

Why the Shroud of Turin is not a Medieval Work? An Argument Map

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Abstract. The Shroud of Turin is an old linen fabric imprinted with the image of a tortured man who lies prone with his hands crossed before him. Since for many it is related to Jesus of Nazareth, this cloth is among the most studied, controversial and enigmatic of all archaeological and religious objects. Since its radiocarbon dating at the end of the eighties of the last century, it is considered by many to be an object made in the Middle Ages. The controversy is due to the fact that there are other scientific and artistic evidences that place this object outside the medieval sphere. An argument map is a critical thinking way of representing the relationships between evidences and arguments, and is used here to represent the sequences of argumentation that defend that the Shroud of Turin is not a medieval object.

Keywords: Shroud of Turin, religious object, argument map, argument diagram, argumentation studies, critical thinking.

Introduction

The Shroud of Turin (ST) is among the most studied, controversial and enigmatic of all archaeological objects. For some people it is a relic related to Jesus of Nazareth and others consider it a medieval object.

The ST is an old linen fabric imprinted with the image of a tortured man who lies prone with his hands crossed before him. The ST contains diverse main constitutive elements: image, bloodstains and body fluids; representing together the frontal and dorsal image of a tortured man (Figure 1).

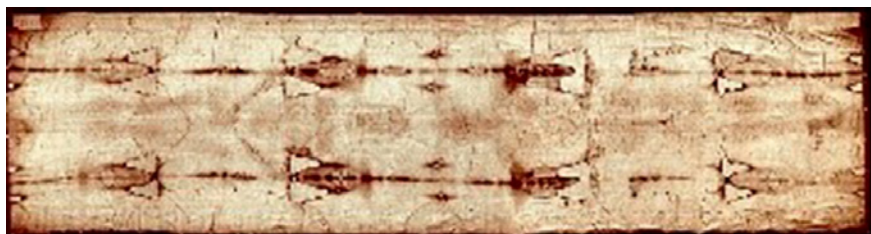


Figure 1. The Shroud of Turin

In an earliest article the author proposed an ontology describing the knowledge concepts and their relations for understanding the image formation process to map out the ST image formation more systematically, and to identify the research challenges more precisely (Fernandez 2005).

A following article continues the previous research proposing a modeling approach combining systems engineering and computer science disciplines, to be applied to the structuring of the ST features (Fernandez-Sanchez 2014).

This article proposes to use an argument map, a representation borrowed from argumentation science, to claim grouping evidences into arguments, that the ST is not a medieval work. It is not the purpose of this article to go further, letting readers think on its authenticity as a relic.

1. Argument map. What is it and what is it for?

An argument map also called an argument diagram is a visual representation of a claim, the arguments that enforce or weaken it, and the evidences that support the arguments and counterarguments. Typically, some sequences of argumentation are used to prove the claim that is the argument map showing how evidences are used in pro and counter argu-

mentation on controversial topics such as the ST origin described here. A detailed description of the use of argument mapping for critical thinking can be found in Eva Van der Brugge thesis (Van der Brugge 2018).

Argument maps have been applied in many areas, but foremost in educational, academic and business settings, including design rationale. Argument maps are also used in forensic science, law, and artificial intelligence. An earlier example of its application to the ST can be found in a book by D. Walton. In his book Walton using less than a dozen evidences claims using an argument map, that the ST is not the burial cloth of Jesus (Walton 2016, 7–12).

There are different ways and tools to represent argument maps. Here are represented four main concepts and the relationships among them. The main concepts used later in the ST argument map (Figure 6) are:

- **Claim**, the claim is the position being taken in the argument – the thesis. Here, the ultimate claim that is at issue in the dispute is represented in the text box at the far left of the map
- **Argument**, here an argument is a reason that supports the claim. We may represent counterarguments as well. A counterargument, representing its link to the claim with a minus sign, weaknesses the claim
- **Rebuttal** is an argument introduced to counter, disprove, or contradict an opposing argument
- **Evidence** is something that furnishes proof. Here the main evidences used are physical evidences: measurements, properties or data, collected from the scientific literature about the ST. But experts' interpretations of the ST image and art experts' opinions are considered evidences as well.

2. Brief description of evidences and arguments

In this section the author describes briefly the evidences obtained from the scientific and art literature dealing with the ST. For the sake of brevity, it is not exhaustive but it is complete enough to defend the claim of this article.

The labelling of evidences is not important is only related how they were obtained from the ST publications used in this research. First, evidences are grouped by knowledge areas because is how they are presented in the ST publications. But, the important issue here, see next section, is how evidences are grouped into arguments to support the main claim of this article.

Image related evidence

No pigments, paints, dyes or stains have been found on ST fibrils (EV 1)

The Shroud of Turin Research Project (STURP) was a very important initiative to study the ST. This team of scientists had access to the ST in 1978 using their testing equipment for 120 hours at Turin. After analyzing the results obtained from reflectance spectra, laser-microprobe Raman spectra, pyrolysis mass spectrometry, and x-ray fluorescence, they concluded these results are not compatible with those relative to painted images, with any of the expected, historically documented pigments. Chemical test shows as well that there is no protein painting medium or protein-containing in ST image areas (Schwalbe and Rogers 1982, 31).

Recent results may seem contradictory to the above but it does not have to be that way. A total number of seventy lapis lazuli particles (and sub-particles) were found on the surface of a 1978 sample of the ST, in particularly corresponding to the face area, and deposited it on a special sticky-tape used for sampling, and were characterized in details: they are little particles (of between 0.1 and 15 μm of maximal length), of blue color, and with a spectrum of chemical elements identical to that of the lapis lazuli mineral (Lucotte and Thomasset 2023). Various explanations can be given, but the most plausible is that they are pigments of painted copies of the ST that were placed over the original to give greater religious meaning to these copies. This was common practice with the ST understood as a relic.

The ST image is extremely superficial (EV 8)

At the fiber level the ST image is superficial considering that color alteration of the fiber is restricted in the approximately 200 nm thick exter-

nal cell layer. At the thread level the coloration is also superficial since it extends only to depths of 2 or 3 fibers into the thread. At the ST fabric level these superficial colorations at the thread and fiber levels cumulative produce the image (Fanti 2010).

The frontal image, at least in correspondence to the area of the ST man face, is doubly superficial (EV 9)

The double superficiality means that in some areas the image resided on the two opposite external cloth surfaces, but there is no image in the middle. The ST frontal image, at least the area of the face, is doubly superficial. This means that there is a superficial face image on the front of the ST cloth and another superficial image on the not shown backside of the cloth. (Fanti and Maggiolo 2004).

There is no superficial image on the backside of the ST opposite to the dorsal image.

This evidence is difficult to understand and suggests that the mechanism that formed the image acted on both sides of the part of the cloth that covered the upper part of the body.

The ST image has the tones of light and dark reversed with respect to what is experienced in human visual perception (EV 10)

The ST image viewed in natural light has the tones of light and dark reversed so when viewing a negative image of it, the image details are easier to perceive. This was observed when the first ST photograph was taken by Secondo Pia in 1898.

This feature of the ST image is unique relative to the images of other known old artistic objects including the painted copies of the ST. As stated by de Wesselow, the ST negative image is enough to dispel the idea that it is a regular work of art (de Wesselow 2012, 22).

The image-density distribution of the ST image (front and back), can be correlated to the distance between a human body object and a cloth covering that body (EV 11)

The ST image processing by computer shows that the shading of the ST image has a correlation with expected cloth-body distances as the shad-

ing produced by an unknown image formation mechanism actuating on a cloth draping over a body shape (Jackson et al. 1984).

This evidence also known as 3-dimensional image, supports the display of areas of the body that were non-contact body-cloth, for example those between nose and cheek.

There are no side images of the body (EV 12)

There is no evidence of body image formation at the sides of the body, similarly there is no image of the top of the head between the frontal and dorsal ST images (Figure 1).

No image can be found under the bloodstains (EV 15)

The absence of an image beneath the bloodstains is an evidence proposed by STURP, because experiments performed employing enzymatic removal of the blood from the ST cloth samples revealed that there was no image beneath the blood or the blood serum at the boundary of tested bloodstains. These findings suggest than the bloodstains where present on the cloth before the body image formation mechanism actuated on the ST cloth (Jackson 2017, 75).

The ST body image is a result of concentrations of yellow to light brown fibers (EV 17)

This evidence is based on STURP examinations of the ST using photomicroscope. Their work, color photomicroscopy, which had never been done on the ST before, involved photographing chosen details of particular importance through a microscope to record and later intensively study the image. The actual photos were grouped into five categories: bloodstain, body image, water stain, scorch and clear background.

They conclude that the body image itself is a uniform, light sepia yellow color on the points of highest relief of the ST threads. There is no indication of any artificial coating or pigments on the surface of these darkened fibrils. Some areas, presumably those where contact between the body and the cloth was more complete or direct, simply have more concentration of the darkened fibers (Figure 2) (Pellicori and Evans 1981).



Figure 2. Microscope photography of ST area with image (© Vernon Miller, 1978)

The ST body image is very faint (EV 18)

The ST image is very faint. The image on the ST is more readily perceived at a distance of meters, than it is at a close range. The ST image does not have sharp boundaries nor well defined contours (Figure1).

The ST image forming mechanism operated regardless of different body structures such as skin, hair, some teeth and some hand bones (EV 24)

The ST image shows major parts of a human body such as face, frontal and dorsal body and hair, including some teeth and bone structures. In fact, the image appears to reveal bones associated with the palm of the hand (Schumacher 1999).

Some measurements made on the ST image, such as hands, calves and torso do not agree with anthropological standards (EV 25)

The ST body image shows anatomical details in close agreement with standard human body measurements although some measurements such as hands, calves and torso do not agree with anthropological standards. Ercolessi suggests that these image distortions are caused by projecting

a three-dimensional object (the body) onto a curved cloth drape (Ercoline et al. 1982).

The ST image fibers colored coating cannot be dissolved, bleached, or changed by standard chemical agents, but it can be decolorized by reduction with diimide (EV 26)

Heller and Adler tested some ST cloth samples in the laboratory. They checked that Neutral Superoxyl (30% H₂O₂) did not bleach the yellow color from the ST image fibrils, even in the presence of UV irradiation, nor did weak reductants such as ascorbate. However, hydrazine bleaches the yellow body ST image fibril color very slowly and diimide, a very powerful reducing agent bleaches it instantly. The solvent, redox, and acid-base tests are also consistent with the lack of any applied stains or dyes, but are consistent with the chemistry of carbonyl groups as a chromophore (Heller and Adler 1981, 95).

Medical forensic evidence

There are several traumatic injuries from body scourging on both front and back of the ST image (EV 2)

The ST body appears as this man was scourged. Scourge marks are visible on both the front and back of the ST body image but it is important to notice that many of these scourge marks when are illuminated by ultraviolet light, unknown in the medieval times, show fine scratches not otherwise visible to the naked eye (Jackson 2017, 47–48).

The ST man was dead (EV 3)

Death is determined by handling a deceased body, but this handling can not be applied on the ST as we deal with an image. But here the weight of forensic evidence shows that the wound to the right side of the chest is post-mortem (Jackson 2017, 54). So, the main observable evidence that this man was dead is that the wound in his side is postmortem.

A more difficult question is the condition of this man when the image was produced. What happened during this particular condition is outside of this article and current scientific analysis since it cannot be replicated at laboratory.

A Most forensic experts' interpretation of the ST image is that this person demonstrates rigor mortis (Brucker 1987). The thorax is hyper-expanded, and the maiores pectoral muscles are contracted and prominent (Bevilacqua et al. 2018). As an additional sign of death, the abdomen seems distended referring to postmortem intestinal meteorism (Svensson and Heimbürger 2012).

Hontanilla offers another medical interpretation to the ST image. He states that the presence of bilateral nasogenian grooves, especially in the right side, lead him to think that the ST man is alive. He also states that at the moment the image was produced, there was an inspiration and a contraction of the abdominal muscles, and since there is no deformation of the gluteal area or the back, one possibility would be the body was levitating and at that moment, initiating a getting up gesture with a forced inspiration (Hontanilla 2022).

Rigor mortis and Hontanilla's life signs interpretations are still valid to support the argument the ST wrapped a body that was a corpse for a period of time (Argument 4).

The red stains are those of human blood and serum retraction rings generally surround the bloodstains (EV 13)

Examinations by medical forensic experts are in agreement that bloodstains on the ST are not just flows of whole human blood, identified by chemical and serological testing performed by several scientists (Heller and Adler 1980) (Bollone 2006), but are in many cases exudates from clotted wounds transferred to the cloth by contact. These exudates are primarily associated with the scourge wounds. It is also very important to consider the significance of the serum halos surrounding bloodstains. These rings are invisible to the naked eye. They are only revealed when they are irradiated by ultraviolet light under which they fluoresce, a phenomenon that only became known in the 19th century (Jackson 2017, 74).

Bloodstains appear on the ST body image and also outside the area of the body image (EV 14)

It can be deduced that contact with a body was the cause of most bloodstains. There are other bloodstains for example those off the left foot, the

flow below the back, and the blood appearing off the right elbow that are consistent with flow away from a body being wrapped by the ST.

The ST enveloped a human body (EV 16)

The ST bloodstains show very different flow directions. Some flows are consistent with a vertical position of the body, for example a crucifixion position. Other blood flows are postmortem flows consistent with horizontal burial of an actual corpse (Jackson 2017, 76).

It is important to note that there too many publications on forensic medicine and the ST to be referenced here. Recently a group of forensic experts from the University Hospital Düsseldorf Institute of Legal Medicine perform some experiments regarding the possible bloodstains' formation on the ST mainly for those attributed to the crown of thorns, the lance wound and the belt of blood. Regarding this evidence is important to consider the belt of blood that is shown in the ST body back. They recreated a similar blood pattern by simulating a sequence of events where the body was lying in a supine position in the sepulchre and later, they put the body onto the shroud, the body was rotated to the left side so the shroud could be tucked under the body back. In their experiments, this rotation of the body resulted in a postmortem flow of blood or bloody fluid across the back and, after transfer to the cloth, in similar rivulets to those of the ST belt of blood (König et al. 2023).

There are two types of bloodstains: premortem and postmortem (EV 19)

Scourging, crown of thorns, and wrist wounds correspond to the blood exudate from clotted wounds and transferred to the ST cloth by contact with a human body (Fanti et al. 2010).

Side wound produced a bloodstain that come out after the death. It shows blood separation in a dense part and a serous part (Fanti et al. 2010).

The chemical and physical properties of the bloodstains are different than mineral compositions proposed by artists (EV 20)

All the microscopic (Figure 3), chemical, spectroscopic, and immunological evidence is consistent with these ST bloodstains, not only being

exudates from clotted wounds, but those of a man who suffered severe trauma prior to death, explaining the red color of the blood at the microscopic level. Proposed mineral compositions simulating blood are not consistent with these various measured chemical and physical parameters (Adler 1996).



Figure 3. Microscope photography of ST area with bloodstains
(© Vernon Miller, 1978)

Blood flows on the ST cloth show some limited capillarity (EV 23)

Blood flows have gone onto the ST cloth as viscous liquids penetrating the cloth through to the back, and diffusively seeping along the threads near the edges of the stains demonstrating some limited capillarity flow (Jumper et al. 1984, 458–459).

There is a class of particles on the ST ranging in color from red to orange that test as blood derived residues (EV 28)

The bloodstains on the ST cloth are blood-derived materials produced from contact of the cloth with clotted blood wounds on a human body and are not composed of an artist's applied mineral pigment mixture (Adler 1996, 226).

The ST bloodstains on the dorsal view of the head are the result of a sort of cap of thorns than covered the whole head (EV 34)

The ST bloodstains near the top of the head imply a sort of thorns cap, instead of a medieval crown of thorns that covered the whole head.

Avinoam Danin was a researcher at the Department of Evolution, Systematics and Ecology, the Hebrew University of Jerusalem. In his book “Botany of the Shroud,” he mentions the previous work of Fleury based on thorn relics found in Europe. Fleury considered thorns of *Ziziphus spina-Christi*, and *Rhamnus lycioides* as the thorns used by the roman soldiers. Danin found images of both species on the ST, Danin notes that it seems very interesting to try to link the two sources of information reaching us from early times through plant parts and through their images. He does not see any conflict between the botanical information seen on the ST and the assumptions made by Fleury based on thorn relics (Danin 2010, 56).

There are many medical studies on the cap of thorns. For the sake of brevity, I will reference one of the most recent articles attributed to König et al. In it, these forensic experts, from the Institute of Legal Medicine, University Hospital Düsseldorf (Germany), after experimenting with volunteers, study, among other wounds, those of the cap of thorns. Their experiments with focus on the bloodstains due to wounds caused by the cap of thorns show that by simulating the sequence “blood from antemortem scalp wounds is covering hair and face – blood is coagulating and/or drying – blood components are mobilized by postmortem washing (with and without oiling),” blood (or blood components) was mobilized and could be transferred to a cloth wrapped around the head. By applying oil in addition to washing, findings most similar to the bloodstains seen on the ST could be obtained (König et al. 2023).

Linen cloth evidence

The ST cloth weave and particular stitching are very distinctive and rare (EV 4)

The ST cloth is woven in three-to-one herringbone twill. Twill supposedly typical of near-Eastern cloths of antiquity (Jumper 1984, 464). Nothing comparable has been found in medieval European linens.

Mechthild Flury-Lemberg, the textile expert that was involved in the ST 2002 cloth interventions, found that the stitching pattern of the seam that attaches the sidestrip to the ST main cloth is similar to that present in the hem of a cloth that was discovered in the tombs of the Jewish fortress of Masada and dated between 4 B.C. and 73 A.D. (Jackson 2017, 59).

The ST cloth is a very poor textile product by comparison to medieval European fabrics (EV 5)

John Tyrer, a textile expert stated that the ST fabric is a poor product by comparison to medieval European fabrics. The ST cloth is full of weaving defects (Jackson 2017, 56–57).

The ST cloth herringbone weave has been discovered in other ancient wool artifacts (EV 6)

The weave of the ST cloth is seen to be a 3 to 1 herringbone twill supposedly typical of near-Eastern cloths of antiquity.

Archaeologists have found in the ruins of a Roman fort in Egypt first century dated cloths with a herringbone weave similar to the ST cloth (Jackson 2017, 57).

The ST linen cloth shows darker and lighter banding in both the vertical and horizontal directions (EV 7)

Banding is produced by yarn density, and is particularly apparent in transmitted light photographs of the ST. So, ST cloth darker and lighter banding can result when individual collections of flax used have different color as result of their particular retting and bleaching process. Medieval linen was manufactured differently so they do not show banding as that found on the ST cloth (Jackson 2017, 57).

The ST cloth linen thread was hand-spun and hand-loomed (EV 22)

The ST cloth linen thread was hand-spun and hand-loomed; after year 1200 A.D., most European thread was spun on the wheel (Meacham 1983, 9).

Dating the ST evidence

Further statistical studies of radiocarbon dating results demonstrated the presence of a linear bias which makes the radiocarbon sample no representative of the whole ST cloth (EV 21)

Years after the publication in Nature of the results of the radiocarbon tests, see evidence 29, various groups of researchers carried out statistical studies of these results (Casabianca et al. 2019) (di Lazzaro et al. 2020). Among these it is worth highlighting those of Casabianca et al. summarized here.

The goal of Casabianca's team study was to conduct a robust statistical analysis using the raw data and to compare these results with those obtained using the radiocarbon laboratories sampling data. They used statistical tests to determine whether the measurements intra and inter radiocarbon laboratories can be combined to obtain a calendar range.

The three radiocarbon laboratories stated that each ST raw and published radiocarbon date indicates a medieval interval for its fabric. Casabianca's team arguments this reasoning would simply assume a constant amount of ^{14}C atoms among the subsamples. This basic assumption is not supported by the heterogeneity of the ST raw data, the consistent ages of the control samples, the significant statistical trend in the ST radiocarbon dates and the amount of foreign material found by the three radiocarbon laboratories. The data showed a significant decrease in the radiocarbon age as one gets closer to the center of the sheet (in length, from the sampled and tested ST corner). This variability of the three laboratories radiocarbon dates in a few centimetres, if linearly extrapolated to the opposite side of the ST, would lead to a dating in the future (Casabianca et al. 2019).

The lignin that can be seen at the wall thickenings and dislocations of the ST linen fibers does not give positive the standard test for vanillin (EV 27)

Rogers' preliminary estimates of the kinetics constants for the loss of vanillin from lignin indicate a much older age for the cloth than the radiocarbon analyses. These chemical tests on a ST sample probe that van-

illin cannot be detected in the lignin on its fibers. The comparison with Dead Sea scrolls linen, and other very old linens indicates that the ST is quite old. If the ST had been stored at a constant 25 °C, it would have taken about 1319 years to lose a conservative 95% of its vanillin. At 23 °C, it would have taken about 1845 years. At 20 °C, it would take about 3095 years. A linen produced in 1260 A.D., the ST radiocarbon date, would have retained about 37% of its vanillin in 1978 (Rogers 2005).

The results of radiocarbon measurements of ST samples yield a calibrated calendar age range with at least 95% confidence for the samples linen of 1260 – 1390 AD (EV 29)

One of the main milestones of the ST research was its cloth dating by radiocarbon accelerator mass spectrometry techniques (AMS). Three laboratories from Oxford, Zurich and Arizona participated in this dating. The results were published in Nature (Damon et al. 1989) and are summarized here.

The sampling of the ST took place at the Turin Cathedral on April 21, 1988. Three samples, each approximately 50 mg in weight were collected from a single site on the main body of the ST away from any patches or charred areas. Three containers containing the ST samples were handed to the laboratories representatives. All laboratories examined the ST samples microscopically to identify and remove any foreign material. The cleaning procedure was not the same for the three laboratories. All laboratories combusted the cleaned textile subsample with cooper oxide in sealed tubes, then converted the resulting CO₂ to graphite targets. Each laboratory measured the graphite targets made from the samples, together with appropriate standards and blanks. Each laboratory performed between three and five independent measurements for each textile sample. The radiocarbon ages were calculated using the procedures suggested by Stuiver and Polach. The results of radiocarbon measurements of ST samples yield a calibrated calendar age range with at least 95% confidence for the samples linen of 1260–1390 AD (rounded down/up to nearest 10 years).

The experimental results of Wide-Angle X-ray Scattering (WAXS) dating of a ST sample are compatible with the hypothesis that it is a 2000-year-old cloth (EV 30)

On a sample of the ST, de Caro team applied a new method for dating ancient linen threads by inspecting their structural degradation by means of Wide-Angle X-ray Scattering (WAXS). The X-ray dating method was applied to a sample of the ST consisting of a thread taken in proximity of the 1988 radiocarbon area (corner of the ST corresponding to the feet area of the frontal image, near the so-called Raes sample).

This analysis, showed that the ST fabric is much older than the seven centuries proposed by the 1988 radiocarbon dating. The experimental results are compatible with the hypothesis that the ST is a 2000-year-old linen cloth (de Caro 2022).

Historical evidence

The ST image style and material composition defies categorization alongside even the most marginalized ranks of medieval, renaissance and baroque art (EV 31)

Andrew R. Casper, associate professor of Art History at Miami University, states in a recent book that the ST image's pictorial style and material composition described as amorphous, monochromatic, and blood-flecked stains of a human corpse, lingering on the brink of abstraction, have defied categorization alongside the most marginalized ranks of medieval, renaissance and baroque art (Casper 2021,7).

Thomas de Wesselow is an art historian living in Cambridge (England), who wrote a detailed book about the ST referenced below. He states that technically, conceptually and stylistically the ST makes no sense as a medieval artwork. Also, he mentions that there is no art-historical evidence for a medieval craftsman producing images with real blood (de Wesselow 2012, 104).

Documentary records trace the ST existence at least as far back as the mid-1300s (EV 32)

There are documentary records that the ST first emerged historically in 1354, when it is recorded in the hands of a French knight, Geoffrey de Charny, seigneur de Lirey (France).

The documentary record places the Shroud in Lirey, northern France, for four years until 1357 and after in the alpine town of Chambery from 1502 to 1578 where it was damaged by fire, before being passed to the Dukes of Savoy. In 1578, the Savoyes moved ST to their capital Turin, and aside from periods of wartime evacuation, it has stayed in the royal chapel of the San Giovanni Battista Cathedral ever since.

A previous reference to highlight would be the Pray Codex. It is a collection of medieval manuscripts housed in the National Széchényi Library of Budapest, Hungary. These manuscripts date from 1192–1195. Jesus is shown naked, like the ST and he has his arms crossed modestly at the wrists. There are four distinct small circles drawn in the pattern of the letter “L” that seem to match the “L” shaped pattern of burn holes on the ST. It seems the authors of this manuscript must have seen the ST (Jackson 2017, 27).

According to the French Crusader knight Robert de Clari memoirs, the ST was at early years of the 13th century placed on public exhibition in Blachernae, the district nearest to the most vulnerable of Constantinople city’s walls. He states that he had seen a cloth that was raised up every Friday, displaying an image of Christ (Jackson 2017, 29)

The consensus has been that the Shroud’s history pre-1300 will never be well established. As the archaeologist William Meacham stated: “The enigma of the Shroud’s history prior to the Crusades will probably never be resolved, but certain points of departure for hypothesis can be established. Pollen samples taken from it reveal that it has been in Turkey and Palestine, and the medical evidence seems to place it in the era of crucifixion. These data strongly suggest that the Shroud is a relic from the early church period. Whether forgery, accident, or genuine, however, the cloth has escaped the gaze of history through a long period in which a relic pur-

porting to be Christ's burial linen and actually bearing his image would have attracted enormous attention and pilgrimage" (Meacham 1983).

Comparison of the ST image with images of the dead Christ produced by artist of the fourteen century (EV 33)

De Wesselow, and art historian mentioned above, compares the ST image with images of the dead Christ produced by 14th century artists. One comparison example is the paint of the entombed Christ in the "Parement de Narbonne" (Figure 4), created sometime between 1364 and 1380. It is an ink-wash image on silk. Other recommended comparison is the Man of Sorrows by Naddo Ceccarelli that was probably painted around 1347 (Figure 5).

As de Wesselow states the blood flows depicted by medieval artists were imagined as blood dribbling from the hand wounds leaving the fore-



Figure 4. Burial section of the Parement de Narbonne

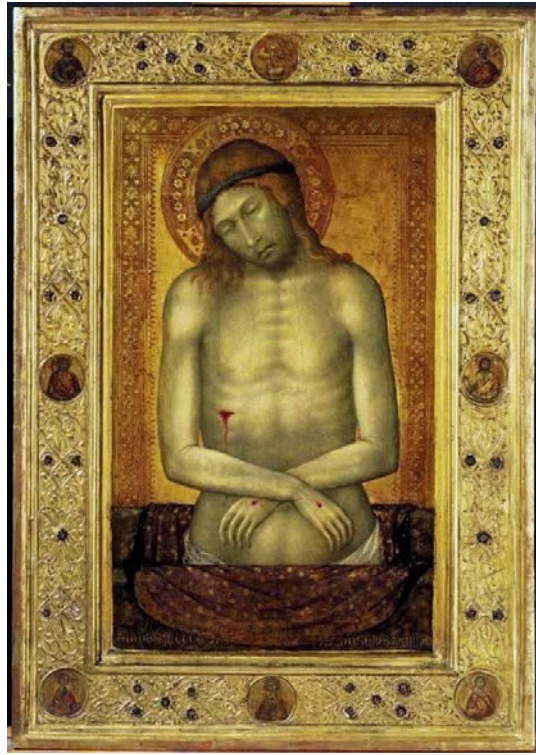


Figure 5. Man of Sorrows by Naddo Ceccarelli, Liechtenstein Museum

arms clean. The ST irregular, asymmetrical character of the bloodstains is unlike anything a medieval artist might have imagined. Compare the continuous trickles of blood depicted in the burial section of the “Parement de Narbonne” (Figure 4). If the ST were a medieval work, the wounds on the feet, along with every other wound, would surely have been clearly marked (de Wesselow 2012, 121).

Unlike the ST in medieval representations Christ is presented as an image of perfection beautiful, symmetrical and unblemished (EV 35)

Unlike the medieval representations of Christ, the ST image of the face is thoroughly awkward and asymmetrical. This difference is especially significant in the eyes; in place of Man of Sorrows (Figure 5) finely drawn

eyelids and irises, the ST face image has two vague hollows, which seen lit from within (de Wesselow 2012, 135).

Arguments

For the sake of supporting the claim the above evidences obtained from diverse publications dealing with the ST are grouped reinforcing the following arguments:

Argument 1. ST textile is not from medieval Europe

This argument defends that the ST fabric was not manufactured in Europe during the Middle Ages since neither the weave nor the manufacturing methods used obey the medieval manufacturing standards in Europe.

Table 1. Evidences that reinforce argument 1

Evidence	Brief description
EV 4	The ST cloth weave and particular stitching are very distinctive and rare
EV 5	The ST cloth is a very poor textile product by comparison to medieval European fabrics
EV 6	The ST cloth herringbone weave has been discovered in other ancient wool artifacts
EV 7	The ST linen cloth shows darker and lighter banding in both the vertical and horizontal directions
EV 22	The ST cloth linen thread was hand-spun and hand-loomed

Argument 2. The ST image is not consistent with medieval style art

The image of Christ of the ST is not consistent with the medieval style. On the one hand, he appears naked and with multiple wounds. His face is disfigured and asymmetrical.

Table 2. Evidences that reinforce argument 2

Evidence	Brief description
EV 25	Some measurements made on the ST image, such as hands, calves and torso do not agree with anthropological standards

Evidence	Brief description
EV 31	The ST image style and material composition defies categorization alongside even the most marginalized ranks of medieval, renaissance and baroque art
EV 33	Comparison of the ST image with images of the dead Christ produced by artist of the fourteen century
EV 34	The ST bloodstains on the dorsal view of the head are the result of a sort of cap of thorns than covered the whole head
EV 35	Unlike the ST in medieval representations Christ is presented as an image of perfection beautiful, symmetrical and unblemished

Argument 3. The radiocarbon dating of ST cloth samples as medieval

Three samples, each approximately 50 mg in weight were collected from a single site on the main body of the ST away from any patches or charred areas. Three radiocarbon laboratories performed between three and five independent measurements for each textile sample. The results of radiocarbon measurements of the three ST samples yield a calibrated calendar age range with at least 95% confidence for the samples linen of 1260–1390 AD.

Since the radiocarbon sampling was local, the three laboratories' results showed some biases and other tests gave different results, there are three evidences: EV 21, EV 27 and EV 30, which weaken radiocarbon results (EV 29). Table 3 shows both types of evidences.

Table 3. Evidences that reinforce argument 3

Evidence	Brief description
EV 21	Further statistical studies of radiocarbon dating results demonstrated the presence of a linear bias which makes the radiocarbon sample no representative of the whole ST cloth.
EV 27	The lignin that can be seen at the wall thickenings and dislocations of the ST linen fibers does not give positive the standard test for vanillin
EV 29	The results of radiocarbon measurements of ST samples yield a calibrated calendar age range with at least 95% confidence for the samples linen of 1260 – 1390 AD
EV 30	The experimental results of Wide-Angle X-ray Scattering (WAXS) dating of a ST sample are compatible with the hypothesis that it is a 2000-year-old cloth

Argument 4. The ST cloth wrapped a corpse

The image in the ST and some of the blood stains suggest that it covered a corpse. Table 4 show the evidences that reinforce this argument.

Table 4. Evidences that reinforce argument 4

Evidence	Brief description
EV 3	The ST man was dead
EV14	Bloodstains appear on the ST body image and also outside the area of the body image
EV 16	The ST enveloped a human body

Argument 5. The ST image properties are beyond the medieval knowledge

The image of the ST has macroscopic and microscopic characteristics that are beyond the level of the technology known in the Middle Ages. Table 5 shows evidences that reinforce this argument.

Table 5. Evidences that reinforce argument 5

Evidence	Brief description
EV 1	No pigments, paints, dyes or stains have been found on ST fibrils
EV 8	The ST image is extremely superficial
EV 9	The frontal image, at least in correspondence to the area of the ST man face, is doubly superficial
EV 10	The ST image has the tones of light and dark reversed with to respect to what is experienced in human visual perception
EV 11	The image-density distribution of the ST image (front and back), can be correlated to the distance between a human body object and a cloth covering that body
EV 12	There are no side images of the body
EV 17	The ST body image is a result of concentrations of yellow to light brown fibers
EV 18	The ST body image is very faint
EV 24	The ST image forming mechanism operated regardless of different body structures such as skin, hair, some teeth and some hand bones
EV 26	The ST image fibers colored coating cannot be dissolved, bleached, or changed by standard chemical agents, but it can be decolorized by reduction with diimide

Argument 6. The ST historical traceability is incomplete

It seems clear that it is not possible to accurately determine the history of the ST in the period before 1300. Table 6 shows the evidence that reinforce this counterargument.

Table 6. Evidence that reinforces argument 6

Evidence	Brief description
EV 32	Documentary records trace the ST existence at least as far back as the mid-1300s

Argument 7. The ST bloodstains properties are beyond medieval knowledge

The knowledge of medicine particularly that related to blood as a non-Newtonian fluid, its components, and its circulation in the body that is seen in the ST is incompatible with the medieval knowledge. Table 7 shows the evidences that reinforce this argument.

Table 7. Evidences that reinforce argument 7

Evidence	Brief description
EV 2	There are several traumatic injuries from body scourging on both front and back of the ST image
EV 13	The red stains are those of human blood and serum retraction rings generally surround the blood stains
EV 15	No image can be found under the bloodstains
EV 19	There are two types of bloodstains: premortem and postmortem.
EV 20	The chemical and physical properties of the bloodstains are different than mineral compositions proposed by artists
EV 23	Blood flows on the ST cloth show some limited capillarity
EV 28	There is a class of particles on the ST ranging in color from red to orange that test as blood derived residues

3. Argument map applied to the Shroud of Turin

Figure 6 is the argument map defending the claim that the ST is not a medieval work. Five arguments enforce the claim supported by diverse evi-

dences. Two arguments are really counterarguments of the claim. For the radiocarbon dating counterargument a rebuttal that this counterargument is inconclusive is stated. It is based on three evidences than result from statistical analysis and other measurements taken on the ST cloth.

4. To conclude

A detailed study of the literature on research on the Shroud of Turin was performed and used to identify evidences that reinforce the arguments that support the claim that the Shroud of Turin is not a medieval object.

The argument map is a practice widely used in education and other disciplines that allows the depiction of the relations of evidences to arguments and counterarguments. This representation allows the reader to verify whether evidence is sufficient to support an argument or counterargument.

The scope of this article remains here. It is not addressed in this article to determine whether this cloth is the relic of Jesus of Nazareth but the author finds no major objections besides ST historical documentation traceability to this consideration.

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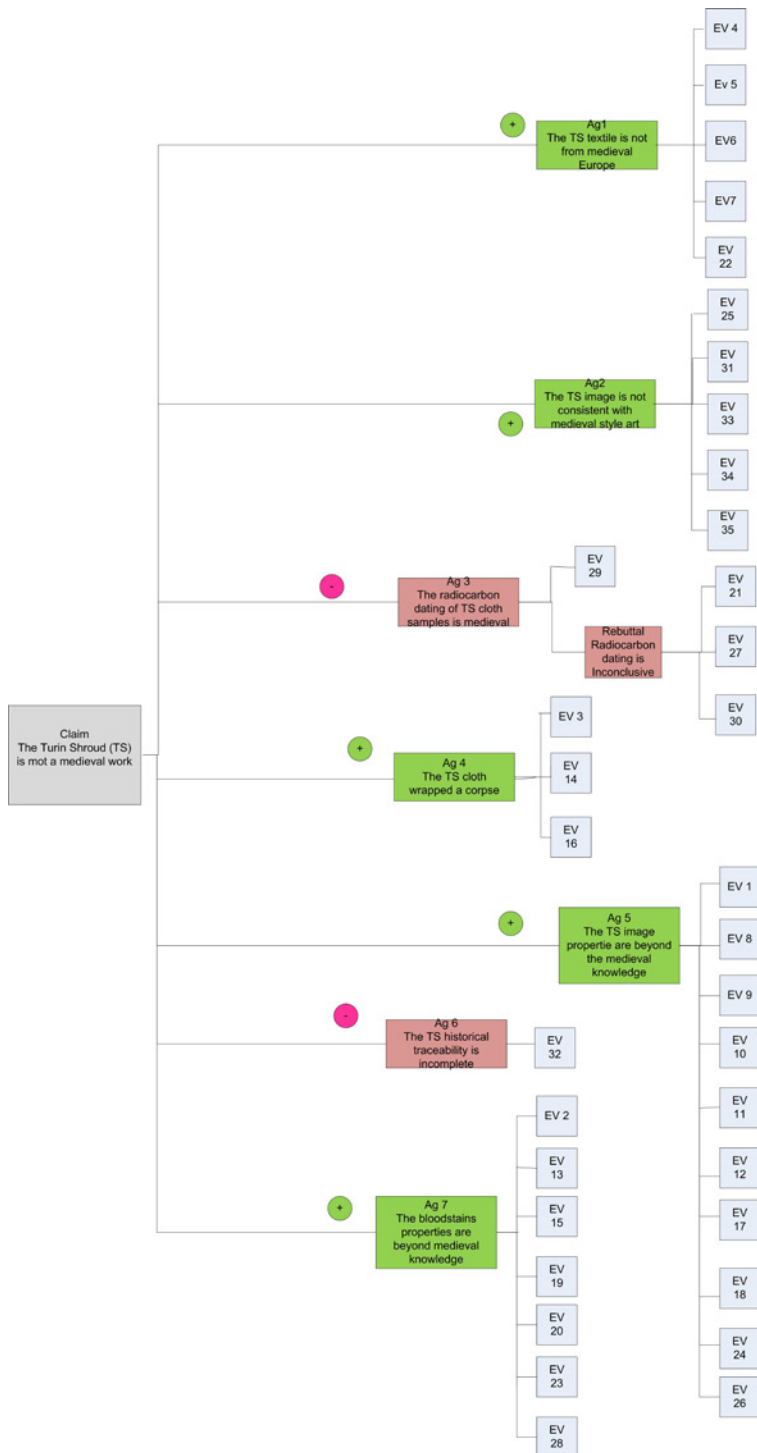


Figure 6. Argument map representing the ST claim, arguments and evidences

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