Artificial Intelligence in International Arbitration

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1. Introduction

International arbitration has now become the default mechanism to resolve commercial and investment disputes providing that the involved disputants preliminary consented to give jurisdiction to the arbitral tribunal. This success of international arbitration is undoubtedly due to the benefits it purported to bring; yet some of those initial promises have now eroded.

Indeed, as an alternative to litigation in domestic courts (for commercial disputes) and to diplomatic protection (for investment ones), international arbitration was initially presented as offering – all at the same time – the advantages of neutrality, expertise, a final and binding award, confidentiality, and efficiency[1]. Neutrality was ensured with an arbitral seat remote from the disputants' territories but also with the selection of arbitrators through party-appointment; arbitrators, who should normally demonstrate expertise in a particular domain (business, law, etc.)[2]. The final and binding award was also one of the main reasons for the popularity of international arbitration. Owing to international agreements widely ratified by the international community (i.e. the 1958 New York Convention and the 1965 International

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[1] For a definition of international arbitration encompassing those characteristics, see: Gary Born, *International Commercial Arbitration* (Kluwer Law International, Leiden, 2014), 291 ('process by which parties consensually submit a dispute to a non-governmental decision maker, selected by or for the parties, who renders a binding decision finally resolving the dispute in accordance with neutral, adjudicative procedures affording the parties an opportunity to be heard').

[2] E.g. International Convention for the Settlement of Investment Disputes (ICSID), Article 14.

Convention for the Settlement of Investment Disputes), arbitral awards are in fact given a presumption of recognition and enforcement in courts rendering the arbitration regime more efficient than litigation – for which judgments are not as easily recognised and enforced[3]. Furthermore, this pro-enforcement presumption is a strong one as the finality of the arbitral outcome is guaranteed through a lack of an appeal mechanism to review the case on its merits. Besides, the grounds for review or for challenge of the award before a domestic court or for its annulment before an ad hoc appellate committee are limited as they are mainly touching upon the integrity of the proceedings and public policy issues – and not upon the substantive legal issues (i.e. merits) of the case[4]. Finally, one of the core claims of international arbitration was its efficiency – being initially presented as cheaper and quicker than litigation.

Yet, due to the explosion of cases submitted to arbitral tribunals – both in its commercial and investment branches – international arbitration is now facing rising criticisms as it falls short of those ideals. This backlash is even 'louder' in the international investment regime[5]. Indeed, compared to its commercial counterpart which only involves private parties (as a result of a contractual agreement between them) and does not affect domestic law, the former does, in touching upon issues of public interest impacting the host State domestic laws

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[3] Ibidem, Article 54. New York Convention, Article III. Note though that the recognition and enforcement of judgments rendered by EU Member States in other Members States is facilitated by the Regulation (EU) No 1215/2012 of the European Parliament and of the Council of 12 December 2012 on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters (Brussels Regulations II).

[4] ICSID, Article 52. New York Convention, Article V.

[5] See Gabrielle Kaufmann-Kohler and Michele Potestà, 'Can the Mauritius Convention Serve as a Model for the Reform of Investor-State Arbitration in Connection with the Introduction of a Permanent Investment Tribunal or an Appeal Mechanism?': <https://www.uncitral.org/pdf/english/CIDS_Research_Paper_Mauritius.pdf> accessed 22 July 2019.

and policies[6]. In a nutshell, it is contented that international arbitration fails to satisfy its goal of efficiency as it can be more expensive than litigation[7]. In a survey, the cost and duration of the proceedings were even identified as two disadvantages[8]. The impartiality or fairness of the system is also questioned, as it involves a tight community of private arbitrators non-democratically elected who might be driven by considerations others than purely legal ones[9]. And, in turn, this criticism feeds the one related to the absence of an appeal mechanism or substantive review of the decision which opens the door for errors of law to sustain or inconsistencies to settle[10].

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[6] This is why there are no legitimacy issues in international commercial arbitration, while there are some in international investment arbitration, see Part 4 below.

[7] Jean-Claude Najar, 'Inside Out: A User's Perspective on Challenges in International Arbitration' (2009) 25(4) Arbitration International 515. Some talking about judicialization of international arbitration: Fabricio Fortese and Lotta Hemmi, 'Procedural Fairness and Efficiency in International Arbitration' (2015) 3(1) Groningen Journal of International Law 110.

[8] Queen Mary, University of London, School of International Arbitration and PwC, REPORT: *International Arbitration Survey 2013: Corporate Choices in International Arbitration: Industry Perspectives* (2013), at <https://www.pwc.com/gx/en/arbitration-dispute-resolution/assets/pwc-international-arbitration-study.pdf> accessed 22 July 2019.

[9] See Thomas Schultz and Robert Kovacs, 'The Law Is What the Arbitrator Had for Breakfast: How Income, Reputation, Justice, and Reprimand Act as Determinants of Arbitrator Behaviour' in Julio César Betancourt (ed), *Defining Issues in International Arbitration: Celebrating 100 Years of the Chartered Institute of Arbitrators* (Open University Press 2016). For more details, see Part II below.

[10] Though the lack of consistency is not a concern in international commercial arbitration, it is in investment arbitration. Yet, only unjustified inconsistencies (occurring within the same treaty) are problematic as we cannot possibly achieve absolute consistency due to the fragmentation of the investment treaty regime.

But still, despite those concerns, it is important to safeguard international arbitration so as to avoid a return to domestic courts or to diplomatic protection which are far from ideal. Plus, the negative concerns formulated against this system should not make us forget about the exclusive benefits it provides – benefits which are in fact missing in the aforementioned alternatives; hence making the preservation of international arbitration an even more important matter. In that context, it was asserted that international arbitration – which is 'broken' – needs to be repaired[11]. This reparation is warranted not only because of the specific properties of the system that makes it advantageous but also owing to broader considerations of justice and international adjudication. Indeed, it is a well-accepted fact that justice needs not only to be done but also perceived to be[12]. Nonetheless, the resentment against international arbitration necessarily leads us to question whether this perception is present in arbitration – having regard to the concerns touching upon the alleged lack of independence and impartiality of the decision-makers for example. Furthermore, considering the functions of international adjudication (i.e. dispute settlement, fact-finding, law-making, and governance)[13], we can fairly assert that international arbitration answers those to some extent – either in its investment or commercial branches, or both. Considering the dispute settlement function – which is kind of obvious one has to admit – it encompasses three pursuits: the maximisation of the

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[11] Najar (n 7), 517.

[12] R. v. Sussex Justices; Ex parte McCarthy (1924) 1 KB 256.

[13] José E. Alvarez, 'What Are International Judges For? The Main Functions of International Adjudication' in Cesare P. R. Romano, Karen J. Alter, and Yuval Shany (eds) *The Oxford Handbook of International Adjudication* (Oxford University Press 2013). See also on the primary function of resolving disputes: Nienke Grossman, 'Legitimacy and International Adjudicative Bodies' (2009) 41 George Washington International Law Review 107, 111. ('Specifically, they (international fora) must find facts, identify and interpret relevant legal rules or "law," use secondary principles to fill legal gaps and ambiguities, and apply the relevant law to the facts at hand for the purposes of issuing a ruling').

satisfaction of the parties, the furthering of the rule of law, and the promotion of substantive societal values[14]. The first two are of interest here as it has already been claimed and proven that international arbitration does or did indeed achieve those to some extent[15]. Plus, it was also claimed that international arbitration needs to be kept in order to continue the development of the international rule of law[16].

This chapter hence advocates for the introduction of artificial intelligence in international arbitration. Indeed, the contention is that it would not only reinstate confidence in the arbitral system (from the perspective of the parties and the general public) and participate to the development of the rule of law, but also engage with broader systemic considerations in equally enhancing its legitimacy, fairness, and efficiency[17]. Yet, before addressing the why, what, and how of this proposition, a definition of artificial intelligence is warranted. At the onset, it should be noted that this concept has a variety of meanings. Nonetheless, starting with the basics, the online Oxford dictionary provides that it consists in:

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[14] Thomas Schultz, 'The Three Pursuits of Dispute Settlement' (2010) 1 Czech (& Central European) Yearbook of Arbitration 227.

[15] David W. Rivkin, 'The Impact of International Arbitration on the Rule of Law' (2013) 29(3) Arbitration International 327. See also Thomas Schultz and Cédric Dupont, 'Investment Arbitration: Promoting the Rule of Law or Over-Empowering Investors? A Quantitative Empirical Study' (2015) 25(4) The European Journal of International Law 1147. On the maximisation of the satisfaction of the parties, see Queen Mary, University of London, School of International Arbitration and PwC (n 8).

[16] Rivkin (n 15).

[17] Note that efficiency here is concerned with the length and costs of the proceedings and legitimacy is a concern exclusive to investment arbitration: see Part 4 below.

The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages[18].

Despite the lack of consensus on its meaning, this chapter will thus use artificial intelligence as encompassing both semi-autonomous and autonomous computer systems (i.e. algorithms) dedicated to assist or replace human beings for decision-making tasks[19]. Indeed, the former consist in supervised algorithms pre-programmed, instructed, by humans for which the same input will always produce the same output, whereas the latter present "some learning capabilities"[20].

Now that this concept is clarified, I will start with a brief review of the literature to make the point that legal adjudicators (i.e. judges and arbitrators) are far from Montesquieu's ideal of the 'mouth of the law'[21] but are instead subjected to a number of extra-legal considerations, especially behavioural ones. I will then present the conclusions of two extensive research programmes respectively dealing with the performance of statistical (i.e. mechanical) models and naturalistic (i.e. expert) decision-making. From that behavioural analysis, this proposition will be discussed against the general considerations of international adjudication (mentioned above) and the specific goals pertaining to international arbitration (in

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[18] See <https://www.lexico.com/en/definition/artificial_intelligence> accessed 22 July 2019.

[19] For more details on those, see Part V below.

[20] Spyros Makridakis, 'The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms' (2017) 90 Futures 46, 49.

[21] Montesquieu, *De l'Esprit des Lois*, Livre XI, Chapitre VI, (1748): ("Les juges de la nation ne sont que la bouche qui prononce les paroles de la loi, des êtres inanimés, qui n'en peuvent modérer ni la force ni la rigueur").

its commercial and/or investment branches). I will show that this model will participate to their fulfilment, while it could still present some limitations – though outweighed by its advantages. I will then end with practical insights (i.e. how this could be realistically implemented).

2. The Law is More Than What Is Found in the Books.

This affirmation clearly contradicts the now unrealistic assumption formulated by legal formalists claiming that the law – as embedded in legal texts, status, and precedent – provides determinate answer to legal issues; so that the exercise of judges only consists in the application of the law to the facts at hand[22]. Yet, this mechanical view of judging as being deprived of any extra-legal influences was then challenged with legal realism explicitly recognising the role of those latter (alongside legal considerations) in judicial decision-making[23]. It was thus contended that judges first reach an outcome and then try to rationalise it in providing legal explanations: a phenomenon known as originalism or textualism-originalism[24]. Such a backward inference running contrary to the syllogistic exercise characteristic of legal formalism.

Consequently, the question that necessarily follows this acknowledgement is: what could those extra-legal factors be? Attempts were first made to answer this question applying

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[22] See Matthew C Stephenson, 'Legal Realism for Economists' (2009) 23 Journal of Economic Perspectives 191.

[23] For more details on this distinction between legal formalism (i.e. law in books) and legal realism (i.e. law in action) see the chapter written by Thomas Schultz in this volume 'The Ethos of Arbitration' nicely presenting those schools of thought.

[24] Richard A Posner, *How Judges Think* (Harvard University Press 2008).

the assumptions of rational choice theory to law; hence giving rise to law and economics. Nevertheless, although quite simple and parsimonious, this literature failed to generate accurate predictions[25]. This failure was due to the fact that the premises of rational choice theory – considering human beings as unbounded in rationality in that they had unlimited capabilities and could not possibly be the subject of personal or social influences – were far from matching reality[26].

Accordingly, this unverifiable (and unrealistic) picture was questioned by Herbert Simon theorising that humans are actually bounded in rationality. Using the metaphor of a pair of scissors, he came to the conclusion that this bound is due to two aspects: the cognitive limitations of an individual and the structure of his/her environment[27]. Compared to its predecessor, this concept presents the advantage to be empirically testable; task that a number of researchers took in their own hands leading to the furthering of psychology, especially in its cognitive and social elements. Uncontestably, the main contributors to this research programme are Daniel Kahneman and Amos Tversky with their prospect theory (challenging the expected utility model at the core of the rational choice theory / economics methodology)

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[25] Cass R Sunstein, Christine Jolls, and Richard H Thaler, 'A Behavioral Approach to Law and Economics' (1998) 50 Stanford Law Review 1471.

[26] Gerd Gigerenzer and Peter M Todd, 'Fast and Frugal Heuristics: The Adaptive Toolbox' in Gerd Gigerenzer, Peter M Todd and ABC Research Group (eds), *Simple Heuristics That Make Us Smart* (Oxford University Press 2000). 5 ('Many models of rational inference view the mind as if it were a supernatural being possessing demonic powers of reason, boundless knowledge, and all of eternity with which to make decisions').

[27] Herbert A Simon, 'A Behavioural Model of Rational Choice' (1955) 69 The Quarterly Journal of Economics 99. Also: Herbert A Simon, 'Invariants of Human Behavior' (1990) 41 Annual Review of Psychology 1, 7. ("Human rational behaviour is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor").

and the identification of rules of thumbs (heuristics) leading to systematic errors (biases) used by decision-makers to cope with their limited cognitive abilities[28].

Hence, in the 1970s, the picture of human beings as super-organisms was abandoned to be replaced by a more realistic view endorsing their bounds. Indeed, not only their rationality was bounded, but equally their self-interest and willpower – those limitations being the three pillars of the behavioural economics methodology[29]. This shift – or alternatively improvement – of the paradigm (from economics to behavioural economics) was then applied to real-world situations, thus contributing to the development of behavioural law and economics (on the domestic and international planes)[30]. This importation of behavioural, psychological, findings in a legal context was an explicit recognition that:

> While computers function solely on logic, human beings do not. All sorts of extraneous
> factors – emotions, biases, preferences – can intervene, most of which you can do

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[28] Daniel Kahneman and Amos Tversky, "Prospect Theory: An Analysis of Decision under Risk" (1979) 47 Econometrica 263. Amos Tversky and Daniel Kahneman, "Judgment under Uncertainty: Heuristics and Biases" (1974) 185 Science 1124.

[29] See e.g. Sunstein, Jolls Thaler (n 22). Tomer Broude, 'Behavioral International Law' (2015) 163 University of Pennsylvania Law Review 1099. Anne van Aaken, 'Behavioral International Law and Economics' (2014) 55 Harvard International Law Journal 421.

[30] Ibidem. See also the chapter written by Tomer Broude and Anne van Aaken in this volume entitled 'Arbitration from a Law and Economics Perspective' presenting both movements: law and economics and behavioural economics.

absolutely nothing about (except play upon them, if you happen to know what they are)[31].

To reiterate, as this point is equally relevant in our arbitral context, by this statement *Supreme Court Justice Scalia* endorsed that legal adjudicators are subjected to those influences as well. This point has even been empirically proven with a number of studies focusing on the bounded rationality of judges or arbitrators[32]. It was thus found that judges and arbitrators are both subjected to the following cognitive illusions when completing their decision-making task: anchoring, confirmation bias, egocentrism, framing, hindsight bias, and representativeness[33]. Plus considering the second blade of Herbert Simon's scissors, it was also demonstrated that adjudicators are socially influenced by their colleagues on the bench through panel effects for example[34]. It should be noted that this literature is in fact a mere confirmation that experience, expertise, and cognitive abilities (intelligence) are no inoculation against biased decision-

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[31] B.A. Garner, A. Scalia, *Making Your Case: The Art of Persuading Judges* (Thomson West, Aspatore Books 2008), Introduction.

[32] For a detailed review, see: Myriam Gicquello, 'The Reform of Investor-State Dispute Settlement: Bringing the Insights of Social Psychology into the Debate' (forthcoming).

[33] On judges, see e.g.: Chris P Guthrie, Jeffrey J Rachlinski, and Andrew J Wistrich 'Inside the Judicial Mind' (2001) 86 Cornell Law Review 777. On arbitrators: Edna Sussman, 'Arbitrator Decision-Making – Unconscious Psychological Influences and What You Can Do About Them' (2015) 4 Yearbook of International Arbitration 69. Susan D. Franck, Anne van Aaken, James Freda, Chris Guthrie, and Jeffrey J. Rachlinski, 'Inside the Arbitrator's Mind' (2017) 66 Emory Law Journal 1115.

[34] Pauline T Kim, 'Deliberation and Strategy on the United States Courts of Appeals: An Empirical Exploration of Panel Effects' (2009) 157 University of Pennsylvania Law Review 1319.

making[35]. Therefore, in light of those fallacies affecting decision-makers – novices or experts to the task; adjudicators having tenure or party-appointed – we might wonder whether it would not be wise to introduce artificial intelligence in international arbitration to tackle them.

3. Humans Versus Machines: Who Wins?

A – Artificially Intelligent Decision-Making.

This proposition is supported by extensive research that consisted in the comparison of mechanical versus clinical decision-making. Those methods differing as:

> By mechanical (or statistical), I mean that the prediction is arrived at by some straightforward application of an equation or table to the data… The defining property is that no juggling or inferring or weighting is done by a skilled clinician[36].

As a number of studies has since then been conducted, the terminologies employed have expanded – yet still conveying the same idea. Hence, the distinction between mechanical and clinical decision-making was reflected in the debates considering mechanical and non-

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[35] See Part 3.2 below on expertise. On cognitive abilities: K.E. Stanovich, *What Intelligence Tests Miss: The Psychology of Rational Thought* (Yale University Press 2010).

[36] Paul E Meehl, *Clinical vs. Statistical Prediction: A Theoretical Analysis and a Review of the Evidence* (Minneapolis: University of Minnesota 1954), 15-16. See also Robyn M Dawes, David Faust and Paul E Meehl, 'Clinical Versus Actuarial Judgment' (1989) 243 Science 1668.1668 ('In the clinical method, the decision-maker combines or processes information in his or her head. In the actuarial or statistical method, the human judge is eliminated and conclusions rest solely on empirically established relations between data and the condition or event of interest').

mechanical, objective and subjective, actuarial and case-study, quantitative and qualitative methods[37]. Furthermore, decision-making not being unitary task but involving two activities (i.e. collection and interpretation of data), it is worth noting that most of the research evaluating those methods is concerned with their accuracy in the combination (i.e. interpretation) of previously collected data (either statistically or clinically)[38]. This point is not to be missed as the conclusions on the accuracy of these methods for each aspect are not uniform. Plus, it is relevant in our arbitral framework as tribunals are only entrusted with the interpretation of legal provisions and limited by the submission of the parties (i.e. cannot introduce new arguments).

After setting the picture right with those preliminary remarks, it is time to address what has been found over the last six decades and what those results entail. First of all, the father of this research programme is Paul Meehl, who, in 1954 published a "disturbing little book" entitled *Clinical Versus Statistical Prediction[39]*. Relying on twenty studies, he found that overall (except in one case) the statistical predictions "were either approximately equal or superior to" the clinical ones[40]. This finding was then reiterated by other researchers: in 1966, Jack Sawyer equally found – using forty-five studies – that the statistical combination of data was "always equal or superior to the clinical mode" adding that "whatever the data, clinical

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[37] Jack Sawyer, 'Measurement and Prediction, Clinical and Statistical' (1966) 66 Psychological Bulletin 178. For the sake of consistency and simplicity, this chapter will employ the terms statistical and clinical.

[38] Harrison Gough, 'Clinical vs. Statistical Prediction in Psychology' in L. Postman (ed), *Psychology in the Making* (New York: Knopf 1962), 530. ('The defining distinction between clinical and actuarial methods is instead to be found in the way in which the data, once specified, are combined for use in making the prediction').

[39] Paul E Meehl, 'Causes and Effects of My Disturbing Little Book' (1986) 50 Journal of Personality Assessment 370. Meehl (n 36).

[40] Meehl (n 36), 119.

combination never surpasses mechanical combination"[41]. Thirty years later, William Grove and Paul Meehl reached (again) the same conclusion in an even bigger meta-analysis – using one hundred and thirty-six studies – finding that in sixty-four statistical combination generated better results than its clinical counterpart, in sixty-four they were equal, and in only eight the clinical method was better[42]. Besides, those constant findings on the better or equal accuracy of statistical models against clinicians are not limited to a specific context or set of conditions but rather applies to "a wide range of circumstances" involving any "judgment task, type of judges, judges' amount of experience, or types of data being combined"[43]. Therefore, reflecting on his initial findings and the subsequent proliferation of studies on that matter, Paul Meehl concluded in 1986:

> **There is no controversy in social science that shows such a large body of qualitatively diverse studies coming out so uniformly in the same direction as this one** (the relative validity of statistical versus clinical prediction). When you are pushing ninety investigations, predicting everything from the outcome of football games to the

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[41] Sawyer (n 37), 192-193.

[42] William M Grove and Paul E Meehl, 'Comparative Efficiency of Informal (Subjective, Impressionistic) and Formal (Mechanical, Algorithmic) Prediction Procedures: The Clinical-Statistical Controversy' (1996) 2 Psychology, Public Policy, and Law 293. 298 (Yet, those latter could be discarded as: 'According to the logicians' 'total evidence rule', the most plausible explanation of these deviant studies is that they arose by a combination of random sampling errors (eight deviant out of one hundred and thirty-six) and the clinicians' informational advantage in being provided with more data than the actuarial formula'. Indeed, according to Paul Meehl, for such comparisons to be valid they should rely on identical data provided to the statistical model and the clinician and they should also avoid contexts that could favour the accuracy of the statistical method).

[43] William M Grove, David H. Zald, Boyd S. Lebow, Beth E. Snitz, and Chad Nelson, 'Clinical vs Mechanical Prediction: A Meta-Analysis' (2000) 12 Psychological Assessment 19. 19.

diagnosis of liver disease and **when you can hardly come up with a half dozen studies showing even a weak tendency in favour of the clinician, it is time to draw a practical conclusion,** whatever theoretical differences may still be disputed[44].

One such conclusion was first reached by Robyn Dawes and his colleagues urging people to focus not on the improvement of clinical methods (as is usually the case) but rather on the amelioration of the statistical models[45]. Then, he and Reid Hastie came up with a radical advice: "whenever possible, human judges should be replaced by simple linear models"[46].

One should wonder what effects the introduction of artificial intelligence in decision-making could possibly entail (in general and more specifically in the arbitral context). To begin with, it is fair to assume that it will undoubtedly be an opportunity to comply with the requirements of rational choice theory – something impossible as long as clinicians are involved due to their bounded rationality. In turn, this focus on deliberation – as opposed to intuition – will enhance the predictability of the arbitral system as statistical models will always produce the same result (i.e. output) for the same set of data (i.e. input); while the same cannot

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[44] Meehl (n 39). 373-374 (Emphasis added)

[45] Robyn M Dawes, David Faust and Paul E Meehl, 'Statistical Prediction versus Clinical Prediction: Improving What Works' in Gideon Keren and Charles Lewis (eds), *A Handbook for Data Analysis in the Behavioral Sciences: Methodological Issues* (Hillsdale, NJ: Lawrence Erlbaum 1993).

[46] Reid Hastie and Robyn M Dawes, *Rational Choice in an Uncertain World: The Psychology of Judgment and Decision Making* (SAGE Publications 2009). 60. (Note that this latter conclusion is not unanimously accepted in the literature as others consider that clinical decision-making should be favoured, or that both statistical and clinical methods should be combined: see below).

be said with a clinician[47]. Indeed, whereas humans are inevitably subjected to a number of influences – with or without conscious awareness – on their decision-making behaviour; artificially intelligent systems are free from those[48]. Furthermore, identifying the factors contributing to the superiority of statistical models, Robyn Dawes and his colleagues mentioned fatigue, recency, framing effects, motivational changes as well as the general tendency for individuals to be subjected to a confirmation bias in the interpretation of information – data which is only a skewed sample of evidence, and thus not representative[49]. Additionally, a statistical model is cheaper and less time-consuming than a clinical one relying on an individual or a group – hence promoting efficiency – but also rely on explicit procedures and not on suspicions on what could or has happen(ed) in the clinician's head[50]. Finally, the lack of feedback as well as an irregular decision-making environment equally contribute to the superiority of statistical models[51]. It suffices here to say that international arbitration seems to be currently lacking those[52].

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[47] Grove and Meehl (n 42) 315. ('Humans simply cannot assign optimal weights to variables, and they are not consistent in applying their own weights').

[48] Jörg Rieskamp and Ulrich Hoffrage, 'When Do People Use Simple Heuristics, and How Can We Tell?' in Gerd Gigerenzer, Peter M Todd and ABC Research Group (eds), *Simple Heuristics That Make Us Smart* (Oxford University Press 2000). 165. ('The main individual characteristics that are reported to influence decision strategies are knowledge and experience, emotional and motivational factors, cognitive abilities, and gender').

[49] Dawes, Faust and Meehl (n 36) (along the 'self-fulfilling prophecies' of clinicians and their overconfidence).

[50] Ibidem.

[51] Daniel Kahneman, *Thinking, Fast and Slow* (Reprint edition, Penguin 2012). See also below on expertise.

[52] See Part 3.2 on expertise and Part 4 below.

Accordingly, the introduction of artificial intelligence in international arbitration could have a number of benefits[53]. Not only could it allow a return to legal formalism (i.e. 'law in the books') – if that ever existed – tackling (behavioural) extra-legal factors in applying the law mechanically to the facts of the case. Plus, we could expect that overall this proposition would further the rule of law (in notably bringing certainty and predictability as the same combination of law and facts will always give the same outcome), enhance both the legitimacy of and compliance with the system, and promote its fairness (as the requirements of independence and of impartiality will be automatically restored) and efficiency (through a reduction of its costs and duration). Furthermore, it would equally dispense us with the need for an appeal mechanism (concerned with the correctness of the decision) or a review mechanism (dealing with the integrity of the proceedings) that would compromise the finality of the arbitral award.

Given all those positive effects, one could wonder why this option has not already been considered. To be fair, this omission is not exclusive to the legal or arbitral contexts but is in fact pervasive in a wide range of decision-making situations. Indeed, although it has been extensively demonstrated that statistical combination of data was more accurate (or equal) to clinical interpretation of that same data, the former method is seldom implemented[54]. Reflecting on the effects of its 'disturbing little book', Paul Meehl identified personal factors

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[53] Ibidem.

[54] Grove and Meehl (n 42) 319 (interpreting this behaviour as an instance of 'resistance to scientific discovery' or of 'Mencken's dictum that most people believe what they want to believe').

that might lead to this reluctance[55] to which Robyn Dawes added some cognitive ones[56]. Although those certainly participate in the lack of enthusiasm towards the use of statistical models in decision-making, they might not be the main determinants. Indeed, while the literature – over the last six decades and using over a hundred of studies – is fairly uniform in its conclusions, the practical implications to be given to those latter are far from being settled. On that matter, we could even divide the different schools of thought in three camps: one advocating for the total replacement of clinician decision-making with statistical models, one favouring the reverse (i.e. expert decision-making only), and another defending their combination. That latter option was already advocated by Robert Holt at the very infancy of the research comparing clinical and statistical predictions:

> The real issue is not to find the proper sphere of activity for clinical predictive methods and for statistical ones, conceived in ideal terms as antithetical. Rather we should try to find the optimal combination of actuarially controlled methods and sensitive clinical judgment for any particular enterprise[57].

Recognising this third possibility of judgment strategy (adding to the purely statistical or purely clinician approaches), it remained to settle on the form this combination should take. Here, it

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[55] Meehl (n 39) (i.e. sheer ignorance, the threat of technological unemployment, self-concept, theoretical identifications, dehumanising flavour, mistaken conception of ethics, computer phobia)

[56] Dawes, Faust and Meehl (n 45) (e.g. the belief in the rigidity of the statistical models, the failure to modify those latter with post-decision feedback).

[57] Robert R. Holt, 'Clinical and Statistical Prediction: A Reformulation and Some New Data' (1958) 56 Journal of Abnormal and Social Psychology 1, 12. Malcolm Gladwell, *Blink: The Power of Thinking Without Thinking* (Reprint edition, Penguin 2006).

is necessary to recall the distinction between collection and interpretation of data which could be both clinical and/or statistical. While there could be a combination of clinical and statistical in the collection phase, this should not occur for interpretation[58]. As the research – on the overall superiority of statistical methods – was principally concerned with the interpretative component, it would be wise to let a pure statistical model interpret the data previously collected by clinician(s) or both methods. For the proponents of a clinical-statistical mix, this way is the most popular due to the specificities of each component. Indeed, while 'the human brain is a relatively inefficient device for noticing, selecting, categorising, recording, retaining, retrieving, and manipulating information **for inferential purposes'**[59], things are different for data collection as experts have access to some 'inside information' that models cannot pretend[60]. Furthermore, the reverse combination (i.e. statistical in collection and clinical in interpretation) has already been tested in a number of contexts where it did worse than a pure statistical method[61].

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[58] Dawes, Faust, and Meehl (n 36), 1668 ('If clinical and actuarial interpretations agree, there is no need to combine them. If they disagree, one must choose one or the other').

[59] Grove and Meehl (n 42), 316 (emphasis added).

[60] Dawes, Faust and Meehl (n 45) 5 quoting Robert C Blattberg and Stephen J Hoch, 'Database Model and Managerial Intuition: 50% Model + 50% Manager' (1990) 36 Management Science 887 ("We have elected to label this inside information as intuition and see it as a valuable decision input"). See also Sawyer (n 37) 181 ('There is good reason to think that incorporating a clinician into data collection might improve prediction' as he could catch information (e.g. from observation) that a statistical model would miss).

[61] Dawes, Faust and Meehl (n 45)

B – Expert Decision-Making.

Human decision-making being flawed in some respects and accounting for the conclusions of the statistical versus clinical research programme, keeping clinicians to make decisions (either exclusively or in combination with statistical models) seems quite paradoxical. Yet, after consideration of the literature dealing with intuitive, naturalistic, expert decision-making, it might not be the case after all. Indeed, while Daniel Kahneman and Amos Tversky depicted intuition as disruptive to rational decision-making (i.e. heuristics and biases research programme)[62], others adopted the opposite view conceiving it as helpful. This point was illustrated by Antonio Damasio and his colleagues who studied the decision-making abilities of brain-damaged patients; those latter presenting intact cognitive processes but impaired emotional ones. Although presenting the ability to be fully rational due to their pathology, their decision-making abilities were negatively affected. This led them to develop the somatic marker hypothesis according to which "emotion could assist the reasoning process rather than necessarily disturb it"[63] and a "*reduction in emotion may constitute an equally important source of irrational behaviour*"[64]. Therefore, as intuition could be helpful in certain circumstances, it has been claimed that it should be blended with deliberative, logical, statistical, decision-making rather than completely eliminated[65].

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[62] Kahneman and Tversky (n 28).

[63] Antonio Damasio, *Descartes' Error: Emotion, Reason and the Human Brain* (Vintage 2006). Preface

[64] Ibidem, 53.

[65] Gary A Klein, *Streetlights and Shadows: Searching for the Keys to Adaptive Decision Making* (MIT Press 2011).

This alternative view on intuition – coined the 'learning perspective' by Robin Hogarth[66] – depicts it as being built "on mental representations that reflect the entire stream of prior experiences"[67]. This importance of experience (or of expertise if sufficiently developed) constitutes the focus of the naturalistic decision-making research tradition. This latter consisting in the study of the decision-making of individuals in "real-contexts that are meaningful and familiar to them"[68]. From that approach, this type of intuition was labelled *source of power* and *source of knowledge* that should not be dismissed in favour of statistical models[69]. To support this claim, it was even found that intuitive decision-making can outperform deliberative models providing certain conditions[70]. Hence, what could those be? They touch upon the decision-makers and their surrounding environment. Accordingly, the

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[66] Robin M Hogarth, 'On the Learning of Intuition' in Henning Plessner, Cornelia Betsch and Tilmann Betsch (eds), *Intuition in Judgment and Decision Making* (Routledge 2014).

[67] Henning Plessner, Cornelia Betsch and Tilmann Betsch (eds), *Intuition in Judgment and Decision Making* (Routledge 2014), 9. For a more detailed definition, see also: Tilmann Betsch, 'The Nature of Intuition and Its Neglect in Research on Judgment and Decision Making' in Henning Plessner, Cornelia Betsch and Tilmann Betsch (eds), *Intuition in Judgment and Decision Making* (Routledge 2014). 4. ('Intuition is a process of thinking. The input of this process is mostly provided by knowledge stored in long-term memory that has been primarily acquired via associative learning. The input is processed automatically and without conscious awareness. The output of the process is a feeling that can serve as a basis for judgments and decisions'). Hastie and Dawes (n 46), 2 ('Choosing wisely is a learned *skill*, which, like any other skill, can be improved with experience').

[68] Raanan Lipshitz, Gary Klein, Judith Orasanu, and Eduardo Salas, 'Taking Stock of Naturalistic Decision-Making' (2001) 14 Journal of Behavioral Decision Making 331. 332. Gary A Klein, *Sources of Power: How People Make Decisions* (20th Anniversary Edition edition, MIT Press 2017). 1 (defining it as 'the study of how people use their experience to make decisions in field settings').

[69] Betsch (n 67); Klein (n 68).

[70] T.D. Wilson, *Strangers to Ourselves: Discovering the Adaptive Unconscious* (Harvard University Press 2002).

individual needs to be an expert – to be distinguished from being experienced[71]. Thus, how does one become an expert? First of all, expertise building upon experience, it is well-accepted that the concerned individual must have "a sufficient opportunity to practice"[72]. Yet, this repetition of behaviour does not render an expert omniscient; on the contrary, the ensuing expertise will be limited to the particular skill, domain, or task considered[73]. Another necessary condition to develop expertise – and not only experience – resides in reliability meaning that decision-makers should be consistent across their own behaviours (intra-consistency) but also between them (inter-consistency)[74]. This latter condition is in fact a mere manifestation of the requirement of regularity of the environment, as a lack of consistency (as seen in international investment arbitration in particular) greatly hinders predictability[75]. Besides, failure to meet those conditions could render intuition detrimental instead of helpful in the decision-making process[76]. Finally, the development of expertise – through the learning of those regularities with repeated practice – is also dependent on feedback (especially its speed and quality)[77]. This

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[71] Hogarth (n 66). Note that while expertise is built on past experiences (through prolonged practice), those latter do not necessarily entail the former.

[72] Kahneman (n 51), 241. See also on deliberate practice: K Anders Ericsson, 'Deliberate Practice and Acquisition of Expert Performance: A General Overview' (2008) 15 ACAD EMERG MED 8.

[73] Barbara A Spellman, 'Judges, Expertise, and Analogy' in David E Klein and Gregory Mitchell (eds), *The Psychology of Judicial Decision Making* (Oxford University Press 2010). 152. ('Due to **study, training, and practice** – often in addition to **talent and motivation** – experts are better than non-experts in some domains of performance. One clear characteristic of expertise is that it is quite limited in domain' (emphasis added)).

[74] Hillel J Einhorn, 'Expert Judgment: Some Necessary Conditions and an Example' (1974) 59 Journal of Applied Psychology 562.

[75] Kahneman (n 51), 240 ('The two basic conditions for acquiring a skill (being) an environment that is sufficiently regular to be predictable and an opportunity to learn these regularities through prolonged practice').

[76] Ibidem, 241 ('Intuition cannot be trusted in the absence of stable regularities in the environment').

[77] Ibidem.

last feature being particularly relevant in the legal context as it provides low-fidelity feedback thus contributing to poor performance[78].

Assuming that someone does actually become an expert in a particular domain, what would that entail on his/her decision-making abilities? First, it will imply a departure from the rational choice theory (as relying on an intuitive component), and thus could not possibly be captured by pure statistical models[79]. On this departure, it notably results from the fact that experts rely on decision-making strategies that are not comprehensive neither in the search of information nor in its evaluation[80]. This point is in fact illustrated by the Recognition-Primed-Decision (RPD) model uncovered by Gary Klein after an investigation of the behaviour of nurses and firefighters. This framework aimed to describe how expert decision-makers use their acquired knowledge to arrive at a judgment or decision. It theorised that experts combine both intuitive and deliberative thought processes to reach an outcome (i.e. as opposed to relying exclusively on one or the other); this association being even inherent to the RPD model consisting in two subsequent processes – pattern recognition (i.e. the intuitive component) and

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[78] James Shanteau and Ward Edwards, 'Decision Making by Experts: Influence of Five Key Psychologists' in Evan A. Wilhelms and Valerie F Reyna (eds), *Neuroeconomics, Judgment, and Decision Making* (Psychology Press 2014).

[79] Klein (n 65) (Hence explaining the discrepancies in performance between the two methods).

[80] Jennifer K Phillips, Gary Klein, Winston R Sieck, "Expertise in Judgment and Decision-Making: A Case for Training Intuitive Skills" in Derek J Koehler, Nigel Harvey (eds), *Blackwell Handbook of Judgment and Decision-Making* (Wiley-Blackwell 2004), 305. ('An important attribute of expert decision-makers is that they seek a course of action that is workable, but not necessarily the best or optimal decision. Human decision-making is qualitatively different from normative theories, and this is so among experts as well as novices').

simulation (i.e. the deliberative part)[81]. On the impossibility to capture the insights brought by expertise in procedures or statistical models, this is owed to the fact that expertise permits to "see the invisible"[82]. This ability being in turn due to the development of tacit knowledge – to be distinguished from explicit that could easily be implemented and communicated – consisting in "being able to do things without being able to explain how… tacit knowledge is the basis for our skills and the reflection of our experience"[83]. Additionally, not only this expanded knowledge-base differentiates experts from novices in their area of expertise[84], it is also responsible for a number of phenomena:

> Within their domain of expertise, experts tend to be faster and more accurate than novices, tend to have superior short-term and long-term memory for information, see deeper relations in the structure of information, use less cognitive effort, and have more accurate monitoring skills[85].

Finally, experts also present inherent characteristics contributing to those advantages, those being consistency (i.e. reliability), narrowness (i.e. domain-specificity), validity, and

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[81] Klein (n 65). Klein (n 68), 24 ("The recognition-primed decision model fuses two processes: the way decision-makers size up the situation to recognise which course of action makes sense, and the way they evaluate that course of action by imagining it").

[82] Ibidem.

[83] Klein (n 65), 35.

[84] Phillips, Klein, and Sieck (n 80), 299. ('The primary distinction that separates experts from novices appears to be the breadth and depth of their domain specific knowledge. Competence is inherent in the definition of expertise')

[85] Spellman (n 73), 152.

discrimination[86]. On that latter, although an expert tends to rely on "relatively little information" compared to a layperson, it is his/her ability to discriminate between relevant and irrelevant information which is crucial – a skill novices are missing as those are prone to use both types[87].

Yet, the disadvantages of expertise should not be forgotten either; hence the call for combining statistical and clinical methods (with clinicians being experts not novices). Indeed, relying on experts can be far from ideal under certain circumstances (e.g. in the absence of a predictable, regular, environment). Furthermore, expertise is no inoculation against biases – even though they might be subjected to those cognitive errors to a lesser extent than a layperson[88]. This limitation of expert decision-making is nicely illustrated by Amos Tversky asserting that "Whenever there is a simple error that most laymen fall for, there is always a slightly more sophisticated version of the same problem that experts fall for"[89]; and equally in the judicial and arbitral decision-making literature that proved that judges, jurors, and arbitrators are subjected to heuristics and biases[90]. Finally, experts are also suffering from overconfidence as "a person acquiring more knowledge develops enhanced illusion of her skill"[91]. Yet, this feeling is quite problematic since, being uncorrelated to accuracy, it engenders an illusion of validity.

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[86] David J. Weiss, James Shanteau, "Who's the Best? A Relativistic View of Expertise" (2014) 28(4) Applied Cognitive Psychology 447.

[87] Shanteau and Edwards (n 78), 12.

[88] Yet, the literature is not in agreement on that point, for a review see: Hastie and Dawes (n 46).

[89] Quoted in Shanteau and Edwards (n 78), 14.

[90] See Part 2 above.

[91] Kahneman (n 51), 219

Consequently, the answer to the question 'Humans versus Machines: who wins?' is not straightforward. Indeed, both present limitations; yet, **_purely_** clinical decision-making should still be avoided whenever possible due to the number of influences they might be subjected to something not susceptible to happen with a statistical model[92]. Plus, although undoubtedly competent due to the requirements bearing on them to exert this role, arbitrators might not necessarily rise to the level of expertise as defined above. Accordingly, the ideal alternative would be to introduce artificial intelligence so as to counteract human decision-makers' limitations.

4. Artificial Intelligence in International Arbitration: So, What?

Proposing a new model based on psychological findings is one thing, assessing its purported benefits is another. Yet, before addressing those and potential disadvantages, some preliminary remarks are in order. Indeed, combining statistical and clinical methods seems like a reasonable alternative to begin with due to the features of international arbitration that hinders the development of expertise. Besides, reliance on a pure clinical model – as is already the case in the current system – has already proven its defects in light of the backlash we are now witnessing. Yet, although the superiority of statistical models – compared to clinicians – has been extensively demonstrated, the literature is still divided as to the implications of this finding (i.e. does that mean that we should get rid of any sort of human input in decision-making?). Furthermore, the complete elimination of arbitrators – to be replaced with a statistical model – could be highly controversial not only because of this unsettled literature but also owing to the fact that it might be a change people are not ready to accept yet (i.e.

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[92] See Klein (n 65), 296-297 ('Experience-based thinking is different from analysis-based thinking. The two are not opposed to each other; they are complementary, like daytime vision and night vision').

handing over their fate to machines)[93]. To favour the welcoming of this introduction of artificial intelligence in international arbitration, it would be undoubtedly better to proceed progressively by first using artificially intelligent models to assist the arbitral community (the former being concerned with data interpretation and collection, the latter with data collection only (i.e. feeding it to the computer program)). As, in any event, an outcome generated by a statistical model (even partially) will always be more accurate than or equal to the one strictly based on clinicians[94]. And then, once this mechanism implemented – and hopefully praised by its users and the general public – we could consider the replacement of the clinical part by artificial intelligence as well (thus leading to a pure statistical model) but only in last resort (i.e. if it would present additional advantages). Accordingly, the combination – as the prime alternative – will be discussed[95].

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[93] See e.g. Edwina L. Rissland 'Artificial Intelligence and Law: Stepping Stones to a Model of Legal Reasoning' (1990) 99 The Yale Law Journal 1957, 1980 ('There will always be a need for human lawyers and judges. The goal is to assist, not to replace')

[94] See Katz's equation for legal prediction tasks: Daniel Martin Katz, 'Quantitative Legal Prediction – or – How I Learned to Stop Worrying and Start Preparing for the Data-Driven Future of the Legal Service Industry' (2013) 62 Emory Law Journal 909, 929 ('Humans + Machines > Humans or Machines')

[95] Note that this proposition is in accordance with Milgram's advice in the criminal justice framework to design algorithms to assist judges so as to bring more informed and more objective decisions: Angèle Christin, 'Algorithms in Practice: Comparing Web Journalism and Criminal Justice' (2017) 4(2) Big Data & Society 1, 6 (citing Anne Milgram: 'Judges have the best intentions when they make these decisions about risks, but they are making them subjectively. They are like the baseball scouts 20 years ago who were using their instinct and their experience to try to decide what risk someone poses. They are being subjective, and we know what happens with subjective decision-making, which is that we are often wrong. What we need in this space are strong data and analytics').

The argument here is that the introduction of artificial intelligence in the interpretive phase of the decision-making process will be highly beneficial to international arbitration as it will enhance its (perception of) legitimacy, fairness, and efficiency, while also promoting the rule of law. Furthermore, as this proposition will participate to the fulfilment of the initial goals of international arbitration, it should equally restore the confidence of its users and the public.

On the legitimacy of international arbitration, it should be first emphasised that this is a concern exclusive to international investment arbitration. Indeed, international commercial arbitration resulting from a private contractual agreement, the following award has only an effect on the parties and hence cannot possibly impact domestic laws and policies – whereas an investment arbitral award might. Hence, this impact on the States' regulatory power is one of the reasons why investment arbitration is allegedly confronted to a legitimacy crisis, adding to the fact that those public laws and policies are in fact challenged by non-democratically elected individuals (party-appointed arbitrators)[96]. As it is contended that, to be legitimate, international adjudicative bodies should present decision-makers accountable to the general public[97]. Those criticisms of a lack of legitimacy and of accountability in investment arbitration has even been ironically paraphrased by one arbitrator, Johnny Veeder:

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[96] See Rivkin (n 15), 354 ('Many have described a 'backlash' against investor-state arbitration, viewing it as an illegitimate process through which laws and policies are made and unmade, threatening the rule of law by imposing norms, allocating public funds, and constraining the actions of those bestowed with a direct democratic mandate, through a procedure that is beyond public scrutiny and in which the public has no say').

[97] Mark L. Movsesian, 'International Commercial Arbitration and International Courts' (2008) 18 Duke Journal of Comparative and International Law 424.

The concept… that an arbitrator is a super-judge, that an arbitral tribunal can operate above any international law with a discretion not given to state courts, a lack of accountability for its conduct and an absence of transparency not afforded to any comparable professional activity in the world, except, possibly secret policemen[98].

But what is legitimacy and why should we be concerned about it or its perception in international (investment) arbitration? Despite the lack of consensus on the meaning to be given to this concept and the variety of its "jobs"[99], it was recognised that the legitimacy crises of international courts and tribunals might face should not be ignored but carefully analysed[100]. More specifically, in the arbitral context, this was illustrated by Thomas Schultz highlighting that the use of this concept allows us "to understand the stability of a regime; its likelihood of change; the direction; velocity, extent, drivers of that change; its implications too"[101]. In this chapter, legitimacy is taken as a justification of the authority of an institution as emphasised by Tom Tyler providing that "legitimacy is psychological property of an authority, institution, or social arrangement that leads those connected to it to believe that it is appropriate, proper,

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[98] Johnny Veeder, *Due process - balancing fairness and efficiency - the harmonising chord,* IBA 12th International Arbitration Day, Due Process in International Arbitration, Transcripts.

[99] Thomas Schultz, 'Legitimacy Pragmatism in International Arbitration: A Framework for Analysis' in J. Kalicki and M. Abdel Raouf (eds) *Evolution and Adaptation: The Future of International Arbitration* (Wolters Kluwer 2018).

[100] See Grossman (n 13), 109 ('Attempting to define, identify, and analyse legitimacy challenges that international courts and tribunals face is useful to those seeking to expose and remedy their flaws and deepens our understanding of how these institutions should function').

[101] Schultz (n 99).

and just"[102]. In turn, this means that if the arbitral regime is perceived as legitimate compliance by the parties should be enhanced and the general feeling towards it being rather positive. Hence, the contention that the introduction of artificial intelligence in that framework will achieve this as it will promote the three factors conferring an international adjudicative body its legitimacy: "(1) fair and unbiased; (2) interpreting and applying norms consistent with what states believe the law is or should be; and (3) transparent and infused with democratic norms"[103]. As briefly mentioned above, statistical models relying on explicit procedures – and not on vague assumptions of what could be happening in the clinicians' heads – this will enhance the transparency (but also consistency) of the system as the parties will have access to the whole interpretive process. Consistency in interpretation which also participates to the acceptation by States and stakeholders of the system[104]. Similarly, this reliance on statistical models will equally promote the fair and unbiased nature of the institution[105].

Also related to legitimacy is the concept of the rule of law, as a system failing to enhance the later will lose the former[106]. But what is the rule of law? As the legitimacy, it has

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[102] Tom Tyler, 'Psychological Perspectives on Legitimacy and Legitimation' (2006) 57 Annual Review of Psychology 375, 375. See also Daniel Bodansky, 'The Legitimacy of International Governance: A Coming Challenge for International Environmental Law?' (1999) 93 The American Journal of International Law 596, 600 ('A quality that leads people (or states) to accept the authority – independent of coercion, self-interest, or rational persuasion – because of a general sense that the authority is justified').

[103] Grossman (n 13), 115.

[104] Ibidem: The legal soundness of the decision influencing the support to the concerned institution.

[105] For more details, see below on the promotion of fairness, procedural due process, independence and impartiality of arbitrators.

[106] Rivkin (n 15).

a great variety of meanings[107]. In this chapter, this concept is taken in the sense of formal

legality which requires a certain threshold of predictability in the application and interpretation

of rules which "implies, for instance, that rules… be applied **coherently, consistently,**

competently, and impartially"[108]. As the lack of those properties would in turn lead to a state

of uncertainty for the disputants (as already witnessed in international investment arbitration);

hence preventing them to appropriately adjust their conduct[109]. It is thus argued that introducing

artificial intelligence in the interpretive phase of the decision-making process would contribute

to the development of the rule of law as it would bring **automatically** those properties. Indeed,

coherence and consistency in application and interpretation – resulting to predictability,

stability, and certainty – will be ensured since a statistical model will always provide the same

output providing that it is presented with the same input; hence also implementing a de facto

doctrine of precedent[110]. Plus, owing to this lack of regularity, arbitrators (though undeniably

experienced decision-makers) might not have the chance to develop expertise; thus, the need

for a statistical model to assist them first by taking over the task of data interpretation. Finally,

this proposition will also enhance the (perception of) impartiality of international arbitration in

providing an objective means to interpret data not driven by personal considerations external

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[107] Simon Chesterman, 'An International Rule of Law?' (2008) 56 The American Journal of Comparative Law

331.

[108] Schultz and Dupont (n 15), 1164. Emphasis added.

[109] See Schultz (n 14) 240 citing Lon L. Fuller, 'A Reply to Professors Cohen and Dworkin' (1965) 10 Villanova

Law Review 655, 657 (Law's essential function being: 'to subject (…) people's conduct to the guidance of general

rules by which they may themselves orient their behaviour').

[110] Properties currently missing in investment arbitration pervaded with unjustified inconsistencies. There is a

caveat though as it would not be such a milestone in commercial arbitration due to the confidentiality of the

arbitral awards.

to the decision-making task[111]. Plus, it should be noted that it is incumbent to the arbitral community working on improvements of the system to make sure that international arbitration still promotes the rule of law as it has been proven that it already participated to its growth – both domestically and internationally[112]. As David Rivkin emphasised a return to diplomatic protection or to domestic courts would not achieve that goal as neither of them "are conducive to the creation of an international rule of law"[113].

On procedural fairness (or due process) – one element of the rule of law, a goal of arbitration[114], as well as an obligation bearing on arbitrators[115] – it will also be enhanced with artificial intelligence. But, before explaining how, what is procedural fairness and what does it entail for international arbitration? According to Fabricio Fortese and Lotta Hemmi:

> The core guarantees of procedural due process comprise the arbitrator's duty to treat the parties equally, fairly and **impartially**, and to ensure that each party has an opportunity to present its case and deal with that of its opponent[116].

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[111] See below on fairness.

[112] See above (n 15).

[113] Rivkin (n 15), 354.

[114] David W. Rivkin, 'Towards a New Paradigm in International Arbitration: The Town Elder Model Revisited' (2008) 24(3) Arbitration International 375, 377 (Those being '(i) a fair and neutral process, (ii) conducted by intelligent and experienced arbitrators, (iii) resulting in a timely and well-reasoned decision, and (iv) benefiting from an effective enforcement mechanism').

[115] William W. Park, 'Arbitration in Autumn' (2011) 2(2) Journal of International Dispute Settlement 287 (alongside the duties to render an accurate, efficient (time- and cost-wise), enforceable award).

[116] Fortese and Hemmi (n 7), 112. Emphasis added.

Furthermore, those requirements of procedural fairness are particularly important in international arbitration as a failure to comply with those will result in the non-recognition or non-enforcement of the arbitral award[117] – the enforceability of an award being equally one goal of international and one obligation incumbent to arbitrators[118]. Accordingly, the combination (statistical model for data interpretation with experts for data collection) will respond to those requirements. Indeed, it will bring an objective, unbounded, rational, decision-maker in the arbitral context – feature that is currently missing due to the number of influences (behavioural, motivational, cognitive, social, or else) human beings might be subjected to. Owing to this bounded rationality, it is of no surprise that investment arbitrators are often considered to lack independence and impartiality. Furthermore, the design of the current system: party-appointed arbitrators – hence having their reputation and income dependent on their ability to secure such appointments – and the possibility to double-hat – thus potentially generating conflicts of interests – undoubtedly participate in this general feeling[119]. Although the selection of adjudicators by the disputants is criticised, it is also of value as it furthers the latter's confidence and acceptation of the system in providing them with (the sentiment of) a neutral forum to solve their disputes. This is why the combination will not undermine this aspect as they will still have to appoint someone or some people to collect the data (i.e. through written submissions and oral hearings) to be fed to the artificially intelligent model. Consequently, this proposition presents the convenience to tackle the alleged partiality and dependence of adjudicators, while keeping the parties involved in their appointment and in still providing them with the opportunity to present their case and respond to their opponent; hence answering to the above requirements of procedural fairness.

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[117] Park (n 115).

[118] Ibidem.

[119] Schultz and Kovacs (n 9).

Doing so will also allow the reconciliation of fairness and efficiency (in terms of costs and duration) considerations often portrayed as conflicting with each other. It was thus thought that some trade-off had to be found between those as they could not be satisfied at the same time[120]. Yet, this balancing exercise was revealed problematic in some circumstances as it prevented arbitral tribunals to complete their obligation to render an enforceable award[121]. Nevertheless, at its infancy, the efficiency of international arbitration was advanced as a reason why it should be favoured over litigation. Yet, this picture has now changed; some even claiming that this 'foundation of efficiency has begun to dissolve'[122] and others that the costs and length (notably due to a judicialization) of the process are dangers[123]. Thus, how could the introduction of artificial intelligence help for that matter? First of all, it will exempt us from the creation of a second layer of control mechanisms. Indeed, such an optimal device for interpretation will render a review or annulment mechanism (mainly concerned with the integrity of the proceedings) redundant; hence limiting the costs and duration of the proceedings as well. Equally, there will be no need for an appeal mechanism to control the correctness of the decision as this latter will necessarily be rightly (in the sense of objectively, optimally, mechanically) produced by the computerised model. Furthermore, this reform option exhibits a number of inherent positive cost- and efficiency-related effects. Indeed, statistical models – not relying on groups or committees for interpretation – will inevitably be less time-consuming and more economic (i.e. no deliberations neither remuneration of the people participating in those). It is true that the design and implementation of this proposition

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[120] Fortese and Hemmi (n 7) (As an illustration, they applied Dr Joerg Risse's dilemma of the 'magic triangle' to international arbitration).

[121] Ibidem.

[122] Najar (n 7), 517.

[123] Queen Mary, University of London, School of International Arbitration and PwC (n 8).

will inevitably entail costs. Yet, those initial expenses will then be compensated by the fact that once properly settled, artificially intelligent systems do not incur costs each time they are used – surely not as significant as the ones we are now witnessing with group decision-making – as additional costs will only be engaged sporadically in order to adapt the model to feedback[124]. It is worth noting that such an adjustment is impossible in the legal decision-making context as it does not provide it (though a necessary condition to develop expertise)[125].

B – … Yet Not Immune to Potential Drawbacks.

Despite its purported advantages, artificial intelligence also presents limitations that should not be forgotten either. These conflicting feelings toward this new technology are nicely illustrated by Stephen Hawkins emphasising that "the rise of powerful artificial intelligence will be either the best or the worst thing ever to happen to humanity. We do not yet know which"[126]. Those concerns about artificial intelligence could be classified into three categories: some consisting in general statements, others being more specific to the legal system as being expressed by lawyers, and last but not least some relying on the actual working of an artificially intelligent system in decision-making.

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[124] Dawes, Faust and Meehl (n 36). Grove, Zald, Lebow, Snitz, and Nelson, (n 43).

[125] See above and especially in international arbitration due to the dissolution of the tribunal after the resolution of the dispute and the absence of control mechanisms.

[126] Stephen Hawkins, Transcript of Professor Hawkin's speech at the launch of the Leverhulme Centre for the Future of Intelligence, October 19, 2016: <https://www.cam.ac.uk/research/news/the-best-or-worst-thing-to-happen-to-humanity-stephen-hawking-launches-centre-for-the-future-of> accessed 22 July 2019.

Regarding the general opponents to this introduction, the 'pessimists' fear that humans could become "computers' pets"[127]. Indeed, they consider that if machines do make better decisions than humans, this task will simply be delegated to the former with the latter only watching[128]. Others see artificial intelligent systems as competitors to humans, a sentiment shared by the legal profession with Daniel Martin Katz witnessing that the number of legal professionals needed is going to decline as a result of this combination[129]. Furthermore, this scepticism from the legal profession towards the introduction of algorithms to assist them in their decision-making has already been demonstrated by Angèle Christin in the criminal justice context[130]. Analysing how machines are already used in that legal area, she observed that this feeling is due to the actors' confidence in their legal judgment in turn fed by the fact that access to the legal profession involves "a long training process and high barriers to entry" and their resistance towards technological innovation[131]. Finally, others assert that the properties of the legal system (i.e. 'open-textured' concepts; dynamic, and without a 'right answer') make it particularly challenging to welcome the introduction of artificial intelligence[132]. Yet, alongside those rather abstract concerns, others are more practice-oriented in that they have regard to the actual functioning of artificially intelligent systems. Thus, those are for example alleged to

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[127] Makridakis (n 20), 50.

[128] Ibidem.

[129] Katz (n 94)

[130] Christin (n 95).

[131] Ibidem, 11.

[132] L. Thorne McCarty, 'Artificial Intelligence and Law: How to Get There from Here' (1990) 3(2) Ratio Juris 189. Though this challenge is not an obstacle, see Part 5 below.

present ethical[133] and liability issues[134], as well as to lack accountability[135] and transparency[136]. Briefly, it is claimed that machines are not responding to this ideal of objectiveness as they are notably influenced by the values and interests of their designers[137]. It is equally asserted that they are opaque in that transparency requires both accessibility and comprehensibility of information, qualities that are missing in algorithmic decision-making[138].

Notwithstanding those limitations, it is argued that artificial intelligence should still be introduced in international arbitration as its alleged benefits will outweigh those alleged limitations. This 'pragmatic' view is justified as there will be an artificial intelligence revolution in any event – as the industrial and digital ones we already had – and therefore, "the rational alternative is to identify the risks involved and devise effective actions to avoid their negative consequences"[139]. This identification having already started – as illustrated by the

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[133] Brent Daniel Mittelstadt, Patrick Allo, Mariarosaria Taddeo, Sandra Wachter, and Luciano Floridi, 'The Ethics of Algorithms: Mapping the Debate' (2016) 3(2) Big Data & Society 1 (highlighting six ethical issues algorithms might be confronted to).

[134] David C. Vladeck, 'Machines Without Principals: Liability Rules and Artificial Intelligence' (2014) 89 Washington Law Review 117.

[135] Joshua A. Kroll, Joanna Huey, Solon Barocas, Edward W. Felten, Joel R. Reidenberg, David G. Robinson, and Harlan Yu, 'Accountable Algorithms' (2017) 165 University of Pennsylvania Law Review 633.

[136] Ibidem. Mittelstadt, Allo, Taddeo, Wachter, Floridi (n 133).

[137] Ibidem. See also: Batya Friedman and Helen Nissenbaum, 'Bias in Computer System' (1996) 14(3) ACM Transactions on Information Systems 330 (identifying three categories of bias in computer systems: pre-existing, technical, and emergent).

[138] Mittelstadt, Allo, Taddeo, Wachter, and Floridi (n 133). The functionality of algorithms sometimes being kept secret, and if not, their specificities are often incomprehensible for a layperson.

[139] Makridakis (n 20), 59. Similarly, Rissland (n 93), 1981 ('Successful projects require not only thorough knowledge of both artificial intelligence and the law, but also a willingness to try new approaches without knowing

aforementioned concerns – a number of ex-ante or ex-post approaches have been thought of[140] or effective regulations implemented[141].

5. Practical Insights.

The combination of both statistical and clinical methods being favoured in the first place two aspects need to be addressed: the furthering of expertise in the arbitral framework and the design of the statistical model that would both take on the collection of data (alongside experts) and its interpretation (though exclusively for that one).

On the intuitive (or clinical) component of the combination, it was previously demonstrated that intuition can be quite useful when it relies on past experiences rising to the level of expertise – as opposed to being based on heuristics. Indeed, this power of intuition derives from the experts' ability to 'see the invisible' in turn allowing them to discriminate between relevant and irrelevant information. This is specifically because of that latter property that clinicians should not be suppressed in whatever decision-making context (i.e. legal, medical, business, etc). Instead, the data should be collected building on those competences (in association with a statistical model as well), data subsequently to be fed to the statistical model

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exactly where they will lead, or whether or not they will achieve exactly the desired result. In short, work in artificial intelligence and the law is no different from work in other fields; you cannot get anywhere without trying; and one invariably learns from trying').

[140] Kroll, Joanna Huey, Barocas, Felten, Reidenberg, Robinson, and Yu (n 135).

[141] For a review: Lilian Edwards and Michael Veale, 'Enslaving the Algorithm: From a 'Right to an Explanation' to a 'Right to Better Decisions'?' (Forthcoming).

for its interpretation. Consequently, this requires us to answer the following question: How could the members of the arbitral community develop expertise in this domain?

The conditions of expertise – detailed above – will certainly be a good starting point; yet, proponents of this intuitive-deliberative combination also came up with guidelines to do so. To understand those, we must first recall that according to Gary Klein and Daniel Kahneman one of the necessary conditions to develop reliable intuitions is that people must have opportunities to learn[142]. This, in turn, happens in two ways through deliberate practice associated with feedback[143]. Accordingly, the enhancement of expertise will inevitably deal with those and K. Anders Ericsson after a review of the literature observed that:

> Significant improvements in performance were realized when individuals were 1) given a task with a well-defined goal, 2) motivated to improve, 3) provided with feedback, and 4) provided with ample opportunities for repetition and gradual refinements of their performance[144].

Consequently, those features should be worked on and brought in international arbitration. Indeed, we could assert that it already presents the first characteristic – the goal being the

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[142] Kahneman (n 51). Klein (n 65).

[143] Note that in this case outcome feedback is quite useless, and thus should be on the process: Klein (n 65).

[144] Ericsson, (n 72), 991. See also Gary Klein positing four similar techniques favouring the learning of expertise: Phillips, Klein, and Sieck, (n 80), 306. ('1. Engaging in deliberate practice and setting specific goals and evaluation criteria; 2. Compiling extensive experience banks; 3. Obtaining feedback that is accurate, diagnostic, and reasonably timely; and 4. Enriching their experiences by reviewing prior experiences to derive new insights and lessons from mistakes').

resolution of the dispute at hand – yet with the caveat on being based on quite vague provisions and the unsettled jurisprudence on some interpretative issues (in investment arbitration). As to the existence of the second factor, it could be questionable. Indeed, ideally, arbitrators should be motivated to ameliorate their decisions; yet, as demonstrated by Thomas Schultz, this might not be the case[145]. The third requirement is equally missing as the fourth one owing to the discrepancies in the appointment rates of arbitrators – some being repeatedly appointed, others not.

Yet, should the combination of clinical and statistical methods be considered, the development of expertise would bear on the people entrusted to feed the algorithms with the data relevant to resolve the dispute. This information is now treated by arbitrators through written submissions and oral hearings preceding the deliberations and outcome of the tribunal. Hence, the question is to whom this responsibility to provide inputs to the statistical model should be conferred? The logical answer would be to let this task to party-appointed arbitrators since it will provide the disputants with confidence in the system. Yet, for this clinical-statistical method to be optimal, we might prefer to use independent legal experts instead.

On the deliberative (or statistical) component of the combination, several questions arise pertaining to its form and the people entrusted to design it. The answers to those are far from being straightforward due to the lack of adoption of this method across a wide range of contexts (despite extensive literature proving the numerous benefits). Yet, rareness does not equal inexistence which means that some models have already been used and could thus be

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[145] Thomas Schultz, 'Arbitral Decision-Making: Legal Realism and Law & Economics' (2015) 6 Journal of International Dispute Settlement 21.

borrowed and adapted to international arbitration[146]. Furthermore, the artificial intelligence and the law movement is now new, with even some computer systems already designed in areas touching upon criminal justice[147], taxation law[148], legal predictions[149], and legal reasoning[150]. Indeed, this approach was meant two fulfil two motivations, one (theoretical) concerned with the understanding of legal reasoning and argumentation and another (practical) focusing on "building computational tools useful for legal practice, teaching, or research"[151]. While law is a challenging area for the introduction of artificial intelligence due to its specific characteristics (e.g. open-textured concepts, dynamic, no right answer), efforts for its successful integration are deemed worth continuing due to the numerous 'desiderata' it could bring to law[152]. Nevertheless, the design of those programs in the legal system is not an easy thing and requires a number of preliminary steps. In the context of international arbitration, those would entail to map arbitral reasoning, to represent the knowledge of the field, and to design methods (i.e. rules) to use this knowledge[153].

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[146] Note that to be able to compare statistical and clinical decision-making in the myriad of studies (mentioned above), statistical models have already been developed and applied.

[147] Christin (n 95).

[148] On TAXMAN, see e.g.: L. Thorne McCarthy, 'Reflections on Taxman: An Experiment in Artificial Intelligence and Legal Reasoning' (1977) 90(5) Harvard Law Review 837.

[149] Katz (n 94).

[150] Rissland (n 93) presenting the HYPO project reasoning with cases and hypotheticals.

[151] Ibidem, 1960. McCarty (n 132).

[152] For the lists of law's particular characteristics and of desiderata for artificial intelligence and law: Rissland (n 93).

[153] Richard E. Susskind, 'Expert Systems in Law: A Jurisprudential Approach to Artificial Intelligence and Legal Reasoning' (1986) 49(2) The Modern Law Review 168, 185: (Knowledge representation being 'the central issue of the study of legal knowledge engineering'). Similarly: McCarthy (n 132).

Once those steps elucidated, the form of the algorithmic model to be used to assist arbitrators in their decision-making should then be settled on: Will it take the form of a conventional computer system or machine learning? It can be fairly asserted that for the time being, the former might be favoured as the latter is still in its infancy. Indeed, conventional computer systems only relies on pre-programmed instructions – hence presenting no autonomy whatsoever as compared to a machine learning program – in the form of "logic, if-then rules, and decision trees" and are equally able to deal with difficult decisions involving a lot of data that human decision-makers (e.g. arbitrators) could not realistically apprehend due to their cognitive limitations[154].

Nevertheless, the use of machine learning algorithms in international arbitration will definitely be an option to consider – albeit at a later point in time – as it was forecasted in 2017 that the artificial intelligence revolution will happen within the next twenty years with an impact even more important than the ones observed with the industrial and digital revolutions[155]. Indeed, machine learning systems present a number of additional advantages[156] currently missing from conventional algorithms (computer systems) such as: improvement of performance over time by themselves as they are learning from experience, detection of patterns as the data is presented to them (patterns that could be missed by humans due to their limitations) and the development of heuristic rules, all of that to make automated predictions

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[154] Makridakis (n 20), 49.

[155] Ibidem.

[156] Harry Surden, 'Machine Learning and Law' (2014) 89 Washington Law Review 87, 95 ('The focus in machine learning is upon computer algorithms that are expressly designed to be dynamic and capable of changing and adapting to new and different circumstances as the data environment shifts').

or decisions[157]. Although, they would present limitations notably pertaining to liability, transparency and accountability but also accuracy, adaptability, and over-generalisation, the usefulness of this technology in law would still be preserved provided that those are not ignored and properly dealt with[158]. Besides, one area of law in which machine learning is deemed to be particularly handy is in the prediction of future legal outcomes as

> The goal of using machine learning is to analyse past data to develop rules that are generalisable going forward. Such a learned model is thus useful to the extent that the heuristic inferred from past cases can be extrapolated to predict novel cases[159].

Of interest here is that if such a programme can already forecast the outcome of a case, there is equally a potential for prescription: deciding the outcome of the case after that same data analysis.

On the last interrogation – responsibility to design the programme –, it will necessarily bear on the shoulder of a computer scientist, undoubtedly with the assistance of the arbitral

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[157] Ibidem, 107 ('Machine learning techniques are also useful for discovering hidden relationships in existing data that may otherwise be difficult to detect'). Note that it is true that conventional algorithms can adjust to feedback as mentioned earlier but this needs some human intervention.

[158] Liability issues being even more problematic as those machine learning programs lack a principal as they are autonomous, unsupervised: Vladeck (n 134).

[159] This predictive function being already undertaken by machine learning systems outside law: Katz (n 94).

community (e.g. arbitral institutions) to properly integrate the subtleties of the legal system, and particularly of international arbitration[160].

6. Conclusion.

This chapter considered the introduction of artificial intelligence in international arbitration in order to restore its initial goals that have made it popular in the first place. Indeed, this mode of dispute resolution – alternative to domestic litigation or diplomatic protection – being now 'broken', it could benefit from such innovation. Furthermore, it was demonstrated that not only the materialisation of this proposition would participate to the fulfilment of international arbitration ideals but would equally engage with broader considerations of international adjudication such as the promotion of the rule of law (both domestically and internationally) as well as the enhancement of legitimacy, efficiency, and fairness of the system.

This implementation of computerised decision-making in international arbitration is first warranted by the psychological literature experimentally proving that human decision-makers are bounded in rationality; and second, by the extensive research programme comparing statistical against clinical methods of interpretation. Furthermore, those findings have been already proven equally relevant in the legal context – which makes the matter all the more interesting as those decision-makers are normally appointed for their purported expertise. Hence, the question: why this alternative has not been considered earlier? After all, there

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[160] Bruce G. Buchanan and Thomas E. Headrick, 'Some Speculation About Artificial Intelligence and Legal Reasoning' (1970) 23 Stanford Law Review 40, 40: ('the time has come for serious interdisciplinary work between lawyers and computer scientists to explore the computer's potential in law').

already exists an artificial intelligence and the law literature, the last decades have witnessed a number of technological innovations expanding our possibilities, and artificial intelligence is increasingly becoming a 'hot topic' – some even arguing that we will witness a revolution soon. The answer might be that this is due to a scepticism against machines accompanied with the praising of expert decision-making. Hence, the idea to combine both methods as after all decision-making entails two different phases – collection and interpretation of data. Besides, clinicians have been quite good in the former aspect, but rather bad in the latter. Nevertheless, while this introduction of artificial intelligence into arbitral decision-making could also present limitations, adopting a pragmatic approach – as the benefits are thought to outweigh the disadvantages – it was asserted that those could be appropriately dealt with.

Moving on to the practicalities of this proposition, the combination of expertise with artificially intelligence entails that both need to be developed in international arbitration. As it is doubtful that arbitrators could be labelled experts from a psychological perspective, the arbitral context failing to exhibit the conditions to acquire it. Of particular interest here, as it is the focus of this chapter is the form of the computerised system to be adopted: will it be semi-autonomous or autonomous? Yet, whichever program is developed by a computer scientist with the help of the arbitral community, the introduction of even the simplest (i.e. supervised by human hands, semi-autonomous) appropriately designed to understand the specificities will be highly beneficial to international arbitration. But still, owing to the scarcity of applications and to fructuous objections, there is still more work to do on both the promotion and implications of this proposition.