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A methodological consideration on international trafficking of cultural property: An approach from Bayesian statistics[1]

1. Introduction

As international instruments in the area of Cultural Heritage Law, both the UNESCO 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (hereinafter: the 1970 UNESCO Convention)[2] and the UNIDROIT Convention on Stolen or Illegally Exported Cultural Objects (hereinafter: the 1995 UNIDROIT Convention)[3] have played central roles in regulating international trafficking in movable cultural objects. The year 2020 naturally became an important milestone for these international regimes, as the year marked the fiftieth anniversary of the 1970 UNESCO Convention, and it also marked the twenty-fifth anniversary of the 1995 UNIDROIT Convention. Thus, in 2020 there was a series of events celebrating the achievements of these international instruments so far, and enlightening the public about the current challenges to the governance of the international art market, even though some of the celebratory activities had to be rescheduled to 2021 because of the COVID-19 pandemic.[4]

For example, on 8 and 9 October 2020, "The 1995 UNIDROIT Convention: Cultural objects at the crossroad of rights and interests," a two-day academic event to celebrate the twenty-fifth anniversary of the 1995 UNIDROIT Convention, was held in the form of a hybrid conference, at which some participants appeared in UNIDROIT and online

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[2] The 1970 UNESCO Convention was adopted on 14 November 1970 and entered into force on 24 April 1972. The text of the 1970 UNESCO Convention is available at *United Nations – Treaty Series* 1972, vol. 823, pp. 231–252.

[3] The 1995 UNIDROIT Convention was adopted on 24 June 1995 and entered into force on 1 July 1998. The text of the 1995 UNIDROIT Convention is available in: H.S. Burman, "International Institute for the Unification of Private Law (UNIDROIT): Final Act of the Diplomatic Conference for the Adoption of the Draft Unidroit Convention on the International Return of Stolen or Illegally Exported Cultural Objects", *International Legal Materials* 1995, vol. 34 , issue 5, pp. 1322–1339.

[4] "Report of the Secretariat on its activities", UNESCO Doc. C70/20/8.SC/5 (a working document for the 8th session of the Subsidiary Committee of the 1970 Convention), p. 4.

participation was also available.[5] Also, the German Federal Foreign Office took the initiative to organize an international online conference "Cultural Heritage and Multilateralism: Regional and International Strategies for the Protection of Cultural Heritage", held from 16 to 18 November 2020 in Berlin and broadcast online.[6]

Inspired by those events, which consisted of thought-provoking speeches by various experts and stakeholders, this article focuses on the topic of illicit trafficking of movable cultural property. More specifically, with the aim of promoting methodological development in the field of Cultural Heritage Law, this article proposes the introduction of a probabilistic tool as a way of analyzing problems concerning the international trafficking of movable cultural property.

2. The need for a methodological approach in the area of the international trafficking of cultural property

2.1. The regulatory development on the disposition of movable cultural properties

The first part of this article briefly summarizes the historical background to the development of international instruments concerning the disposition of movable cultural properties since the Second World War (2.1).[7] It then highlights recent challenges that are considered very important in this field (2.2), with the purpose of pointing out the need to develop a methodological perspective to consider those challenges (2.3).

The disastrous destruction of cultural property during the Second World War led to a movement to prepare a comprehensive international regime dealing specifically with the protection of cultural heritage, commencing with the establishment of the United Nations Educational Scientific and Cultural Organization (UNESCO).[8] In the history of international law, the Convention for the Protection of Cultural Property in the Event of Armed Conflict (hereinafter: the 1954 Hague Convention) was the first treaty dealing

[5] The report and program of the academic event is available at: https://www.unidroit.org/89-news-and-events/2958-unidroit-celebrates-25th-anniversary-of-1995-convention-on-cultural-property (accessed: 30.11.2020).

[6] The program and other materials of the online conference are available at: https://cultural-heritage-and-multilateralism2020.com/ (accessed: 30.11.2020).

[7] For attempts at regulating the movement of cultural property before the end of the Second World War, see, for example: P.J. O'Keefe, *Commentary on the 1970 UNESCO Convention*, 2nd ed., Institute of Art and Law, Builth Wells 2007, pp. 3–4.

[8] The Constitution of the United Nations Educational, Scientific and Cultural Organization was adopted on 16 November 1945 and entered into force on 4 November 1946. See: C. Ehlert, *Prosecuting the Destruction of Cultural Property in International Criminal Law: With a Case Study on the Khmer Rouge's Destruction of Cambodia's Heritage*, Martinus Nijhoff, Leiden 2013, p. 42; see also: R. Atwood, *Stealing History: Tomb Raiders, Smugglers, and the Looting of the Ancient World*, St. Martin's Press, New York 2004, pp. 150–151.

exclusively with cultural property after the Second World War.[9] Before that, we can only observe the prohibition of pillage by occupying forces within the framework of the laws of war and war crimes, as can be seen in the Hague Conventions of 1899 and 1907.[10]

Article 4(3) of the 1954 Hague Convention stipulates that the "High Contracting Parties further undertake to prohibit, prevent and, if necessary, put a stop to any form of theft, pillage or misappropriation of, and any acts of vandalism directed against, cultural property". This provision is seen as an important turning point by which the right to booty in cultural property was hereby excluded from the institutions of international law.[11]

In the following period, it is clear that the adoption of the 1970 UNESCO Convention was one of the most significant legislative developments for controlling the trafficking of movable cultural property. By 2020, 140 countries had become State Parties of the 1970 UNESCO Convention.[12] In a recent development, in 2015, at the third Meeting of State Parties, "Operational Guidelines for the Implementation of the 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property" was adopted.[13]

In the early 1990s, the European Union made efforts to regulate illicit trade in national treasures with the establishment of the single market. A significant regional regulation in the European Union during this period is the Council Directive 93/7/EEC of 15 March 1993 on the return of cultural objects unlawfully removed from the territory of a Member State (OJ L 74, 27.03.1993, pp. 74–79). Directive 93/7/EEC stipulates that cultural objects unlawfully removed from one Member State to another "shall be returned in accordance with the procedure and in the circumstances provided for in this Directive" (art. 2), and it also imposes an obligation on Member States to cooperate for the purpose of returning such unlawfully removed cultural objects (art. 4). The Directive attracted attention in the art market, together with the contemporaneous Council Regulation (EEC) No. 3911/92 of 9 December 1992 on the export of cultural goods (OJ L 395, 31.12.1992, pp. 1–5), which was later replaced by Council Regulation (EC) No. 116/2009 of 18 December 2008 on the export of cultural goods (codified version: OJ L 39, 10.02.2009, pp. 1–7). Although Directive 93/7/EEC offered the prospect of affecting many practices relating to the return of unlawfully removed cultural property, in fact it was applied in a relatively small number of cases.[14] Thus, to improve

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[9] The 1954 Hague Convention was adopted on 14 May 1954 and entered into force on 7 August 1956. The text of the Convention is available at *United Nations – Treaty Series* 1956, vol. 249, pp. 240–364.

[10] See, for example: H. Zhong, *China, Cultural Heritage, and International Law*, Routledge, New York 2019, pp. 88–89.

[11] See, for example, K. Zeidler, *Restitution of Cultural Property: A Hard Case – Theory of Argumentation – Philosophy of Law*, Gdańsk University Press – Wolters Kluwer, Gdańsk – Warsaw 2016, p. 156.

[12] A list of the State Parties of the 1970 UNESCO Convention is available at: https://en.unesco.org/fighttrafficking/1970 (accessed: 30.11.2020).

[13] The Operational Guideline of the 1970 UNESCO Convention is available at: http://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/operational-guidelines/ (accessed: 30.11.2020).

[14] A. Jakubowski, *State Succession in Cultural Property*, Oxford University Press, Oxford 2015, p. 251.

the situation, a new instrument, Directive 2014/60/EU,[15] was implemented with four substantial modifications. These are: 1) the elimination of the annex giving age or financial thresholds; 2) the extension of the time limit for offences; 3) the improvement in administrative cooperation through the Internal Market Information System; and 4) the shift of the burden of proof.

Efforts in the early 1990s also resulted in the adoption of the 1995 UNIDROIT Convention.[16] The 1995 UNIDROIT Convention is designed to complement the regime of the 1970 UNESCO Convention, especially in terms of private law issues, such as due diligence, good faith acquisition, duty of care, indemnity, and so on.[17] Furthermore, although the current number of Contracting States is smaller than that to the 1970 UNESCO Convention, it is noticeable that the 1995 UNIDROIT Convention has even had an indirect impact on the domestic legislation of states that have not yet ratified it.[18]

With these regulatory frameworks in mind, some of the specific issues on the international trafficking of cultural properties will be highlighted in the following section (2.2).

2.2. Challenges of high importance in recent years

2.2.1. The role of inventories and databases

The establishment of appropriate data banks on pieces of cultural property and their status is one of the key preventive measures for controlling the illicit art trade. There have been many efforts to manage inventories or databases for this purpose, although it is also frequently pointed out that there remain cases in which inventories are not managed appropriately and cases where such inventories are non-existent.[19] For police and customs authorities, such data banks are essential tools for effectively detect-

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[15] Directive 2014/60/EU of the European Parliament and of the Council of 15 May 2014 on the return of cultural objects unlawfully removed from the territory of a Member State, and amending Regulation (EU) No 1024/2012 (Recast), OJ L 159, 28.05.2014, pp. 1–10.

[16] For a discussion of the relation between Directive 2014/60/EU and the 1995 UNIDROIT Convention, see, for example: W.W. Kowalski, "Ratification of the 1995 UNIDROIT Convention on Stolen or Illegally Exported Cultural Objects, in Light of Directive 2014/60/UE on the Return of Cultural Objects Unlawfully Removed from the Territory of a Member State: The Perspective of Poland", *Santander Art and Culture Law Review* 2016, no. 2, pp. 165–178; see also: M. Schneider, "The 1995 UNIDROIT Convention: An Indispensable Complement to the 1970 UNESCO Convention and an Inspiration for the 2014/60/EU Directive", *Santander Art and Culture Law Review* 2016, no. 2, pp. 149–164.

[17] See, for example: L.V. Prott, "UNESCO and UNIDROIT: A Partnership against Trafficking in Cultural Objects", *Uniform Law Review* 1996, vol. 1, issue 1, pp. 59–71; see also: *idem, Commentary on the UNIDROIT Convention*, Institute of Art and Law, Leicester 1997, p. 15.

[18] See, for example: A. Jakubowski, "Return of Illicitly Trafficked Cultural Objects Pursuant to Private International Law" [in:] *Illicit Traffic of Cultural Objects in the Mediterranean*, eds. A. F. Vrdoljak, F. Francioni, 2009/09 *EUI Working Paper AEL*, pp. 142–148, https://cadmus.eui.eu/bitstream/handle/1814/12053/AEL_2009_09.pdf (accessed: 30.11.2020).

[19] P.J. O'Keefe, L.V. Prott, *Cultural Heritage Conventions and Other Instruments: A Compendium with Commentaries*, Institute of Art and Law, Builth Wells 2011, p. 65.

ing cases of illicit trafficking. Also, with reference to art dealers and other possessors of cultural property, both art. 4(4) of the 1995 UNIDROIT Convention and art. 10 or the Directive 2014/60/EU, with regard to the obligation of exercising due diligence or due care and attention, expect them to consult "any accessible register of stolen cultural objects."

For those purposes, databases on stolen cultural properties have been developed at various levels.[20] As an example, a department of the French Central Office for the Fight against Illicit Trafficking in Cultural Goods (OCBC) has a database of stolen cultural objects called "TREIMA" (Thesaurus of Electronic and Image Research in Artistic Matters).[21] As another example, the ICOM Red Lists Database provides a useful platform, and Emergency Red Lists published by ICOM are authorized reference materials in this field.[22]

The birth of specialized units for the protection of cultural heritage contributed to the development of a scheme for comprehensively collecting information on stolen artifacts and on related criminal events. On 3 May 1969, the Italian Carabinieri for the Protection of Cultural Heritage (Comando Carabinieri per la Tutela del Patrimonio Culturale, the TPC) was set up.[23] The Carabinieri manages a database of unlawfully removed cultural property called "Leonardo", developed in the 1980s and now provided for by art. 85 of the Italian Code of Cultural Property and Landscape (Legislative Decree of 22 January 2004, no. 42).[24]

In the management of comprehensive information about art crimes, INTERPOL is also an important actor. Since its first involvement in 1925, INTERPOL has also played a significant role in controlling art theft and the trafficking of looted cultural property.[25] In 1947, with the creation of a Works of Art Unit, INTERPOL started circulating International Notices on Stolen Art Works. Since 1990, this effort by INTERPOL has evolved into a computer-based system, namely the Stolen Works of Art Database.[26] Through the project codenamed PSYCHE (Protection System for Cultural Heritage), which was organized under the leadership of the Carabinieri in collaboration with INTERPOL, updates in their databases are now synchronized. With such comprehensiveness, use of

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[20] S. Manacorda, "Criminal Law Protection of Cultural Heritage: An International Perspective" [in:] *Crime in the Art and Antiquities World: Illegal Trafficking in Cultural Property*, eds. S. Manacorda, D. Chappell, Springer, New York 2011, p. 20.

[21] See, for example: S. Gauffeny, "The Preventive Measures in the Fight against Illicit Trafficking of Cultural Property and the Database TREIMA" [in:] *3rd International Conference of Experts on the Return of Cultural Property, Athens – Ancient Olympia, 23–27 October 2013: Proceedings*, ed. S. Choulia-Kapeloni, Archaeological Receipts Fund, Athens 2014, p. 245.

[22] ICOM Red Lists Database and Emergency Red Lists are available at: https://icom.museum/en/resources/red-lists/ (accessed: 30.11.2020).

[23] See, for example: G. Nistri, "The Experience of the Italian Cultural Heritage Protection Unit" [in:] *Crime in the Art and Antiquities World*…, p. 183.

[24] See, for example: P. Montorsi, "The Italian Carabinieri for the Protection of Cultural Heritage" [in:] *3rd International Conference of Experts*…, p. 239.

[25] See: T.D. Bazley, *Crimes of the Art World*, Praeger, Santa Barbara 2010, pp. 159–160.

[26] See, for example: F. Panone, "INTERPOL's Role in the International Prevention and Combat against Illicit Traffic of Cultural Goods" [in:] *3rd International Conference of Experts*…, p. 233.

the Stolen Works of Art Database is highly important in practice in relation to the obligation to exercise due diligence.[27]

A further need for development of data management and its effective utilization is anticipated as an outcome of technical advance, such as the rise of blockchain, AI, and so on. Recognizing this, the methodological discussion below (4.1) pays attention to the problem of how the consultation of such data banks affects the control of the illicit art trade.

2.2.2. Synergy between international regimes

As another noteworthy trend in Cultural Heritage Law, the discussion on how to enhance synergies between international instruments has become an increased point of focus. This trend can also be seen in relation to the trade in movable cultural property.[28]

It is pointed out that there is "the lack of intersection among the treaties that address wartime circumstances and those that address peacetime movement",[29] placing an obstacle to effectively governing the trade in movable cultural property. The comprehensiveness of the 1970 Convention and the 1995 UNIDROIT Convention can be evaluated positively in the sense that they are applicable to movements of cultural objects either during armed conflict or during peace time. However, there remains room to discuss their effectiveness in situations of armed conflict.[30]

For instance, the Croatian War of Independence (1991–1995) resulted in a massive loss of movable cultural objects. Nevertheless, the actual data on missing works of art during the period could hardly be reported since, presumably, considerable numbers of them were in store-rooms, destroyed, or plundered.[31]

The situation following the Second Gulf War in 2003 also raised a similar problem. The invasion caused considerable damage to various types of cultural property in Iraq such as archaeological objects, monuments, manuscripts, and so on.[32] Data collection on the missing properties was so difficult and time-consuming, as the "looted objects find their way to European, American, Asian, and Arab black markets".[33]

Together with the importance of the data banks (2.2.1), in the methodological discussion, attention will be paid to how efforts at data sharing between the regime on armed conflict and peacetime can have a positive impact on the process of detecting illicit trade in art (4.2).

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[27] Z. Boz, "Repatriation of Cultural Antiquities Forming a Legal and an Archaeological Procedure" [in:] *3rd International Conference of Experts*…, pp. 219–224.

[28] See, for example: "Report of the Secretariat on its Activities," UNESCO Doc. C70/20/8.SC/5 (a working document for the 8th session of the Subsidiary Committee of the 1970 Convention), p. 7.

[29] P. Gerstenblith, "The Disposition of Movable Cultural Heritage" [in:] *Intersections in International Cultural Heritage Law*, eds. A. Carstens, E. Varner, Oxford University Press, Oxford 2020, p. 19.

[30] *Ibidem.*

[31] B. Šulc, "The Protection of Croatia's Cultural Heritage during War, 1991–95" [in:] *Destruction and Conservation of Cultural Property*, eds. R. Layton, P. Stone, J. Thomas, Routledge, New York 2001, p. 162.

[32] S. Eskander, "Wars, Uprisings, Invasions, and Terrorism: The Looting and the Recovery of Iraq's Cultural Property" [in:] *3rd International Conference of Experts*…, p. 179.

[33] *Ibidem.*

2.3. Methodological consideration: The potentials of a probabilistic approach

In view of the challenges of high importance summarized above, this article proposes the introduction of a probabilistic approach in Cultural Heritage Law (3). Before moving on to the argument in favor of probabilistic analyses, this section will explain in what way the probabilistic approach that this article proposes has prospects for contributing to solving these challenges.

For the State Parties of the 1970 UNESCO Convention, from May to June 2020, an online consultation was organized by the UNESCO Secretariat for preparing UNESCO's Medium-Term Strategy 2022–2029 (41 C/4) and the Programme and Budget for 2022 (41 C/5). The Secretariat received sixty responses. The result of this consultation exercise was reported as an annex to a working document in the 8th Session of the Subsidiary Committee of the 1970 UNESCO Convention.[34] In the questionnaire, in which the State Parties were asked to specify the "key indicators of success in the operationalization of the 1970 Convention during the 2022–2029 period," approximately 90% of respondents chose the item "reinforce capacity of stakeholders, in particular police and customs officials and cultural heritage professionals, to prevent and fight against the illicit trafficking in cultural property" as an indicator of "high importance".[35]

In relation to the effective utilization of databases (2.2.1), a probabilistic methodology facilitates assessment of cases involving trade in movable property in practice, and, moreover, it enables scholars to create for academic purposes a model to depict how the data contribute to the determination of illicit art trade by police or customs authorities. In relation to the synergy between different regimes (2.2.2), the model proposed in the following sections also describes how information from the laws of war affects the control of the art trade.

3. Introduction of Bayesian statistics in cultural heritage law

3.1. The perspective of Bayesian statistics and its possible impact on cultural heritage law

In the following part, this article initially elaborates what type of statistical approach can be proposed as an effective tool in the area of cultural heritage law (3.1). Then, it sets out definitions of some mathematical concepts (3.2) as preparatory notes for discussing a statistical model relating to the control of illicit trafficking of cultural property.

In a broad perspective, this article focuses on the methodological merits of statistics, more specifically those of statistic inference, which is a way for data analysis to

[34] Annex "Consultation with the Governing Bodies of the 1970 Convention on the preparation of UNESCO's Medium-Term Strategy 2022–2029 (41 C/4) and Programme and Budget 2022–2025" (41 C/5) [in:] "Report of the Secretariat on its activities," UNESCO Doc. C70/20/8.SC/5 (a working document for the 8th session of the Subsidiary Committee of the 1970 Convention), pp. 10–16.

[35] *Ibidem*.

infer properties of underlying probability distribution. Since it provides a description of a past phenomenon and some predictions about a future phenomenon of a similar nature[36], it is worth setting out a probabilistic modeling of actions by art dealers or a probabilistic modeling of operations on the part of police or customs authorities.

In a more detailed view, there are two different approaches in the area, namely frequentism and Bayesianism[37]. This paper advocates the latter approach and proposes a way of applying the Bayesian approach in the field of Cultural Heritage Law for the following reasons. Differently from the frequentist method, the Bayesian approach can be applicable even in cases in which a small amount of data or evidence is available. Furthermore, Bayesian inference can lead to suggestive interpretations with regard to the subjective belief or decision of an actor, as will be demonstrated in subsequent parts (4.1 and 4.2).

3.2. Definitions

3.2.1. Probability

In this section, we discuss the definition of probability. Where a set is the set of all outcomes ("sample space"), to each subset ("event"), we define the "probability of A" ($p(A)$) as follows:

$$p(A) = \frac{|A|}{|\Omega|}.$$

In the equation, $|A|$ is the number of outcomes where the event A occurs, and $|\Omega|$ is the number of all outcomes. The probability of Ω is normalized to be $p(\Omega) = 1$, and $p(\Phi) = 0$. We also take as an axiom that, if $A_1, A_2, A_3 \cdots$ are mutually exclusive (disjoint subsets of Ω), then $p(A_1 \cup A_2 \cup A_3 \cdots) = p(A_1) + p(A_2) + p(A_3) + \cdots$.

In summary,

1. $0 \leq p(A) \leq 1$, $p(\Phi) = 0$, $p(\Omega) = 1$.
2. If $A_1, A_2, A_3 \cdots$ are mutually exclusive,
   then $p(A_1 \cup A_2 \cup A_3 \cdots) = p(A_1) + p(A_2) + p(A_3) + \cdots$.

From what we have summarized above, it follows that where A^C means an event in which A does not occur, $p(A^C) = p(\Omega) - p(A) = 1 - p(A)$. Of course, $0 \leq p(A^C) \leq 1$.

3.2.2. Conditional probability

A "conditional probability" is a probability taking into account a given condition. It means the probability of an event A occurring, given that another event B has already

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[36] C.P. Robert, *The Bayesian Choice: From Decision-Theoretic Foundations to Computational Implementation*, 2nd ed., Springer, New York 2001, pp. 1–2.

[37] As regards frequentism, see: J. Neyman, E.S. Pearson, "On the Problem of the Most Efficient Tests of Statistical Hypotheses", *Philosophical Transactions of the Royal Society – A* 1933, vol. 231, pp. 694–706. As regards Bayesianism, see: T. Bayes, R. Price, "An Essay towards Solving a Problem in the Doctrine of Chances", *Philosophical Transactions of the Royal Society of London* 1763, vol. 53, pp. 370–418.

occurred. If we write $p(A|B)$ in symbols, we read it as "the probability A of given B" and take the definition as follows:[38]

$$p(A|B) = \frac{p(A \cap B)}{p(B)}.$$

As an example, suppose there is a pair of standard dice thrown, and we add up the numbers that come up.[39] Under this rule, let us suppose that A is the event in which the total is 10. There are $6^2 (= 36)$ ways in total. Because there are only three ways, including (4,6), (5,5), and (6,4), to make 10, we can conclude that the probability of A is $\frac{3}{36}$ $(= \frac{1}{12})$. In symbols, we write: $p(A) = \frac{1}{12}$.

However, if we add another assumption that we have already observed that the first die came up as a 6, the probability of the event that the total will be 10 becomes updated. Here let us suppose that B denotes the event that the first die comes up as a 6. Now, we can calculate that the "conditional probability" that the total is 10, given the information of B, is $\frac{1}{6}$. This means the probability that the other die comes up as a 4, under the assumption that the first die came up as a 6. Here we can write: $p(A|B) = \frac{1}{6}$.

3.2.3. Bayes' Theorem

Having defined probability and conditional probability, this section will summarize the concept and formula of Bayes' Theorem.

For obtaining the formula of Bayes' Theorem, we can start with the definition of the conditional probability shown below:

$$p(A|B) = \frac{p(A \cap B)}{p(B)}.$$

From this equation, it follows that $p(A \cap B) = p(A|B) \cdot p(B)$.

Then, since $p(A \cap B)$ is the same as $p(B \cap A)$, we obtain the equation below:

$$p(A|B) \cdot p(B) = p(B|A) \cdot p(A).$$

Therefore, dividing this equation through by $p(B)$, we obtain the formula:

$$p(A|B) = \frac{p(B|A) \cdot p(A)}{p(B)}.$$

This is the formula called Bayes' Theorem. As a significant feature of this formula, we can observe that the conditional probability of A given B ($p(A|B)$) is expressed in

[38] In other words, the probability of A given B is defined to be the probability of A and B divided by the probability of B.

[39] For this example, see: T. Gowers, "Bayesian Analysis" [in:] *The Princeton Companion to Mathematics*, eds. T. Gowers, J. Barrow-Green, I. Leader, Princeton University Press, Princeton 2008, p. 159.

terms of the conditional probability of *B* given *A* ($p(B|A)$). Accordingly, if *A* denotes a hypothesis and *B* denotes a set of data or evidence, $p(A)$ can be regarded as a probabilistic statement of belief about *A* before obtaining *B*.[40] In this interpretation, $p(A|B)$ can be regarded as a probabilistic statement of belief *A* about after obtaining *B*.[41] This means, having specified $p(B|A)$ and $p(B)$, this formula works as a probabilistic model to depict the problem of how to learn from data or evidence.

4. Bayesian inference on the legal status of a movable cultural property

4.1. Prior probability and posterior probability

With the concepts defined in the previous section (3.2), the following sections set out a tentative probabilistic model for depicting the process whereby a trade in stolen cultural property is detected (4.1 and 4.2).

Suppose that a piece of cultural property is exported from State X to State Y. A customs official in State Y suspects that it is a stolen object. Thus, in order to check the legal status of the object, the official examines available evidence on the trade. The official finds that the object is registered in the Stolen Works of Art Database of INTERPOL. With this evidence, the official increases his/her suspicion concerning the illicit trade.

In summary, this situation can be described with the concept of conditional probability as follows;

What the customs official needs to consider is $p(A|B)$ where;

A : the event that the object is a stolen cultural property

B : the event that the object is registered
in the Stolen Works of Art Database of INTERPOL.

As will be set out below, Bayes' Theorem makes it possible mathematically to observe the process of detection of stolen cultural properties in such a situation.

As the first step, we can start with settling the "prior probability" ($p(A)$), which denotes the prior belief or instinct that the customs official has had before making reference to the database or any other source of evidence. Generally, in Bayesian inference, prior probability can be tentatively based on a small amount of objective data or even developed in a subjective manner. Moreover, a Bayesian approach allows us to start with allocating an equal probability to each event (like that $p(A) = \frac{1}{2}$ and $p(A) = \frac{1}{2}$) with the "principle of insufficient reason".

It goes without saying that the number of pieces of cultural property illegally distributed by theft in the world changes constantly. In order to examine our tentative model, let us make an initial assumption that, at the time when we need to determine whether the object in question is stolen or not, the customs official knows or believes that 10% of pieces of imported cultural property are stolen ($p(A) = 0.1$, and it

[40] J.M. Bernardo, A.F.M. Smith, *Bayesian Theory*, John Wiley and Sons, Chichester 1994, p. 2.
[41] *Ibidem.*

follows $p(A^C) = 1 - p(A) = 1 - 0.1 = 0.9$) (see: the top line of the diagram in Figure 1-1). Here, $p(A) = 0.1$ means "prior probability" that the object in question is a stolen cultural property.

Then, suppose further that, at that time, objects of 80% of the stolen cultural properties in the world are registered in the Stolen Works of Art Database of INTERPOL, despite the inference that this percentage will also change from time to time, and that in a later stage the registration rate will be higher if the country of origin act in a correct manner. This means $p(B|A) = 0.8$, and it follows that $p(B^C|A) = 1 - p(B|A) = 1 - 0.8 = 0.2$ (see: the left-side of the diagram in Figure 1-1.) With these assumptions, we can obtain two probabilities as follows. Firstly, $p(B \cap A) = p(B|A) \cdot p(A) = 0.8 \cdot 0.1 = 0.08$; and secondly, $p(B^C \cap A) = p(B^C|A) \cdot p(A) = 0.2 \cdot 0.1 = 0.02$ (see: Figure 1-1).

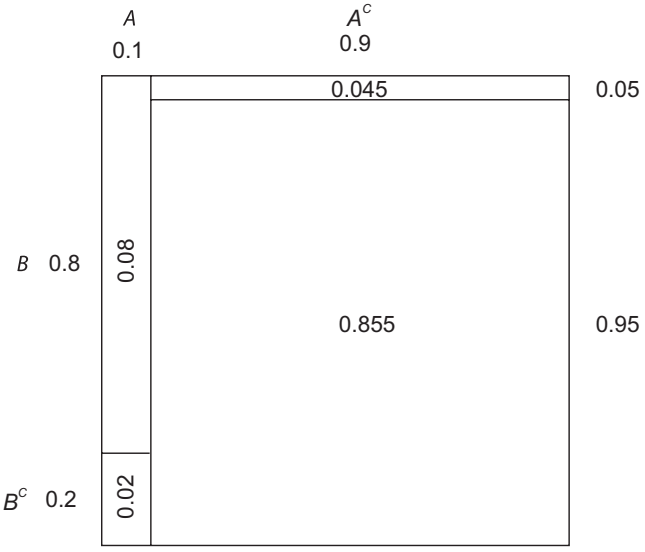

Figure 1-1

In addition, let us tentatively suppose that the rate of false registration in the database, at the same time, is only 5%. This means that $p(B|A^C) = 0.05$, and it follows that $p(B^C|A^C) = 1 - p(B|A^C) = 1 - 0.05 = 0.95$ (see: the right-side of the diagram in Figure 1-1). Then we obtain the probabilities, including $p(B \cap A^C) = p(B|A^C) \cdot p(A^C) = 0.05 \cdot 0.9 = 0.045$, and $p(B^C \cap A^C) = = p(B^C|A^C) \cdot p(A^C) = 0.95 \cdot 0.9 = 0.855$ (see: Figure 1-1).

Here, in the diagram in Figure 1-1, we can confirm that the sample space (Ω), or the universal set of probabilities, is normalized to be $p(\Omega) = 1$, since this square diagram is drawn to be 1 in area ($p(B \cap A) + p(B^C \cap A) + p(B \cap A^C) + p(B^C \cap A^C) = 1$).

As a second step, we can now introduce the additional information that the customs official has actually found that the object was registered in the Stolen Works of Art Database of INTERPOL. Confirming that the event B has been observed, what we should to do next is to erase the areas of probabilities concerning B^C from the diagram in Figure 1-1. The result of this task is Figure 1-2.

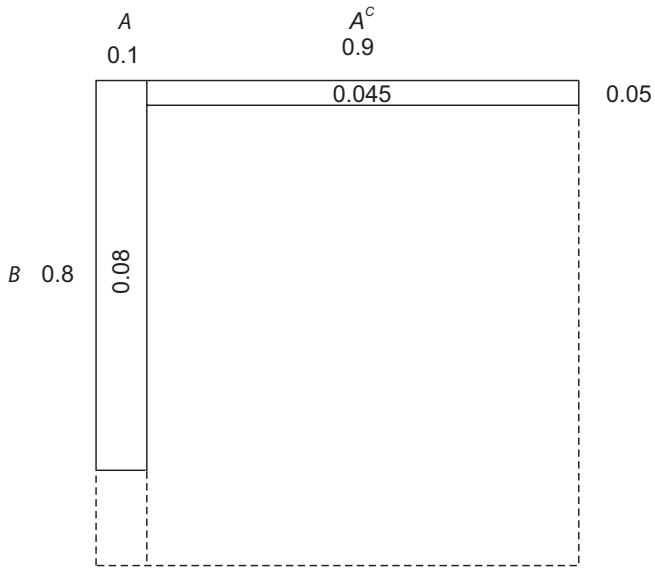

Figure 1-2

Figure 1-2 suggests that, given the evidence that the event *B* had been observed, now the probability that the object is a stolen cultural property must be updated. Then, we can write down the remaining probabilities in the form of a ratio, with the process of normalization, as follows:

$$p(B \cap A) : p(B \cap A^C) = 0.08 : 0.045$$
$$= \frac{0.08}{0.08 + 0.045} : \frac{0.045}{0.08 + 0.04}$$
$$= 0.64 : 0.36.$$

Thus, we obtain, $p(A|B) = 0.64$. Of course, in another way of calculation, we can use the formula of Bayes' Theorem as shown below:

$$p(A|B) = \frac{p(B|A) \cdot p(A)}{p(B)}$$
$$= \frac{0.8 \cdot 0.1}{0.08 + 0.045}$$
$$= 0.64.$$

As a result of calculation, this model suggests that, given that the event *B* has been observed, the percentage of the chance that the object is a stolen cultural property is increased from 10% to 64%. In this sense, in Bayes' Statistics, $p(A|B)$ is conceptualized as "posterior probability".

It should be noted that the calculation process above shows how important the Stolen Works of Art Database of INTERPOL is, by quantifying the actual impact of the matching check of the database in the process of detecting stolen cultural property. In this way, mathematical modelling seems to have potential to provide a methodological tool for evaluating each current tool or instrument for fighting against illicit trafficking in cultural property.

4.2. Sequential Bayesian updating

As a continuing scenario from the previous section (4.1), let us suppose the following story. After having updated the inference on the legal status of the object in question by reference to the Stolen Works of Art Database of INTERPOL, the customs official now has a "posterior" belief that $p(A) = 0.64$. Moreover, the official checks the social situation of the Country of Origin (State X) with the aim of further updating his/her inference. Then the official confirms that there is an armed conflict underway within State X. With the knowledge that the occurrence of armed conflict negatively affects the trafficking of stolen cultural properties, the official strengthens his/her suspicion regarding the legal status of the object.

What the customs official is considering is $p(A|C)$, where:

A : the event that the object is a stolen cultural property
C : the event that in the State X (Country of Origin)
there is an armed conflict occurring

The model depicted by Figure 2-1 makes the assumptions given below.

Firstly, as a prior probability at this stage, we can take $p(A) = 0.64$ (see: the top of the diagram in Figure 2-1). This probability is the one drawn as the "posterior probability", given the event B (see: the section 4.1). With this assumption, it follows that $p(A^C) = 1 - p(A) = 1 - 0.64 = 0.36$ (see: the top of the diagram in Figure 2-1).

Secondly, suppose that, at the time of examination, 30% of stolen cultural property was exported from a country where an armed conflict is in progress. This means that $p(C|A) = 0.3$, and $p(C^C|A) = 1 - 0.3 = 0.7$ (see: the left-side of the diagram in Figure 2-1). From these, we can obtain probabilities such as $p(C \cap A) = p(C|A) \cdot p(A) = 0.3 \cdot 0.64 = = 0.192$ and $p(C^C \cap A) = p(C^C|A) \cdot p(A) = 0.7 \cdot 0.64 = 0.448$ (see: Figure 2-1).

Thirdly, suppose that, if we see the space where the cultural properties are not stolen (A^C), at the time of examination 10% of the properties come from a site of armed conflict. This means that $p(C|A^C) = 0.1$, and $p(C^C|A^C) = 1 - 0.1 = 0.9$ (see: the right-side of the diagram in Figure 2-1). Then we obtain the probabilities that include $p(C \cap A^C) = = p(C|A^C) \cdot \cdot p(A^C) = 0.1 \cdot 0.36 = 0.036$, and $p(C^C \cap A^C) = p(C^C|A^C) \cdot p(A^C) = 0.9 \cdot 0.36 = 0.324$ (see: Figure 2-1).

Again, in the diagram in Figure 2-1, we can confirm that the sample space (Ω) is normalized to be $p(\Omega) = 1$, as this square diagram is drawn to be 1 in area ($p(C \cap A) + + p(C^C \cap A) + p(C \cap A^C) + p(C^C \cap A^C) = 1$).

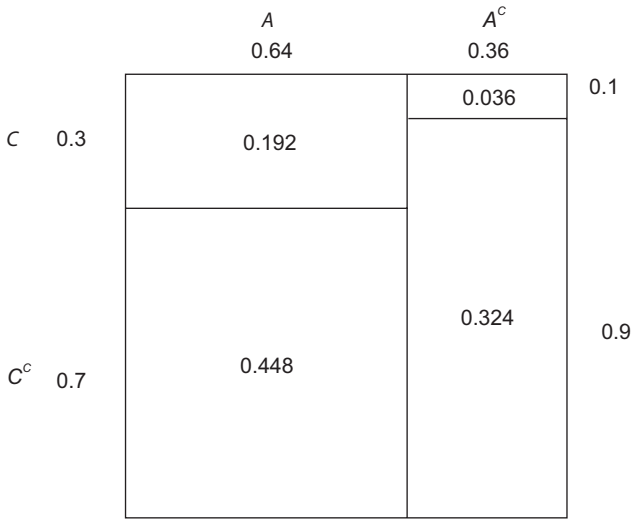

Figure 2-1

Under these assumptions, let us introduce the condition that the customs official actually confirms that the exporting country is a site of armed conflict. As the event *C* has been observed, we can erase the areas of probabilities concerning C^C (see: Figure 2-2).

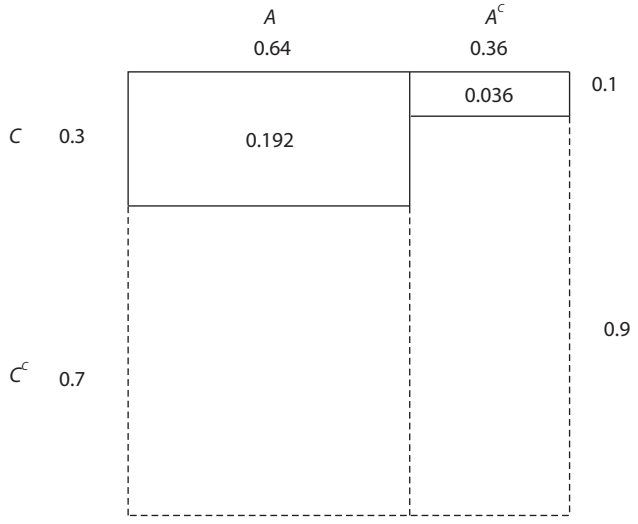

Figure 2-2

Now we can calculate the posterior probability as shown below:

$$\begin{aligned} p(C \cap A) : p(C \cap A^{\complement}) &= 0.192 : 0.036 \\ &= \frac{0.192}{0.192 + 0.036} : \frac{0.036}{0.192 + 0.036} \\ &= 0.84210526 : 0.15789474. \end{aligned}$$

(They are rounded to nine decimal places.)

Thus, we obtain $p(A|C) = 0.84210526$, We can go over the accounts by the formula of Bayes' Theorem as shown below:

$$\begin{aligned} p(A|C) &= \frac{p(C|A) \cdot p(A)}{p(C)} \\ &= \frac{0.3 \cdot 0.64}{0.192 + 0.036} \\ &= 0.84210526. \end{aligned}$$

The calculation above shows a process in which, by obtaining the evidence that the object was exported from a site of armed conflict, the probability of illegal export/import is further updated to be approximately 84%. In this sense, the model here suggests the effectiveness of data sharing between the regime of armed conflict and that of peacetime.

This continuous updating process in Bayesian inference is called "Sequential Bayesian Updating". Importantly, the results of updating the probability will be equal between 1) in the case where the customs official updates his/her belief with the observation *B* of and *C* in a sequential manner, and 2) in the case where the official updates his/her belief with the simultaneous observation of *B* and *C*.

4.3. Methodological merits of Bayesian inference in the field of illicit trafficking in cultural property

This section discusses possible issues to which the tentative statistical model shown above can be applied with the aim of considering how the model should be developed in the future.

Firstly, the tentative model shown above would contribute to the development of methodological study in police and customs authorities and provide informative tools in their capacity-building activities. The statistical assumptions may be set out on a case-by-case basis, according to the regional features of the importing country and the characteristics of the object in question.

Secondly, in the experimental application in the previous section (4.1), this article takes a situation where the customs official refers to the database of INTERPOL. However, these data banks are useful not only for police or customs officials in order to enhance their detection capabilities, but also for dealers to ensure that they take action

in accordance with their obligation to exercise due diligence. Thus, a similar attempt at modelling could be developed for analyzing ethical conduct on the part of art dealers and other stakeholders.

Thirdly, as another way of utilization, the model could be developed to be a methodological tool for monitoring regulations, since, for example, we may consider the probability of an event in which a stolen object is found in a State Party of the 1995 UNIDROIT Convention. With such assumption, there is room to discuss the impact of increase in its State Parties from a statistical viewpoint.

5. Conclusions

This article makes an experimental attempt to introduce a statistical methodology in Cultural Heritage Law. As discussed with regard to the tentative model, the method of Bayesian inference can be a useful tool in this field for analyzing how the belief or recognition of stakeholders, by which they make decisions, is updated through the process of collecting data or evidence.

As a limitation of the tentative model in this article, both the evidence obtained from the consultation of INTERPOL's database and the evidence on the exporting country are obviously matters in the control of the art trade. Accordingly, in any future research, a trial study is expected in order to examine what other facts can affect the assessment of lawfulness in the art trade.

As another limitation, the article has set out a mode dealing with a case of detecting a piece of stolen cultural property, but it does not explore cases of trade in movable cultural property in a comprehensive manner. Thus, there remains a need to consider whether this kind of statistical model works in other situations involving the illicit art trade.

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Summary

Ren Yatsunami

A methodological consideration on international trafficking of cultural property: An approach from Bayesian statistics

Focusing on issues of illicit trafficking in movable cultural property, this article proposes the introduction of a probabilistic tool called Bayesian Inference in the area of cultural heritage law. With a tentative probabilistic model, it is demonstrated how Bayesian Inference can be utilized for quantifying the actual impact of evidence on the process whereby a customs official detects illicit trade in stolen cultural property.

Keywords: Bayesian Inference, Movable Cultural Property

Streszczenie

Ren Yatsunami

Rozważania metodologiczne dotyczące międzynarodowego handlu dobrami kultury – podejście ze statystyki bayesowskiej

W niniejszym artykule, tematycznie osadzonym w zagadnieniach nielegalnego handlu ruchomymi dobrami kultury, zaproponowano stosowanie narzędzia probabilistycznego znanego jako wnioskowanie bayesowskie w sprawach z zakresu prawa ochrony dóbr kultury. Postulowany model probabilistyczny pokazuje, w jaki sposób można wykorzystać wnioskowanie bayesowskie

do oszacowania wpływu materiału dowodowego na całość postępowania w przypadku, w którym organy celne wykryłyby taki właśnie nielegalny handel.

Słowa kluczowe: wnioskowanie bayesowskie, ochrona ruchomych dóbr kultury