

ON THE FUTURE OF FREE ASSESSMENT OF EVIDENCE STATISTICAL AND PROBABILISTIC EVIDENCE IN THE ERA OF ARTIFICIAL INTELLIGENCE¹

O BUDÚCNOSTI ZÁSADY VOĽNÉHO HODNOTENIA DÔKAZOV - ŠTATISTICKÉ A PRAVDEPODOBNOSTNÉ DÔKAZY V ÉRE UMELEJ INTELIGENCIE

Michaela Szittyaiová²

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ABSTRACT

This paper addresses the research question of: 'How should the institute of free assessment of evidence in Slovak civil contentious proceedings be transformed in the event of integrating artificial intelligence into the decision-making process?'. In the introductory parts, the reader is presented with the practical dimension of the problem in the Slovak Republic and the Czech Republic on specific decisions of the highest judicial authorities. In these chapters, the author processes, analyses, and compares relevant academic writings concerning the issues and approaches to the evaluation of probabilistic and statistical evidence. The article smoothly transitions into a juxtaposition of the Anglo-American and European approaches to the assessment and evaluation of evidence in civil proceedings, which concludes with a summary of the comprehensive ideological basis on which the subsequent parts of the article are built. In the following chapter, the reader is offered a mathematical approach to the evaluation of probability. This is accompanied by several notes by the author about the (un)readability of said evaluation for artificial intelligence – for the sake of straightforwardness of the narrative, the author's demonstrative comments with specific practical examples are given for each mathematical formula. The author then applies the aforementioned ideas to the Czecho-Slovak legal context and concludes the paper with de lege ferenda considerations, keeping this expected development in mind.

ABSTRAKT

Článok sa zaoberá výskumnou otázkou: 'Ako by sa mal transformovať inštitút voľného hodnotenia dôkazov v slovenskom civilnom sporovom konaní pre prípad integrácie umelej inteligencie do rozhodovacieho procesu?' V úvodných častiach je prezentovaný praktický rozmer problému v Slovenskej a Českej republike na konkrétnych rozhodnutiach najvyšších súdnych autorít. Autor v nich spracúva, analyzuje a komparuje relevantnú svetovú akademickú spisbu týkajúcu sa problematiky a prístupov k hodnoteniu pravdepodobnostných a štatistických dôkazov. Článok plynulo prechádza do juxtapozície anglo-amerického a európskeho prístupu k vyhodnocovaniu dôkazov v civilnom konaní, čo završuje zhrnutím ucelenej myšlienkovvej základne, na ktorej sú vybudované nadväzné časti článku. Nasledujúca kapitola prezentuje matematický prístup k vyhodnocovaniu pravdepodobnosti. Tento sprevádza niekoľko poznámok autora o jeho (ne)čitateľnosti pre umelú inteligenciu – pre priamočiarosť výkladu je pri

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² Assistant Professor, Department of Civil Law, Faculty of Law, Pavol Jozef Šafárik University, Kováčska 26, Košice, Slovak Republic.

Doctoral Student, Faculty of Law, University of Miskolc, 3515 Miskolc-Egyetemváros, Hungary.

Junior Researcher, Central European Academy, 1122 Budapest, Városmajor utca 12-14, Budapest, Hungary.

jednotlivých vzorců uvedený demonstrační výklad autora ve vztahu ku konkrétnemu príkladu z praxe. Autor následne rozpracované myšlienky podrobne aplikuje na česko-slovenský kontext a článok završuje úvahami de lege ferenda, ktoré majú tento predpokladaný vývoj na pamäti.

I. INTRODUCTION

This article delves into an examination of the research question ‘*How should the institute of free assessment of evidence in Slovak civil contentious proceedings be transformed in the event of integrating artificial intelligence into the decision-making process?*’. This question was formulated in response to the fact that although the Slovak (and Czech) legal order in civil proceedings (*in contentious sense*) prefers the principle of formal truth³ and free assessment of evidence, these will probably soon encounter their practical limits, in the form of the rapid emergence of artificial intelligence as a data-processing tool in civil proceedings (*among others*). The research aims to identify ‘blind spots’ in the procedural-legal framework, taking into account the approach of artificial intelligence to evaluating the probability of claims, and through *de lege ferenda* considerations to outline possible legislative ‘patches’ for these spots, so that AI may also ‘freely assess’ evidence.

The question of the objective versus subjective evidentiary standards has been and remains the subject of intensive academic discussion. A significant part of this discussion took place in the second half of the 20th century in the German-speaking legal context (*Prütting*⁴, *Musielak*⁵, *Rosenberg*⁶). This discussion was also followed up by the Czech and Slovak academy, dominated in particular by the Brno proceduralist Macur⁷. This discussion concluded in the sense that the European concept of evidence assessment is fundamentally subjectivist in nature (*i.e., assessment based on the subjective conviction of the individual judge, not an externally quantified standard – e.g., 80% persuasiveness*⁸). We maintain, however, that current developments in procedural law indicate a specific problem in this regard that could not have been foreseen in the 1960s, namely, the integration of AI into decision-making. Indeed, the question of integrating AI into decision-making in our context is currently discussed primarily in the role of a ‘supporting assistant’, rather than a ‘judge’⁹. On the other hand, global developments indicate that AI is already subsidiarily taking on the role of a judge (*e.g., Estonia, China, USA, Canada*). This naturally gives rise to the question of how AI judges perceive the taking of evidence. This article addresses the legal regulation of their approach to evidence through mathematical probability. Mathematical theories on probabilistic evidence (*Bayes’ theorem, Dempster-Shafer theory*) have been known and academically developed since the end

* The translation of this paper from Slovak into English was performed with aid of artificial intelligence (Claude Sonnet 4.6) with subsequent review and corrections done by the author. The author takes full responsibility for the final translation.

³ ‘Prefers’, because the so-called principle of formal truth does not apply one hundred percent even in civil contentious proceedings [for exceptions see *e.g. proceedings in matters concerning the protection of the weaker party – see the second title of the third part of Act No. 160/2015 Coll. Civil Contentious Procedure Code as amended (hereinafter ‘CCP’)*].

⁴ PRÜTTING, Hanns. *Gegenwartsprobleme der Beweislast: Eine Untersuchung moderner Beweislasttheorien und ihrer Anwendung insbesondere im Arbeitsrecht*. München: C.H. Beck, 1983. 388 pp.

⁵ MUSIELAK, Hans-Joachim. *Die Grundlagen der Beweislast im Zivilprozeß*. Berlin; New York: Walter de Gruyter, 1975. 445 pp.

⁶ ROSENBERG, Leo. *Die Beweislast auf der Grundlage des Bürgerlichen Gesetzbuchs und der Zivilprozessordnung*. 5. Aufl. München: C.H. Beck, 1965. 411 pp.

ROSENBERG, Leo; SCHWAB, Karl Heinz; GOTTWALD, Peter. *Zivilprozessrecht*. 18. Aufl. München: C.H. Beck, 2019. 1240 pp.

⁷ MACUR, Josef. *Důkazní břemeno v civilním soudním řízení*. Brno: Masarykova univerzita, 1995. 172 pp.

MACUR, Josef. *Zásada projednací v civilním soudním řízení*. Brno: Masarykova univerzita, 1997. 233 pp.

⁸ For further context, cf. Chapter II of this article.

⁹ Cf. *e.g.* CHESTERMAN, Simon. *All Rise for the Honourable Robot Judge? Using Artificial Intelligence to Regulate AI. Technology and Regulation*, 2023, Vol. 2023, pp. 45–57. or SUSSKIND, Richard. *Online Courts and the Future of Justice*. Oxford: Oxford University Press, 2019. 336 pp.

of the last century¹⁰. Their application in practice, however, predominantly remains at the level of mathematical-theoretical research. The state of knowledge lacks an analysis of how current European evidentiary standards should be transformed so as to be readable by AI and controllable by legislators and software engineers. This article attempts to fill this gap by researching the compatibility of the European concept of free assessment of evidence with AI decision-making, concluding with *de lege ferenda* considerations from the perspective of the Slovak legal environment.

II. METHODOLOGY, OBJECTIVES, AND CONTRIBUTIONS OF THE RESEARCH

The specific subject of the research is a particular part of civil trial evidence-taking – namely, the so-called statistical and probabilistic evidence¹¹. The entry of artificial intelligence into judicial decision-making has the potential to drastically change the institute of evidence-taking in civil proceedings, precisely in relation to this type of evidence. Statistical evidence is most traditionally dealt with by criminal courts¹² however, in academia, these conclusions are sometimes further elaborated with remarks on their applicability to civil courts¹³. Civil courts also have a docket with a statistical element, in cases where evidence-taking depends on the findings of exact sciences (*e.g.*, *DNA testing in family law matters*¹⁴). Every court in every branch of law works with probabilistic conclusions¹⁵. The subject of further examination will be statistical and probabilistic evidence in civil (*contentious*) trials, which, in specific cases¹⁶ is even characterized by probabilistic conclusions. The main contribution of the article is the elaboration of the established research question in the Czech and Slovak context, which has traditionally been neglected by legal scholars in domestic legal academia. In the introductory parts of the paper, we analyse the current state of the decision-making activity of the highest judicial authorities of the Slovak Republic (hereinafter ‘**SR**’) and the Czech Republic (hereinafter ‘**CR**’), and we identify the forms this issue takes in our context. We then use the method of legal comparison to compare two global concepts of evidentiary standards in civil proceedings, with the aim of providing a comprehensive academic perspective on the limits of persuasiveness that form the conceptual basis of the subsequent analyses. We follow this with an analysis of two fundamental mathematical evidentiary theories applied directly to a specific case from Slovak practice, for the purpose of concluding the article with an analysis of the legal framework *de lege lata* from the perspective of the anticipated future involvement of artificial intelligence in civil decision-making. The article concludes with several authorial reflections *de lege ferenda* on the optimization of the legal framework for the purposes of the anticipated development of evidence-taking in civil proceedings.

For the sake of clarifying the intent of this article, we consider it appropriate to emphasize that our aim is not to build upon the 1960s proceduralist academic debate on the subjectivization and objectivization of evidentiary standards. This discussion was primarily

¹⁰ E.g. FINKELSTEIN, Michael O. and William B. FAIRLEY. A Bayesian Approach to Identification Evidence. *Harvard Law Review*, 1970, Vol. 83, No. 3, pp. 489–517.

¹¹ Various cross-translations of ‘Statistical evidence’

¹² See e.g.

LITTLEJOHN, Clayton. Truth, knowledge, and the standard of proof in criminal law. *Synthese*. 2020, Vol. 197, No. 12, p. 5253–5286.

GLESS, Sabine. AI in the Courtroom: A Comparative Analysis of Machine Evidence in Criminal Trials. In *Georgetown Journal of International Law*, 2020, Vol. 51, No. 2, p. 195

or

ROSS, L. Rehabilitating statistical evidence. *Philosophy and Phenomenological Research*. 2021, Vol. 102, No. 1, p. 3–23.

¹³ Cf.: DI BELLO, Marcello. Trial by Statistics: Is a High Probability of Guilt Enough to Convict? *Mind*. 2019, Vol. 128, No. 512, p. 1045.

¹⁴ CHENG, Edward K. – NUNN, G. Alexander. DNA, Blue Bus, and phase changes. *The International Journal of Evidence & Proof*. 2016, Vol. 20, No. 2, pp. 112–120.

¹⁵ See the entire following chapter.

¹⁶ E.g. the so-called payment order (§265 et seq.CCP), interim and protective measures (§324 et seq.CCP).

focused on the question of whether the evidentiary standard (*the degree of required persuasiveness of evidence*) should be derived from the internal (*subjective*) conviction of the judge or should be an externally defined (*objective*) standard. Our research consciously departs from this topic and focuses on a different issue, namely, the expected development of the institute of free assessment of evidence as a result of the gradual integration of artificial intelligence into civil judicial decision-making over the next 5 to 10 years. The paper thus focuses on the question of how evidentiary standards must be reformulated so as to be 'readable' to artificial intelligence.

At present, artificial intelligence is in the early stages of integration into the judicial process as a supporting tool; however, there are already successful international projects that replace the judge with artificial intelligence entirely. For example:

- 1) Smartsettle ONE (*Canada*) – an AI mediator based on artificial intelligence. It uses the 'blind-bidding' principle (bids by the parties are hidden). A dispute that previously took three months is intended to be resolved in one hour.¹⁷
- 2) AI judge in Estonia (*disputes up to EUR 7,000*). An appeal against its decision may be filed, which is then reviewed by a human judge.¹⁸
- 3) Chinese internet courts – Hangzhou Court (*Alibaba*). In operation since 2017, the process takes place entirely online (*from the initiation of proceedings to the decision*). In the course of two years, it judged over almost 20,000 cases. In June 2024, a comprehensive AI system was introduced in China for decision-making in these courts.¹⁹
- 4) Arbitrus.ai (*Harvard, USA*) – launched in February 2025 and described as 'the first true AI judge' (*it is a private arbitration service*). The authors promise to reduce costs from ~\$100,000/case (*when a human judge decides*) to ~\$10,000/case (*when Arbitrus.ai decides*). The decision is to be delivered within 72 hours (*compared to 60–90 days for human arbiters*) with extensive support for various types of evidence (*including video evidence*).²⁰
- 5) eBay and PayPal ODR system (*60+ million disputes per year – automated resolution of simple disputes in specific categories: 'item not received', 'item not as described', 'unpaid item'*)²¹.

¹⁷ Cf. websites:

Legal blog LawSites. Available from: <https://www.lawnext.com/2025/02/on-lawnext-is-arbitrus-ai-the-first-true-ai-judge-the-future-of-dispute-resolution.html> [Accessed 2026-04-23].

Website of Smartsettle. Available from: <https://www.smartsettle.com/smartsettle-one> [Accessed 2026-05-11].

Website of mediator Bruce Greig. Available from: <https://www.brucegreigmediator.com/post/robot-mediators-a-short-review-of-smartsettle-one> [Accessed 2026-04-07].

Leaflet from a conference presentation. Smartsettle. Available from: <https://info.smartsettle.com/wp-content/uploads/2019/11/1911-rewarding-good-negotiating-behaviour.pdf> [Accessed 2026-05-28].

Smartsettleresolutions.com. Available from: <https://www.smartsettleresolutions.com/post/negotiating-online-with-smartsettle-one> [Accessed 2026-04-16].

¹⁸Russian business portal TAdviser. Website. Available from: https://tadviser.com/index.php/Project:In_Estonia_was_provided_the_robot_judge_considering_claims_for_the_amount_to_7_thousand_euros [Accessed 2026-05-03].

Legal newspaper Law360 Canada. Available from: <https://www.law360.ca/ca/articles/1747943> [Accessed 2026-04-30].

Website of Harvard International Review (HIR). Available from: <https://hir.harvard.edu/your-honor-ai/> [Accessed 2026-04-12].

¹⁹ Portal Lexis Nexis. Originally published in Law360 Canada Available from: <https://www.lexisnexis.com/en-ca/ihc/robots-justice-chinas-use-of-internet-courts> [Accessed 2026-05-19].

²⁰Legal newspaper Legal Futures. Available from: <https://www.legalfutures.co.uk/latest-news/robot-mediator-settles-first-ever-court-case> [Accessed 2026-04-25].

Also see KIEFFABER, Jack; GANDALL, Kimo; McLAREN, Kenny. We Built Judge.ai. And You Should Buy It. SSRN Electronic Journal, 2025. 88 pp.

Portal Chinadaily.com.cn Available from: <https://www.chinadaily.com.cn/a/202501/02/WS6775eb0aa310f1265a1d8810.html> [Accessed 2026-05-06].

Or the Law360 portal. Available from: <https://www.law360.com/pulse/articles/2293413> [Accessed 2026-04-21].

²¹ News portal Pew. Available from: <https://www.pew.org/en/research-and-analysis/articles/2019/06/04/online-dispute-resolution-moves-from-e-commerce-to-the-courts> [Accessed 2026-05-24].

- 6) (Further mentions: e.g. DoNotPay (UK/USA) – AI chatbot focused on parking fines²² and Dyspute.ai – AI mediator for commercial and consumer disputes²³)

In view of the above-mentioned, the topic of this paper may be considered extremely important in relation to the question of how legislation could and should respond to this ‘New Age of Judicial Decision-Making’. For this reason, particular emphasis is placed on the citation index more recent than the year 2019.

The trend of gradually introducing AI into legal reasoning can also be observed in the legal conditions of the SR, for example in the form of educational activities focused on the use of AI by practising lawyers, although currently in a less developed form (e.g. a workshop, organized on 10.06.2026 by the legal publisher C.H.Beck, of which a ‘Practical demonstration of various AI tools’ is a part²⁴, the new AI assistant of the judikáty.info portal, the so-called ‘AI – Judikátor’, or the recent success of UPJŠ students in designing an AI agent for the special needs of lawyers and legal professionals²⁵). With a high degree of probability, however, the future integration of AI into legal reasoning cycles can also be expected in our conditions – and perhaps the above-mentioned examples of foreign AI ‘judges’ may be the first indicators of what is to come.

III. INTERDISCIPLINARY FINDINGS AND POINTS OF VIEW

1. Probability in civil courts

The following references to ‘probability’ in civil proceedings refer to any most probable conclusion of a civil court (*on questions of both fact and law*). Based on a quantitative analysis of the decision-making activity of the highest judicial authorities of the SR and the CR, it can be argued that in civil proceedings, courts at every level form probabilistic conclusions of various kinds (*and not only in connection with evidence-taking*). In some cases, the law even requires the court to make such a conclusion²⁶. The analysis of available case law suggests probabilistic conclusions:

- 1) In questions of law interpretation (illustratively²⁷ see:

resolution of the Supreme Court of SR (hereinafter ‘SC SR’) No. 1CdoGp/1/2023 ‘Either the legislator simply forgot about the situation of a petition aimed

Output from the University of Missouri library. Available from: <https://libraryguides.missouri.edu/c.php?g=557240&p=3832247> [Accessed 2026-04-03].

Interview with Colin Rule, one of the founders of the first ODR platforms. Available from: <https://www.adr.org/news-and-insights/nerding-out-on-dispute-resolution-an-interview-with-odrcom-s-colin-rule/> [Accessed 2026-05-15].

²² Website of DoNotPay. Available from: <https://donotpay.com/learn/parking-tickets/> [Accessed 2025-1-31].

²³ Website of Dyspute.ai. Available from: <https://dyspute.ai/> [Accessed 2025-1-31].

²⁴ Website of the publisher C.H. Beck Available from: https://www.beck-konferencia.sk/2025/konferencia/pravo-vo-svetle-umelej-inteligencie-zmluvne-vztahy-ai-incidenty-a-nastroje-5?xnpe_tifc=b11j4dnXOFO_xDVXxDoj4MpZhFEWVjQsVuU_O.oZx.HJxIE1EMB5VZ8DRjpL4fx7bDesxIs_4.1lh.YX&utm_source=exponea&utm_campaign=seminare_260326&utm_medium=e-mail [Accessed 2025-05-18].

²⁵ Website of the Faculty of Law of UPJŠ. Available from: <https://www.upjs.sk/aktuality/studenti-upjs-uspeli-vo-finale-yeslab-2-0/> [Accessed 2025-05-18].

²⁶ E.g. under § 75 of Act No. 36/5005 Coll. on the Family, when determining alimony the court also takes into account the income that the obliged party could hypothetically have earned.

See also CSACH, Kristián. Preukazovanie (vybraných) hypotetických okolností v súkromnom práve. In: Dokazovanie v civilnom a trestnom konaní. Kolektív autorov. Pezinok: Justičná akadémia, 2012, p. 71.

²⁷ Illustratively see also:

resolution of the SC SR No. 20bdo/10/2018 ‘The concept of ‘ordinarily achieved profit’ cannot, in the defendant’s view, be understood as ‘average profit’ ascertainable from historical statistical data, but rather as the profit that the injured party would have achieved with a probability approaching certainty, because it is a standard profit that regular business partners had been achieving over a long period of time in their mutual business relations with a certain regularity.’

resolution of the SC SR No. 20bdo/48/2020 ‘...which is, according to the appellant, contrary to § 16 para. 2 letter c/ of Act No. 382/2004 Coll. (the defendant probably had in mind § 16 para. 2 letter d/ of Act No. 382/2004 Coll. – the expert is obliged to perform expert activities impartially’.

at establishing paternity after the death of the putative father, or by its concept of party standing wished to indicate that it does not intend to regard the guardian as an independent party, and thus wishes to depart from historical case law. We consider the second variant to be more probable.'),

resolution of the SC SR No. 4Cdo/316/2020 'it is hardly probable that the legislator intended to express, by means of identical wording within one and the same part of the Civil Code, something different for co-ownership in shares and something different for joint marital property.'

resolution of the SC SR No. 4Obdo/85/2021 'In this regard, it is more than probable that the adoption of all these changes within a single amendment (substantive-law changes in the Commercial Code, as well as procedural-law changes in the Civil Non-contentious Procedure Code), which concern the commencement of liquidation and additional liquidation of a business company, the transitional provision applies not only to the liquidation of a business company, but must simultaneously be applied also to proceedings for ordering the additional liquidation of a business company'.

2) In procedural questions (illustratively²⁸ see:

resolution of the SC SR No. obdo/51/2022 'beyond what has been stated, the court of first instance noted that in the event that it had not dismissed the action on grounds of the limitation of the plaintiff's claim, it would probably have dismissed it on grounds of a disputed legal title to the amount claimed',

resolution of the SC SR No. 4xeobd/6/2023 '...it is more than probable (based on hundreds to thousands of cases in similar matters), that in such a case the entitled party would have filed an appeal against the decision of the appellate court and the Supreme Court would have had to discontinue the proceedings on this ordinary remedy,'

resolution of the Supreme Court of CR (hereinafter 'SC CR') No. 26 Cdo 1607/2024 '...the suspension of enforceability or legal effect of the contested decision under Section 243 of the Civil Procedure Code may only be considered once the conditions for appellate review proceedings have been met, the appeal is free of defects, and, at least on the basis of a preliminary assessment, the appeal appears likely to succeed. (cf. e.g. resolution of the SC CR of 14 September 2017, No. 30 Cdo 865/2016, or of 3 October 2017, No. 20 Cdo 4097/2017),'

3) and in factual questions (illustratively²⁹ see:

²⁸ For the SC CR see also e.g.

resolution of the SC CR No. 21Cdo 2245/2024 'the inadmissibility of the appeal on points of law is not established by Section 238(1)(i) of the Code of Civil Procedure, as the appellate court (presumably) assumed....'

resolution of the SC CR No. 20Cdo 2879/2024 '...the debtor would, even in the event of a favorable decision of the Supreme Court on his appeal on points of law, most likely not be able to recover this amount back.'

resolution of the SC CR No. 23Cdo 2255/2024 '... that it provided the first two advance payments toward the purchase price and that proving this fact will likely be difficult.'

For the SC SR see also e.g.

resolution of the SC SR No. 1Cdo/44/2020 'Since the appellate court at the time of deciding on the appeal probably did not have available the 'confirmation of submission of a filing' (which at that time had not yet been displayed to them – at the time before the deployment of version APV SM 5.0.1.0), it relied only on the delivery receipt.'

judgment of the SC SR No. 2Obo/14/2019 'The appellate court can only assume that the appellate court probably in its ruling, No.2Obo/255/2006, proceeded from the enforcement immunity of the state, which legal opinion has been overcome as of yet.'

²⁹ For the SC CR see also e.g.

resolution of the SC CR No. 33Cdo 3489/2023 'If, according to the expert report, the disputed receipt was likely altered, specifically by changing the amount of CZK 85,000 to CZK 850,000.'

resolution of the SC CR No. 24Cdo 1297/2024 'According to the expert report of Prof. Mgr. Jiří Drábek, Ph.D., dated 14 August 2021, in the field of genetics, the full sibling relationship between the petitioner and Š. P. is 99.998% probable.'

judgment of the SC SR No. 7Cdo/345/2021 *'In this context, it is necessary to deal with the question connected to ordinary life experience, and specifically, whether it is probable that a debtor would pay a creditor the debt if he knew that the debt did not belong to him.'*

judgment of the SC SR No. 4Cdo/106/2021 *'The court of first instance was of the opinion that the purpose of the future purchase contract was the intention of the plaintiffs to conclude a purchase contract with the defendant in the future, to sell him the land parcels, which intention continues, and therefore considered the action as a means of extricating themselves from the obligation which they entered into under the agreed terms probably because they have another buyer who would pay a higher price for the property, when they refused to accept the defendant's request to conclude the purchase contract.'*

resolution of the SC CR No. 21 Cdo 2245/2024 *'...The appellate court properly addressed the defendant's assertion that 'the injured party contributed to the fall himself, because he must have been in close proximity to the entrance to the balcony, or, more likely, was taking a shortcut to the second apartment unit via the balcony,' by concluding that the defendant had failed to discharge the burden of proof.'*

The further subject of this paper will be only the probabilistic conclusion of the acting court in factual questions (i.e., the most obviously relevant for the topic of free assessment of evidence) – namely, probabilistic evidence-taking in civil trial.

For the analysis of statistical and probabilistic evidence, it is first necessary to establish what degree of persuasiveness or probability is required in civil proceedings *de lege lata*. In other, simpler words, if we imagine an AI judge assessing a (im)probable sequence of events, we must provide it within the framework of oversight of its activity with a 'threshold value' between a probable and an improbable conclusion (for example – 'Consider a claim proven only if the probability comes out higher than 90%'). Such a 'threshold value' can be established by taking a comparative look at legal systems that have a percentage-based 'evidentiary standard' or 'measure of evidence' (a rule expressing when evidence may be considered proven).

2. Comparison of approaches in variable legal contexts

The evidentiary standard in civil contentious trials differs across the world of European legal practice *ad hoc*. The continental concept of free assessment of evidence enshrined in the CCP³⁰, compared to the Norwegian and common law percentage standard can be described as very vague (*in domestic literature one may also encounter the designation 'standard of Scandinavian states'*³¹, this view is however not conceptually precise given that Sweden and Denmark apply free assessment of evidence in the same way as the SR and CR³²).

resolution of the SC CR No. 25Cdo 3603/2023 *'They also considered the claim for damages to be well-founded, as the conclusion of the contract appeared highly likely, the claimant expected the contract to be concluded, and the defendant terminated the negotiations on the contract without having a fair reason to do so.'*

For the SC SR see also e.g.

resolution of the SC SR No. 7Cdo/105/2019 *'Given the strained relations between the parties to the dispute, it is most probable that further disputes would arise between them also regarding the possible maintenance of the property, if the plaintiff were required to enter the defendant's land'*

resolution of the SC SR No. 10bdo/69/2019 *'If he had such an intense eye inflammation and pain as he claimed, it is very improbable that he would have transported himself to the place of the specialized eye examination. The court agreed with the defendant that it is notable that the announcement of the alleged health problems on the day of the hearing was made almost a month later, when he learned that the court had issued a default judgment.'*

³⁰ §191(1) CCP: The court shall assess evidence at its own discretion, each piece of evidence individually and in their mutual context; in doing so it shall carefully take into account everything that came to light during the proceedings.

³¹ GÁBRIŠ, Tomáš – LACLAVÍKOVÁ, Miriam. Štandardy pravdy a istoty v procesnom práve (právno-filozofické a právnohistorické pozadie problému). Právnické listy. 2022, Vol. 2, p. 17.

³² Cf.(on the following page)

According to the commentary on §191 CCP (*Assessment of evidence*), *'the conclusion as to veracity is the result of the judge's inner subjective conviction'*³³. This, in practice, means a marginally different standard of probability for each individual judge.

In academic debate, one may also encounter the view that continental law has only two evidentiary standards: *persuasive and unpersuasive*³⁴. In general, this is not an incorrect conclusion – yet ultimately it lacks the nuances of the particularities of formal truth³⁵ (*simplified: only what has been proven in proceedings in compliance with the rules of procedure may be considered true – i.e., even a persuasive claim resting on inadmissible evidence will in principle not be taken into account in the proceedings*). Formal truth is, according to some Slovak authors, a misleading name, given the fact that it is not about searching for *'truth'* in the proper sense – a more accurate term in this context is, in their view, formal *'probability'*³⁶. In view of the above, formal *'persuasiveness'* appears to be the most suitable possible designation.

Schweizer (*Ger.*) empirically translates this continental *'persuasiveness'* in civil matters as a 90% probability – in other (*Schweizer's*) words: *near certainty*³⁷. This corresponds loosely with the interpretation offered by the commentary on §191 CCP (*Assessment of evidence*), according to which, in the sense of *'the so-called material conduct of litigation, the factual situation established by the court should correspond to the greatest possible extent to the actual substantive-law relationship of the parties to the dispute'*³⁸

In contrast to the continental model, the Anglo-American and Norwegian evidentiary standard in civil matters is defined as a mathematical probability in principle³⁹ corresponding to 51%⁴⁰ or *balance of probabilities* in the United States and *preponderance of evidence* in Great Britain (in criminal matters, this probability is to correspond to 90–95%⁴¹ – *beyond a reasonable doubt*). Just like free assessment of evidence, this mathematical standard is also the subject of academic disputes,⁴² e.g. according to Smith this threshold is among other things too

BYLANDER, E. Evidence in civil law-Sweden. Institute for Local Self-Government and Public Procurement Maribor, 2015, p. 24.

WAAGE, F. – HERBORN, M. Evidence in Civil Law-Denmark. Institute for Local Self-Government and Public Procurement Maribor, 2015, p. 10.

or

§ 132 of Czech Act No. 99/1963 Coll. Civil Code of Procedure as amended (hereinafter *'czCCP.'*)

The court evaluates evidence according to its own judgment, considering each piece of evidence individually as well as in their mutual context; in doing so, it carefully takes into account everything that has come to light during the proceedings, including what the parties have stated..

³³ ŠTEVČEK, Marek – BAJÁNKOVÁ, Jana. § 191 [Hodnotenie dôkazov]. In: ŠTEVČEK, Marek – FICOVÁ, Svetlana – BARICOVÁ, Jana – MESIARKINOVÁ, Soňa – BAJÁNKOVÁ, Jana – TOMAŠOVIČ, Marek et al. *Civilný sporový poriadok*. 2nd edition. Praha: C. H. Beck, 2022, p. 786.

³⁴ *'...European Civil Law, on the other hand, recognizes just one standard of full conviction...'*

SCHWEIZER, Mark. The civil standard of proof – what is it, actually? Preprints of the Max Planck Institute for Research on Collective Goods, No. 2013/12. Bonn: Max Planck Institute for Research on Collective Goods, 2013. p. 1.

³⁵ Cf. e.g. payment order proceedings in the conditions of the SR and CR (*without further elaboration*)

In the SR *'Payment order'* (§265 et seq.CCP).

or in the CR *'Payment order'* (§ 172 et seq. czCCP).

³⁶ Cf. GÁBRIŠ, Tomáš – LACLAVÍKOVÁ, Miriam. *Štandardy pravdy a istoty v procesnom práve (právno-filozofické a právnohistorické pozadie problému)*. Právnické listy. 2022, Vol. 2, p. 17.

³⁷ SCHWEIZER, Mark. *The civil standard of proof – what is it, actually?* Preprints of the Max Planck Institute for Research on Collective Goods, No. 2013/12. Bonn: Max Planck Institute for Research on Collective Goods, 2013. p. 5.

³⁸ ŠTEVČEK, Marek – BAJÁNKOVÁ, Jana. § 191 [Hodnotenie dôkazov]. In: ŠTEVČEK, Marek – FICOVÁ, Svetlana – BARICOVÁ, Jana – MESIARKINOVÁ, Soňa – BAJÁNKOVÁ, Jana – TOMAŠOVIČ, Marek et al. *Civilný sporový poriadok*. 2nd edition. Praha: C. H. Beck, 2022, p. 789.

³⁹ In some significant civil matters, a higher standard is applied – *clear and convincing evidence*. (e.g. wills and inheritance, fraudulent conduct, gifts and transfers of property).

⁴⁰ E.g. SMITH, M. Civil liability and the 50%+ standard of proof. *The International Journal of Evidence & Proof*. 2021, Vol. 25, No. 3, p. 183–199.

⁴¹ SULLIVAN, Sean P. *A likelihood story: The theory of legal fact-finding*. *U. Colo. L. Rev.* 2019, Vol. 90, p. 20.

⁴² *'Scholars cannot agree on an evidentiary theory'*

low⁴³ (and at the same time in some borderline situations too high – e.g. when it is beyond doubt clear and fair that a claim should not be granted; e.g. claims contrary to good morals, which the continental concept of free assessment of evidence broadly subsumes under the item ‘judge’s subjective conviction of the truthfulness’).

In practice, 51% probability thus means that procedural success is sufficient if the acting judge assesses the claimed right as more probable than not⁴⁴.

A higher or lower evidentiary standard may be applied in both systems on an *ad hoc* basis. Factors may include, for example, the judge’s emotionality in decision-making⁴⁵, economizing on costs⁴⁶ (*a clearly probable claim will therefore not need to be proven as intensively as an improbable one*), higher social importance⁴⁷ (note: e.g. disputes involving politicians; Ragavan recommends introducing a special evidentiary standard), as well as subjective importance for the parties⁴⁸ (*the evidentiary standard changes depending on what is at stake*). After all, procedural rules are primarily intended to ensure that judgments are based on both a truthful description of the facts and material justice⁴⁹.

In the 1970s, a study was conducted in the United States in which judges and jurors were asked about the degree of conviction they would require in the course of evidence-taking for the procedural success of one party or the other (only judges showed an average probability of 54% required for them to consider a claim convincingly proven (note: in civil matters)⁵⁰. These standards, however, according to analogous findings in continental civil procedure, range between 80% and 90%⁵¹.

Over the last decades, the institute of assessment of evidence has in principle changed very little [*for comparison, the current (2022 ed.) commentary on §191 CCP (Assessment of evidence) draws on literature from the years 1970 to 1997 and case law up to 2010 (with one exception in 2018) and the commentary on Art. 8 (Obligation to plead and burden of proof) draws on literature from the years 1996 to 2012*⁵²).

In connection with current and future developments, however, the European initiative aimed at standardizing civil procedural law in Europe deserves attention. In 2016,⁵³ (and again

Cf. CLERMONT, Kevin M. A Theory of Factfinding: The Logic for Processing Evidence. Marq. L. Rev. 2020, Vol. 104, p. 351.

or CLERMONT, Kevin M. Factfinding Deconstructed Logically. A General Theory of Evidence and Proof: Forming Beliefs in Truth. Cham: Springer International Publishing, 2024, p. 165.

⁴³ SMITH, M. Civil liability and the 50%+ standard of proof. The International Journal of Evidence & Proof. 2021, Vol. 25, No. 3, p. 183.

⁴⁴ SULLIVAN, Sean P. A likelihood story: The theory of legal fact-finding. U. Colo. L. Rev. 2019, Vol. 90, p. 18.

⁴⁵ See in more detail e.g. SALERNO, Jessica M. The impact of experienced and expressed emotion on legal factfinding. Annual Review of Law and Social Science. 2021, Vol. 17, No. 1, pp. 181–203.

⁴⁶ E.g. GUERRA, Alice – LUPPI, Barbara – PARISI, Francesco. Standards of proof and civil litigation: A game-theoretic analysis. The BE Journal of Theoretical Economics. 2019, Vol. 19, No. 1, p. 26.

⁴⁷ RAGAVAN, Shamini K. An intermediate standard of proof in serious civil cases in England and Wales. N. Ir. Legal Q. 2014, Vol. 65, p. 437.

⁴⁸ RAGAVAN, Shamini K. An intermediate standard of proof in serious civil cases in England and Wales. N. Ir. Legal Q. 2014, Vol. 65, p. 505.

⁴⁹ KÁČER, Marek. Opodstatnenie procesnej spravodlivosti. Právny obzor. Teoretický časopis pre otázky štátu a práva (Juridical Review. Theoretical Journal for the Questions of State and Law). 2021, Vol. 104, No. 5, pp. 333–344.

⁵⁰ SCHWARTZ, David L. – SEAMAN, Christopher B. Standards of proof in civil litigation: an experiment from patent law. Harv. JL & Tech. 2012, Vol. 26, pp. 437–438 or cf. SIMON, Rita James. Judges’ Translations of Burdens of Proof into Statements of Probability. Trial Lawyer’s Guide, 1969, Vol. 13, pp. 103–114.

⁵¹ Cf. e.g. SCHWEIZER, Mark. The civil standard of proof – what is it, actually? Preprints of the Max Planck Institute for Research on Collective Goods, No. 2013/12. Bonn: Max Planck Institute for Research on Collective Goods, 2013. 31 p.

⁵² Cf. ŠTEVČEK, Marek – BAJÁNKOVÁ, Jana. § 191 [Hodnotenie dôkazov]. In: ŠTEVČEK, Marek – FICOVÁ, Svetlana – BARICOVÁ, Jana – MESIARKINOVÁ, Soňa – BAJÁNKOVÁ, Jana – TOMAŠOVIČ, Marek et al. Civilný sporový poriadok. 2nd edition. Praha: C. H. Beck, 2022, p. 785–790.

⁵³ Cf. TULIBACKA, Magdalena; SANZ, Margarita; BLOMEYER, Roland. Common Minimum Standards of Civil Procedure: European Added Value Assessment. Annex I – Research Paper. Brussels: European Parliament, 2016. 109 pp

in 2019,⁵⁴), there was international discourse on a common minimum civil standard, but so far without a significant result⁵⁵. An ambitious outcome of this discourse could, according to the authors of the cited publications, be a Code, which, however, we do not anticipate in the current situation. Nevertheless, *considering the gradual introduction of AI into the decision-making process in every country*, we anticipate that in the next decade, at least a partial shift can be expected regarding the harmonization of civil procedural law across Europe. Evidentiary standards would, in that case, have to be one of the key areas of this cooperation.

3. Legal-theory point of view

In this paper, the term ‘statistical evidence’ is used to denote evidence by which the fact to be proven cannot be proven with statistical certainty – in other words: evidence by statistics. The term ‘probabilistic evidence’ is used to denote evidence that is unable to prove the fact to with certainty due to objective limitations of human perception (*e.g., a witness's inattentiveness, the fading of a memory trace, etc.*). Legal theory has already dealt with probabilistic and statistical evidence in the last century by means of parables that clearly demonstrate the frame of reference within which the acting judge works. These parables are illustrated below in two alternatives (*the first with purely statistical evidence and the second with probabilistic evidence, based on the subjective conviction of a witness*):

Bus analogy (*Smith v. Rapid Transit, Inc.*)⁵⁶

Statistical evidence: *Betty Smith, the plaintiff, sued the bus company Rapid Transit, Inc. on the grounds that a bus of that company had run her off the road, thereby causing her to collide with another car parked by the road. She had not noticed the bus in detail and proved the fact solely by a timetable, according to which at that time there was a 90% chance that it was a bus of the company Rapid Transit, Inc.*⁵⁷.

Probabilistic evidence: *Betty Smith, the plaintiff, sued the bus company Rapid Transit, Inc. on the grounds that a bus of that company had run her off the road, thereby causing her to collide with another car parked by the road. Although she had not noticed the bus, the entire accident was witnessed by a witness – an elderly gentleman with poor eyesight, who is convinced that it was a bus of the company Rapid Transit, Inc.*

The Guilty Prisoner (*Parable by Charles Nesson*)⁵⁸

⁵⁴ Cf. EVAS, Tatjana; VAN BALLEGOIJ, Wouter. Common Minimum Standards of Civil Procedure: European Added Value Assessment Accompanying the European Parliament's Legislative Own-Initiative Report. Luxembourg: European Parliamentary Research Service (EPRS), 2019. 45 pp.

⁵⁵ This discourse resulted in document 2015/2084(INL), a proposal for a European Parliament (EP) resolution – this resolution, however, was never adopted.

At the level of soft law one may also mention Model European Rules of Civil Procedure jointly developed by European proceduralists – specifically its Art. 87: ‘A contested issue of fact is proven when the court is reasonably convinced of its truth.’ The above-mentioned publications (footnotes 51 and 52) were, however, interesting from the perspective of the article's topic, because they are accompanying documents to draft resolutions in which the authors sought to address the problem that in some European countries a percentage persuasiveness is applied and in others ‘only’ persuasiveness. They then debated the difficulty of a possible reconciliation. The MERCP, by contrast, is ‘merely’ an optional time-saving tool for arbitral tribunals from which it is possible (and indeed intended) to deviate – i.e. the authors of the MERCP sought to create an optional online ‘template’ that would be internationally usable and readable (analogous to a contract template downloaded from the internet), not to unify the evidentiary standard.

⁵⁶ *Smith v. Rapid Transit, Inc.*, 58 N.E.2d 754 (1945).

⁵⁷ *The parable is also known as the ‘Blue Bus’, in its alternative version: In the city only blue and red buses operate. A colorblind plaintiff is struck by a bus. The Blue company owns 75% of the buses in the city. The plaintiff sues the Blue company. Cf. e.g. PARDO, Michael S. The paradoxes of legal proof: A critical guide. BUL Rev. 2019, Vol. 99, p. 237. or RISINGER, D. Michael. Off the Rails: The Surprising Story of Smith v. Rapid Transit, Inc. Seton Hall Journal of Legislation and Public Policy. 2024, Vol. 48, No. 3, pp. 233–290.*

⁵⁸ *This is also a well-known parable.*

Originally NESSON, Charles R. Reasonable Doubt and Permissive Inferences: The Value of Complexity. Harv. L. Rev. 1979, Vol. 92, pp. 1187, 1192–1193, but also elaborated later, e.g. GARDINER, Georgi. Legal evidence and knowledge. In: The

Statistical evidence: 100 prisoners are exercising in the prison yard. 99 of them engage in a fight, and one refuses to participate. The judge decides that, given the 99% probability that any one of them did it, he will punish a randomly selected prisoner (let us call him Marián). Marián is, in fact, guilty.

Probabilistic evidence: 10 prisoners assault a guard. A second guard thinks he spotted Marián among them. Based on his testimony, the judge punishes Marián. Marián is, in fact, guilty.

The described legal question is also technically referred to as the evidential paradox ('the paradox of legal proof'⁵⁹). In the academic literature, it can be read that legal practice responds to the described problem of statistical evidence with the hypothesis that claims in favour of the plaintiff (*offensive*) cannot be based on statistical evidence and, conversely, claims in favour of the defendant (*defensive*) can⁶⁰.

The problem arises, however, when we try to assign a numerical value of persuasiveness (probability) not only to statistical but also to probabilistic evidence. In both cases above, it would certainly not be 100% probability or persuasiveness. The reliability of human perception can, in the described cases, be assigned an estimated probability⁶¹ of, say, a generous 80–90%.

In the first case (*Bus analogy*), the mathematical degree of persuasiveness of statistical evidence would therefore be equal to or lower than the persuasiveness of probabilistic evidence. In the second case (*Guilty prisoner*), the degree of persuasiveness of statistical evidence would in every instance be appreciably higher than that of probabilistic evidence (*it is difficult to imagine a person who under any circumstances would perceive every fact with 99% or higher accuracy*). Nevertheless, reading (*even the more probable*) variants of both cases based on statistical evidence evokes an intuitive sense of injustice⁶². The Supreme Court, as well, in the cited case, *Smith v. Rapid Transit, Inc.*, decided that statistical evidence is not sufficient for a claim to be granted.

4. Probability and mathematics

Mathematicians have for decades been trying to solve the problem of probabilistic legal evidence. The historically oldest option is the so-called Bayes' theorem⁶³ (*in Slovak 'Bayesova*

Routledge Handbook of the Philosophy of Evidence. Routledge, 2022, pp. 453–466. or DAVIDSON, Barbara – PARGETTER, Robert. Guilt Beyond Reasonable Doubt. Australasian J. Phil. 1987, Vol. 65, pp. 182–183.

⁵⁹ PARDO, Michael S. The paradoxes of legal proof: A critical guide. BUL Rev. 2019, Vol. 99, p. 237.

⁶⁰ PARDO, Michael S. The paradoxes of legal proof: A critical guide. BUL Rev. 2019, Vol. 99, p. 238.

⁶¹ The unreliability of witness testimony is pointed out by e.g. GARDNER, Dillard S. *Perception and memory of witnesses*. Cornell LQ. 1932, Vol. 18, pp. 391–409.

Conversely, the reliability of witness testimony is pointed out by e.g. WIXTED, John T. – MICKES, Laura – FISHER, Ronald P. Rethinking the reliability of eyewitness memory. Perspectives on Psychological Science. 2018, Vol. 13, No. 3, pp. 324–335.

⁶² Author's marginal note: Although in this article we primarily speak of persuasiveness for the judge (or the 'artificially intelligent' judge), persuasiveness and its evaluation can also be debated with regard to any other observer. One of the requirements placed on the reasoning of a decision is ultimately also persuasiveness (also, for example) for the unsuccessful party to the dispute.

Cf. MOLNÁR, P. Procesná aktivita sporovej strany ako limit prieskumu v opravnom konaní. In Právny obzor. 2024, Vol. 107, No. 6, p. 636. or DUDITŠ, L. Komentár k §220 [Písomné vyhotovenie rozsudku] In ŠTEVČEK et al. Komentár CSP, 2nd edition, Praha: C.H. Beck, p. 882–895.

⁶³ E.g. FENTON, N. – NEIL, M. – BERGER, D. Bayes and the law. Annual Review of Statistics and Its Application. 2016, Vol. 3, No. 1, pp. 51–77.

or PEČARIČ, Mirko. Confirmation of standards of proof through Bayes Theorem. Archiv für Rechts- und Sozialphilosophie. 2020, Vol. 106, No. 4, pp. 532–553.

or DE ZOETE, Jacob, et al. Resolving the so-called 'probabilistic paradoxes in legal reasoning' with Bayesian networks. Science & Justice. 2019, Vol. 59, No. 4, pp. 367–379.

veta⁶⁴), which was first applied to a legal context in the 1970s by the lawyer-mathematician duo of Michael O. Finkelstein and William Fairley⁶⁵.

Bayes' theorem:

$$P(A|B) = \frac{P(A) \times P(B|A)}{P(B)}$$

Description of the equation:

A and B are two random events, each with its own probability of occurrence [P(A) and P(B)],

P(A|B) is the probable occurrence of A, on the assumption that event B has previously occurred,

P(B|A) is the probable occurrence of B, on the assumption that event A has previously occurred.

As an illustration we use the probabilistic question from the above-cited judgment of the SC SR No. 7Cdo/345/2021 *'whether it is probable that a debtor would pay a creditor the debt if he knew that the debt did not belong to him.'*

**In the equation we use D in place of 'debtor' and C in place of 'creditor'.*

P(D knows that debt does not belong to the C |and pays nonetheless)

=

$$\frac{P(\text{that } D \text{ knows that the debt does not belong to } C) \times P(\text{that } D \text{ will pay | and afterwards learns that the debt does not belong to } C)}{P(\text{that the } D \text{ will pay the debt})}$$

$$P(A|B) = \frac{(90\%) \times (5\%)}{(80\%)}$$

P(that the debtor knows that the consideration does not belong to the creditor and pays nonetheless) = 5.625%♥

According to some authors, Bayes' theorem cannot absorb all the complexities of evidence-taking⁶⁶, contains too little data⁶⁷, and does not consider evidence in their mutual interconnections⁶⁸. This is why these authors lean towards a more complex formula – the so-called Dempster-Shafer theory. The Dempster-Shafer theory, or the *'Theory of Belief Functions'*, is an evidential theory that is a variant of Bayes' theorem and takes into account several objectively possible eventualities (i.e., *it does not evaluate the probability of just a single piece of evidence, as is the case with Bayes' theorem*).

⁶⁴ This is how it is translated by e.g. Staněk In STANĚK, Jakub. Úlohy diskrétní pravděpodobnosti. Matematika–Fyzika–Informatika. 2020, Vol. 29, No. 1, pp. 7–17.

or Bahník and Rubínová In BAHNÍK, Š. – RUBÍNOVÁ, E. Psychologická metodologie v praxi klinického neuropsychologa. In: KULIŠŤÁK, P. et al. Klinická neuropsychologie v praxi. 1st ed. Praha, Czech Republic: Karolinum, 2017, 904 pp.

⁶⁵ FINKELSTEIN, Michael O. – FAIRLEY, William B. *A Bayesian approach to identification evidence*. Harvard Law Review. 1970, Vol. 83, pp. 489–517.

♥ The values are illustrative only, for the sake of clarity. We do not have access to a sufficient body of practical cases and technical means on the basis of which we could determine the actual probability of occurrence of the described phenomena. This is not the case for courts, which have access to databases of all judicial decisions. In the future, we do not exclude interdisciplinary collaboration for a more detailed elaboration of this question.

⁶⁶ CLERMONT, Kevin M. A Theory of Factfinding: The Logic for Processing Evidence. Marq. L. Rev. 2020, Vol. 104, p. 397. or also CLERMONT, Kevin M. Factfinding Deconstructed Logically. In: A General Theory of Evidence and Proof: Forming Beliefs in Truth. Cham: Springer International Publishing, 2024. P. 165.

⁶⁷ Cf. MARTINS, João Marques. A system of communication rules for justifying and explaining beliefs about facts in civil trials. Artificial Intelligence and Law. 2020, Vol. 28, pp. 135–150.

⁶⁸ CLERMONT, Kevin M. Factfinding Deconstructed Logically. In: A General Theory of Evidence and Proof: Forming Beliefs in Truth. Cham: Springer International Publishing, 2024. P. 165.

The Dempster-Shafer theory, as interpreted by Janasová and Strelcová, operates through 4 relationships⁶⁹:

The degree of uncertainty is expressed in two quantities $Bel(h_i)$ and $Pl(h_i)$, where h_i denotes the evaluated hypothesis, i.e. the specific examined version of a factual circumstance, e.g. *'the debtor knew of the absence of a legal title'*; m denotes the basic assignment of credibility, i.e. the weight that a particular piece of evidence assigns to the given hypothesis or set of hypotheses:

1) The belief function $Bel(h_i)$ expresses the lower bound of the probability interval.

(In other words, the least probable variant – obtained, e.g. by the subjective estimate of an expert)

$$Bel(h_i) = \sum_{h_j \subseteq h_i} m(h_j).$$

2) The plausibility measure $Pl(h_i)$ expresses the upper bound of the probability interval.

(In other words, the probability that all evidence supported the established hypothesis)

$$Pl(h_i) = \sum_{h_j \cap h_i \neq \emptyset} m(h_j).$$

3) The combination formula for multiple hypotheses takes into account multiple eventualities simultaneously.

(E.g., a plurality of expert reports, proven facts, injured parties, items of evidence, etc.)

$$m_{AB}(h_k) = \frac{\sum_{h_i \cap h_j = h_k} m_A(h_i) \cdot m_B(h_j)}{\sum_{h_i \cap h_j \neq \emptyset} m_A(h_i) \cdot m_B(h_j)} = \frac{\sum_{h_i \cap h_j = h_k} m_A(h_i) \cdot m_B(h_j)}{K},$$

4) The combination formula where the intersection of sets is empty.

(In other words, where the examined hypotheses never occur simultaneously – they are mutually exclusive, e.g., the damage could not have been caused simultaneously by a blue and a red bus)

$$m_{AB}(h_k) = \frac{\sum_{h_i \cap h_j = h_k} m_A(h_i) \cdot m_B(h_j)}{1 - \sum_{h_i \cap h_j = \emptyset} m_A(h_i) \cdot m_B(h_j)} = \frac{\sum_{h_i \cap h_j = h_k} m_A(h_i) \cdot m_B(h_j)}{1 - K},$$

In the model case of the judgment of the SC SR No. 7Cdo/345/2021, and the question *'whether it is probable that a debtor would pay a creditor consideration if he knew that the consideration did not belong to him,'* the Dempster-Shafer theory allows for the consideration of probable eventualities – for example, with a plurality of debtors, creditors, and performances. Given the legal character of this article, however, we will not engage in a deeper mathematical analysis of this theory.

The Dempster-Shafer theory and Bayes' theorem remain to this day the two most common mathematical approaches to assessing the persuasiveness of evidence⁷⁰.

⁶⁹ Formula taken from the publication: 24. JANASOVÁ, Denisa – STRELCOVÁ, Stanislava. Stanovenie subjektívnej pravdepodobnosti pri hodnotení podnikateľských rizík. Súdny inžénrství. 2018, Vol. 29, No. 1, pp 43-47.

⁷⁰ Cf. e.g. XIAO, Fuyuan. Generalization of Dempster-Shafer theory: A complex mass function. Applied Intelligence. 2020, Vol. 50, pp. 3266–3275. DU, Yuan-Wei – ZHONG, Jiao-Jiao. Generalized combination rule for evidential reasoning approach and Dempster-Shafer theory of evidence. Information Sciences. 2021, Vol. 547, pp. 1201–1232 or NANCE, Dale A. Belief functions and burdens of proof. Law, Probability and Risk. 2019, Vol. 18, No. 1, pp. 53–76 and NEIL, Martin – FENTON, Norman – LLOYD, David. Modelling competing legal arguments using Bayesian model comparison and averaging. Artificial Intelligence and Law. 2019, Vol. 27, pp. 403–430.

With the intent of comprehensive civil evidence-taking, the Dempster-Shafer theory thus appears to be more suitable in the conditions of the SR, given the requirement imposed by the CCP on the acting judge in §191 to evaluate each piece of evidence ‘*individually and in their mutual context*’. Both approaches described above, however, share one characteristic: exactness and objective verifiability of the result. This currently stands in contrast to the vagueness of ‘free assessment of evidence’.

5. Perspectives of the AI ‘judge’ on evidence-taking

At this point, it is also appropriate to specify the reason for directing our attention to probabilistic approaches. At present, one can speak of deterministic (*e.g., random forests, logistic regression, linear regression, standard neural networks*) and probabilistic methods of machine learning (*e.g., Bayesian networks, naïve Bayes classifier, Gaussian processes, hidden Markov models*)⁷¹. A deterministic result for the same input data will always return the same result (in our case, *e.g., ‘the accused is guilty’ or ‘the contract is valid’*) without information about the degree of certainty or uncertainty of this conclusion. A probabilistic model, by contrast, assigns to each result also a degree of uncertainty (*e.g., ‘the accused is guilty with 82% probability’, or there is a ‘23% chance that the signature on the contract is forged’*). It is precisely the probabilistic model, therefore, that returns a result which allows the user to assess how much reliance can be placed on the AI judge's conclusion and how much it needs to be revised with human input. Likewise, a probabilistic conclusion allows for a better degree of external control (*e.g., setting the required degree of persuasiveness at a specific percentage*). Current freely available AI models are so-called ‘black boxes’ from the perspective of figuring out the method used⁷² – the users themselves cannot see whether the model used pattern matching or Bayesian reasoning. At the same time, it holds that certain forms of evidence-taking are more suitable for deterministic models and others for probabilistic models. We demonstrate this with the model example below:

Let us say it is a civil law matter consisting of evaluating the (in)validity of a signed contract. One contractual party claims that at the time of signing, they were not of sound mind due to the influence of strong pain medication, causing their incapacity to perform legal acts. The other contractual party claims that at the time of signing, there were no visible signs of a loss of cognitive capacity. In the proceedings, it is necessary to evaluate three expert reports (let us say one in favour of one party, the second in favour of the other party, and one with an indecisive conclusion) and two witness statements (one witness claims that the influence of medication was clearly visible on the person, the second witness claims that the person behaved in a standard manner).

In making the assessment, the (AI) judge must proceed as follows:

First, the AI judge will apply probabilistic reasoning – *e.g.:*

- a) Which expert has a better qualification for this specific problem?*
- b) Which report is methodologically more persuasive?*
- c) Which conclusion is consistent with the other evidence?*
- d) Where do two experts agree against one?*
- e) Which witness is more credible?*

This is the so-called ‘Bayesian’ probabilistic reasoning carried out intuitively, without explicit numbers and concealed by the language of ‘free assessment of evidence’.

⁷¹ See in more detail *e.g.* PAWLAK, Zdzisław – WONG, S. K. Michael – ZIARKO, Wojciech. Rough sets: probabilistic versus deterministic approach. *International Journal of Man-Machine Studies*. 1988, Vol. 29, No. 1, pp. 81–95 or GHAHRAMANI, Zoubin. Probabilistic machine learning and artificial intelligence. *Nature*. 2015, Vol. 521, No. 7553, pp. 452–459.

⁷² RUDIN, Cynthia. Stop explaining black box machine learning models for high stakes decisions and use interpretable models instead. *Nature Machine Intelligence*. 2019, Vol. 1, No. 5, p. 206–207.

The judge, of course, will not write ‘*the probability of incapacity is 73%.*’ In the judgment, they will simply state that ‘*the court considers it established that...*’. The cognitive process behind this result is, however, probabilistic.

In the second phase, deterministic reasoning takes over – e.g.:

Subsumption under the correct norm (*In other words, we either apply §38 of the Act. No. 40/1964 Coll. (Civil Code) or we do not. We cannot apply it with e.g. 60% probability*)

An AI judge would therefore proceed by combining both methods. A purely deterministic approach will fail, because three different expert reports do not have an unambiguous logical implication (*the pieces of evidence need not be of equal ‘weight’ – e.g., one expert may be more experienced and qualified in the matter than the other two combined, which will lead to their conclusions being evaluated as more probable*).

We therefore use the probabilistic model when conflicting inputs are commensurable – i.e., they address the same question through the same type of claim (*balancing of evidence*).

If, for example, we accept the assumption that the continental standard of persuasiveness corresponds to an empirically estimated 80–90%. In order for the legislator or judicial oversight to control the AI's decision, they need to know to what degree of persuasiveness the AI reached the stated conclusion. A deterministic model that returns only the data ‘valid/invalid contract’ without a declared degree of persuasiveness is uncontrollable for legal oversight, which, in turn, is precisely the problem this paper is attempting to address. AI systems currently used in the judiciary (*COMPAS*⁷³, etc.) produce risk scores, not binary decisions — precisely in order to enable human oversight. Thus, practice also confirms that a purely deterministic output is insufficient for judicial practice.

IV. CONTROLLED TRANSFORMATION OF FREE ASSESSMENT OF EVIDENCE: DE LEGE FERENDA CONSIDERATIONS

The preceding chapters identified the legal problem and offered several solutions brought forward by the current state of knowledge. It may, however, be assumed that in the coming decades the legal framework will begin to adapt to the involvement of AI in the decision-making process of (*not exclusively*) civil courts, to which the continental concept of free assessment of evidence, which has remained stable and unchanged for decades, pays no heed (*see the section on evidentiary standards in the SR*).

In the academic literature, the initial phases of incorporating AI into decision-making in legally simple matters are discussed⁷⁴. What exactly constitutes a legally simple matter can, of course, be a subject of debate – in general, however, it is possible to argue that it may involve, for example, form-based proceedings, which in many respects ‘stand or fall’ on probability and

⁷³ *Correctional Offender Management Profiling for Alternative Sanctions*.

Cf. BRENNAN, Tim – DIETERICH, William. *Correctional offender management profiles for alternative sanctions (COMPAS)*. Handbook of Recidivism Risk/Needs Assessment Tools. 2018, p. 49–75.

⁷⁴ IU, Kwan Yuen – WONG, Vanessa Man-Yi. *ChatGPT by OpenAI: The End of Litigation Lawyers?* SSRN 4339839. 2023, p. 2. *The estimated level of open AI is currently approximately at the level of an American law student with a C+ grade.*

For further examples cf. the introductory part of this article, where we describe currently operating AI systems in the position of a judge.

Also cf. ANDRIATI, S. L. – MALIAN, A. N. B. M. – RIZKI, I. K. *Justice on Trial: How Artificial Intelligence is Reshaping Judicial Decision-Making*. Journal of Indonesian Legal Studies, 2024, Vol. 9, No. 2, p. 909 – 942. and BARYSÉ, D. – SAREL, R. *Algorithms in the Court: Does It Matter Which Part of the Judicial Decision-Making Is Automated?* Artificial Intelligence and Law, 2024, Vol. 32, pp. 117–146.

persuasiveness⁷⁵ (*substantiation of the claim*)⁷⁶. In these proceedings, it will be necessary to establish an evidentiary standard that is readable for AI (*i.e., a specific percentage threshold of persuasiveness – for with the continental institute of ‘free assessment of evidence’, AI could again deal only statistically – by analysing the database of previous decisions, assigning percentage values and establishing the evidentiary standard as the average of these values*).

Indeed, some academics do not perceive the difference between the conditions of evidence assessment (*e.g., assessing evidence individually and in their mutual interconnection*) and the evidentiary standard (*the required degree of persuasiveness*)⁷⁷, which contributes to a certain degree of confusion in academic literature. We see the cause in the institute of free assessment of evidence, which implies an *ad hoc* degree of persuasiveness dependent on the specific judge. In the case of continental free assessment of evidence, academic attention focuses rather on the conditions of assessment, and the term evidentiary standard is used more or less interchangeably (*although passionate expert debates arise here too*⁷⁸). Conversely, in Anglo-American systems, where we rely on a percentage threshold, the key question of publication efforts is the degree of persuasiveness, *i.e.*, the evidentiary standard.

If we were to return to the European idea of a unified minimum civil standard of persuasiveness in evidence-taking, the first step would have to be agreement on a common framework of persuasiveness (*uniformity of concepts as well as uniformity of variant and level of evidentiary standard*). This would, in practice, mean for each European state the gradual overcoming of long-standing case law and legal concepts. The question of harmonization of civil evidence-taking thus comes into consideration only after some period of time, during which each individual state can naturally and spontaneously adapt its legal framework to the involvement of AI (*i.e. a gradual departure from free assessment of evidence as the subjective conviction of the judge and the application of nominal standards of persuasiveness corresponding to clearly defined thresholds – e.g. 51%, 90%, etc.*).

In the spirit of final *de lege ferenda* considerations, we present for consideration as a model example of this future development the following:

Given that the initial phases of this process could be concentrated on form-based proceedings, let us focus on the reminder proceedings under Act No. 307/2016 Coll. on Reminder proceedings as amended (hereinafter ‘**RPA**’) and the analogous payment order proceedings under the CCP.

Current wording of §6(1) RPA (<i>Rejection of the petition</i>) The court shall reject the petition if a) the petition is inadmissible, c) the petitioner has failed to remedy defects in writing and other obvious errors upon the court's request, or b) <u>the claimed right cannot be reasonably anticipated</u> .	Proposed wording (with integration of AI in mind) §6(1)(b) RPA ‘ <i>the claimed right is not reasonably persuasive</i> ’.
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Analogously, current wording of §265(1) CCP (<i>Payment order</i>) ‘ <i>If it is possible to decide on the</i>	Proposed wording of §265(1) CCP ‘ <i>If it is possible to decide on the merits of the case or a</i>
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⁷⁵ Note: for example, reminder proceedings, judgement execution matters or cadastral proceedings.

⁷⁶ According to the SC SR, substantiation does not equal proof-taking. Substantiation means that the court, through the designated evidence, ascertains only the most significant facts important for the decision on the petition for the ordering of an interim measure.

See resolution of the SC SR No.6 M Cdo 5/2012, of 28 November 2012.

⁷⁷ Cf. TUZET, Giovanni. Evidence assessment and standards of proof: a messy issue. *Quaestio facti. Revista internacional sobre razonamiento probatorio*, 2021, No. 2, pp. 87–113. or YASYNOK, Dmytro et al. The Concept of the Standard of Proof in Common and Continental Law. *Revista Justiça do Direito*, 2025, Vol. 39, No. 1, pp. 125–152.

⁷⁸ CLERMONT, Kevin – SHERWIN, Emily. A Comparative View of Standards of Proof. *The American Journal of Comparative Law*, 2002, Vol. 50, pp. 243–275.

as against TARUFFO, Michele. Rethinking the Standards of Proof. *The American Journal of Comparative Law*, 2003, Vol. 51, pp. 659–677.

<i>merits of the case or a part thereof on the basis of facts asserted by the plaintiff, <u>about which the court has no doubts</u>, in particular if these facts follow from documentary evidence, the court may decide on the action without the defendant's statement and without scheduling a hearing by means of a payment order...</i>	<i>part thereof on the basis of <u>reasonably persuasive</u> facts asserted by the plaintiff, in particular if these facts...</i>
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Subsequently, a specific evidentiary standard, clearly readable for AI, corresponding to reasonable persuasiveness, would need to be established by a special regulation (*for example, an executive act*):

Current wording: N/A	Proposed wording of a provision of such a decree: <i>'For the purposes of decision-making in reminder proceedings under a special regulation by means of information and computing technologies, reasonable persuasiveness corresponds to a value of 80* percentage points.'</i>
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Concepts of civil evidence-taking of individual states that have evolved in this or a comparable manner could subsequently be integrated into a unified civil standard or civil framework (*initially only in the form of isolated rules or principles – for example through the precedential effect of the case law of the Court of Justice of the European Union*) and only subsequently – (*with the condition that there must be common political will*) within a time horizon (*in the author's estimate*) of 30 or more years will a common European evidentiary reference framework or code come into consideration. Extended *de lege ferenda* reflections on further development would, however exceed the intended scope of this paper, as they currently appear to be getting ahead of a distant and politically uncertain time horizon.

V. CONCLUSION

The paper directed its research effort at the research question formulated as: 'How should the institute of free assessment of evidence in Slovak civil contentious proceedings be transformed in the event of integrating artificial intelligence into the decision-making process?'. The analysis of the decision-making activity of the highest judicial authorities revealed that probabilistic reasoning is present and essential in almost every area of judicial decision-making. The subsequent comparison of the continental and Anglo-American approaches to evidence assessment demonstrated a fundamental difference in the conceptual understanding of persuasiveness, contrasting the continental concept of 'free assessment of evidence' and 'subjective conviction of the judge' with the common law quantified threshold of 51%. This substantive difference is no longer merely abstract-terminological today but potentially indicates a fundamental limit for the implementation of artificial intelligence into the decision-making process – the key finding being that free assessment of evidence is very difficult for artificial intelligence to read and objectively regulate. AI cannot reliably and controllably work with the instruction '*decide according to your internal conviction*'. For the purposes of human oversight and control, it is necessary to establish explicit, quantified limits of persuasiveness. Mathematical approaches to probability evaluation are a possible solution – their use, however, presupposes the existence of a quantified persuasiveness of evidence, which continental law lacks. The cited cases of AI judges being used in Estonia, China, the USA, and Canada

* The value is illustrative only. The specific level would have to be the result of a society-wide legal debate and a commented legislative process.

demonstrate that the issue is not merely hypothetical but reflects technological development in real time, which will soon confront the Slovak legal community with dilemmas. The legislative amendments proposed above demonstrate one of the possible sustainable responses of the legal order to this development. The limitation of the research presented lies in the impossibility of empirically specifying the timeframe and exact form of the integration of AI into the decision-making process in the SR – we therefore consider it prudent to emphasize that we present one of the possible solutions above. Answering the question of whether European lawyers will choose the path of legislative preparedness or of attempting to reject AI in judicial decision-making is already beyond the scope of this research.

KEY WORDS

Free assessment of evidence, formal truth, civil litigation, artificial intelligence, persuasiveness of evidence

KLÚČOVÉ SLOVÁ

Voľné hodnotenie dôkazov, formálna pravda, civilné sporové konanie, umelá inteligencia, presvedčivosť dôkazov

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AUTHOR CONTACT DETAILS

JUDr. Michaela Szittyaiová, PhD.

Assistant Professor

Faculty of Law

Pavol Jozef Šafárik University

Kováčska 26, 040 01 Košice, Slovak Republic

Phone: +421 55 234 4164

E-mail: michaela.szittyaiova@upjs.sk

ORCID: <https://orcid.org/0009-0001-8724-2269>

Junior Researcher

Central European Academy

1122 Budapest, Városmajor utca 12-14, Budapest, Hungary

E.mail: michaela.szittyaiova@centraleuropeanacademy.hu

ORCID: <https://orcid.org/0009-0001-8724-2269>

Doctoral student

Faculty of Law

University of Miskolc

3515 Miskolc-Egyetemváros, Miskolc, Hungary

E-mail: szittyaiova.michaela@student.uni-miskolc.hu

ORCID: <https://orcid.org/0009-0001-8724-2269>