This article has been published in final form in *Theology and Science* (2024)
https://doi.org/10.1080/14746700.2024.2436781

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Systematic Evaluation of Recent Research on the Shroud of Turin

Abstract

This study critically reviews four decades of academic research on the Shroud of Turin, a highly debated archaeological artifact. Employing advanced epistemological methods such as argument mapping and Bayesian analysis, the study systematically evaluates the two leading hypotheses: the medieval creation of the Shroud and its authenticity as the burial cloth of Jesus of Nazareth. This examination suggests a warrant for the proponents' belief in the authenticity hypothesis. It highlights the vitality and complexity of the controversy surrounding the dating and image formation process of the Shroud of Turin.

Keywords: Shroud of Turin; Jesus of Nazareth; Middle Ages; Miracle; Radiocarbon Dating; Epistemology; Bayesian Statistics.

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1. Introduction

The archaeological enigma of the Shroud of Turin, a linen cloth kept in the Cathedral of Saint John the Baptist in Turin, Italy, is yet to be resolved. This reasonable conclusion was drawn four decades ago[1]. However, does this conclusion hold true? The piece of textile, approximately 4.4 m by 1.1 m, depicts an image of the front and back of a crucified man; it is considered by many Christians and some other theists and agnostics to be the burial cloth of Jesus of Nazareth. The cloth has been extensively studied since 1898, when Secondo Pia, an Italian photographer, saw its first negative image, sparking a controversy that could not be resolved even by hundreds of research publications.[2]

This fact itself should be deeply puzzling, and it is partially due to the restrained direct scientific access to the artifact since the nineteenth century. Nevertheless, many of its characteristics are well-known and undisputed.[3] During the twentieth century, two famous scientific investigations were conducted on the Shroud. The first investigation was led by a group called the Shroud of Turin Research Project (STURP) in 1978. Despite collecting voluminous data, STURP could not explain the image formation process.[4] The second investigation, conducted in 1988, involved the radiocarbon dating of a sample.[5] Damon et al. concluded that the Turin Shroud was crafted from late medieval linen.[6] It aligned with its first certain historical record in the hamlet of Lirey in the Diocese of Troyes, France, in the second half of the fourteenth century. The medieval interval contributed to the scholarly consensus that the Shroud of Turin was a medieval artifact created between the second middle of the thirteenth century and the middle of the fourteenth century.[7]

Despite the radiocarbon dating and the first certain historical record, some historians and scientists maintain a cautionary stance regarding the attribution of the artifact to a medieval forger or artist.[8] Other scholars lean towards or support the so-called thesis of “authenticity,”

according to which the cloth once covered the crucified corpse of Jesus of Nazareth.[9] Such a spectrum of opinions, which are often polarized, creates an epistemological challenge for researchers studying religion and science.[10]

In 1983, the Shroud became the property of the Holy See. Today, its authenticity and religious status is a subject of significance for many Christians, particularly Catholics and some theists and agnostics. Two major public ostensions occurred in 2010 and in 2015, and some additional confidential events have occurred since. The last three Popes visited and prayed before the Shroud of Turin. Following STURP's investigations, Pope John Paul II used the expression "unusual and mysterious relic"[11] to refer to the Shroud. After the radiocarbon dating, John Paul II described the Shroud as an icon, a "challenge to our intelligence,"[12] and a "mirror of the Gospel."[13] Pope Benedict XVI considered it an "icon written in blood; the blood of a man who was scourged, crowned with thorns, crucified and whose right side was pierced."[14] Nevertheless, under his pontificate but in his non-magisterial writings, Ratzinger Pope Benedict XVI referred to the Shroud as a "relic,"[15] indicating his personal inclination toward the thesis of an antique cloth.

This study examines the extensive and often contradictory body of academic publications, addresses the historical and archaeological controversies surrounding, and explores the epistemological approaches that were proposed after STURP's investigations on the Shroud. This literature review focuses on highly significant topics associated with the Shroud and mostly examines peer-reviewed academic papers to provide a synthetic, up-to-date, and interdisciplinary perspective on the research related to the Turin Shroud. Accordingly, state-of-the-art epistemological frameworks (inference to the best explanation, argument mapping and Bayesian framework) are discussed to obtain a broad consensus on the historical origins of the Shroud of Turin.

2. Disputed reliability of the historical bedrock

Modern interdisciplinary arguments regarding authenticity date back to the end of the nineteenth century. The first argument against the authenticity of the Turin Shroud is simple but powerful[16] and is based on a draft, or partial copy, of a memorandum written by the Bishop of Troyes Pierre d'Arcis to Pope Clement VII in Avignon. In 1389, Pierre d'Arcis claimed that the image was an artifact (an object made by an individual), and that the unnamed artist was known to his predecessor, Henri de Poitiers (ca. 1356 AD). According to recent historical research, Clement VII addressed the question of the Shroud's authenticity in a careful but ambiguous manner, reflecting the medieval pontificate's general stand on many relics.[17]

Recent scholarship has not allowed an increase in confidence in d'Arcis' testimony. The physical investigations conducted by STURP revealed that the image of the man is not a painting, especially given its extreme superficiality on the top of the fibers—a fifth of a thousand of a millimeter.[18]

After 1978, a controversy arose regarding the possible identification of the Shroud of Turin in a drawing in the Pray Codex, which is the first Hungarian manuscript dating to ca. 1192–1195 AD.[19] This representation has some striking features of the Shroud. Accordingly, the hypothesis of a direct or an indirect representation or evocation of the Shroud, which was then kept in Constantinople before the sack of the city in 1204 AD, can no longer be dismissed easily.[20]

3. Advances in archaeological and scientific measurements

3.1. Radiocarbon dating

Following the publication of STURP investigations in peer-reviewed journals, the 1980s emerged as a prominent academic period for scientific research. The radiocarbon dating of the

Shroud took place in 1988, and its results were published in 1989. Three laboratories—Oxford; Tucson, Arizona; and the Swiss Federal Institute of Technology, Zürich—analyzed three samples taken from one extremity of the cloth, along with three known age control samples. They asserted the presence of "conclusive evidence"[21] in favor of a medieval date, calibrated calendar intervals of 1262 to 1312 AD and 1353 to 1384 AD with 95% confidence and concluded it dates back to between 1260 and 1390 AD.

More than three decades later, researchers' confidence in the precision and accuracy of the results decreased significantly.[22] It could no longer be said that "almost all of the recent discussions questioning the validity of the 14C measurements on the Shroud are vetted in non-peer-reviewed sources."[23] This reduction was caused by protocol breaches, such as the unplanned conservation of pieces of samples in Tucson and, probably, Zürich.[24] Further, multiple analyses of threads and fibers revealed that the sample was taken in an area at risk of not being chemically representative of the complete artifact.[25] Although a homogeneity analysis found no trace of coating in an untested sample kept in Tucson, it revealed a significant difference between the thickness of the sample (ca. 0.25 mm) and that of the adjacent part (0.34–0.45 mm).[26]

From a statistical viewpoint, the parametric and nonparametric analyses of raw data, which either involve assuming a known distribution (parametric) or do not make any assumptions (nonparametric), strongly suggested that the number of carbon 14 atoms significantly differed among the results of different laboratories and even within the Tucson laboratory.[27] Furthermore, the statistical analysis supported the hypothesis of the presence of a spatial trend among the radiocarbon dates. This probable linear trend along the length of the cloth explains the reduction in the pertinence of the 1989 results: The radiocarbon dates seem to be dependent on the parts of the Shroud from which samples were taken. This suggests the presence of a systematic flaw that makes the mathematical calculation of the calendar interval

absurd.[28] The probable causes of this spatial trend, including non-mutually exclusive explanations, such as invisible reweaving during the French Renaissance or differences in cleaning procedures, remain under speculation.[29]

Internal reports from the Oxford and Tucson laboratories support the hypothesis of a contamination problem: The sample selected by textile experts contained multicolored threads and ancient cotton, whereas the Turin Shroud is made of pure linen. This diminished confidence in the reliability of the 1989 conclusion aligns well with the contamination problems occurring in the dating of ancient linen textiles using the Accelerator Mass Spectrometry method in the 1980s.[30] These problems are still occurring today.[31] The following question emerges: Based on the physical evidence, documentation, and statistical analysis of the 1988 radiocarbon dating, would the partisans of a medieval artifact have put great confidence in such an article concluding to a first-century interval?

3.2. Ethnic origins of human DNAs and the analysis of pollen grains

During the first important twenty-first-century academic contestation, a vanillin test was conducted. The test's calendar interval was significantly older than the radiocarbon calendar interval and compatible with the authenticity hypothesis.[32] However, this result is yet to be confirmed.[33] Similarly, during the last decade, the analysis of the DNAs collected in 1978 and 1988 in the filters of the vacuum cleaners was considered one of the most interesting archaeological discoveries.[34] Approximately 40% of the collected DNAs were from the Indian subcontinent. However, there is no documentation of any person of Indian origin touching the Shroud before 1988. This analysis provides evidence supporting the antique origin of the Shroud's linen, which was reinforced by the regularity of commercial relationships that existed between India and the crossroads of the Middle East in the first century AD.[35] This hypothesis is undermined by the lack of validation of the sample and the inability of replicating the experiment.

The antique hypothesis was reinforced by the last reinterpretation of the images of the pollen grains that were present on the linen cloth.[36] It comes after decades of debate on the identification of the pollen grains. Contrary to the assertions of some supporters of authenticity,[37] doubts on the quality of the collected data were reasonable. Nevertheless, the abundance of the genus *Helichrysum* and the presence of other pollen traces suggest a coherence with antique rituals and Jewish burial practices.[38]

3.3. New measurements using multiparametric analysis and wide-angle X-ray scattering

In the last decade, two elements were added to the case for the authenticity of the Shroud. The first was the multiparametric results obtained in 2015 using mechanical and optical measurements.[39] The nondestructive dating results were consistent with the second element, wide-angle X-ray scattering (WAXS), which involved directing X-rays and observing the scattered rays. These WAXS results closely matched the data profiles of a first-century-AD Israeli linen sample from Masada.[40]

The aforementioned methodologies and conclusions were criticized for the lack of diversity in textile samples, the uncertainty associated with preservation conditions, their novelty, and the absence of replication. However, the ever-increasing variety of nondestructive methods for dating millimetric pieces of cellulosic materials, including fluorescence emission, WAXS, and Raman spectrometry, appears promising.[41]

The convergence of antique calendar intervals involves various uncertainties; however, it provides an argument in favor of authenticity. Other explanations (e.g., biases, data dredging, errors, and fraud) remain plausible, despite being associated with high explanatory costs.

4. New perspectives on body image and bloodstains

Following STURP investigations, numerous forensic and pathological studies examined the Turin Shroud and the possibility that it once enveloped a crucified human body.

In the early 1980s, biochemical analyses primarily focused on identifying the presence of human blood and hematite, a red pigment often used by artists.[42] Over time, an array of analyses reduced the dissent among chemists regarding this matter, as the red stains on the Shroud were shown to contain real blood.[43] Most of the pigments detected on the sticky tapes collected by STURP were likely the result of a post-fourteenth-century relic-by-contact process during which believers touched the Shroud to sanctify their painted copies. Despite the implications of the findings of some microchemical traces, the image on the Shroud is not a painting.[44] The occurrence of cross-reactivity in serological tests indicates that definitively affirming a human, as opposed to an unspecified primate, origin for the blood on the Shroud is unwarranted from a biochemical viewpoint.[45] This chemical uncertainty might be alleviated by a historical reasoning suggesting the unlikelihood of an antique, or medieval, artist or forger using a primate's blood.

The enduring reddish color of the bloodstains, which should have blackened over time, triggered numerous hypotheses on the bloodstains' cause, ranging from pigments to intense suffering–related production of high bilirubin levels in blood. The pigment hypothesis had some shortcomings such as the impossibility of extrapolating representativeness from a few detected particles. Further, the effect of long-term ultraviolet irradiation on bilirubin levels has been tested and is considered the most plausible explanation.[46]

The image on the Turin Shroud is that of a man with puncture wounds, scourge marks, and bloodstains. These markings suggest a crown of thorns, flagellation, a crucifixion, and a spear wound to the side. The image's anatomical accuracy has long been a subject of significant debate. The most contentious points include the length of the arms and fingers[47] and position

of the alleged nails in the hands or wrists through the Destot's space.[48] The consistency of the allegedly tortured corpse with a man's crucifixion scenario has led to contradictory interpretations in numerical and forensic analyses.[49]

5. Advantages and disadvantages of the medieval and authenticity hypotheses

5.1. Medieval hypothesis

The primary advantage of the radiocarbon dating interval of the Turin Shroud is it overlaps the confirmed historical record. The reliability of this result is supported by the assessments of various textile experts, historians, and chemists who found no significant evidence of reweaving or contamination in the area.[50] Moreover, there is a significant disparity in the C14/C12 ratio between the first- and thirteenth-century calendar intervals.

Further, the medieval hypothesis conforms to the naturalistic worldview shared by many contemporary scholars, irrespective of their religious beliefs. This perspective underscores historians' inability to assign a probability to the occurrence of past supernatural events. Some proponents of this view assert the physical impossibility of the occurrence of such events, as well.[51] However, these two prominent elements, prevalent in arguments supporting the medieval thesis, are challenged by two main questions: who and how?

Since the beginning of the twentieth century, the medieval thesis has been facing criticism: It could not identify the artifact's creator(s) in late medieval European art history. This criticism arose from internal disagreement among the supporters of the medieval thesis regarding the Shroud's qualitative assessment. Is it ordinary or extraordinary work?

The notion of ordinary work conflicts with the Shroud's exceptional characteristics (length, linen quality, image size, and frontal nudity in a post-crucifixion scene), which deviate significantly from the characteristics of other alleged medieval relics. What would be the most similar piece of cloth in records from the Middle Ages? This question illustrates the

importance of obstacles. On the other hand, if the creator is an unknown medieval genius who produced this unique piece, how does one avoid a dilemma? To circumvent this issue, a Byzantine art historian recently proposed a highly speculative plot in a popular book and suggested that the forger was an relatively obscure, immoral, medieval disciple of Sienese Master Simone Martini.[52] With the assistance of the King of France and the antipope in Avignon, the disciple created this "artistic achievement without precedent in the history of art."[53] In contrast, this conjecture highlights the difficulty of the challenge. The controversial nature of the object, along with the difficulty in integrating the Turin Shroud into art history, explains the conspicuous silence of many European medieval scholars on the Shroud's creation, despite radiocarbon dating.

Another question addressed by the medieval thesis is how the main image features were physically reproduced. Following decades of trial and error, the most promising explanation was proposed by Italian chemist Luigi Garlaschelli, who used a rubbing technique to chemically etch linen fiber cellulose.[54] Nevertheless, Garlaschelli's full-size attempt only partially reproduced the Shroud's key features. He failed to replicate the extreme superficiality of the image and the absence of an image under bloodstains. Hence, even if one focuses more on physical possibilities than the development of European art history between the mid-thirteenth and fourteenth centuries, the challenge of reproducing the image remains a significant consideration in a naturalistic context.[55]

5.2. Authenticity hypothesis

Since the 2000s, the authenticity hypothesis has been drawing strength from the growing academic contestation of the precision, accuracy, and representativity of radiocarbon dating results. At least five direct measurements indicated an antique cloth.[56] Nevertheless, the variety of authors and techniques and the concordance of results could not hide the fragility of their methods.

The presence of bloodstains on the Shroud might indicate that it once covered a corpse.[57] To date, the authenticity hypothesis has resisted anatomical contestation.[58]

The authenticity hypothesis benefits from the possibility of contradictory naturalistic and supernatural explanations. Accordingly, the image could have been that of the Resurrected Jesus of Nazareth, or the result of some physicochemical processes occurring during the normal decomposition process of the corpse, such as the Maillard reaction,[59] or the result of some electrostatic phenomenon, such as a corona discharge triggered by a telluric effect.[60] The Maillard reaction and the corona discharge hypotheses, among others,[61] fit well within a naturalistic worldview. In this framework, they attempt to replace and overcome the alleged historian's inability to describe supernatural events. However, it remains difficult to reconcile these naturalistic image formation processes with the well-established historical fact of the empty tomb.[62]

In addition to the alleged "conclusive evidence" provided by radiocarbon dating, the most persuasive obstacle to the authenticity hypothesis is the so-called historical gap. Although the expression is mostly used by Turin Shroud scholars, who explain the period between the sack of Constantinople in 1204 and the mid-fourteenth century, it could easily be extended to the death of Jesus of Nazareth, despite the presence of elements that could minimize it (e.g., the twelfth-century Pray Codex). The lack of solid historical evidence for 1,300 years poses a significant challenge to the validity of the authenticity hypothesis. Nevertheless, the argument of silence is notably weak for reasoning about ancient history, even if silence from antique sources would be the expected situation in the case of a medieval artifact. The lack of antique sources makes it difficult to prove or disprove authenticity. For example, one can only speculate about Jesus' anatomical posture on the cross and the specific instrument called *flagrum* used for his flagellation.[63]

Since 1988, many major Christian historians and biblical scholars ignored this topic.[64] Nevertheless, today, the apologetic approach, which uses only reason to prove the truths of faith, is applied to defend the case for authenticity.[65] This approach, which was developed in the 1970s, enables the reappraisal of philosophical arguments for the existence of theism, miracles, and historical arguments for Resurrection.[66] However, this approach remains a minority perspective among scholars, since most of them prefer naturalism.

From a theological perspective, it is opined that an abundance of evidence undermines the faith of a believer. This argument was advanced to prevent Christians from involving themselves in controversies. Furthermore, it was suggested that, owing to divine hiddenness, God would never provide his human creatures with an abundance of understandable scientific evidence or proof in favor of God's existence.

6. Systematic evaluations

6.1. Minimal facts approach and argument mapping

Arguments about the Turin Shroud challenge our intelligence. Even after the Shroud's radiocarbon dating in 1988, some philosophers and historians argued in favor of its authenticity.[67] Subsequently, other arguments that were generally used by the partisans of authenticity, including probabilistic models, emerged.[68] Those unrealistic results only showed that if there was a forger, then he wanted to reproduce the narrative of the Passion.

In recent years, two new systematic approaches have been proposed. The first method, which supports authenticity, is the inference-to-the-best-explanation-approach, which is based on widely accepted facts.[69] The Minimal Facts approach is more conservative. In the case of the Shroud, it applies five traditional historiographical criteria to assess main hypotheses on the image formation process in decreasing order of importance: (1) Plausibility, (2) Explanatory

scope, (3) Explanatory power, (4) Less *ad hoc*, and (5) Illumination.[70] The latter method was inspired by contemporary publications on the historicity of the Resurrection.[71]

When applied to the Turin Shroud, this methodology does not presuppose that it was wrapped around a body or that human blood was present. However, it faces criticism, notably for its forced omission of the 1988 radiocarbon dating as accurate and representative of the cloth, due to the lack of strong consensus. The Minimal Facts approach leans toward the Resurrection hypothesis, particularly within the framework of classical theism. New Testament scholar Dale Allison, who wrote that the methodology's principles were correct,[72] criticized its application to the Turin Shroud by saying that it will work only if "one already believes, or is inclined to believe, in an omnipotent deity with distinctively Christian proclivities."[73] However, there is no guarantee that a sound belief system would follow a top–down independent structure and transition deity belief to the Shroud's authenticity using the Resurrection event. If one accepts Allison's criticism, its consequence is that Christians who support the medieval thesis, including Allison and Nicolotti, should engage with this kind of inference to the best explanation.

Conversely, Douglas Walton provided another systematic argument, using the Turin Shroud debate as an example to clarify how to comprehend and solve complex cases using an argument diagram.[74] It illustrated the structure of the ongoing controversy and supported the medieval origin of the Turin Shroud.[75]

The sole ambition of Walton was to present a "realistic enough case, despite its incompleteness."[76] Nevertheless, this "realistic enough case" immediately appears misleading to the Shroud scholar. First, Walton made some factual errors in describing the case: According to him, the "presence of the shroud in Turin, Italy, was attested to in the fourteenth century,"[77] whereas the Shroud was in Lirey, France. Moreover, he wrote that radiocarbon dating was performed "in 1980,"[78] instead of 1988, and that some claimed that C14 experts

tested “a fragment of the shroud that could have been introduced in the Middle Ages,”[79] instead of the French Renaissance after a fire damaged the Shroud in Chambéry (Savoie, actual France) in 1532 AD. These factually incorrect statements regarding basic data indicate Walton’s lack of familiarity with the topic.

The text boxes on the 1988 radiocarbon dating are particularly problematic. Walton presented the C14 tests as though the interval 1260 to 1390 AD obtained by laboratories in Oxford, Zürich, and Tucson was identical each time. Furthermore, he introduced some confusion between the general conclusion and the three distinct intervals.[80] Therefore, the argument map was misleading because it provided three independent confirmations.

While describing his case, Walton considered the con argument of Chambéry repair. In his diagram, this argument is not based on any expert opinion. Further, Walton said that “if some evidence for [the repair hypothesis] were given, for example based on expert opinions of scientists who had examined the Shroud in the repair fragment, it could be a very strong counterargument, and might defeat the network of pro-arguments supporting the ultimate claim at issue.”[81] Hence, articles published since 2005 constitute this piece of evidence and provide a strong counterargument.

Based on this argument map, one can update and improve the accuracy of the heuristic approach, considering many of the studies mentioned. [Figure 1] The new diagram must be read from the right (arguments provided in the text box) to the left (the ultimate claim), and circles indicate whether the arguments are supported by experts. It depicts some proposals (from A1 to A18) reinforced by the consensus of experts (plus or minus EX) that support or contradict four central claims (from B1 to B4).[82] The ultimate claim (The Shroud of Turin is the burial cloth of Jesus, which is named C1) remains untouched. Each main hypothesis’s strengths and weaknesses indicate where our knowledge of the artifact could be improved and clarify a potential interdisciplinary examination of the cloth to attenuate the divergences

among scholars (e.g., regarding the coherence of bloodstains with narratives of the Passion, A4 versus A14).

The case, as depicted by the new diagram, appears much more complex to solve than proposed by Walton; many proposals supporting or opposing the central claim are supported by expert consensus. Moreover, this heuristic approach could be misleading because each proposition could have a different weight in solving the controversy.

6.2. Bayesian evaluation

The Bayesian framework might provide a sound systematic approach for the argument evaluation of two mutually-exclusive statements. Based on the content of the updated diagram, certain numbers can be used to provide a 'realistic enough' example of calculation. [Table 1] In Equation (1),

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B|A)\,P(A) + P(B|\neg A)\,P(\neg A)} \quad (1)$$

the posterior probability P(A|B) is determined by the multiplication of the prior probability P(A) and the probability of evidence P(B|A), which is divided by the sum of the numerator and inverse prior probability P(¬A) multiplied by the probability of the reversed evidence P(B|¬A). Assuming an equal prior probability of .5 for each mutually-exclusive hypothesis, one attributes to proposals A, reinforced by experts' consensus, a probability of .9 (others receive a probability of .7). Accordingly, the mean supporting the ultimate claim C1 (i.e., The Shroud of Turin is the burial cloth of Jesus of Nazareth) is 0.54, and the median is 0.7. If we consider the 18 proposals to be independent, then it is highly probable that the ultimate claim, C1, is true (*P*=.9878). This is because a superior number of proposals with expert consensus supports the C1 hypothesis. If the prior probability is of .01, then *P(C1)*=.45.

The same results are applicable on grouping each of the 18 proposals into its specific B group, *P(C1)*=.9878, with a prior probability of .5 on each grouping. This is mostly because one of

the two B groups against C1 (B2: An artist could have made the image in the Middle Ages) is only supported by two proposals with consensus and one without, facing three proposals with consensus against it. If the prior probability is of .3, then *P(C1)*=.5394 However, if the prior probability is of .1, then *P*(C1) is highly unlikely (*P(C1)*=.0014). [Figure 2]

This calculation illustrates the practical possibility of a significant shift in the subjective belief in the Shroud of Turin controversy. With neutral prior probability, posterior probability is higher than the prior probability, mean, and median of the proposals supporting authenticity. This Bayesian evaluation, which is based on a simplified updated argument map, should be interpreted with caution because its conclusion may be reversed using only a few pieces of opposing evidence. Furthermore, one could discuss at length the number of required proposals, subjective prior probability of a singular miracle claim, existence of consensus on certain data, or subjective number attributed to these numbers. The decision to merge some pieces of evidence was subjective, as well. Nevertheless, this calculation provides an example of a metric to assess the strengths of individual contents in complex interdisciplinary arguments.[83]

7. Conclusion

At the beginning of the 1980s, the dating and image formation process of the Shroud of Turin was both an archaeological enigma and an epistemological challenge.

As depicted in Walton's diagram, the results of the 1988 radiocarbon dating played a crucial role in developing a heuristic approach to the Turin Shroud case. Most scholars not deeply engaged with the academic literature on the topic consider the 1988 radiocarbon dating a straightforward disproof, even though the validity of the test has been increasingly questioned in the scientific literature during the last 20 years. However, analytical arguments suggest the existence of a warrant (a hypothesis more likely than not) for proponents' belief in the

authenticity of the Turin Shroud. The results of two Bayesian analyses challenge the dismissal of the Shroud's authenticity. Under the assumption that the antique and medieval hypotheses hold equal likelihood, the probability that the Shroud of Turin is the burial cloth of Jesus of Nazareth emerges as remarkably high, reaching 99%.

This literature review shows the vitality of the academic debate on the dating and image formation process of the Shroud of Turin. The ongoing controversy regarding the Shroud's authenticity underscores the persistence of and resistance to the dismissal of supernatural claims in the academic realm. In this disputed interdisciplinary context, systematic approaches, especially the Bayesian framework, should be used by scholars to justify their opinion, assess the impact of their belief system on the controversy, and plan future tests of the artifact.

Disclosure statement

The author reports there are no competing interests to declare.

Notes

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[75] This section stems from an initial analysis of Walton's argument map related to the epistemology of the Turin Shroud, first presented on July 22, 2017. Cf. Tristan Casabianca, "Do We Really Need New Evidence and Arguments about the Turin Shroud" (International Conference on The Shroud of Turin: Seeking Solutions to the Mysteries of the Shroud, Pasco, WA, 2017), https://www.academia.edu/34734035/Do_we_really_need_new_evidence_and_arguments_about_the_Turin_Shroud. Following the acceptance of the current article in June 2024, an article significantly inspired by this conference paper was published in October 2024. Cf. José L. Fernández-Sánchez, "Why the Shroud of Turin Is Not a Medieval Work? An Argument Map," *Scientia et Fides* 12:2 (2024), 123–50. Although fully aware of this 2017 conference paper during his writing process, Fernández-Sánchez chose not to include this reference in his article. He also declined to include a correction or an addendum (personal communication with the author, October 30, 2024).

[76] Ibid., 8.

[77] Ibid.

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[82] Considering the presence or absence of consensus for each assertion is essential in an argument map. In this regard, Fernández-Sánchez fails to provide robust evidence supporting the authenticity of the Turin Shroud (Fernández-Sánchez, "Why the Shroud of Turin Is Not a Medieval Work?").

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Table 1

Bayesian Evaluation of Shroud of Turin Controversy

A Group	Proposal A	*P*(A)	B Group	Proposal B	*P*(B|A)
A1	The results of three radiocarbon laboratories showed that the Shroud was made between 1260 and 1390 AD	.9	B1	The dates and marks are not consistent with the cloth being the burial cloth of Jesus of Nazareth	.9878
A2	The first certain historical records date from the fourteenth century	.9			
A3	The local bishop Pierre d'Arcis argued against authenticity	.9			
A4	The blood stains are incoherent with the narrative of a crucified man	.7			
A5	The 1988 radiocarbon dating suffers from lack of precision and accuracy, and might not be representative of the whole cloth	.1			
A6	Some historical evidence points towards a presence of the Shroud in Constantinople before 1204 AD (Pray Codex)	.3			
A7	According to his successor, the bishop knew who the artist was	.9	B2	An artist could have made the image in the Middle Ages	.2059
A8	Traces of painting on the Shroud	.9			
A9	The image formation process is reproducible with means available in the Middle Ages	.7			
A10	Traces of painting mostly due to relic–by–contact process	.1			
A11	The alleged artist is unknown	.1			
A12	Antipope Clement VII remained ambiguous regarding the claim of his bishop and the status of the Shroud	.1			
A13	At least five independent archaeological measurements are in coherence with a first century dating	.9	B3	The dates and the marks are consistent with the cloth being the burial cloth of Jesus of Nazareth	.9545
A14	There is primate blood on the Shroud	.9			
A15	The Shroud enveloped a real human body with blood stains consistent with the Passion of Jesus of Nazareth	.7			
A16	The measurements are based on new methods and not confirmed	.1			
A17	The image is not a painting, is extremely superficial and there is no image behind the blood stains	.9	B4	The specific features of the image sustain the authenticity	.9878
A18	No historical record of similar features in a medieval image	.9			
Probability (C1|A)	.9878				
Probability (C1|B)	.9878				

NOTE. The prior probability in the Bayesian equation is of .5. C1 = “The Shroud is the burial cloth of Jesus of Nazareth”. Groups B1 and B2 contradict C1; groups B3 and B4 support C1.

Figure 1. Argument map of Shroud of Turin controversy

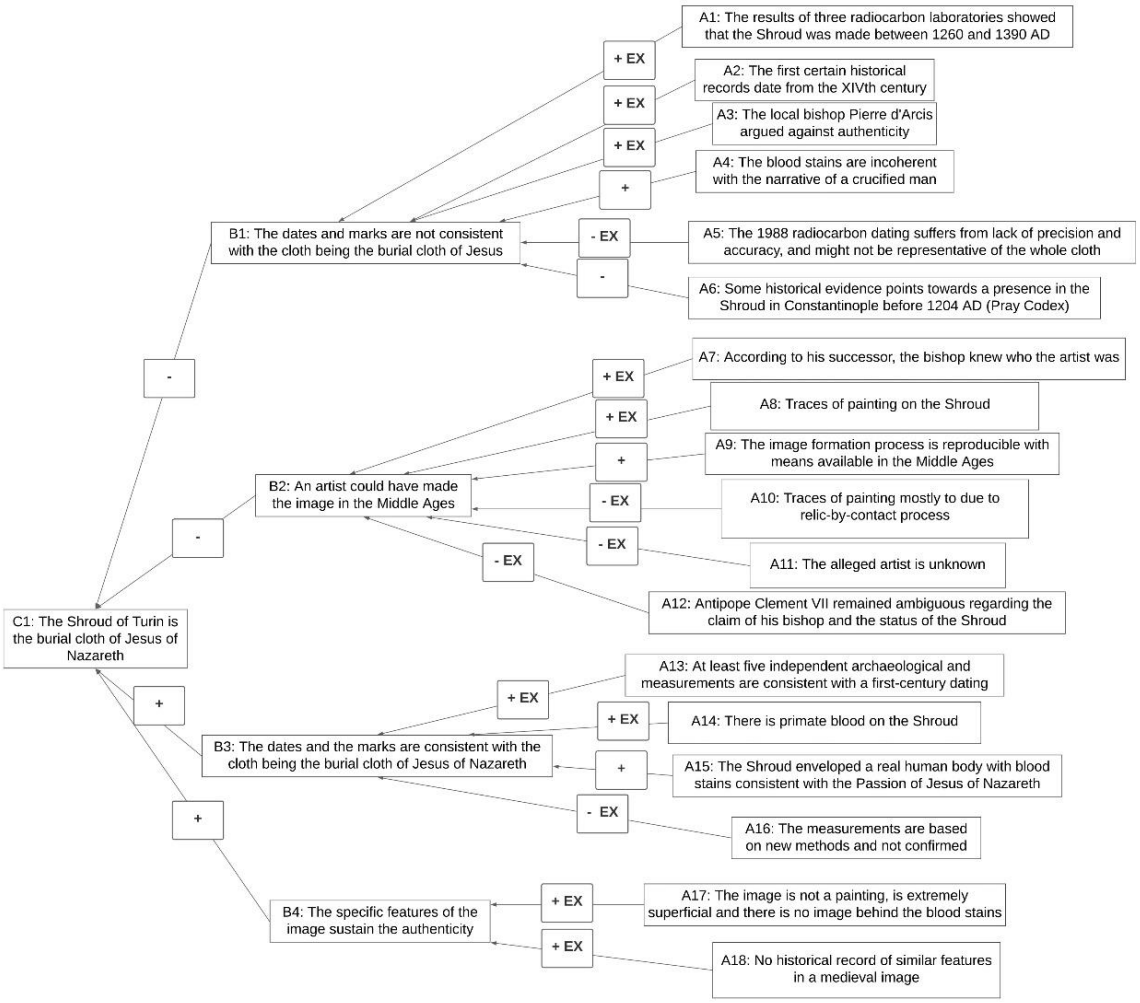

Figure 2. Prior probability and Shroud of Turin assessment