Variation of Brightness with Distance in the Shroud Image

By Craig Paardekooper   [25th Feb 2025]

Aim

The Shroud image looks like a photograph, but it is not. Rather it is an intensity-graph**,** meaning that all its shades are produced by different intensities of radiation.

The greater the distance that the Shroud was from the body, the weaker the radiation was that reached it, and the fainter the image was that the radiation produced.

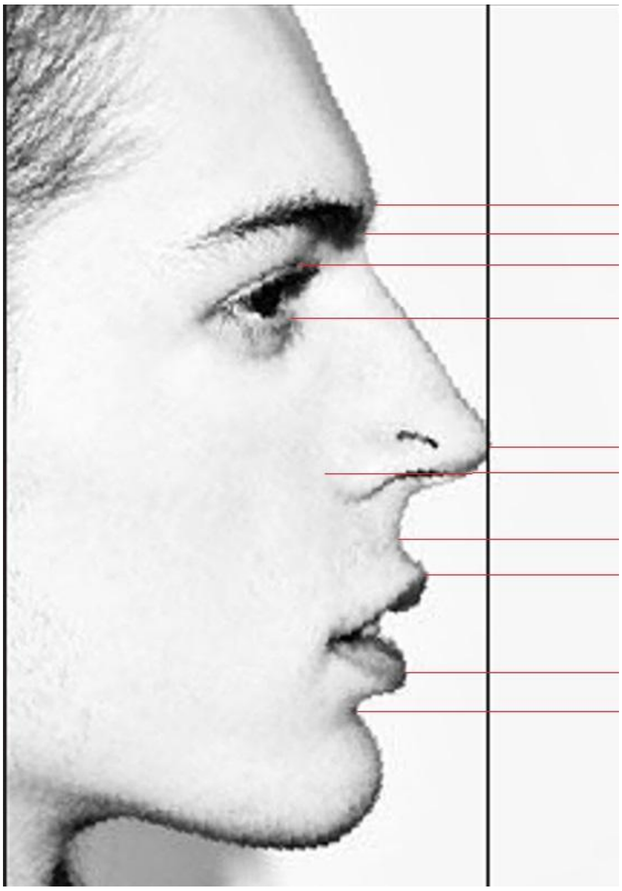
Radiation is not random but obeys fixed laws such that it will decrease in intensity over distance in a constant and regular manner – either linearly or in accordance with the inverse square law.

If the intensity is to convey distance accurately, then the shroud must be flat. If it were not flat, then the image produced would be distorted.

The aim of this study is to see if the depth of physical features correlates with the brightness of these features in the Shroud image. I used a human face to gauge the depth of a series of physical features, then measured the brightness of each of these features on the Shroud image.

Distance Measurements of a Human Face

My first task was to obtain depth measurements of a series of distinct facial points. Measurements were made of the distance of each feature on a human face from a randomly chosen vertical line. I chose the right edge of the picture as the line.



The head was tilted to the same angle as the Shroud image.

Each of the red line distances was measured using a digital caliper.

Feature	Distance from Right of Picture (mn
Brow	40
Bridge	42
Top Eyelid	51.5
Eyelash	53.7
Nose Tip	20.5
Nose Base	36.2
Top Lip	32.1
Bottom Lip	35.3
Chin Cleft	43.2
nostril	47.7

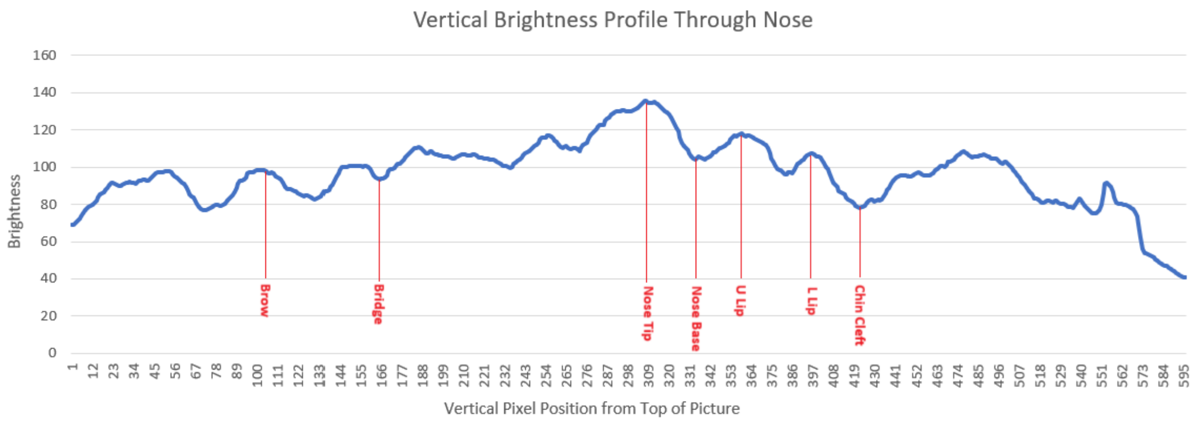
[Pic Source]

Brightness Measurements of the Shroud Face

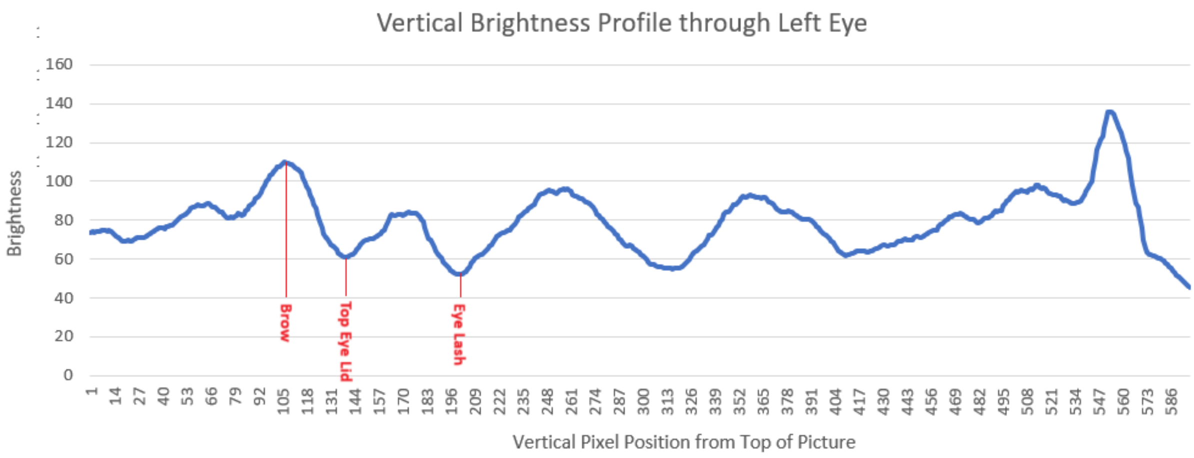
Having obtained realistic depth measurements of a series of facial points, my next task was to measure the brightness of corresponding points on the Shroud image. I took an image of the face of Christ, and captured vertical brightness profiles through the nose and left eye.

Pic Source : Image 056

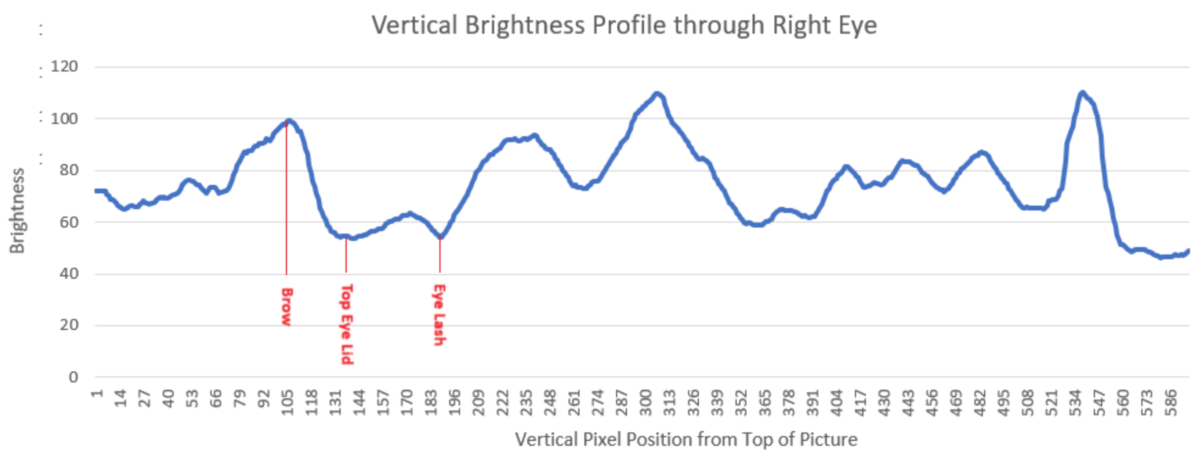
The brightness of each pixel and 5 pixels horizontally on either side of it were averaged. Then the resulting profile was smoothed using a 20-point moving average to obtain a graph of the brightness at each point.



This profile below shows the brightness of the top of eye lid and eye lash. This profile does not go through the nose. The raised area below the eye is the left cheek, followed by the area left of the mouth.



The eye brow of the left eye is more swollen



The eye ball of the right eye is burst.

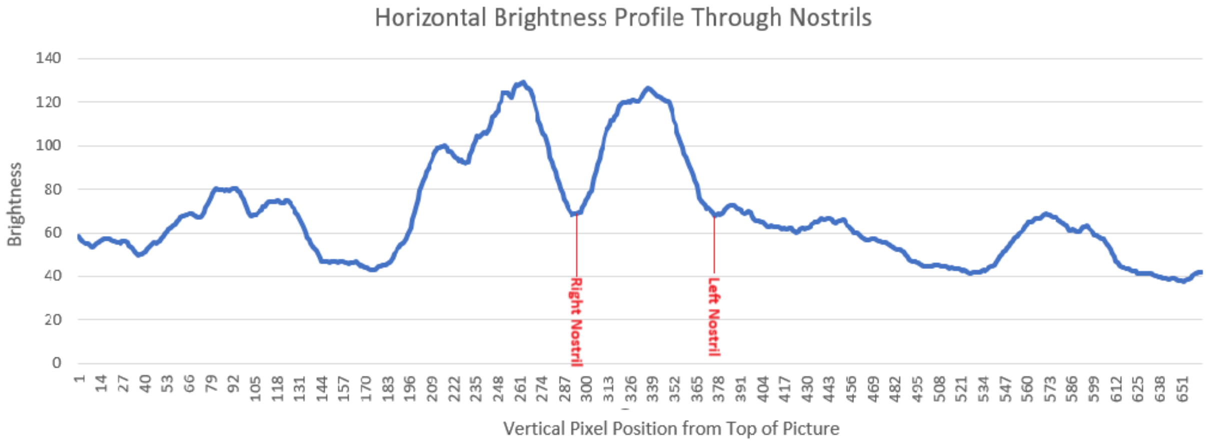
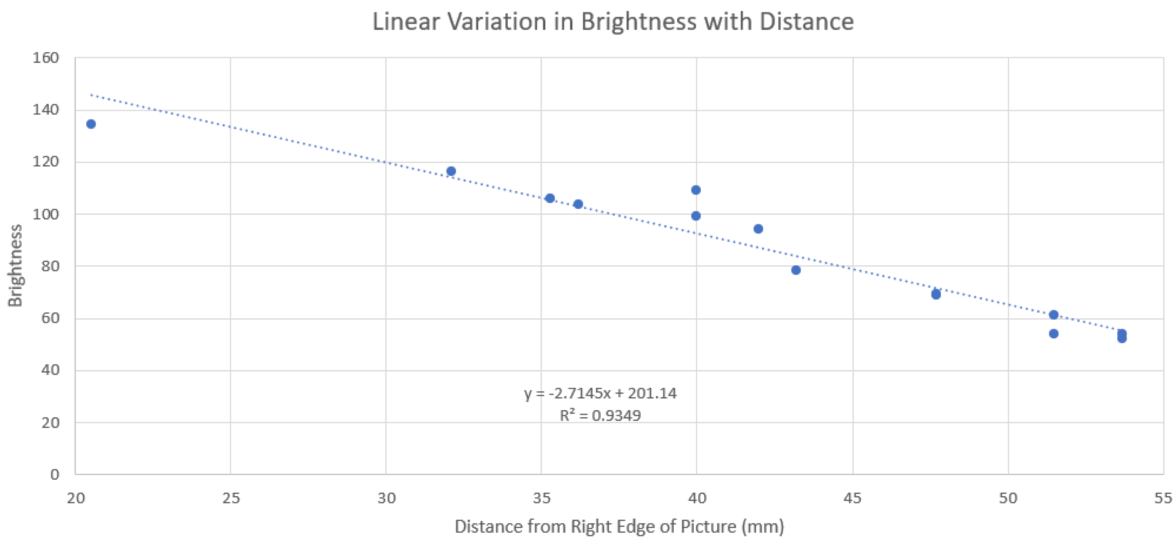


Table of Results

Feature	Distance from Right of Picture (mn	Brightness
Brow(right)	**40**	**99**
Brow (left)	**40**	**109**
Bridge	42	94
Top Eyelid (right)	**51.5**	**53.83**
Top Eyelid (left)	**51.5**	**61**
Eyelash (right)	53.7	54.17
Eyelash (left)	53.7	52.27
Nose Tip	**20.5**	**134.4**
Nose Base	36.2	103.79
Top Lip	**32.1**	**116.475**
Bottom Lip	**35.3**	**105.76**
Chin Cleft	43.2	78.57
Nostril (right)	**47.7**	**69.01**
Nostril (left)	**47.7**	**69.27**
The nostril distance is a line that passes through the highest point of the nose, to its base		

Correlation

R^2 was 0.93 which is a very good fit.



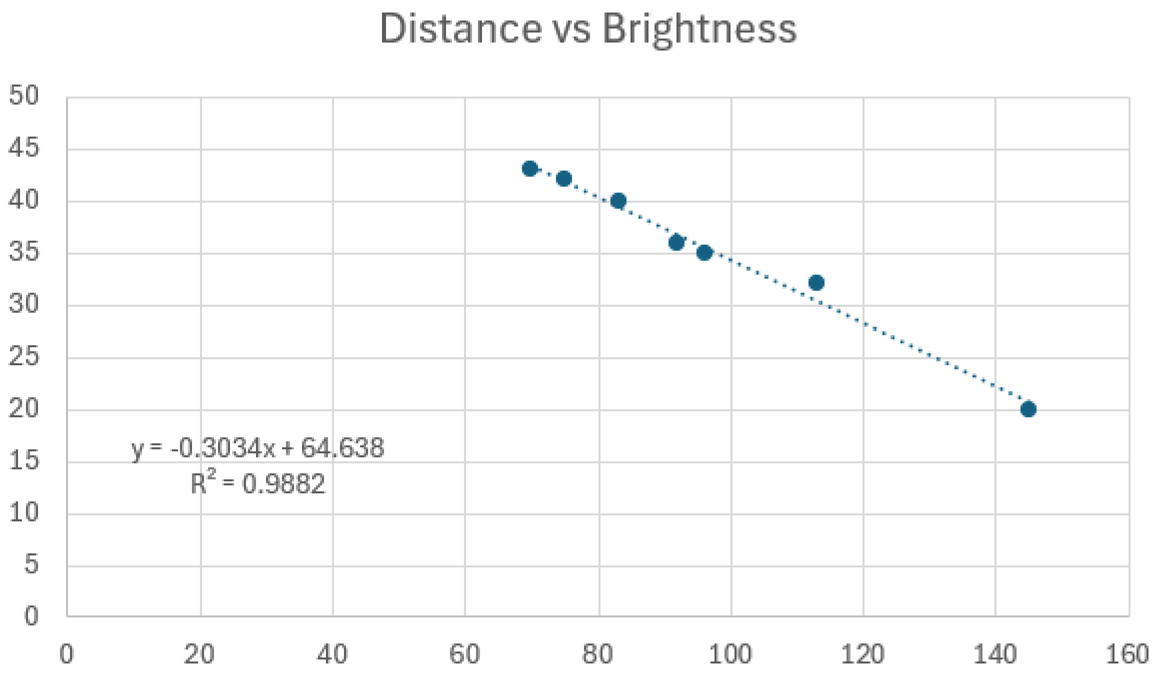
I repeated the measurements with a different picture of Jesus

This was photo 008 from shroudphotos.com

I took horizontal profiles across the brows and lips to get the best estimate of their brightnesses, and I took a vertical profile through the nose to get the brightnesses of bridge, pose tip, nose base and chin cleft.

Here are the results

	brightness	distance
brow	83	40
brid	75	42
tip	145	20
base	92	36
ul	113	32
bl	96	35
cleft	70	43



It is a similar equation to what I obtained before –

Before: Y = -2.724x + 74

Now: Y = -0.3034x + 64.6

So, the point of zero brightness should occur at 64.6 mm from the photo's right border = just beyond the corner of the eyes.

In the picture of Jesus, this would correspond with the far corner of the eye socket.

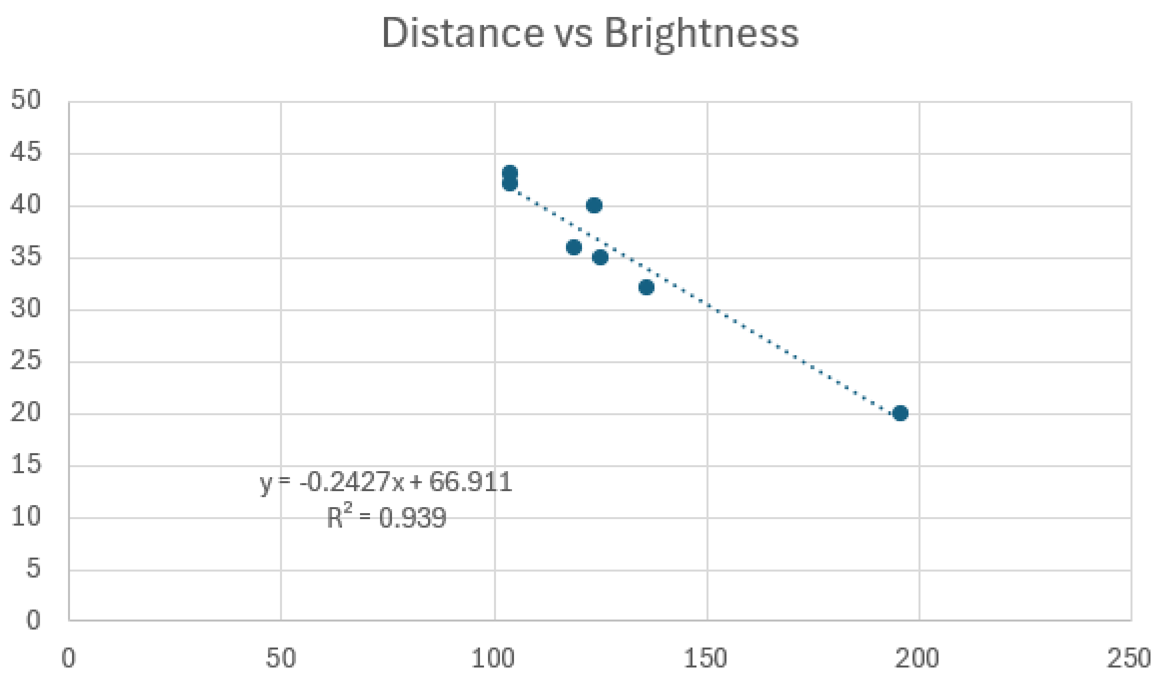
Finally, I used a third picture

I took horizontal profiles across the brows, lips and cleft to get the best estimate of their brightnesses, and I took a vertical profile through the nose to get the brightnesses of bridge, pose tip, nose base and chin cleft.

Here are the results

Given that the face appears to demonstrate an inverse linear relationship between distance from the Shroud and image brightness, I will need to check if this relationship also applies to the rest of the body.

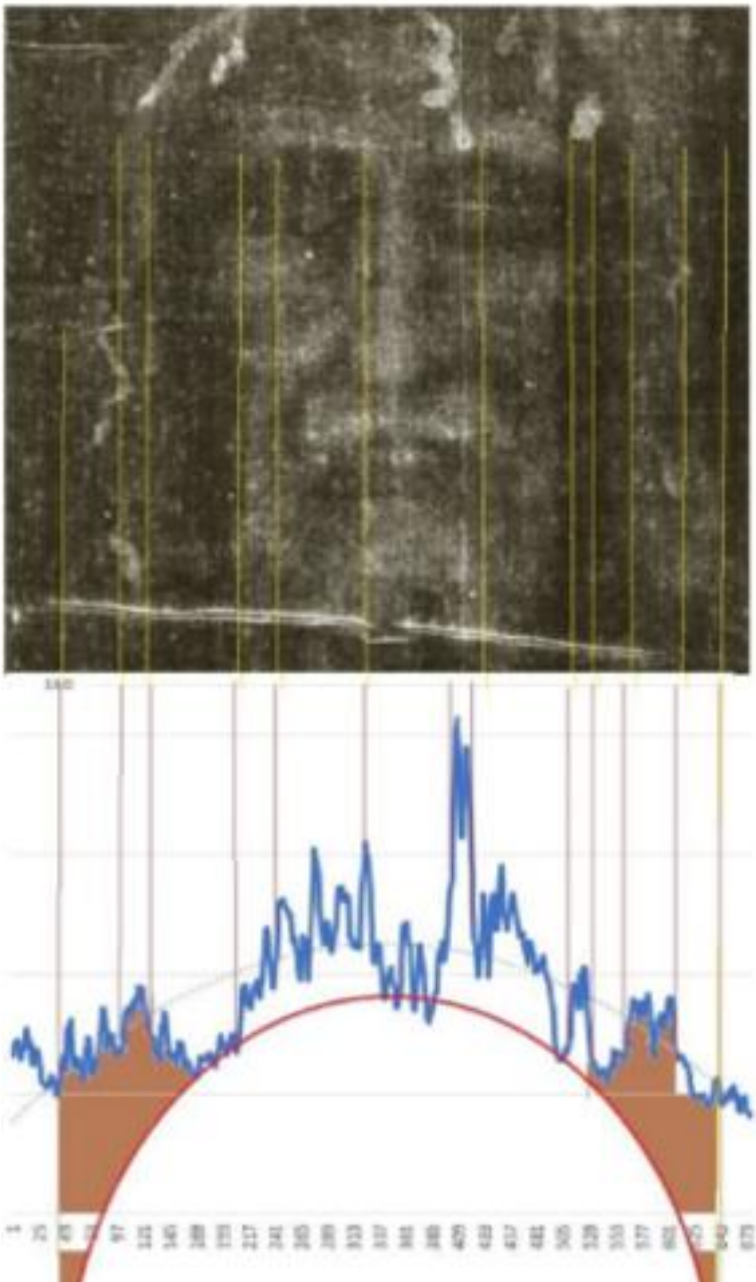
	Brightness	Distance
brow	124	40
bridge	104	42
tip	196	20
base	119	36
ulip	136	32
blip	125	35
cleft	104	43



The equation is similar to the previous two –

Y = -0.2427x + 66.911

So, brightness becomes zero at 67 mm from photo edge – which corresponds to just beyond the corner of the eye.



The hair is level with the cheek bones and temples, which is exactly where hair typically begins (with side burns).

If the shroud were wrapped around the head, then hair brightness should be the same as brow brightness. Instead, we see the brightness levels we would expect if the shroud was perfectly flat and above the face !

The blue chart is the brightness profile through the brow. The brow sits on top of the oval of the skull (it is curious that the skull should be a perfect oval).

The dotted line through the chart is the trendline generated by excel

I have coloured in the areas corresponding to hair.

The left brow shows a strong sloping from right to left, and the right brow shows a strong sloping from left to right.

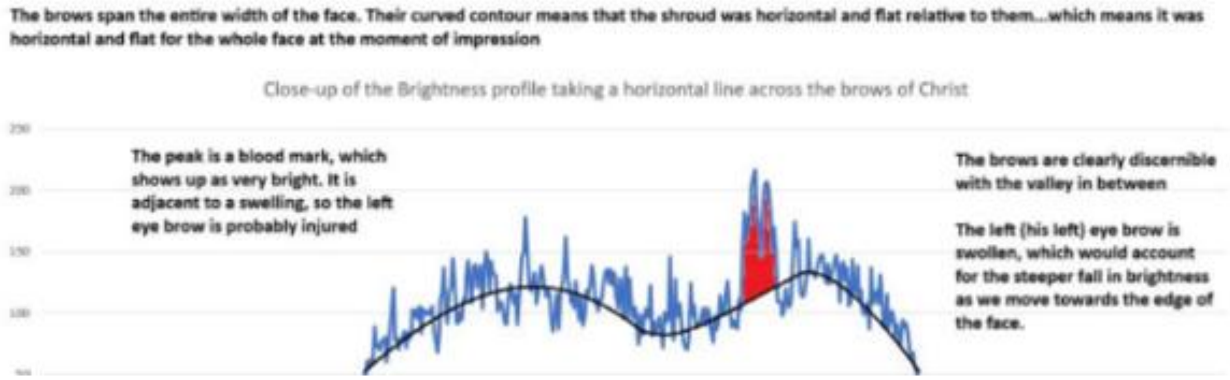
The hair line corresponds to where the temples and cheek bones end.

This brightness profile shows that more distant parts of the body are dimmer - because the radiation that produced the image was attenuated over longer distances.

Therefore, the shroud CANNOT have wrapped AROUND the body, but must have been laying perfectly flat above the body at the moment of impression.

In turn, this means that the radiation that produced the image MUST have been collimated into parallel beams for any image of the face to be produced.

In the chart below I show the brightness profile just for the brows. This contour is only possible if the shroud was perfectly flat and smooth and located above the face.



If the shroud was pressed against the brows and hair, then these would all be of uniform height, since the distance between each of them and the shroud would be the same.

However, instead we find that the hair is far dimmer than the brows, and also the brows themselves vary in brightness along their length I exactly the same way as their elevation varies.

Since the brows span the entire width of the face, therefore this may indicate that the Shroud was flat in the left to right direction, just as we found previously that the shroud seemed to be flat in the top-down direction.

Note that the brightness curve follows the curvature of the skull closely,

On a human face, the brow ridge above each eye tapers off as we move outwards to wards the edge of the face. The brightness profile mirrors this tapering off. If the shroud was pressed against the brows, then they should appear with equal brightness at all points.

We can conclude that the Shroud was flat relative to the brows.

Distortion

If the Shroud was wrapping the body, then it would have captured images of the sides of the body, and this would appear on a flat shroud as a “Mercator” projection.

However, images of the sides are completely absent.

For an image of an object to form on a surface it is necessary for

1. the object to emit radiation towards the surface
2. the surface to be within range of the radiation

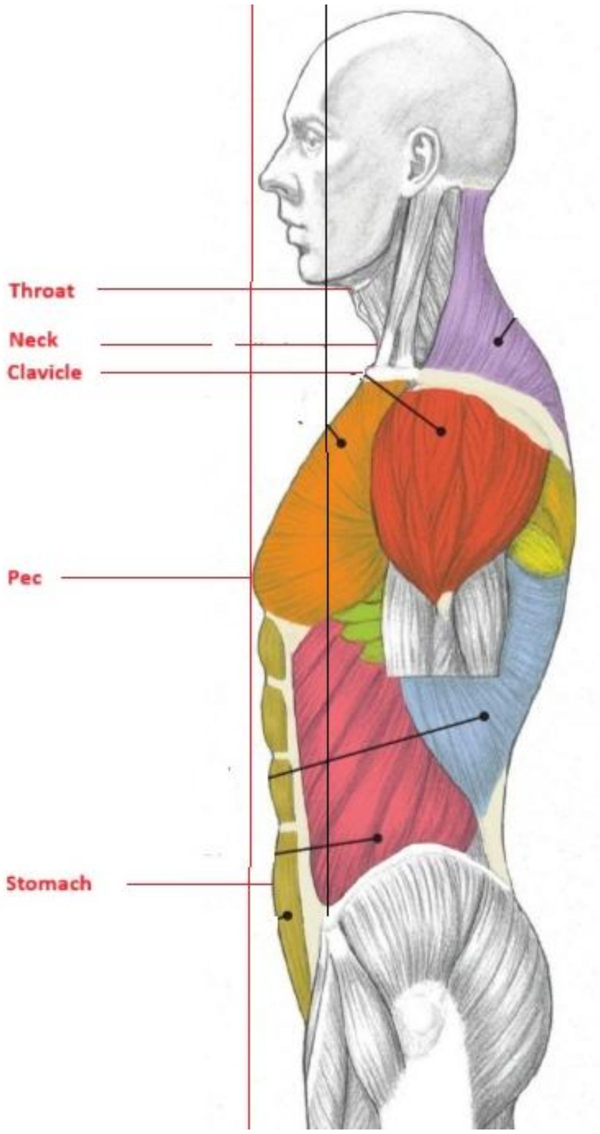
The absence of side images indicates that either the object was only emitting radiation in a top down direction, or that the shroud was not in contact with the sides. If the Shroud was flat, then it would not be in contact with the sides.

The absence of side images of the head indicates that the Shroud was stretched flat in a left-right direction – confirming what we found from the left right brightness profile over the brows.

So, the Shroud was flat in relation to the face, and the absence of side images indicates that it was flat over the rest of the body in a left right direction.

Looking at the Rest of the Body

If the Shroud occupied a perfectly horizontal plane over the entire length of the body, then we should find that body features with the same elevation should possess the same brightness.



Here are the brightnesses that I measured

- Nose tip 218
- Pec 224

Distance of Nose from left edge = 27.4 mm

Distance of pectoral from left edge = 28.2 mm

218/224 = 27.4/28.2

Features at a common elevation are equally bright. But this is only possible if the shroud is flat.

Brightness varies with distance of the shroud from the object surface, but for all the brightnesses to accurately represent distance, and therefore convey a realistic image, then the shroud must be at a constant horizontal distance from the object over the span of that image.

And if the shroud is at a constant horizontal distance then the energy must be collimated.

The Invisibility Line

This is a boundary where the image suddenly becomes darker. It can be observed in the following locations –

1. down both sides of the face,
2. on the wrist of the lower hand,
3. around the hands where they press down on the thighs,
4. on the upper thighs,
5. on the ankles

This boundary is where the image suddenly fades and merges into the background. It is caused when the distance of the image from the shroud renders the radiation too attenuated to exceed the background brightness of the linen.

Obviously, this phenomenon occurs at a common distance from the shroud. If the shroud is horizontal, then this darkness boundary will be occur at a fixed elevation, and give the impression that the man is laying in a shallow pool of water where only his face, chest and knees are above the surface. Everything below the surface is either totally dark or very dim.

This dark boundary occurs at the level of the hips, so that anything lower than the hips disappears into the background.

The existence of this boundary at a common elevation indicates that the shroud was at a relatively constant distance – being at least approximately flat over the whole body.

Pool Experiment

If you lay in a bath with the water reaching up to where your sideburns meet your face, you would find that your neck and shoulders are still submerged. You will also find that your pelvis and legs are submerged.

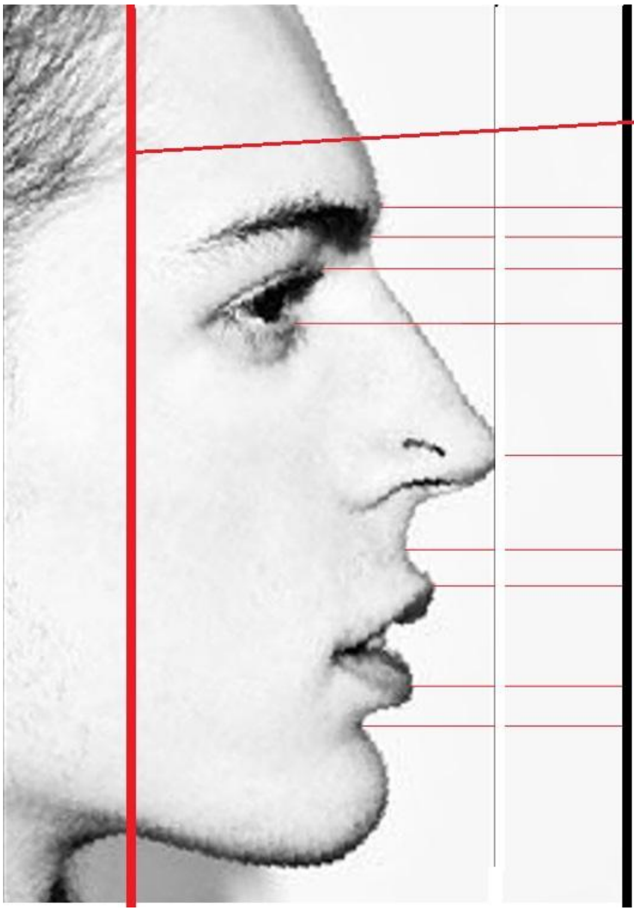
Now bend your knees into the crucifixion position. Raise your left leg so that the foot is pressed flat on the tub floor (as if it was nailed in that position) and place your right foot on top of your left foot (as if it were nailed in that position also).

You will find that your right knee is raised higher than your left knee. The left knee is just above the water, but your right thigh will be almost all above the water, except for the pelvic region. The ankles of both legs will still be submerged.

Now look at this image of Christ and note which areas are submerged in darkness.

What this shows is that there is an elevation below which the shroud image fades into darkness, and this occurs at the same elevation around the head, tummy, pelvis thighs and ankles.

The shroud image fades when a critical distance is reached between the shroud and any body part. Since fading occurs across all body areas at the same elevation, this means that the shroud must occupy a horizontal plane across the entire body, at least approximately.



Radiation Limit

Brightness decreases with distance
and reaches zero at a distance of
74mm on the Brightness - Distance graph

The zero brightness boundary
therefore should occur at the point of
the temples on the Shroud image,
and this is exactly what we find.

Ears and neck are therefore not
visible.

This boundary is a radiation effect, and its
occurrence on the Shroud confirms the
correctness of the graph, and the linear
decrease in brightness with distance.

Radiation Boundary

Sudden disappearance of the image.

Its as if the face were emerging from
water.

The sharp boundary marks the range
limit of the radiation.

On the right side of the face, the range
limit of the radiation is the same, but the
boundary is more irregular because
extensive swelling has raised the tissue
within the radiation range.

Observations

1. Brightness varies linearly with the distance. This shows that the radiation intensity diminished linearly with greater distance from the source (the body surface).

2. There is a point at which brightness reaches zero. On the picture of the human model, the zero point is at 73.97 mm from the right edge of the picture – corresponding to the temples. So features such as ears, and neck should have zero brightness, and therefore be invisible. (see pics on next page)

3. Obtaining such a high correlation relative to a straight vertical line, running parallel to the face, shows that the shroud was perfectly flat at the moment of impression – it was perfectly horizontal – at least in relation to the face.

   If the Shroud had been wrapped around the face at the moment of impression, so that it was touching the brow, nose, and chin, then the linear relationship between brightness and distance would not exist.

4. The linear reduction of brightness with distance suggests that the radiation was not following an inverse square law, and therefore would be collimated.

   [Uncollimated radiation is emitted in all directions and so its intensity diminishes by distance squared from a source. Collimated energy (parallel beams, such as laser) does not diverge with distance, and so its intensity does not follow an inverse square. The linear reduction in brightness must be due to absorption and scattering.]

Brightness

If the shroud was in contact with the body at all points, then we would expect those points to all have equal brightness. The variation in brightness means that the cloth was not in contact with the body at all points. Rather we find that more distant surfaces are dimmer as we move around the curved surface of the face.

Shape

The cloth cannot have wrapped the body because this would create a Mercator projection that would distort the body. The only way to avoid distortion is to have a flat canvas that receives a frontal projection.

Resolution

More distant features are not more blurry. For example, eye lashes, flowers in the hair, curvature of the eye ball, perpetuation of the eye socket. Scourge marks on images of distant areas show no loss of resolution. They even show scratches, and hair strands.

Range

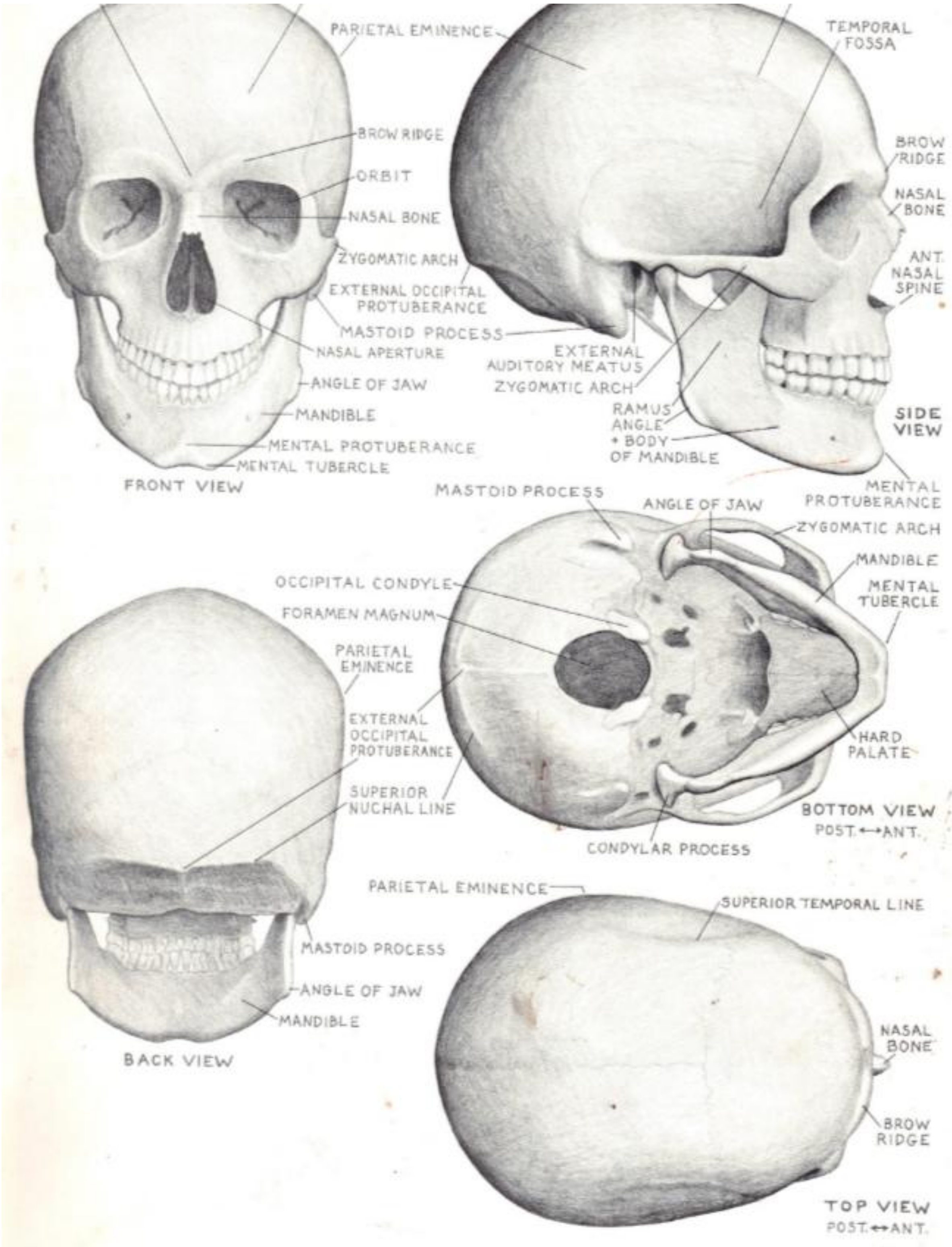
The radiation appears to have a range. There is a distance threshold, but higher areas within the threshold persist for longer.

Inversion

The Image is inverted because nearer areas received more radiation.

Relationship between Intensity and distance

The distance can be calculated for a circular cross section such as the eye brows or chin. The intensity of radiation can then be plotted against vertical distance to see if the relationship is linear or squared.


PARIETAL EMINENCE
BROW RIDGE
ORBIT
NASAL BONE
ZYGOMATIC ARCH
EXTERNAL OCCIPITAL PROTUBERANCE
MASTOID PROCESS
NASAL APERTURE
ANGLE OF JAW
MANDIBLE
MENTAL PROTUBERANCE
MENTAL TUBERCLE
FRONT VIEW
TEMPORAL FOSSA
BROW RIDGE
NASAL BONE
ANT. NASAL SPINE
EXTERNAL AUDITORY MEATUS
ZYGOMATIC ARCH
RAMUS
ANGLE
+ BODY
OF MANDIBLE
SIDE VIEW
MENTAL PROTUBERANCE
MASTOID PROCESS
ANGLE OF JAW
ZYGOMATIC ARCH
MANDIBLE
MENTAL TUBERCLE
OCCIPITAL CONDYLE
FORAMEN MAGNUM
PARIETAL EMINENCE
EXTERNAL OCCIPITAL PROTUBERANCE
SUPERIOR NUCHAL LINE
HARD PALATE
BOTTOM VIEW
POST. ←→ ANT.
CONDYLAR PROCESS
MASTOID PROCESS
ANGLE OF JAW
MANDIBLE
BACK VIEW
PARIETAL EMINENCE
SUPERIOR TEMPORAL LINE
NASAL BONE
BROW RIDGE
TOP VIEW
POST. ←→ ANT.

1. Energy acting over a distance: This study confirms the relationship between brightness and distance – showing that the image on the Shroud was produced by energy acting over a distance.
2. The relationship between brightness and distance is linear, and inverse: Brightness does not diminish with the square of the distance, but linearly with distance.
3. Brightness can be used to measure Distance: It should be possible to determine the exact distance corresponding to a unit change in brightness
4. Radiation has a range: A linear relationship means that the radiation has a range at which brightness = 0. It should be possible to determine this.
5. Linear relationship requires collimation: A linear relationship between brightness and distance suggests collimation.
6. Shroud was horizontal and above the body: The Shroud occupied a perfectly horizontal position at the moment of impression, and lay above the body. No part was touching the body. Therefore, the radiation had to traverse considerable distance.
7. Resolution over distance requires collimation: The maintenance of resolution over the body-Shroud distance requires collimation.

We are able to define this relationship precisely, such that each unit increase in brightness corresponds to a constant reduction of distance between a body surface and the image surface.

A linear relationship suggests that there is a limit to the range of the radiation, a distance at which brightness = 0, and this limit should be apparent when measuring brightness for other features of the body.

For this relationship to exist, the recording medium must have been perfectly horizontal and positioned above the body at the moment of impression.

The position of the shroud means that any diffuse energy, such as heat, would be incapable of generating an image with this resolution over the distances. Rather, the energy producing the Shroud image must have consisted of parallel beams.

The Shroud image has been likened to a photograph, but it is not a photo because –

1. it consists only of depth and shape information, not color information.
2. it was formed by a type of radiation that had a short range (measured in centimeters) such that distances beyond the temples create no impression.
3. The image retained its resolution despite the fact that the radiation was projected onto a flat surface distant from the body. The radiation was therefore collimated (like a laser)

What this means to me

At the moment of impression, the Shroud became perfectly flat, with no part touching the body.

There was a burst of radiant energy, rays shining upwards from every pore in his body.

Dead bodies don’t emit radiation, let alone collimated radiation. This was transformation – transfiguration – resurrection.

It’s as if we were there, in the tomb, on that night – seeing it with our own eyes.

Software Used to Measure Brightness

Image Source: Images were obtained from shroudphotos.com. **Image Inversion**: Photopea.com was used to invert and rotate images.

Image Upload: The image was uploaded with this code

```
Dim OpenFileDialog As New OpenFileDialog

OpenFileDialog1.Filter = "Picture Files (*)|*.bmp;*.gif;*.jpg"

If OpenFileDialog1.ShowDialog = Windows.Forms.DialogResult.OK Then
    PictureBox1.Image = Image.FromFile(OpenFileDialog1.FileName)
End If

Label4.Text = PictureBox1.Image.Width
Label3.Text = PictureBox1.Image.Height
```

Selection of Cross-section: (defines x1 and y1)

```
Private Sub PictureBox1_MouseDown(sender As Object, e As MouseEventArgs) Handles PictureBox1.MouseDown
    'This code selects an x,y coordinate when mouse is clicked over the shroud image.
    'This coordinate defines the axis of the cross-section.
    If Record2.Checked = True Then
        Label5.Text = e.X
        x1 = e.X
        Label6.Text = e.Y
        y1 = e.Y
        If RadioButton1.Checked = True Then
            GetBrightnessVerticalSection()
        ElseIf RadioButton2.Checked = True Then
            GetBrightnessHorizontalSection()
        End If
    End If
End Sub
```

Image Brightness (vertical section)

```
Sub GetBrightnessVerticalSection()  'Gets brightness of a single pixel.
    Dim brightnesstotal As Integer = 0
    Dim sourcebmp2 As New Bitmap(PictureBox1.Image)
    Dim pixelColor As Color = sourcebmp2.GetPixel(x1, y1)
    Dim brightness As Integer = (CInt(pixelColor.R) + CInt(pixelColor.G) + CInt(pixelColor.B)) / 3
    Label9.Text = brightness

    For q As Integer = 0 To PictureBox1.Image.Height - 1
        For r As Integer = x1 - 20 To x1 + 20
            pixelColor = sourcebmp2.GetPixel(r, q)
            brightness = (CInt(pixelColor.R) + CInt(pixelColor.G) + CInt(pixelColor.B)) / 3
            brightnesstotal += brightness

        Next
        TextBox1.Text &= brightnesstotal / 40 & vbCrLf
        brightnesstotal = 0
    Next
```

Image Brightness (horizontal section)

```
Sub GetBrightnessHorizontalSection()  'Gets brightness of a single pixel.
    Dim brightnesstotal As Integer = 0
    Dim sourcebmp2 As New Bitmap(PictureBox1.Image)
    Dim pixelColor As Color = sourcebmp2.GetPixel(x1, y1)
    Dim brightness As Integer = (CInt(pixelColor.R) + CInt(pixelColor.G) + CInt(pixelColor.B)) / 3
    Label9.Text = brightness

    For q As Integer = 0 To PictureBox1.Image.Width - 1
        For r As Integer = y1 - 20 To y1 + 20
            pixelColor = sourcebmp2.GetPixel(q, r)
            brightness = (CInt(pixelColor.R) + CInt(pixelColor.G) + CInt(pixelColor.B)) / 3
            brightnesstotal += brightness

        Next
        TextBox1.Text &= brightnesstotal / 40 & vbCrLf
        brightnesstotal = 0
    Next

End Sub
```

The Output

The mean brightness at every pixel point (horizontally or vertically) was output to Textbox1, and then copied into excel. Excel was then used to smooth the output using either a 20-point moving average or a 40-point moving average. Excel was then used to generate a line graph, which was superimposed upon the shroud photo, so I could see how brightness (elevation) corresponded to anatomical features.

Matching Brightness Profile to Shroud Image

```
Private Sub PictureBox1_MouseMove(sender As Object, e As MouseEventArgs) Handles PictureBox1.MouseMove
    Label15.Text = e.X
    x1 = e.X
    Label16.Text = e.Y
    y1 = e.Y
```

This code simply fetches and displays the pixel coordinates where-ever the mouse is. This enables me to match the coordinates on the shroud image to the excel graph of brightness against pixel coordinate.

If I used a 40-point moving average to smooth the output, then the excel coordinate is 20pt displaced from the image coordinate, such that excel coordinate = image coordinate – 20pt.

So, if the Excel moving average is x points, then the corresponding image coordinate is Excel coordinate + x/2 points.

Software Available

I have created a desktop application of this software, available for purchase. (£30). Please email me at craig@howbad.info. (requires Windows OS)

The software comes with instructions, and I am happy to provide further guidance via Whats-app, Zoom or Teams on an ongoing basis.