What has Photogrammetry got to do with it?
Basically this happened – the allure of time & motion was irresistible. Then followed a rush to create ‘Cinema’, projectors, movie theaters, film studios, and TV.
Let’s go back......
The Birth of Photography

William Henry Fox Talbot 1835

Victorian ‘Natural Philosopher’

Tim Macmillan
IEEE CNSV Lecture
02 September 2014

was Talbot
Talbot's first picture
1835
Calotype Process
NEG/POS – means it could be reproduced.
The beginnings of photography
Talbot's 'Pencil of Nature'
Evolution

• The photographic process
• The photographic camera
• Lots of cameras
• Lots of images
• A new visual language
Photography and Motion analysis

Early animation – phenakistoscope and zoetrope could animate drawings but how did things really move.

Muybridge created a reverse process – to turn movement into still frames

He used ‘Cameras Array’
Photography and Motion analysis

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Muybridge created a reverse process – to turn movement into still frames

He used 'Cameras Array'
Edweard Muybridge 1830-1904

Muybridge had to invent new equipment. He used trip wires initially.
But then progressed to a device which could fire the cameras in a regular sequence. He could tune and adjust the interval between shots to suit the action of the subject. Note the governor at the top – it uses air friction to regulate the speed of the device. Electricity was still a new thing – he couldn’t go to CPC or Maplins and buy a kit!
A fantastic achievement – the horse does indeed have all 4 legs in the air at one point of the gallop. This is proto-cinema – all we need are sequential frames from one camera, and a projector. Hand over to the Lumiere Brothers.
The Stanford wager was probably a myth but that’s not the point....

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A fantastic achievement – the horse does indeed have all 4 legs in the air at one point of the gallop.

This is proto cinema – all we need are sequential frames from one camera, and a projector.

Hand over to the Lumiere Brothers.
Something was overlooked!

Muybridge’s simultaneous series

Frozen-time analysis of bodies in motion

Photography and Motion analysis

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Muybridge created a reverse process – to turn movement into still frames.

He used ‘Cameras Array’.
Nadar - 1820-1910

Nadar – a great French portrait photographer. He's interested in a 360 degree approach. But these are not simultaneous – he is being rotated in front of the camera – you can see him smiling in one of the pictures – so it's a time-based animation but also a photo-sculpture.
Camera Array and Simultaneity...
“Many Different Views Exist and are Related”

Which leads on to something which we think of as being separate – photography and painting!

What we have to appreciate is the completely open discussion and cross-referencing that went on between proto ‘science’ and ‘art’.

Innovations in the understanding and depiction of the world around us were eagerly explored by the artists of the day.

Picasso 1910
Portrait of Henry Kahnweiler

My association with photography begins here.
Which leads on to something which we think of as being separate – photography and painting! What we have to appreciate is the completely open discussion and cross-referencing that went on between proto 'science' and 'art'. Innovations in the understanding and depiction of the world around us were eagerly explored by the artists of the day. My association with photography begins here.
Cheaper than a lens! For a poor art student. But it is a conceptual this as well – an infinite point in space – regular geometry, light rays hitting the film unhampered and undistorted by glass.
Simultaneity

So this is where I come in – a young art student in 1980 exploring Cubist theory and ‘simultaneity’. I realized this could be expressed photographically – you can see many simultaneous views on the one object.

Why on film? I realized this was a way of transforming ‘simultaneous space’ into ‘sequential time’, which made it viewable.

I was actually unifying these two strands of photographic history – the camera array and the motion picture – that was the epiphany.
Cubist simultaneous Film

Time-Slice Camera idea 1980

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16mm Motion Picture Film

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So I started building cameras.

Square camera built 1980 at Bath Academy of Art.

Circular camera built 1982 at Slade School of Art.
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Square camera built 1980 at Bath Academy of Art.

Circular camera built 1982 at Slade School of Art.
But in 1993 I was asked to be on Tomorrow's World thanks to the Arts Council. Had to build a camera as 2 weeks notice.
Is the Dog Dead?

Yes – physically
No – it’s just a photo

Is a photo a representation of death?

Have I stolen the dog’s soul?

The still photo is easier to explain than the Time-Slice movie of the same moment.
The “Insect” Camera

Thanks to BBC Natural History Unit, the Nat Hist documentary has a lot more latitude for technical creativity. Also allowed me to prototype a new generation of cameras.
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The “Josephine” Camera - 1996

120 x 35mm Lenses
3m radius arc
35mm motion-picture
Vistavision 8-perf frame
Programable shutter system
Modular construction
Heat/humidity compensation

It allowed me to get creative.
The “Josephine” Camera - 1996
The “Josephine” Camera - 1996

It allowed me to get creative.
The “Josephine” Camera - 1996

TV Drama

Motion plus frozen-time plates

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Camera Array and Motion Estimation

Basically this happened – the allure of time & motion was irresistible.

Then followed a rush to create 'Cinema', projectors, movie theaters, film studios, and TV.
SLR Camera Array

Improved SLR Sync
But not without issues...

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SLR Camera Array

Waiting for Sharky...
10x Nikon F5 SLR

Raw Frames
Large Disparity
Extreme Occlusions
Interpolated
30x frames
Snell & Wilcox
‘Flomo’ Algorithm

Animal Planet
Great White Shark

10x Nikon F5 SLR
Camera Array and DSLR
DSLR Camera Array

Max 6° Disparity
Flat Image Plane
On-Site Post-Production

BBC TV
"miracles of Jesus" series

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Carefully crafted scenes to work with the limitations of the software

4-D cloning – using adjacent frames to grab detail

This means we can shoot the scene for real – no layers, but a lot of time spent painting the mattes for each character.
 Basically this happened – the allure of time & motion was irresistible. Then followed a rush to create ‘Cinema’, projectors, movie theaters, film studios, and TV.
Camera Array and Virtual Motion

Adobe:
After Effects

The Foundry:
Nuke

3D Rendering

London Dungeon
TV Commercial
Combining 3 shots

Adobe: After Effects

The Foundry: Nuke

3D Rendering
Camera Array and Virtual Motion

5.5 Gigapixel
High-Resolution Motion-Estimation
3D CGI
Camera Array and Virtual Motion

Cinema.......Web

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Camera Array and 3D Scanning

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Nadar – a great French portrait photographer

He's interested in a 360 degree approach. But these are not simultaneous – he is being rotated in front of the camera – you can see him smiling in one of the pictures – so it's a time-based animation but also a photo-sculpture.
Photographic Sculpture

Shilouette Segmentation

Something from the USA

Again the idea of photo-sculpture

I guess they wanted to make his statue after he died, so they used photography to capture him in 3-dimensions.

But it requires the human brain to interpolate the 24 images into a 3-dimensional piece.

Admiral Farragut sits, late 1860s, for photo-sculpture, in which 24 simultaneous photos were taken.
Something from the USA

Again the idea of photo-sculpture. I guess they wanted to make his statue after he died, so they used photography to capture him in 3-dimensions. But it requires the human brain to interpolate the 24 images into a 3-dimensional piece.
Things haven't changed much

This is one of the rigs we commonly use at the moment for creating 3-D portraits. Lots of cameras in a circle – still about 24, plus top & bottom views. However – we now have a lot more electronics – and a plastic chair.
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What is 3D Scanning? (3DS)
How does 3DS relate to multi-cam array?
Basically this happened – the allure of time & motion was irresistible. Then followed a rush to create ‘Cinema’, projectors, movie theaters, film studios, and TV.
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Array and Computational Photography

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2D Array - a Dead End?

Micro and Macro

**Dimensions are in mm**

Conventional vs Multichannel Optics

**Camera Array**

**Virtual Camera**
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Video Array (Continuous 4D Capture)

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The End