know how a single color of light is emitted, but how is that light focused? That focusing happens in the laser tube called the "optical cavity." The tube has mirrors on both ends. One is a full mirror, and the other is a partial mirror which lets some light through. When light is emitted from the gas or crystal inside the laser, that light shoots in all directions. Some of it hits the mirrors on either side of the tube and starts bouncing back and forth, while the rest of it hits the sides of the tubes and gets absorbed. Therefore, only the light moving exactly in a straight line across the tube remains. So now we have a little bit of light moving back and forth in a perfectly straight line, but how does that become enough light to make a laser beam? The answer is a special property of atoms discovered by Einstein and called "stimulated emission." Stimulated emission happens when a photon bumps into an electron in a high energy state. If the electron jumps to a lower energy state, it will release a photon going in the exact same direction as the original photon. So photons bouncing back and forth in a single direction bump into electrons and produce more and more photons moving in the same direction. This is what makes a laser light so focused. Finally, some of the laser light breaks through the partial mirror and becomes the laser beam that we see.

Sources:

<http://science.howstuffworks.com/laser.htm>

<http://www.aps.org/programs/education/highschool/teachers/upload/Physics-of-Lasers-Student-Edition.pdf>

[http://www.optique-](http://www.optique-ingenieur.org/en/courses/OPI_ang_M01_C01/co/Grain_OPI_ang_M01_C01_4.html)

[ingenieur.org/en/courses/OPI_ang_M01_C01/co/Grain_OPI_ang_M01_C01_4.html](http://www.optique-ingenieur.org/en/courses/OPI_ang_M01_C01/co/Grain_OPI_ang_M01_C01_4.html)

<http://en.wikipedia.org/wiki/Laser>

<http://web.physics.ucsb.edu/~phys128/experiments/laser/LaserFall06.pdf>

Section 2. Questions:

Functions

1. Below is a chart of how far a laser can go based how much energy it uses.

- What type of relationship is there between the two variables (linear, quadratic, exponential, rational, etc.)? Why does this relationship make sense?
- Create a best-fit function (using your graphing calculator or excel) that defines a relationship between the energy used by the laser, and the distance it travels.
- Given that the lasers in Night Rainbow use X watts of energy, how far do you predict the laser beams will reach?
- If you wanted the beams to stretch twice as far, how much more energy would you need to use?

2. The radius of a laser beam cross-section is a function of the distance the beam is away from its source. For Night Rainbow, the function $R(d)=XXXX$ describes the diameter of the beam. When the beam is X ft from the source, what will be the area of the beam's cross-section?

Proportions / Unit conversions

1. If one of the *Night Rainbow* / *Global Rainbow* lasers requires X watts of electricity to run and electricity costs Y $\$/\text{KwH}$, How much does it cost to run the 7 lasers for one hour? How much does it cost to run them for 8 hours?

2. All light is made up of light waves, much like waves in the ocean. Just like waves in the ocean light has lows -- called troughs -- and highs -- called peaks -- and these peaks and troughs are evenly spaced apart. A wavelength is the distance from one peak to the next peak. For visible light the distance between peaks is so minuscule that it is measured in billionths of a meter. All color is simply light with a specific wavelength. Below is a chart of the wavelength of light (in nanometers) and the color that the light appears to our eyes. For example, blue light has a wavelength of about 450 nm. If blue light and red light both travel for 1 meter how many more times will the red light vibrate over the course of one meter than the blue light does.

Chart: http://upload.wikimedia.org/wikipedia/commons/4/48/Commercial_laser_lines.svg
<http://en.wikipedia.org/wiki/File:Electromagnetic-Spectrum.png>

Geometry

1. Assume that the lasers in *Night Rainbow* / *Global Rainbow* start in the exact same location. If there is X feet between each beam when they are Y hundred feet from the source, how many feet apart will the beams be when they are Z feet from the source? (challenge, assume the lasers are each separated by 10 at their origin)

Trigonometry

1. The lasers beam used in the artwork can travel X ft before the light is too diffuse to be seen. They beams are pointed at Y angle above the ground. How high will they reach into the sky? Airplane's fly at X height, will they hit airplanes? Cumulus clouds typically start between 2,000 and 6,000 ft high. Will lasers reach the clouds?

2. If you want each laser beams in the artwork to be X ft apart from the one next to it when it is 1 mile (5280ft) from its source, at what angle should you point the lasers (Basic: assume the laser "guns" start in the exact same location, challenge: assume the laser "guns" are each separated horizontally by 20ft)

3. You know that the lasers are pointed at X degrees above the ground. You decide to drive out, following the laser beam until you can no longer see it above you. After driving straight for Y miles, you can no longer see the beam above you. Using this information, how far can the laser beam travel?

Creative

4. Lighthouses and flashlights are early precursors to lasers. They use mirrors to focus light in a single direction. Imagine it is 1700 and you are on the Connecticut government's lighthouse planning commission. You have $\$X$, and each lighthouse costs $\$Y$. You want to place lighthouses along the coastline to signal where the shore is. A lighthouse beam will go Z ft. Where would you place your lighthouses?

Bibliography & Additional Resources

Informational Resources

Lee, Raymond L., Jr. and Alistair B. Fraser, The Rainbow Bridge, Rainbows in Art, Myth and Science, Penn State University Press/SPIE Optical Engineering Press, 2001.

Schiff, Judith, "The Social History of New Haven," New Haven: An Illustrated History, edited by Floyd Shumway & Richard Hegel, New Haven Colony Society, Windsor Publications, CA, 1987.

Whelan, Richard, The Book of Rainbows, Art, Literature, Science & Mythology, First Glance Books, California, 1997.

Picture Books

Callahan, Sean, The Leprechaun Who Lost His Rainbow, illustrated by Nancy Cote, Albert Whitman & Company, Morton Grove, Illinois, 2009.

De Rico, UI, The Rainbow Goblins, Thames & Hudson, 1995.

Freeman, Don, A Rainbow of My Own, Puffin Books/Viking Press, NY, 1966.

Krupp, Edwin C., Rainbow and You, Illustrated by Robin Rector Krupp

Websites

Natural Rainbows

http://www.ehow.com/way_5414891_prisms-experiments.html#ixzz2E2wsTcPr

Lasers

<http://spaceplace.nasa.gov/laser>

http://www.ehow.com/how-does_4566008_lasers-work.html

<http://kids.yahoo.com/science/space/article/laser>

<http://www.laserfx.com/Works/Works2.html>

<http://www.laserfx.com/Science/IndexScience.html>

<http://photonlexicon.com/repairfaq/sam/laserfaq.htm#faqwil>

New Haven History

http://www.criscoladesign.com/pdfs/ehc_census.pdf

Art & Art History

<http://britishart.yale.edu/collections/search>

<http://ecatalogue.art.yale.edu/search.htm>

www.googleartproject.com

About the Artist & Site Projects

www.yvettemattern.com

www.nightrainbownewhaven.com

www.siteprojects.com