

# The Real Time Rolling Shutter

David Monaghan and Noel E. O'Connor  
Insight centre for data analytics  
Dublin City University, Ireland  
david.monaghan@dcu.ie

Anne Cleary and Denis Connolly  
Paris, France  
connollycleary@noos.fr

## ABSTRACT

From an early age children are often told either, you are creative you should do art but stay away from science and maths. Or that you are mathematical you should do science but you're not that creative. Compounding this there also exist some traditional barriers of artistic rhetoric that say, "don't touch, don't think and don't be creative, we've already done that for you, you can just look...". The Real Time Rolling Shutter is part of a collaborative Art/Science partnership whose core tenets are in complete contrast to this. The Art/Science exhibitions we have created have invited the public to become part of the exhibition by utilising augmented digital mirrors, Kinects, feed-back camera and projector systems and augmented reality perception helmets. The fundamental underlying principles we are trying to adhere to are to foster curiosity, intrigue, wonderment and amazement and we endeavour to draw the audience into the interactive nature of our exhibits and exclaim to everyone that you can be what ever you chose to be, and that everyone can be creative, everyone can be an artist, everyone can be a scientist... all it takes is an inquisitive mind, so come and explore the real-time rolling shutter and be creative.

## Keywords

Virtual Mirror, Visual Perception, Rolling Shutter, Interactive Artworks

## 1. INTRODUCTION

In early 2011 some scientists and some artists began to talk. From humble beginnings and email debates, regarding the definitions of science and art, the interactions and crossovers within the fields of art, design and science stemmed an unique collaboration of Art and Science. This collaboration has lead to a series of engaging interactive science/art collaborative pieces that reflect different aspects of how we perceive the world around us. Under the lead of Professor Noel O'Connor at CLARITY (now called Insight) in Dublin City University Dr. David Monaghan has headed

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [Permissions@acm.org](mailto:Permissions@acm.org).

MM'15, October 26–30, 2015, Brisbane, Australia

Copyright is held by the owner/author(s). Publication rights licensed to ACM.

ACM. 978-1-4503-3459-4/15/10 ...\$15.00.

DOI: <http://dx.doi.org/10.1145/2733373.2808110>.

the scientific aspects of this collaboration and together with Dr. Philip Kelly has mentored a team of undergraduate Summer interns that have worked on various technical and engaging scientific challenges embedded in these art works. Anne Cleary and Denis Connolly are fast becoming known as Ireland's foremost new-media artists, easily incorporating innovative new technologies into their work to produce art that is both engaging and significant. They are the only two living Irish artists to have had an exhibition in the Pompidou Centre [2]. As relatively new artists on the scene they are causing a stir within the art community with their playful yet socially aware approach to interactive digital exhibitions. Much of Cleary and Connolly's work is collaborative, with a strong socio-political aspect, both through its subject matter and in its engagement with people. They coined the term "observer participation" to describe their work, which is committed to affirming the active role of the public in art.

The result of this collaboration has been a series of exhibits that leverage emerging sensing technology and image processing that have been exhibited in Farmleigh House, Limerick City Gallery of Art, Solstice Arts Centre, Navan and Kerry County Museum, Tralee before moving to the Centre Culturel Irlandais in Paris. Recently, the Rolling Shutter exhibit was selected to represent Ireland on "Europe Day" in Paris. It was unveiled to the public on May 9th by the Mayor of Paris Bertrand Delanoë in the presence of Mr Dinny McGinley, Delegate Minister of State for Arts Heritage and the Gaeltacht, and the Irish Ambassador to France Mr Paul Kavanagh.

## 2. PREVIOUS WORKS

What follows in this section is a brief overview of the some of our previous art/science exhibitions. By explaining some of these pieces my hope is to convey some of the axiomatic fundamental principles that we are trying to encapsulate within the Real Time Rolling Shutter.

Daniel Finnegan, a talented young computer scientist studying in UCD at the time worked with us for 3 months (mentored by Dr. Kelly and Dr. Monaghan) to develop "virtual reality" helmets for the Cleary/Connolly that allow the wearer to experience the world upside down or as a negative image. It uses android phones as the lens in a specially constructed helmet designed by Irish SME ape.ie. This work is a reboot of George Stratton's classic perceptual adaption experiment in the late 19th century. Stratton was a world-famous US psychologist who pioneered the study of perception in vision. He used prisms to create "upside glasses" which he wore for 8 days running so that his vision system

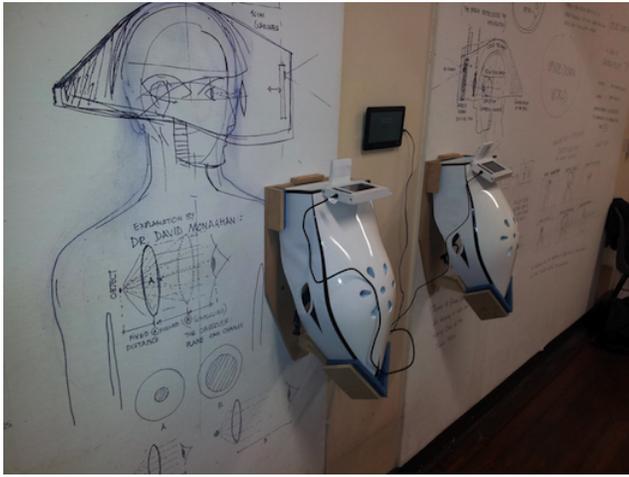


Figure 1: The VR helmets we made for Dublin Contemporary in September 2011



Figure 2: The Dot-Man Exhibition

ultimately adapted to this view of the world. The helmets we designed were exhibited at Dublin Contemporary 2011, see fig 1, where they were cited as the "Stand Out Exhibit" according to one reviewer (Guide2Dublin).

Dr Philip Kelly and Dr David Monaghan developed software for the "Dot Man" exhibit that uses a Microsoft Kinect to show a representation of the viewer as 13 points of light on a black background. This is a re-imagining of the seminal experiments by Swedish psychophysicist Gunnar Johansson on the perception of human bodies in motion. It shows how humans have evolved to recognize human motion, even with very little information and in the presence of large distractions. The "Joining the Dots" exhibit allows the viewer to become a "DotMan" by standing in front of a digital mirror that translates their body into a set of connected dots superimposed into a whirling representation of the stars in the universe.

A large collection of different visually interactive pieces, including the VR perception helmets and the dot-man piece,

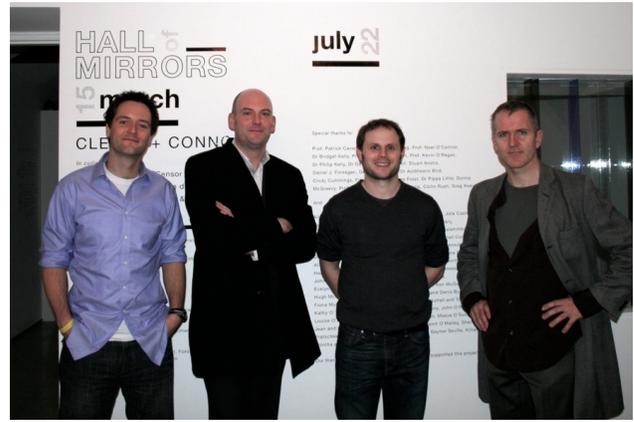


Figure 3: Dr. David Monaghan, Dr. Noel O'Connor, Dr. Phil Kelly of Insight (formerly Clarity) with Denis Connolly at the opening of Hall of Mirrors at Farmleigh, 15 March 2012

were brought together to form the Hall of Mirrors exhibition. Designed to align with Dublin City of Science, the various exhibits were collected into a public exhibition in Farmleigh House, from 15 March - 22 July 2012. The exhibition, entitled Digital Hall of Mirrors was designed to be interactive, hands on and fun! Opened by Brian Hayes TD, the exhibition attracted over 15,000 visitors during its run, including a large number of school visits.

Cleary and Connolly secured a commission, entitled Look Both Ways, from the Rail Procurement Agency, one aim of which was to bring these experiences to your mobile phone. Once again, funded a talented undergraduate student to work on this. Conor Gallagher, now a graduate of DCU's Digital Media Engineering degree programme and a Research Assistant in CLARITY, (mentored by Dr. Monaghan) developed an App for both iPhone and Android that is freely available on Google Play Store and Apple's App Store. This App allows visitors to effectively bring home some of the digital exhibitions with them [3].

### 3. THE REAL TIME ROLLING SHUTTER

Inspired and conceptualized by Cleary-Connolly who worked closely with Dr. David Monaghan who created, firstly an off-line rolling shutter programme followed by the real time software. The objective is to create a mirror-like rolling shutter where the image develops from bottom to top over 4 seconds. This is inspired by a 100-year-old photograph by Jacques Henri Lartigue, which led to the well known (in photographic circles) "Mystery of the Slanting Car", see fig 5.

The car in this photo appeared to lean forward while the spectators appear to be tilting backwards. This expression of movement and is all down to the design of Lartigue's rolling shutter camera and the fact that the photographer was taking the photo from a car moving more slowly than the race car.

The Real Time Rolling Shutter extends this concept by using a virtual digital mirror and shows the exaggerated effects of a rolling shutter camera. Time is expressed a geometric distortion and, as in a fairground hall of mirrors,



Figure 4: Irish Minister of State for the Office of Public Works Brian Hayes, Dr. David Monaghan, Prof. Noel O'Connor and Anne Cleary at the opening of Hall of Mirrors at Farmleigh, 15 March 2012



Figure 5: Lartigue's photo of the slanting car in 1913

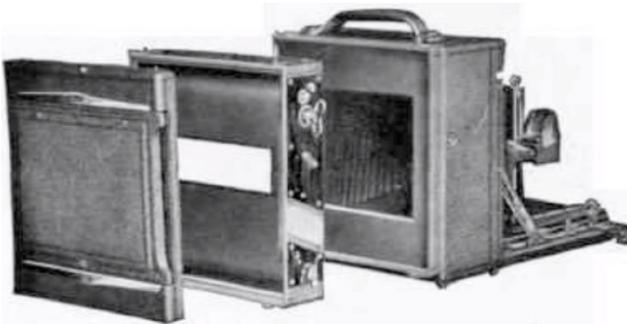


Figure 6: Lartigue's Rolling Shutter camera



Figure 7: The Real Time Rolling Shutter being demonstrated by Dr. David Monaghan Conor Gallagher at Dublin City University

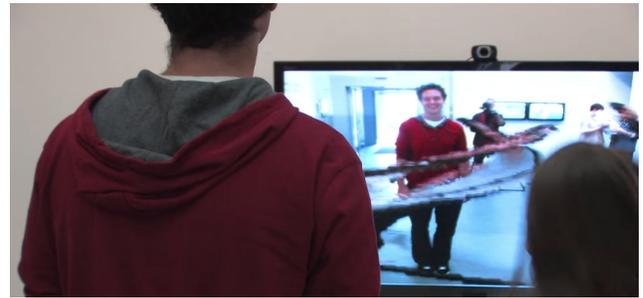


Figure 8: The Real Time Rolling Shutter at Limerick City Art Gallery during the launch of the a show on interact digital art. Here Dr. David Monaghan can be seen being inter-tangled by Anne Cleary and Denis Connolly as the demonstrate the exhibition

the experience is as much fun as it is challenging. To fully experience what the real time rolling shutter does please see this youtube video clip [4] and also [5].

The Real Time Shutter was displayed at the Centre Culturel Irlandais in Paris before being selected to represent Ireland on "Europe Day" in Paris [6, 1]. It was unveiled to the public on May 9th by the Mayor of Paris Bertrand DelanoÁn in the presence of Mr Dinny McGinley, Delegate Minister of State for Arts Heritage and the Gaeltacht, and the Irish Ambassador to France Mr Paul Kavanagh. It was also exhibited by the artists at the Irish booth at the European Parliament Open Day, 4th May 2013, at the invitation of An Taoiseach.

#### 4. THE 2015 ACM MULTIMEDIA EXHIBITION

At the 12th edition of the Interactive Arts Programme at ACM MM 2015 we plan to exhibit the Real Time Rolling Shutter piece. Practically, this will consist of a large TV screen or projector and screen, depending on the venue, a laptop and a web camera as the only equipment needed. The main aim to this piece to draw in the audience, engage them, allow them to play and have fun but at the same time challenging them to think, to analyse, to be creative and



Figure 9: The Real Time Rolling Shutter being demonstrated by Denis Connolly and Vincent O'Shea



Figure 10: The Real Time Rolling Shutter at "Europe Day" in Paris in May 2013

most of all to simply be curious! We are certain that the real time rolling shutter exhibition will be as popular in ACM Multimedia as it has been at the various Art exhibitions where we have displayed it. We have found that each time we display it, that different people find different ways to interact and play with it. We believe that this piece would make an excellent addition to the ACM MM Art exhibition and that the artist merit aligns extremely well with the philosophy of the ACM MM Art Exhibition.

This exhibition can either be display on a small screen on the side of a wall or on a large 20 foot screen, as seen in fig. 10, either way it has never failed to intrigue and engage audiences of all walks of life.

## 5. ACKNOWLEDGMENTS

The research that lead to this paper was supported in part by Science Foundation Ireland. The Authors would like to acknowledge the Scientific and Artistic contribution of Patrick Cavanagh, Vincent O'Shea, Greg Keely, Daniel Finegan, Conor Gallagher and Philip Kelly.

## 6. REFERENCES

- [1] Cleary connolly at the irish cultural heritage centre. [www.cultureireland.ie/eu2013/event/look-both-ways-a-multimedia-installation](http://www.cultureireland.ie/eu2013/event/look-both-ways-a-multimedia-installation).
- [2] Cleary connolly website. <http://www.connolly-cleary.com>.
- [3] Look both ways. <http://www.connolly-cleary.com/LookBothWays/LookBothWays.html>.
- [4] Real time rolling shutter demo video1. <http://www.youtube.com/watch?v=-HHxq16pp8>.
- [5] Real time rolling shutter demo video2. <https://www.youtube.com/watch?v=Fg9Ph53ka2I>.
- [6] Rolling shutter in brussels and paris. <http://www.dcu.ie/news/2013/may/s0513r.shtml>.