

NON-DETERMINISTIC ARTIFICIAL INTELLIGENCE SYSTEMS AND THE FUTURE OF THE LAW ON UNILATERAL MISTAKES IN SINGAPORE

Non-deterministic artificial intelligence (“AI”) systems are black boxes – their programmers lack control and foresight over the AI’s outputs. Under the doctrine of unilateral mistakes, the black box problem renders it impracticable to prove that the non-mistaken party (“NMP”) who contracts via a non-deterministic AI knew of the relevant mistake. Looking ahead, Parliament should legislate that where the NMP issued the disputed offer through a non-deterministic AI, the contract is voidable if a reasonable person should have known of the mistake at the time of the actual trade. Among other benefits, this rule prevents black box AIs from being abused to circumvent the law on unilateral mistakes and more fairly allocates risk between the NMP and his or her counterparty. The black box problem also means that the unconscionability which grounds equity’s jurisdiction in equitable unilateral mistakes will be onerous to prove. Therefore, Singapore’s legislature should further codify a rule for this specific situation: that if the NMP acquires actual knowledge of the mistake post-contract formation, and yet seeks to enforce the contract in a manner amounting to sharp practice or impropriety, rescission remains available, subject to the usual equitable bars.

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I. Introduction

1 As artificial intelligence (“AI”) continues to transform industries, public and private life,² courts and legislators face the unenviable task of adapting the law to meet new challenges posed by AI. Sophisticated

1 This article is written in the author’s personal capacity, and the opinions expressed in the article are entirely the author’s own. This author would also like to convey his appreciation to Megan Chua and Alex Foo for their helpful comments on an earlier draft. Any errors and omissions, however, remain the author’s alone.

2 *American Artificial Intelligence Initiative: Year One Annual Report* (The White House Office of Science and Technology Policy, February 2020) at p 1.

traders and insurers, for instance, deploy AI to execute trades, calculate premiums and potentially conclude policies.³

2 However, using AI as an instrument to conclude contracts has highlighted, in some areas, the inadequacy of existing contractual principles. Of interest is the doctrine of unilateral mistakes as a vitiating factor in contract law. To rely on the doctrine of unilateral mistakes, the mistaken party (“MP”) must prove that its counterparty knew of the relevant mistake when the contract was formed. However, if the non-mistaken party (“NMP”) contracts via a non-deterministic AI, without contemporaneous human involvement at the time of contract formation, whose mental state becomes relevant under the defence of unilateral mistake (the “Knowledge Issue”)?

3 While the Singapore Court of Appeal in *Quoine Pte Ltd v B2C2 Ltd*⁴ (“*Quoine*”) provided much-needed clarity on the Knowledge Issue where contracts are concluded by deterministic AI, there is a lacuna in the law *vis-à-vis* contracts concluded by non-deterministic AI. This article examines the Knowledge Issue in the context of contracts concluded by non-deterministic AI before proposing reforms for analysing the Knowledge Issue and the related requirement of unconscionability in equitable unilateral mistakes. Determining the type or class of mistake (eg, what is a fundamental mistake as to the terms of the contract) that allows a party to invoke the unilateral mistake doctrine in law or equity is an issue beyond the scope of this article.

II. Non-deterministic artificial intelligence and the Black Box Problem

4 AI is an emerging technology that eludes precise definition.⁵ This article will focus on non-deterministic algorithms deployed with humans out-of-the-loop.

3 Thibaut Theate & Damien Ernst, “An Application of Deep Reinforcement Learning to Algorithmic Trading” *arXiv.org* (7 June 2020) <<https://arxiv.org/pdf/2004.06627.pdf>> (accessed 4 January 2021); Romanth Balasubramanian, Ari Libarikian & Doug McElhaney, “Insurance 2030 – The impact of AI on the future of insurance” *McKinsey & Company* (30 April 2018) <<https://www.mckinsey.com/industries/financial-services/our-insights/insurance-2030-the-impact-of-ai-on-the-future-of-insurance>> (accessed 4 January 2021).

4 [2020] 2 SLR 20 at [103].

5 Ronan Hamon, Henrik Junklewitz & Ignacio Sanchez, *Robustness and Explainability of Artificial Intelligence – From Technical to Policy Solutions*, European Commission Joint Research Centre Technical Report (Publications Office of the European Union, 2020) at p 10; Stuart J Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach* (Pearson Education Inc, 3rd Ed, 2010) at pp 1–5.

5 AI systems are, generally, either deterministic or non-deterministic algorithms. Deterministic algorithms produce the same output given the same inputs. To solve a problem, the algorithm merely applies pre-programmed rules to reach pre-set conclusions.⁶ As noted in *B2C2 Ltd v Quoine Pte Ltd* (“B2C2”), deterministic algorithms function “as they have been programmed to operate once activated”. Each step leading to the AI’s conclusion is attributable to a decision made by the programmer.⁸

6 In contrast, a non-deterministic algorithm has “a mind of its own” – given the same inputs, the output may vary.⁹ AIs trained by certain machine learning (“ML”) algorithms are non-deterministic. ML involves conditioning a software to recognise statistical patterns from inputted data, including a training data set.¹⁰ While ML algorithms using decision trees and Bayesian classifiers remain deterministic, others like artificial neural networks (“ANN”) do not.¹¹

A. Artificial neural networks and deep learning

7 ANNs consist of artificial neurons arranged in layers. After the first layer receives raw inputs, neurons in subsequent layers weight the inputs to produce an intermediate output which is passed to downstream neurons. Assuming the inputs are x_1-x_n with weights w_1-w_n , the intermediate output passed on is $f(w_1.x_1-w_n.x_n)$.¹² The above process repeats until the output layer generates the final output. Deep learning networks typically comprise thousands of layers, each containing numerous neurons.¹³

6 Makoto Hong Cheng & Hui Choon Kuen, “Towards a Digital Government: Reflections on Automated Decision-making and the Principles of Administrative Justice” (2019) 31 SAclJ 875 at 878.

7 *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [209].

8 Jacob Turner, *Robot Rules* (Palgrave Macmillan, 2019) at p 18.

9 *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [206]; Techopedia website <<https://www.techopedia.com/definition/24618/non-deterministic-algorithm>> (accessed 30 August 2020).

10 Ronan Hamon, Henrik Junklewitz & Ignacio Sanchez, *Robustness and Explainability of Artificial Intelligence – From Technical to Policy Solutions*, European Commission Joint Research Centre Technical Report (Publications Office of the European Union, 2020) at p 10.

11 Arun Rai, “Explainable AI: From Black Box to Glass Box” (2020) 48(1) *Journal of the Academy of Marketing Science* 137 at 138.

12 Virginia Dignum, *Responsible Artificial Intelligence* (Springer Nature Switzerland, 2019) at pp 27–28.

13 Virginia Dignum, *Responsible Artificial Intelligence* (Springer Nature Switzerland, 2019) at p 28.

8 Non-determinism results from the ANN's ability to adapt and learn on the go.¹⁴ Assume that the network is tasked with issuing an offer price for a particular stock. Possible inputs include the current market price, trading volume and the peak and trough price for a given period. However, as it encounters new data, the ANN may adjust each input's weight. Such adjustments are made pursuant to an optimisation algorithm, such as a gradient descent algorithm, which alters the weights to minimise the ANN's "error" (the difference between the network's offer price and the programmer's desired offer price).¹⁵ Continuous adjustments lead to non-determinism as the ANN may respond differently to the same inputs at different points in time. While an ANN may be restrained from learning post-deployment, this article does not consider such ANNs non-deterministic. Once deployed, such ANNs are unable to vary each input's weight. These weights would have been determined when the ANN was being trained by its programmer and fixed from that time onwards. In theory, once deployed, the ANN would provide the same output given the same input.

B. The Black Box Problem

9 Non-determinism results from continuous adjustments to inputs' weights. Such non-deterministic ANNs are black boxes¹⁶ – while humans may observe the data inputted and conclusions outputted, the machine's intervening logic, *viz.* why certain weights were assigned to each input and thus why a particular output was rendered remains "in the dark" ("Black Box Problem").¹⁷ Such opacity places the AI's future behaviour beyond the control and reasonable foreseeability of its programmers and users.¹⁸

14 Virginia Dignum, *Responsible Artificial Intelligence* (Springer Nature Switzerland, 2019) at p 28.

15 Stuart J Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach* (Pearson Education Inc, 3rd Ed, 2010) at pp 733–736; Jacob Turner, *Robot Rules* (Palgrave Macmillan, 2019) at pp 19 and 326.

16 Expert Group on Liability and New Technologies – New Technologies Formation, *Liability for Artificial Intelligence and Other Emerging Digital Technologies* (Publications Office of the European Union, 2019) at p 33.

17 Stefanie Hänold, "Profiling and Automated Decision-Making: Legal Implications and Shortcomings" in *Robotics, AI and the Future of Law* (Marcelo Corrales, Mark Fenwick & Nikolaus Forgó eds) (Springer Singapore, 2018) ch 6, at p 143; Will Knight, "The Dark Secret at the Heart of AI" *MIT Technology Review* (11 April 2017) <<https://www.technologyreview.com/2017/04/11/51113/the-dark-secret-at-the-heart-of-ai/>> (accessed 28 August 2020).

18 Lord Sales, Justice of the UK Supreme Court, "Algorithms, Artificial Intelligence and The Law", speech at The Sir Henry Brooke Lecture for BAILII (12 November 2019) at p 4; Law Reform Committee, Singapore Academy of Law, *Report on Criminal Liability, Robotics and AI Systems* (February 2021) at paras 4.33–4.36; see also
(*cont'd on the next page*)

10 Quite apart from the ANN's adaptive learning ability, the weights assigned to each input are themselves determined by non-linear relationships, discerned by the ANN, among the inputs.¹⁹ Unfortunately, while humans can envisage the relationship among three variables in a plane, complex geometric relationships among more variables elude human comprehension.²⁰ Taking non-determinism and non-linearity together, it comes as no surprise that ANNs have been denounced as "completely unintelligible" even to their own programmers.²¹

11 With regard to the Knowledge Issue, a question arises as to whether the black box may be "opened" to explain the algorithm's reasoning and reveal what it "knew" or, failing which, how the law should determine if a party, who entered into a contract using a non-deterministic AI, had knowledge of its counterparty's unilateral mistake.

12 The Black Box Problem may arise regardless of whether the AI received unsupervised or supervised training. Even if learning is supervised, *ie*, the training data is labelled to indicate the desired outputs to provide the foundation for the AI's decision-making, the AI can adjust the weights it gives to each input if allowed to do so, thereby obscuring its logic. For unsupervised learning, the AI's logic is even more opaque as the system analyses unlabelled training data to identify outliers or correlations without any guidance – the programmer is not privy to why the AI clusters certain data together, or deems others as outliers.²²

13 For clarity, an autonomous AI may be subject to varying degrees of human supervision. On one extreme, the AI may be deployed with humans out-of-the-loop, *ie*, without human intervention before the AI performs an action in the real-world. Contrastingly, a human in-the-loop will make the final decision under the AI's "advisement". A middle ground involves a human over-the-loop overseeing the task but only

Law and Technology in Singapore (Simon Chesterman, Goh Yihan & Andrew Phang Boon Leong eds) (Academy Publishing 2021) at paras 02.035 and 09.042.

19 Makoto Hong Cheng & Hui Choon Kuen, "Towards a Digital Government: Reflections on Automated Decision-making and the Principles of Administrative Justice" (2019) 31 SA LJ 875 at 901; Ujjwal Karn, "A Quick Introduction to Neural Networks" *the data science blog* (9 August 2016) <<https://ujjwalkarn.me/2016/08/09/quick-intro-neural-networks/>> (accessed 30 August 2020).

20 Yavar Bathaee, "The Artificial Intelligence Black Box and the Failure of Intent and Causation" (2018) 31(2) *Harvard Journal of Law & Technology* 890 at 905.

21 United Kingdom, *Report of the Select Committee on Artificial Intelligence, AI in the UK: Ready, Willing and Able?* (HL 2017–19, 100) at paras 90 and 94 (Chairman: Lord Clement-Jones).

22 John Buyers, *Artificial Intelligence – The Practical Legal Issues* (Law Brief Publishing, 2018) at p 11.

intervening when necessary.²³ This article focuses on out-of-the-loop non-deterministic AIs as the Knowledge Issue is the most nettlesome in this context. To some extent, this article is premature as most ANNs continue to receive human supervision.²⁴ However, as the growth of AI computational power continues to outpace Moore's Law, this author seeks to pre-empt unfair reliance on non-determinism (and the Black Box Problem) to circumvent the unilateral mistakes doctrine in contexts such as algorithmic trading.²⁵ To this end, the following sections will consider whether it is appropriate to broaden the grounds on which constructive knowledge and unconscionability may be established for the purposes of the unilateral mistakes doctrine and, if so, how this may be done.

III. The Knowledge Issue in unilateral mistakes

14 Singapore recognises the doctrine of unilateral mistakes in common law and equity as a vitiating factor in contract law.²⁶ This article focuses on unilateral mistakes as to the terms of the contract.²⁷ The tests for unilateral mistakes in law and equity will first be outlined before considering why the Knowledge Issue is problematic when the NMP contracts via a non-deterministic AI.

A. Unilateral mistake in law

15 The rationale underpinning unilateral mistakes at common law is best elucidated by the “promisee objectivity” theory endorsed by the majority in *Quoine*. Namely, there is no contract to enforce if the NMP knows that the MP did not intend to contract on the present terms; objectively, there is no *consensus ad idem*.²⁸

16 Accordingly, to render a contract void *ab initio* for a unilateral mistake as to the contract's terms at common law, the MP must prove that:²⁹

23 Simon Chesterman, “Artificial Intelligence and the Problem of Autonomy” (2020) 1(2) *Notre Dame Journal on Emerging Technologies* 210 at 240.

24 Jacob Turner, *Robot Rules* (Palgrave Macmillan, 2019) at p 21.

25 Raymond Perrault *et al*, *Artificial Intelligence Index Report 2019* (Stanford University Institute for Human-Centred Artificial Intelligence, 2019) at pp 5 and 66.

26 *Olivine Capital Pte Ltd v Chia Chin Yan* [2014] 2 SLR 1371 at [71]–[72].

27 *Smith v Hughes* (1871) LR 6 QB 597 at 603; *The Law of Contract in Singapore* (Andrew Phang Boon Leong gen ed) (Academy Publishing, 2012) at paras 10.147–10.158.

28 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [81]; *cf*, the “detached objectivity” theory endorsed in *Statoil ASA v Louis Dreyfus Energy Services LP* [2008] EWHC 2257 (Comm) at [87].

29 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [34] and [37].

- (a) it made a fundamental mistake as to a term; and
- (b) the NMP had actual knowledge of this mistake.

17 The Knowledge Issue arises under element (b) where the MP must prove that the NMP actually knew of its mistake “from all the surrounding circumstances, including the experiences and idiosyncrasies of the [NMP]”.³⁰ Further, actual knowledge is satisfied if the NMP was wilfully blind. Such Nelsonian knowledge arises if the NMP had a “real reason” to suppose the existence of a mistake, yet deliberately refused to make an inquiry he ought to have made – the NMP is deemed to know what he feared he might find.³¹

18 However, this author subsequently demonstrates that MPs will find it onerous to prove actual knowledge of the mistake when an NMP contracts via a non-deterministic AI. As a result, the court’s equitable jurisdiction to declare a contract voidable will prove pivotal.

B. Unilateral mistake in equity

19 Where the contract is void under common law, equity cannot intervene.³² However, if the contract survives in law, equity still may render the contract voidable. As compared to its counterpart in common law, the rationale behind the doctrine of unilateral mistakes in equity was framed more broadly by the *Quoine* majority “to assist [courts] in achieving the ends of justice in appropriate cases”.³³ To invoke equity’s jurisdiction, the MP must prove that:³⁴

- (a) it made a fundamental mistake;
- (b) the NMP had constructive knowledge of the mistake; and
- (c) the NMP committed some impropriety or sharp practice making it unconscionable for him to insist on contractual performance. Deliberately omitting to alert his or her counterparty of his suspicion of a possible mistake is sufficient.

20 Under element (b), the inquiry is whether, objectively, a reasonable person *in the position of* the NMP would have known of the

30 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [41].

31 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [42]–[43].

32 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [80].

33 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [89].

34 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [76]–[77] and [80].

mistake. If so, the NMP is imputed with knowledge of the mistake.³⁵ Given the constraints of actual knowledge in law, the nub of the Knowledge Issue is whether the notion of constructive knowledge can be expanded to broaden the court's equitable jurisdiction of rescission.

21 However, where the equities ultimately fall is still influenced by the MP's carelessness or negligence, even though such negligence does not *ipso facto* bar relief.³⁶

C. *The lacuna*

22 In law and equity, the NMP must have known of the MP's unilateral mistake when the contract is formed.³⁷ However, where the NMP contracts using a non-deterministic AI, the Black Box Problem renders it inappropriate to adopt the *Quoine* majority's test which involves examining the *programmer's* state of knowledge. Here, the author submits that absent an admission, the MP will struggle to prove both actual and constructive knowledge ("Lacuna") and may thereby be precluded from relying on the doctrine of unilateral mistakes. To highlight the Lacuna, the *Quoine* majority's knowledge test in the context of deterministic AI systems will be set out before its weaknesses in the non-deterministic AI context are outlined.

(1) *Deterministic artificial intelligence*

23 In *Quoine*, the purported NMP, B2C2 Pte Ltd ("B2C2"), had entered into the disputed trading contracts using a deterministic trading algorithm. The counterparties were margin traders who bought Ethereum from B2C2 to satisfy margin calls triggered by Quoine Ltd's trading platform. The counterparties' market orders to buy Ethereum at the best available price on the platform were placed by Quoine Ltd's trading platform. These market orders were matched initially with lower-priced sell orders, until B2C2's sell orders were the lowest price available.³⁸ Quoine Ltd, which B2C2 accused of unlawfully reversing the disputed trading contracts, argued that the contracts were vitiated as B2C2's counterparties had purchased Ethereum at approximately

35 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [108]; *The Law of Contract in Singapore* (Andrew Phang Boon Leong gen ed) (Academy Publishing, 2012) at para 10.161; Andrew Phang Boon Leong, "Contract Formation and Mistake in Cyberspace – The Singapore Experience" (2005) 17 SAclJ 361 at 389.

36 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [111]; *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [79].

37 *The Law of Contract in Singapore* (Andrew Phang Boon Leong gen ed) (Academy Publishing, 2012) at para 10.159.

38 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [28]–[29].

250 times its market price under a unilateral mistake.³⁹ This ask price was issued by B2C2's algorithm because an update error on Quoine's platform thinned out the order book and deprived B2C2's algorithm of actual transactional data to generate an "output" ask price for Ethereum. B2C2's algorithm fell back on a pre-programmed "virtual price" (which was not obtained from the market) as an input to generate the "output" ask price for Ethereum: 10 Bitcoin for 1 Ethereum. The prevailing market rate was around 0.04 Bitcoin for 1 Ethereum.⁴⁰ The "virtual price" which B2C2's algorithm relied on was inserted by its programmer for the very situation in which there was no or insufficient inputs (or orders) in the trading platform's order book.⁴¹

24 According to the *Quoine* majority, if the NMP contracts via a deterministic AI, to demonstrate actual or constructive knowledge of the alleged unilateral mistake, the MP must prove that when programming the algorithm ("Quoine Majority Knowledge Test"):

- (a) the NMP's programmer did so with actual or constructive knowledge of the fact that the relevant offer by the trading algorithm would *only* ever be accepted by a party operating under a mistake ("First Requirement"); and
- (b) the programmer was acting to take advantage of such a mistake ("Second Requirement").⁴²

25 The Court of Appeal resolved the Knowledge Issue by looking to the programmer's knowledge. This is eminently sound given the programmer controls how a deterministic AI responds to inputs even post-deployment; the AI "only [does] what the programmer has programmed it to do".⁴³ Further, the relevant time for assessing the programmer's knowledge spans from the time of programming to the time of contract formation.⁴⁴

26 It bears emphasising that the foregoing was *obiter dicta* – the defence of unilateral mistake failed from the outset as a mistake as to the contract's terms was not established.⁴⁵ Nevertheless, the majority opined

39 *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [214] and [228]; *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [2].

40 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [17]–[18] and [27]–[29].

41 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [18].

42 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [103].

43 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [98]; *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [210]–[211].

44 *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [210]; *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [99].

45 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [115].

that neither limb of the *Quoine* Majority Knowledge Test was met. First, when programming the “obscene” virtual price which B2C2’s algorithm used to generate the sell price at which the trades were transacted, B2C2’s programmer did not have margin trades in mind. He could not have programmed the NMP’s algorithm knowing that, in situations of illiquidity on the trading platform when the order book was abnormally thin, margin calls and hence orders would be placed to purchase Ethereum at the best available price, thereby creating an opportunity for exploitation.⁴⁶ Second, there was no malice behind programming the exorbitant price as this was done to insulate B2C2 from adverse consequences during market uncertainty.⁴⁷

27 Although Simon Thorley IJ and the *Quoine* majority did not say so expressly, the *Quoine* Majority Knowledge Test arguably relies on rules of attribution to impute the programmer’s actual or constructive knowledge of the unilateral mistake to the NMP. If the programmer is an agent of the NMP, the agent’s knowledge of the unilateral mistake is imputed to the NMP *qua* principal.⁴⁸ Even if the programmer is not an agent, his state of mind is the most relevant for the purposes of the defence of unilateral mistake and is imputed to the latter under “special” rules of attribution.⁴⁹

(2) *Non-deterministic artificial intelligence*

28 However, *Quoine* left open how courts should determine the NMP’s state of knowledge if he or she contracted via a non-deterministic AI.⁵⁰

29 This author submits that if an NMP contracts via a non-deterministic AI, the *Quoine* Majority Knowledge test will generally be answered in the negative.⁵¹ NMPs may abuse non-deterministic AIs to circumvent the doctrine of unilateral mistakes.

30 For the remainder of the article, this author assumes that the NMP using a non-deterministic AI is the offeror. By way of an aside, situations where the NMP using a non-deterministic AI is the offeree may

46 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [119].

47 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [120].

48 *Halsbury’s Laws of Singapore* vol 15 (LexisNexis, 2019) at para 180.288.

49 *Ho Kang Peng v Scintronix Corp Ltd* [2014] 3 SLR 329 at [48] and [67].

50 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [98].

51 Kelvin Low & Eliza Mik, “Unpicking a Fin(e)tech Mess: Can Old Doctrines Cope in the 21st Century?” *Oxford Business Law Blog* (8 November 2019) <<https://www.law.ox.ac.uk/business-law-blog/blog/2019/11/unpicking-finetech-mess-can-old-doctrines-cope-21st-century>> (accessed 30 August 2020).

raise different considerations and, save for this brief discussion, is beyond the scope of this article. Imagine a situation where the mistaken party makes an offer at an abnormally low price. The NMP's non-deterministic AI accepts this offer. Would the *Quoine* Majority Knowledge Test, re-worded simply to fit this factual situation, be adequate? With regard to the First Requirement,⁵² one *possible* view is that the question would then be whether, when programming the algorithm, the NMP knew that the relevant offer would only ever be *given* by a party operating under a mistake. Evidently, such knowledge is not dependent on an understanding of the logic of the non-deterministic AI. It is simply rooted in the NMP's or programmer's contextual understanding of the market. If the First Requirement is satisfied, and assuming that profit-motivated NMPs or programmers would *not* prevent their AIs from accepting offers below a certain price, it appears that even the Second Requirement may be fulfilled. As such it might be interesting to consider, on a separate occasion, whether the law should distinguish situations where the AI-using NMP is the offeror and offeree, or whether it is conceptually neater to treat them alike. Even further still, there may be situations where both the MP and NMP transact via non-deterministic AIs.⁵³

31 Finally, for completeness, ascertaining the AI's state of knowledge itself is futile as present AI systems are not sentient and cannot harbour "knowledge" in the sense of a justified true belief that is attributable to the NMP.⁵⁴

(a) Maximum offer price programmed

32 Where the programmer has in effect set a maximum offer price for the non-deterministic algorithm, the *Quoine* Majority Knowledge Test should remain applicable. This may be achieved, such as in *Quoine*, by programming pre-determined "inputs" for the algorithm to fall back on in the absence of real-time market data. As the programmer actually addressed his mind to the limits within which he or his principal wanted to transact, evidence of these considerations may be adduced to meet

52 See para 24(a) above.

53 This author attempts to make sense of some of the issues in this final situation at para 98 below.

54 Ronan Hamon, Henrik Junklewitz & Ignacio Sanchez, *Robustness and Explainability of Artificial Intelligence – From Technical to Policy Solutions*, European Commission Joint Research Centre Technical Report (Publications Office of the European Union, 2020) at p 11; Sandra Wachter, Brent Mittelstadt & Chris Russell, "Counterfactual Explanations Without Opening the Black Box: Automated Decisions and the GDPR" (2018) 31(2) *Harvard Journal of Law & Technology* 841 at 846.

the *Quoine* Majority Knowledge Test.⁵⁵ For instance, if the price ceiling was chosen for rational commercial reasons, such as to provide a buffer in times of market volatility,⁵⁶ the Second Requirement of the *Quoine* knowledge test is unsatisfied and the contract survives in law and equity.

(b) No maximum offer price programmed

33 However, if no maximum offer price is pre-programmed, the *Quoine* Majority Knowledge Test is inadequate. Assume that an offer price is the output that a non-deterministic algorithm generates by assigning weights to various inputs including the current market price and trading volume.

34 The First Requirement of the *Quoine* Majority Knowledge Test asks if the programmer, when setting the relevant offer price, knew that only a mistaken counterparty would accept the offer. This presupposes that the programmer controls the non-deterministic AI's outputs post-deployment. However, for non-deterministic AIs, the programmer neither circumscribes nor knows with absolute certainty the range of offer prices the algorithm may issue.⁵⁷ Accordingly, the basis for applying the *Quoine* Majority Knowledge Test to determine actual and constructive knowledge disappears as the actual and reasonable programmer respectively lacks control over the AI's outputs.

35 As regards the Second Requirement, MPs will face immense difficulty proving that the programmer trained the non-deterministic AI to take advantage of potential mistakes. Given the problem of autonomy, the AI's logic, *viz*, the weights attached to each input, evolves as it interacts with real market data. The programmer does not limit the possible offer prices the AI system may issue. For instance, if the offer in dispute exceeds the range of outputs in training and test runs, this does not *ipso facto* entail malice by the programmer. Post-deployment, the algorithm could have uncovered a statistical relationship among the inputs that eludes human comprehension. Even the programmers of Google's AlphaGo could not explain how it derived the strategies that defeated Lee Sedol at the game of Go.⁵⁸ Likely, programmers will raise the black box to deny any intention to program the AI to take advantage of potential mistakes.

55 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [119]–[121].

56 *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [113] and [121].

57 *Model Artificial Intelligence Governance Framework* (Infocomm Media Development Authority & Personal Data Protection Commission Singapore, 2nd Ed, 2020) at paras 3.32–3.33.

58 Simon Chesterman, "Through A Glass, Darkly: Artificial Intelligence and the Problem of Opacity" NUS Law Working Paper 2020/011 (April 2020) at p 5.

36 Even co-opting Nik Yeo's modifications to the *Quoine* Majority Knowledge Test – asking whether from the time of training the non-deterministic AI to contract formation, the programmer *reasonably foresaw* that the AI's offer would *likely* be accepted by an MP – is insufficient.⁵⁹ Satisfying this threshold presupposes that the AI programmer knows, from training and historical outputs, that the algorithm has a tendency to weight particular inputs incorrectly or disproportionately. However, without being privy to why the algorithm weighted the inputs in the manner it did *ab initio*, the programmer is unable to assess the correctness of those weights and predict the risk of an unreasonable output being issued.

37 Admittedly, between deployment and contract formation, the programmer has actual or constructive notice of market fluctuations or abnormal market data that the AI encounters. He or she could investigate how the AI weighted inputs differently post-fluctuation. However, even so, the programmer will not know *why* the AI adjusted the weights, if at all, and is in no better position to predict abnormal behaviour by the algorithm.

38 Finally, even under the test of wilful blindness, the programmer must have had a *real reason* to suspect that the AI's offer would only be accepted due to a unilateral mistake. Arguably, this threshold is not easily met. In *Wong Chong Hui v Lim Siong Hoe Lawrence*, when concluding a settlement agreement with the insured, the court found that the insurer was not wilfully blind to the insured's mistaken assumption that the agreement only settled property damage, but not personal injury claims. This was despite the insurer accessing an accident report referencing the insured's personal injuries.⁶⁰ In *OT Africa Line Ltd v Vickers plc*, the plaintiff was not wilfully blind to the defendant's mistake as to the quantum and currency of the settlement offer of £150,000 conveyed by the defendant's solicitors, despite it being roughly half way between the defendant's previous offer of US\$155,000 and the plaintiff's counter-offer of US\$300,000.⁶¹ Even if the non-deterministic algorithm issued an abnormal offer price during training and historical runs, programmers may invoke the black box to deny having a real reason for questioning the algorithm's logic.

59 Nik Yeo, "Mistakes and Knowledge in Algorithmic Trading: The Singapore Court of Appeal Case of *Quoine v B2C2*" (2020) 5 *Journal of International Banking & Financial Law* 300 at 304.

60 *Wong Chong Hui v Lim Siong Hoe Lawrence* [2019] 4 SLR 989 at [9]–[11].

61 *OT Africa Line Ltd v Vickers plc* [1996] CLC 722 (QB) at 726.

39 Where the *Quoine* Majority Knowledge Test is so readily outflanked, the law must adapt. Courts should not force into a Procrustean bed principles that are unfit for novel technologies. Whether negligent training or programming itself attracts civil or criminal liability is beyond the scope of this article.⁶²

(c) The black box – Impregnable?

40 Before proceeding, it behoves this author to ask if the black box is penetrable, thereby allowing the *Quoine* Majority Knowledge Test to apply to non-deterministic algorithms.

41 There are tools that aid in revealing the weights ascribed to various inputs by non-deterministic algorithms.⁶³ However, these do not open the black box fully. We are none the wiser as to why the algorithm weighted the inputs in the manner it did.

42 One such tool is counterfactual probes. By varying each input and recording the sensitivity of outputs to such a change, the relative weight of each input is ascertainable.⁶⁴ However, the probes evidently do not open the black box in the sense described above.

43 A second tool is a generative adversarial network (“GAN”) consisting of two ANNs. As the “generator” network generates outputs, the “adversary” network detects incorrect outputs and prompts the generator to try again. This back-and-forth reveals wrong assumptions made by the generator network. For instance, when prompted to imagine a “bird sitting on a branch”, a generator network assumed that a tree branch, *sans* the bird, was sufficient.⁶⁵ However, while GANs may reveal inputs that were accorded disproportionately high or low weights, this *ex post facto* analysis does not enable the programmer to predict if the non-deterministic algorithm will issue an unreasonable offer which only a mistaken offeree would accept.

62 Penal Code Review Committee Singapore, *Report* (August 2018) at paras 12–16; see also Law Reform Committee, Singapore Academy of Law, *Report on Criminal Liability, Robotics and AI Systems* (February 2021) (Co-Chairpersons: Justice Kannan Ramesh & Charles Lim Aeng Cheng) and Law Reform Committee, Singapore Academy of Law, *Report on the Attribution of Civil Liability for Accidents Involving Autonomous Cars* (September 2020) (Co-Chairpersons: Justice Kannan Ramesh & Charles Lim Aeng Cheng).

63 *Model Artificial Intelligence Governance Framework* (Infocomm Media Development Authority & Personal Data Protection Commission Singapore, 2nd Ed, 2020) at para 3.29; Paul Voosen, “The AI Detectives” (2017) 357(6346) *Science* 22 at 24.

64 Paul Voosen, “The AI Detectives” (2017) 357(6346) *Science* 22 at 24.

65 Paul Voosen, “The AI Detectives” (2017) 357(6346) *Science* 22 at 25.

44 To prevent the Lacuna from immunising non-deterministic AI-users from the doctrine of unilateral mistakes, the knowledge requirement should be adapted by the courts or Parliament.

IV. Reforming the law of unilateral mistakes

45 If the NMP contracts using a non-deterministic algorithm, it is unlikely that actual or constructive knowledge will be proven on existing principles. Given the lack of contemporaneous human involvement by the NMP at contract formation, the solution, if any, lies in equity and not law. This author first considers the relevance of evidence law before asking whether the MP may invoke the court's equitable jurisdiction even if existing categories of knowledge are not established.

46 This section concludes that: (a) evidence law is of little assistance to MPs; (b) Jonathan Mance J's test⁶⁶ lacks authority and is not within the court's power to adopt; (c) for policy reasons, Mance J's test should be codified in a modified form; and (d) the unconscionability requirement in equitable unilateral mistakes may be satisfied even where the NMP is only apprised of the mistake post-contract formation.

A. Section 108 of the Evidence Act

47 Albeit regarding tortious claims involving AI, the European Union ("EU") has contemplated shifting the burden from the victim to the AI-user or developer to disprove causation because an algorithm's decision-making process "may not be readily explicable and often requires costly analysis by experts".⁶⁷ However, this author submits that shifting the legal burden of proving knowledge under Singapore's Evidence Act⁶⁸ ("EA") will not, in practice, benefit the MP as the NMP can raise the black box as a "shield".

48 *Prima facie*, the MP pleading a unilateral mistake bears the legal burden of proving its requisite elements.⁶⁹ However, s 108 of the EA shifts the legal burden to the NMP if the fact in question is "especially within the knowledge of [that] person";⁷⁰ this threshold is met if it is

66 See para 54 below.

67 Expert Group on Liability and New Technologies – New Technologies Formation, *Liability for Artificial Intelligence and Other Emerging Digital Technologies* (Publications Office of the European Union, 2019) at pp 20–21.

68 Cap 97, 1997 Rev Ed.

69 Evidence Act (Cap 97, 1997 Rev Ed) ss 103–105.

70 Evidence Act (Cap 97, 1997 Rev Ed) s 108.

disproportionately difficult for the party originally bearing the burden of proof to prove the fact.⁷¹

49 Assuming the *Quoine* Majority Knowledge Test applies, whether it is satisfied arguably falls within the especial knowledge of the NMP and its programmer (unless the algorithm's code is open-source and its logic is completely explainable). The NMP and its programmer are privy to the nature of the algorithm, its training methodology, training data and the reasons behind those programming decisions. Without such information, it is disproportionately difficult for the MP to prove that the *Quoine* Majority Knowledge Test is satisfied.

50 However, shifting the burden of proof under s 108 of the EA is unlikely to benefit the MP. Under the First Requirement of the *Quoine* Majority Knowledge Test, the NMP will simply invoke the black box to prove that, because the AI's logic is unexplainable, it could not have known that the *only* reason a counterparty would accept the offer is a mistake. Even under the Second Requirement, the NMP will likely raise commercial reasons for deploying the non-deterministic algorithm with humans out-of-the loop to rebut the allegation that it sought to take advantage of unsuspecting counterparties.

51 Ultimately, reversing the burden of proof in respect of the knowledge requirement in unilateral mistakes is cold comfort for MPs. To do justice between the parties, reform by the Judiciary or Legislature is imperative.

B. Judicial law-making?

(1) *The Quoine minority: unilateral mistakes in equity and sui generis actual knowledge*

52 Mance IJ, dissenting in *Quoine*, objected to the MP bearing the risk of being bound by an algorithmic contract which anyone learning of would at once see could only be the result of some fundamental error in the normal operation of the computers involved.⁷²

53 The learned judge introduced a *sui generis* test for knowledge in equity on the grounds that the underlying premise of the doctrine was a principle of justice.⁷³ As Mance IJ was speaking in the context

71 *Public Prosecutor v Chee Cheong Hin Constance* [2006] 2 SLR(R) 24 at [95].

72 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [193].

73 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [181].

of a deterministic algorithm, his reasoning will be outlined before its suitability for application to non-deterministic algorithms is assessed.

(a) *Sui generis* knowledge in equitable unilateral mistakes

54 Mance J opined that equity should render a contract voidable where (“Mance J’s Test”):

- (a) any “honest and reasonable trader”⁷⁴ *would* at once have identified that there has been a fundamental mistake as soon as a computerised transaction comes to their attention (“*Sui Generis* Knowledge”);
- (b) no detriment has occurred (*eg*, NMP has not changed his position);
- (c) no relevant third party interests intervened; and
- (d) the mistake can readily be rectified.⁷⁵

55 Mance J clarified that his test is not for constructive knowledge, but something closer to or paralleling actual knowledge.⁷⁶ Mance J arguably augmented the five-fold classification of knowledge with what this author terms, for convenience, “*Sui Generis* Knowledge”.⁷⁷ It is *sui generis* in the sense that knowledge is assessed pursuant to an altered factual matrix – the algorithm is replaced by a reasonable trader.

56 Accordingly, Mance J’s Test departs from the *Quoine* majority’s in two respects. First, under the latter test, knowledge of the mistake must exist between the time of programming and contract formation.⁷⁸ Contrastingly, Mance J’s Test contemplates rescission even if the NMP gains knowledge of the mistake after contract formation.⁷⁹ Second, the majority examines the programmer’s and/or AI-user’s mental state while Mance J examines the mental state of the reasonable trader in the NMP’s position *after* being apprised of the transaction in question.⁸⁰

74 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [195] and [198].

75 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [183].

76 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [178] and [204].

77 *Baden v Societe Generale pour Favoriser le Developpement du Commerce et de L’Industrie en France SA* [1993] 1 WLR 509 at 575–576.

78 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [99]; *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [210].

79 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [194]–[195], [200] and [204].

80 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [99] and [183].

57 Notwithstanding equity's flexibility,⁸¹ to determine if Mance J's Test is a principled expansion to unilateral mistakes in equity, the reasons underpinning his approach are relevant.

58 First, Mance J criticised the majority's test for disregarding the market circumstances surrounding the actual transaction ("First Reason"). In contrast, Mance J's Test considers if there was anything drastically unusual about the surrounding circumstances or market conditions such that a reasonable trader would have known that the offer was accepted under a mistake.⁸² To him, it was artificial and onerous to prove that the NMP's programmer was "aware in advance" that the offer would only ever be accepted if some fundamental mistake occurred.⁸³

59 Second, Mance J regarded it "unconscionable" to lock the MP in a contract if *Sui Generis* Knowledge was established ("Second Reason").⁸⁴ While acknowledging his test undermined certainty in contracts, the needs of justice outweighed legal certainty.⁸⁵ His test promoted the underlying rationale of unilateral mistakes: upholding "justice", "considerations of fair dealing" and the "natural expectations of reasonable traders".⁸⁶

60 Finally, Mance J emphasised that there is nothing "surprising ... about a test which asks what any reasonable trader would have thought, given knowledge of the particular circumstances".⁸⁷ Similar "objective approach[es]" were found in tort and criminal law (eg, the tort of dishonest assistance)⁸⁸ ("Third Reason").

61 On the facts, Mance J held that the only explanation for the counterparties' acceptance of B2C2's offer was a major error.⁸⁹ B2C2's trading contracts were thus voidable.

(b) Whither Mance J's Test?

62 This author submits that Mance J's Test is too far a departure from principles governing unilateral mistakes in law and equity for a court to adopt. If at all, his test should be implemented through legislative reform.

81 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [77].

82 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [192].

83 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [200].

84 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [205].

85 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [184].

86 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [181] and [195]–[196].

87 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [200].

88 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [199]–[200].

89 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [182] and [201].

63 First, knowledge has always been ascertained in light of the actual transaction. Actual knowledge, objectively ascertained, depends on what a reasonable person *in a similar situation* would have known.⁹⁰ Even for constructive knowledge, equity asks what a reasonable person *in the position* of the NMP ought to have known.⁹¹ Canada,⁹² Australia⁹³ and Art 3.2.2(1)(a) of the UNIDROIT⁹⁴ Principles of International Commercial Contracts 2016⁹⁵ (“UPICC”) agree that constructive notice is rooted in the actual circumstances of the case. Equity has long cautioned that constructive knowledge is “contrary to the truth” and should not be extended.⁹⁶

64 While chastising the *Quoine* Majority Knowledge Test for ignoring the transaction’s context (*ie*, the First Reason), Mance J’s Test is equally artificial. It removes the NMP’s algorithm from the equation, even if parties consented to the absence of human elements in the trades.⁹⁷ In other words, *Sui Generis* Knowledge is unsupported by existing legal or equitable principles.

65 Second, notwithstanding Mance J’s Second Reason, unconscionability as a rationale *per se* is arguably insufficient for Singapore’s courts to depart from existing principles circumscribing constructive knowledge.⁹⁸ Singapore’s courts favour incremental developments to the law.⁹⁹ Predictability and certainty in commercial dealings will be undermined if equity expands the mistake exception with “alacrity or uncertainty”.¹⁰⁰ Innocent third party interests may also be threatened if the doctrine of unilateral mistake acquires an overly broad reach.¹⁰¹

90 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [41].

91 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [108]; *B2C2 Ltd v Quoine Pte Ltd* [2019] 4 SLR 17 at [233]; *The Law of Contract in Singapore* (Andrew Phang Boon Leong gen ed) (Academy Publishing, 2012) at para 10.161; Andrew Phang Boon Leong, “Contract Formation and Mistake in Cyberspace – The Singapore Experience” (2005) 17 SAclJ 361 at 389.

92 [1989] BCJ No 278 (QL) at [16]; *Alcan Auto Parts Ltd v Parkland Farm Power & Equipment Ltd* [1990] BCWLD 1250 at [31].

93 *Taylor v Johnson* (1983) 151 CLR 422 at 428.

94 *Ie*, International Institute for the Unification of Private Law.

95 UNIDROIT Principles of International Commercial Contracts 2016 at p 103.

96 *The English and Scottish Mercantile Investment Co, Ltd v Brunton* [1892] 2 QB 700 at 707–708.

97 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [97].

98 *BOM v BOK* [2019] 1 SLR 349 at [119].

99 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [79].

100 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2004] 2 SLR(R) 594 at [105].

101 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2004] 2 SLR(R) 594 at [105].

66 Furthermore, Mance J's Third Reason lacks force. Under the tort of dishonest assistance, while the normative standard of honesty is objectively ascertained, it is applied against what the alleged assister subjectively knew.¹⁰² *Sui generis* actual knowledge finds little support from existing tort and criminal law.

67 Finally, Mance J's Test departs from authority in another respect. It affords rescission even if the NMP only gained cognisance of the mistake post-contract formation. Hitherto, equity's jurisdiction under unilateral mistakes is not invoked if the NMP's conscience is clear when the contract is formed.¹⁰³

68 Due to the foregoing concerns, the doctrinal basis for judicial adoption of Mance J's Test is tenuous. While the courts do "make" law, this is only permissible when developing the principles of common law and equity. Courts cannot create or amend laws based on extra-legal policy considerations.¹⁰⁴ Therefore, this author submits that the case for adopting Mance J's Test rests on policy reasons (subsequently explored), rather than authority, and should thus be adopted by Parliament.¹⁰⁵

C. *Foreign approaches to unilateral mistakes*

69 This subsection canvasses several foreign approaches to the doctrine of unilateral mistakes before proceeding, in the next sub-section, to propose codifying a modified version of Mance J's Test to promote fairness and equitable risk-allocation if non-deterministic algorithms are involved in contract formation.

(1) *The US*

70 In the US, knowledge of the unilateral mistake is unnecessary. Section 153(a) of *Restatement of the Law Second, Contracts* states that even if the NMP lacks knowledge of the mistake, the contract is voidable if the "enforcement of the contract would be unconscionable".¹⁰⁶ This rule has been adopted by states such as California.¹⁰⁷

102 *George Raymond Zage III v Ho Chi Kwong* [2010] 2 SLR 589 at [22]; *Barlow Clowes International Ltd v Eurotrust International Ltd* [2006] 1 WLR 1476 at 1481.

103 *Riverlate Properties Ltd v Paul* [1975] 1 Ch 133 at 141.

104 *Lim Meng Suang v Attorney-General* [2015] 1 SLR 26 at [77] and [79].

105 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [79].

106 *Restatement of the Law Second Contracts* vol 1 (American Law Institute, 1979) at pp 394–395.

107 *Donovan v RRL Corp* 27 P 3d 702 at 716 (Cal, 2001).

71 In § 153(a) of *Restatement of the Law Second, Contracts*, unconscionability refers to unconscientious behaviour other than at the time of contract formation.¹⁰⁸ Cases like *Donovan v RRL Corp*¹⁰⁹ suggest that courts are willing to unwind a contract if the NMP stands to gain a windfall – the economic impact of the mistake is a significant factor in the unconscionability calculus.¹¹⁰

72 However, this author submits that following the US's approach in Singapore risks codifying a broader doctrine of unconscionability than that in *The Commercial Bank of Australia Ltd v Amadio* which was rejected in *BOM v BOK*.¹¹¹ Freedom and sanctity of contract are hallowed principles in English and Singaporean contract law – courts should not “construct for the parties contracts which they have not in terms made by importing implications which would appear to make the contract more businesslike or more just”.¹¹² Singapore's legislature should therefore be slow to import a broad doctrine of unconscionability.

(2) *Germany*

73 Likewise, the German Civil Code (“BGB 2002”) regards knowledge of the unilateral mistake as sufficient, but unnecessary. Section 119(1) of the BGB 2002 renders a contract voidable if the MP “would not have made the declaration [of will] with knowledge of the factual position and with a sensible understanding of the case”. However, the MP must compensate the NMP for reliance loss flowing from the latter's reliance on the contract unless the NMP had actual or constructive knowledge of the mistake.¹¹³

74 However, Germany's approach is unsuitable for Singapore as removing the knowledge requirement is contrary to the rationales underlying the doctrine of unilateral mistakes in law and equity. At common law, the occurrence of a unilateral mistake indicates a lack of *consensus ad idem*.¹¹⁴ Actual knowledge of this lack of consensus is what makes it unfair for the NMP to enforce the agreement.¹¹⁵ In equity, it is

108 Melvin A Eisenberg, *Foundational Principles of Contract Law* (Oxford University Press, 2018) at p 574.

109 27 P 3d 702 at 723–724 (Cal, 2001).

110 Melvin A Eisenberg, *Foundational Principles of Contract Law* (Oxford University Press, 2018) at p 575.

111 *The Commercial Bank of Australia Ltd v Amadio* (1983) 151 CLR 447 at 474; *BOM v BOK* [2019] 1 SLR 349 at [133], [140] and [142].

112 *Bell v Lever Brothers Ltd* [1932] AC 161 at 226.

113 Civil Code 2002 (Germany) § 122.

114 See para 15 above.

115 See paras 14–44 above and *Halsbury's Laws of Singapore* vol 7 (LexisNexis, Reissue, 2019) at para 80.164.

the NMP's constructive knowledge of the mistake which grounds equity's jurisdiction. If the NMP's conscience is clear at the time of the transaction as he lacked knowledge of the mistake, why should equity unwind the transaction?¹¹⁶

75 Absent such knowledge, the law should not vitiate the contract. Doing so would introduce "intolerable uncertainty in contractual arrangements" as the mere assertion of a subjective mistake would override objective *consensus ad idem*.¹¹⁷ Canadian courts similarly stress the importance of knowledge despite having fused the application of legal and equitable principles of mistake.¹¹⁸ The British Columbia Supreme Court in *Windjammer Homes Inc v Generation Enterprises* noted that contract law "would become a farce if a party could, after agreement, shed his obligations by simply pleading that he had been mistaken over some matter concerned with the contract".¹¹⁹ Retaining the knowledge requirement also encourages potential contractors to take reasonable precautions.¹²⁰ The question is how the knowledge requirement should be adapted.

(3) *UNIDROIT Principles of International Commercial Contracts 2016*

76 UPICC provides a restatement of the general principles of international contract law; it governs, *inter alia*, if the parties so agree.¹²¹ Under Art 3.2.2(1)(b) of UPICC, a contract is voidable if, *inter alia*, the NMP has not "reasonably acted in reliance on the contract" at the time of avoidance. Thus, if a mistaken buyer demands a reversal of the transaction before the seller deals with the money received, the buyer is not bound by the contract.¹²²

116 *Riverlate Properties Ltd v Paul* [1975] 1 Ch 133 at 141.

117 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [81]; Bridget McLay, "Rectification for Unilateral Mistake: Time for a Conceptual Revision?" (2016) 22 *Auckland University Law Review* 315 at 327.

118 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [51].

119 *Windjammer Homes Inc v Generation Enterprises* [1989] BCJ No 278 (QL) at [13].

120 Hugh Beale, *Mistake and Non-Disclosure of Facts: Models for English Contract Law* (Oxford University Press, 2012) at pp 80–81.

121 Model Clauses for the Use of the UNIDROIT Principles of International Commercial Contracts at para 2 <<https://www.unidroit.org/instruments/commercial-contracts/upicc-model-clauses>> (accessed 30 August 2020); UNIDROIT Principles of International Commercial Contracts 2016 at p 1.

122 Working Group for the Preparation of Principles for International Commercial Contracts, UNIDROIT, *Summary Records of the Meeting Held in Rome from 16 to 20 January 1989* (June 1989) at p 14 (Secretariat: Lana Peters).

77 However, as it is not the court's role to re-write a bad bargain, the UPICC's approach risks advancing substantive fairness at the expense of certainty for commercial parties who undertake future planning.¹²³ If the US's approach containing a threshold of unconscionability is not adopted, *a fortiori*, the UPICC's lower threshold for rescission in unilateral mistakes is unsuitable in Singapore.

D. Legislative reform – Singapore

(1) Reform 1: Modifying Mance J's Test

78 Mance J's Test, while arguably an unprincipled expansion to the doctrine of unilateral mistakes in equity, may, through modification better balance the competing policies of contractual certainty and fairness than the foregoing approaches.¹²⁴

(a) *Sui generis* constructive knowledge?

79 Preliminarily, this author proposes to frame Mance J's Test as being more similar to constructive, rather than actual knowledge: what *should* a reasonable trader have known?¹²⁵ The *raison d'être* of *sui generis* knowledge is to ameliorate injustice by imputing knowledge where none actually exists. It is analogous to the equitable device of constructive notice which is likewise a legal fiction that serves to further the ends of justice.¹²⁶ Constructive knowledge better accommodates the artificiality involved in Mance J's Test than actual knowledge.

80 However, Mance J's Test still defies the authorities which infer constructive knowledge from the actual circumstances of the transaction. It also departs from the *laissez-faire* philosophy of classical contract law, which eschews intervention in contracts due to fairness or justice, by

123 *Riverlate Properties Ltd v Paul* [1975] 1 Ch 133 at 141; Gareth Spark, *Vitiating of Contracts: International Contractual Principles and English Law* (Cambridge University Press, 2013) at p 149.

124 Kelvin Low & Eliza Mik, "Unpicking a Fin(e)tech Mess: Can Old Doctrines Cope in the 21st Century?" *Oxford Business Law Blog* (8 November 2019) <<https://www.law.ox.ac.uk/business-law-blog/blog/2019/11/unpicking-finetech-mess-can-old-doctrines-cope-21st-century>> (accessed 30 August 2020); Nik Yeo & Joseph Farmer, "Mapping the Landscape: Cryptocurrency Disputes under English Law (Part 2)" (2019) 5 *Journal of International Banking & Financial Law* 290 at 291.

125 Nik Yeo, "Mistakes and Knowledge in Algorithmic Trading: The Singapore Court of Appeal Case of *Quoine v B2C2*" (2020) 5 *Journal of International Banking & Financial Law* 300 at 304.

126 *The English and Scottish Mercantile Investment Co, Ltd v Brunton* [1892] 2 QB 700 at 708 and 718.

broadening the grounds for rescission.¹²⁷ Despite these concerns, for the following four policy reasons, this author endorses the adoption of a *modified* Mance IJ Test¹²⁸ to correct the injustice of denying an MP any reasonable opportunity of equitable relief.

(i) Abusing the black box

81 First, NMPs should not be allowed to abuse the black box to circumvent the defence of unilateral mistakes. As argued above,¹²⁹ the *Quoine* Majority's Knowledge Test is an onerous standard for the MP to overcome when the NMP employs a non-deterministic algorithm, even with the benefit of s 108 of the EA. By preventing the enforcement of "contracts" where there is no *consensus ad idem*, or where the NMP's conscience is tainted, the doctrine of unilateral mistakes upholds notions of fair dealing.¹³⁰ To pre-empt non-deterministic algorithms from becoming vehicles for exploitative trade practices, the law should hold AI users to the same standards of commercial dealing by unwinding contracts where *sui generis* constructive knowledge is found.

82 The *Quoine* majority criticised Mance IJ's Test for being disconnected from reality – the trades had been conducted algorithmically, rather than on an imagined meeting on some trading floor, and the parties had not bargained for a right to review, confirm or invalidate any ensuing contract.¹³¹ However, as argued by Allen Sng, the *Quoine* majority's approach overlooks the following:¹³²

[It] does not take into account the extent which parties in algorithmic contracting are able to bargain for such risks of mistakes to be reallocated. Menon CJ's approach may be best applied in the context where (a) all contracting parties were aware that they were contracting with deterministic algorithms; (b) there was some antecedent agreement between the involved parties, such as platform terms; and (c) parties are sophisticated and were able to negotiate the risk allocation.

83 A retail investor, for instance, would agree to the terms of a trading platform "on a take it or leave it basis. How can such investors realistically ask for platform terms to allow [themselves] a right to

127 Kwek Mean Luck, "Law, Fairness and Economics – Unilateral Mistake in *Digilandmall*" (2005) 17 SAclJ 411 at 411–412.

128 See para 108(b)(i) below.

129 See paras 33–39 above.

130 *Thomas Bates & Son Ltd v Wyndham's Ltd* [1981] 1 WLR 505 at 520; *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [195].

131 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [104].

132 Allen Sng Kiat Peng, "Contract Formation and Mistake in Cyberspace (Again): The Story So Far and Where to Next?" (2021) 33 SAclJ 692 at 717.

review if their contracts were entered into due to computational errors on their end?”¹³³ Accordingly, in the interest of preventing the abuse of non-deterministic AI and having the imbalance of bargaining power catching unsophisticated investors unawares, Mance IJ’s Test warrants serious consideration. Naturally, however, different investors have different levels of sophistication. This author is therefore not opposed to the future legislative regime allowing sophisticated investors to *opt out* of the presumptive starting point (*ie*, a modified Mance IJ’s Test¹³⁴) and negotiate risk allocation among themselves separately.

(ii) Functional equivalence

84 Second, the closely related policy of functional equivalence militates in favour of a modified Mance IJ Test.¹³⁵ All else constant, if the contract would be voidable if the NMP contracted via a human agent or deterministic algorithm instead of a non-deterministic algorithm, why should rescission be disallowed in the latter situation?

85 Promoting functional equivalence has driven previous legislative developments in Singapore. The Electronic Transactions Act¹³⁶ (“ETA”) ensures functional equivalence between electronic and paper-based transactions by recognising the binding nature of the former.¹³⁷ In particular, s 16(1) of the ETA, which codifies Art 14 of the United Nations Convention on the Use of Electronic Communications in International Contracts¹³⁸ (“UNCUEC”), aligns the outcomes regardless of whether the MP communicates with an automated message system or a natural person to conclude the contract. In the former situation, it is “almost impossible” to prove actual or constructive knowledge of an error since the NMP contracted through an “automated process”.¹³⁹ The ETA jettisons the knowledge requirement and entitles the MP to withdraw portions of the electronic communication that contain input errors if, among other requirements, the NMP is notified of said error as soon as possible.

133 Allen Sng Kiat Peng, “Contract Formation and Mistake in Cyberspace (Again): The Story So Far and Where to Next?” (2021) 33 SAclJ 692 at 718.

134 See para 108(b)(i) below.

135 See para 108(b)(i) below.

136 Cap 88, 2011 Rev Ed.

137 Cap 88, 2011 Rev Ed; Jeffrey Chan Wah Teck, “Legal Issues in E-commerce and Electronic Contracting: The Singapore Position”, at the ASEAN Law Association 8th General Assembly (29 November–2 December 2003) Workshop V, Paper IV at p 17.

138 23 November 2005, (entry into force 1 March 2013).

139 United Nations Convention on the Use of Electronic Communications in International Contracts (23 November 2005), (entry into force 1 March 2013) at p 74.

86 Similarly, Mance J's Test promotes functional equivalence between situations where the NMP contracts via a non-deterministic algorithm and other situations; this prevents the MP from losing an equitable remedy merely because the NMP deployed a non-deterministic algorithm. Mance J's Test is preferred over s 16 of the ETA as the remedy contemplated under the latter is withdrawal of a *portion* of the communication; this may not necessarily affect the validity of the contract. As the doctrine of unilateral mistakes contemplates rescission of the *contract*, retaining the knowledge requirement is preferable. Admittedly, functional equivalence does not justify adopting the modified Mance J's Test in all scenarios.¹⁴⁰

(iii) Risk allocation

87 Third, economically, the risk of non-deterministic algorithms issuing abnormal or unreasonable offers should presumptively lie with the NMP or AI-user. Such offers could result, for instance, from disproportionately high weights being accorded to anomalous data from a market bubble, speculative trading or market manipulation. While Mance J's Test lacks direct authority, it comports with a growing consensus that manufacturers or developers of AI should bear responsibility and risk for injury caused by the AI in tort law.¹⁴¹ Further, using the law of unilateral mistakes to more efficiently allocate risk is not novel. Risk allocation was cited by Kwek Mean Luck to explain the outcome in *Chwee Kin Keong v Digilandmall.com Pte Ltd*¹⁴² ("*Digiland*") where the contract was voided as the buyer snapped up a bargain, *viz*, a grossly under-priced laser printer on a website.¹⁴³ Kwek argued that the law on unilateral mistakes was used in *Digiland* to spread risk equitably between online vendors and online purchasers. If online vendors wholly shouldered the risk of online pricing mistakes, vendors would turn to insurance and pass on increased costs to consumers. Overall, it would be less costly to society to vitiate the contract in question by unilateral mistake.

140 See para 108(b)(i) below. An exception to the Test is discussed subsequently at para 98.

141 Expert Group on Liability and New Technologies – New Technologies Formation, *Liability for Artificial Intelligence and Other Emerging Digital Technologies* (Publications Office of the European Union, 2019) at pp 39–44; Simon Chesterman, "Artificial Intelligence and the Problem of Autonomy" (2020) 1(2) *Notre Dame Journal on Emerging Technologies* 210 at 218–222; Yavar Bathaee, "The Artificial Intelligence Black Box and the Failure of Intent and Causation" (2018) 31(2) *Harvard Journal of Law & Technology* 890 at 936.

142 [2005] 1 SLR(R) 502.

143 Kwek Mean Luck, "Law, Fairness and Economics – Unilateral Mistake in *Digilandmall*" (2005) 17 SAclJ 411 at 421–422.

88 Codifying Mance J’s Test would allocate the risk of the non-deterministic algorithm performing unreasonably to the AI-user. Risk is shifted to the NMP as the statutory scope of unilateral mistakes will be broader than unilateral mistakes in equity – mere *sui generis* constructive knowledge will open the contract to rescission.

89 The question is why risk-allocation should “prejudice” the non-deterministic AI-user or NMP bearing in mind that both parties could be innocent or negligent to varying degrees? Assume *arguendo* that both parties are equally negligent. For the following reasons, this author maintains that the loss should lie with the AI-user or NMP.

90 First, the NMP or AI-user should bear the risk as he or she is the cheapest cost avoider or taker of insurance. For instance, the NMP could have deployed the algorithm with humans-in-the-loop, consigning the algorithm to an advisory role, or used deterministic algorithms instead. As the party who created an algorithm which is non-deterministic and reasons in a non-linear manner, benefits from the algorithm and controls its use, the NMP or AI-user should bear the risk of third-party losses and insure itself accordingly. Arguably, this “cheapest cost avoider” policy also underpins the statutory requirement to obtain liability insurance in respect of motor vehicles – the vehicle’s owner or operator presumptively bears the risk of third-party injuries.¹⁴⁴

91 Second, overall social cost would fall if non-deterministic AI-users bear the risk. This argument is premised on an assumption that the number of non-deterministic AI-users, currently, forms a minority of traders or investors. If so, it would be less socially costly for these non-deterministic AI-users to take insurance than to foist the cost of insurance on the remainder of the investing community.

92 Naturally, however, the foregoing risk allocation is an imperfect solution. For one, an MP’s degree of negligence or fault may affect where the equities fall.¹⁴⁵ The presumptive allocation of risk could shift in exceptional cases where the MP demonstrated gross negligence. Additionally, non-AI users may become complacent when scrutinising transactions given *sui generis* constructive knowledge expands the scope for rescission. However, this author suggests that this is unlikely if:

144 Motor Vehicles (Third-Party Risks and Compensation) Act (Cap 189, 2000 Rev Ed) s 3(1); Expert Group on Liability and New Technologies – New Technologies Formation, *Liability for Artificial Intelligence and Other Emerging Digital Technologies* (Publications Office of the European Union, 2019) at p 35.

145 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [111]; *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [79].

(a) Parliament limits the operation of Mance J's Test;¹⁴⁶ and (b) courts are vigilant in determining if the MP's gross negligence precludes equitable relief, such as where the MP is a highly experienced trader or received professional advice on the trade.

(iv) Encouraging explainable AI

93 Finally, the effect of allocating the risk of non-deterministic AIs performing unexpectedly to their users is to encourage the development and use of explainable AI. This, however, presents a trade-off. Encouraging explainability may hinder the development of non-deterministic AI, arguably violating the principle of technological neutrality which eschews unreasonable discrimination among technologies.¹⁴⁷ Further, as non-deterministic systems can perform complex operations more accurately than deterministic systems, hampering the former's development impedes AI's computational advancement.¹⁴⁸

94 Notwithstanding the above, this author supports the encouragement of explainable AI. First, explainability allows AI to be audited.¹⁴⁹ By uncovering the AI's overall logic, the law may allocate risk and liability for losses more equitably and allow persons to contest AI decisions. AI users or developers should not be above the law. Further, with aggressive research in explaining black box models and transparency by design, potentially, computational advancement and explainability may not be mutually exclusive.¹⁵⁰

146 Discussed at paras 97–98 below.

147 Chris Jay Hoofnagle, "Should Regulation be "Technology Neutral?" *hoofnagle.berkeley.edu* (2 February 2018) <<https://hoofnagle.berkeley.edu/2018/02/02/should-regulation-be-technology-neutral/>> (accessed 15 August 2020).

148 Miriam C Buiten, "Towards Intelligent Regulation of Artificial Intelligence" (2019) 10 *European Journal of Risk Regulation* 41 at 58.

149 Law Reform Committee, Singapore Academy of Law, *Applying Ethical Principles for Artificial Intelligence in Regulatory Reform* (July 2020) at para 2.40 (Co-Chairpersons: Justice Kannan Ramesh & Charles Lim Aeng Cheng).

150 Riccardo Guidotti *et al*, "A Survey of Methods for Explaining Black Box Models" (2018) 51(5) *ACM Computing Surveys* at pp 14 and 17.

95 Second, jurisdictions like the EU,¹⁵¹ the UK,¹⁵² the US¹⁵³ and Australia¹⁵⁴ are gravitating towards explainability to hold AI users or developers accountable and expose automated decisions to review. For instance, Arts 13(2)(f) and 14(2)(g) of the EU General Data Protection Regulation¹⁵⁵ (“GDPR”) require “meaningful information of the logic involved”, *viz*, the rationale or criteria relied on by the AI to be disclosed to affected persons.¹⁵⁶ Mance J’s Test similarly balances the social benefits and costs of non-deterministic AI and aligns with in-principle support for explainability in Singapore.¹⁵⁷

(b) Further modifications

96 Two further modifications to Mance J’s Test are proposed.

97 First, *sui generis* constructive knowledge should be assessed at the time of contract formation. Mance J permitted ascertaining knowledge *whenever* the NMP gained cognisance of the mistake. However, to circumscribe the ambit of *sui generis* constructive knowledge and to minimise the risk of it from being assessed with the benefit of

151 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) Art 29; Article 29 Data Protection Working Party Guidelines on Automated Individual Decision-Making and Profiling for the Purposes of Regulation 2016/679 (6 February 2018) at pp 24–25 and 29.

152 United Kingdom, *Report of the Select Committee on Artificial Intelligence, AI in the UK: Ready, Willing and Able?* (HL 2017–19, 100) at p 105 (Chairman: Lord Clement-Jones); Information Commissioner’s Office & The Alan Turing Institute, “Explaining Decisions Made with AI” *ico*. (2020) <<https://ico.org.uk/media/for-organisations/guide-to-data-protection/key-data-protection-themes/explaining-decisions-made-with-artificial-intelligence-1-0.pdf>> (accessed 1 August 2020).

153 *Big Data: A Report on Algorithmic Systems, Opportunity, and Civil Rights* (Executive Office of the President, May 2016) at pp 9 and 23–24.

154 *Automated Decision-making: Better Practice Guide* (Commonwealth Ombudsman, 2019) at pp 25–26.

155 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

156 Article 29 Data Protection Working Party Guidelines on Automated Individual Decision-Making and Profiling for the Purposes of Regulation 2016/679 (6 February 2018) at p 25.

157 Law Reform Committee, Singapore Academy of Law, *Applying Ethical Principles for Artificial Intelligence in Regulatory Reform* (July 2020) at paras 2.40–2.50 (Co-Chairpersons: Justice Kannan Ramesh & Charles Lim Aeng Cheng); Law Reform Committee, Singapore Academy of Law, *Report on Criminal Liability, Robotics and AI Systems* (February 2021) at para 4.38 (Co-Chairpersons: Justice Kannan Ramesh & Charles Lim Aeng Cheng).

hindsight, the reasonable trader should be placed in circumstances contemporaneous with the actual transaction.

98 Second, allocating risk to the AI-user or NMP should only be the presumptive starting point. If the MP expressly or impliedly consents to sharing the risk of the consequences of a mistake, this should form an exception to the modified Mance IJ Test.¹⁵⁸ Two non-exhaustive examples are explored. First, where the MP also contracts via a non-deterministic algorithm that unexpectedly accepts the disadvantageous offer, it is submitted that the loss should lie where it falls even if the MP is locked into a bad bargain. Any party which deploys a novel and unexplainable technology should bear the risk of that technology performing unexpectedly and causing loss to himself or herself. It is unfair to presumptively burden either party with the risk. Second, for sophisticated investors, this author intimated above¹⁵⁹ that such investors may opt out of the legislative regime based on the modified Mance IJ Test¹⁶⁰ and consent to bearing the risk involved in algorithmic trading. Where such consent is given by the MP, the *Quoine* Majority Knowledge Test should apply by default, even if this is likely to uphold the bargain.

(2) *Reform 2: Unconscionability*

99 A final question *Quoine* left open is how the element of unconscionability is satisfied if the NMP lacked actual knowledge of the mistake when the contract was formed.¹⁶¹ Mance IJ stressed that unconscionability was unnecessary to obtain rescission.¹⁶² However, as mere negligence in failing to discover the mistake is insufficient to ground equity's jurisdiction, the additional element of unconscionability should be retained.¹⁶³

100 English and Australian authorities which applied unconscionability as a jurisdictional bar in equity indicate that the NMP's impropriety must manifest before or at contract formation.¹⁶⁴ However, if unconscionability requires conduct motivated by the NMP's actual

158 See para 108(b)(i) below.

159 See para 83 above.

160 See para 108(b)(i) below.

161 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [109]–[110].

162 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [204].

163 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [77]–[78].

164 *Taylor v Johnson* (1983) 151 CLR 422 at 433; *Tutt v Doyle* (1997) 42 NSWLR 10; *Solle v Butcher* [1950] 1 KB 671 at 692; *Riverlate Properties Ltd v Paul* [1975] 1 Ch 133 at 141.

knowledge or suspicions, it will invariably be unsatisfied where the NMP contracted via a non-deterministic algorithm.¹⁶⁵

101 One solution is to find that unconscionability is *ipso facto* satisfied if *sui generis* constructive knowledge is established; the fact that a natural person ought to have realised the mistake is already an affront to commercial fair play or morality.¹⁶⁶ Alternatively, Mance J posits that if unconscionability were required, it crystallises only when the NMP gains cognisance of the mistake post-contract formation, yet dishonourably seeks to retain the benefit.¹⁶⁷ Given the former approach appears tantamount to imposing a duty of care to discover mistakes, because mere *sui generis* constructive knowledge will attract rescission, the latter approach is preferred. However, it bears mentioning that some sharp practice or impropriety must flow from the NMP's actual knowledge of the mistake, as stated above.¹⁶⁸ This author also suggests an additional two reasons for why Mance J's position with regard to unconscionability is not entirely unsupported by authority. Although Parliament is, of course, not bound by the principles of *stare decisis*, this brief discussion aims to shed light on the force behind Mance J's approach.

102 First, the Court of Appeal in *Digiland* did not appear to address its mind to whether unconscionability arising after the contract is formed would enliven equity's jurisdiction. It therefore did not close the door on this possibility. Admittedly, *Riverlate Properties Ltd v Paul*,¹⁶⁹ which was cited by the Court of Appeal in *Digiland* when outlining the ambit of equity's jurisdiction in the context of unilateral mistake, made clear that: "If conscience is clear at the time of the transaction, why should equity disrupt the transaction?" Russell LJ did not see fit that the protests of "some high-minded men" [emphasis added] should override the "attitudes of much the *greater part* of ordinary mankind (not least the world of commerce)"¹⁷⁰ [emphasis added]. However, if the converse were true, *ie*, if the greater part of ordinary mankind would regard it as an affront to their sense of commercial fairplay or morality for a contract to be upheld, *even if* the NMP's conscience were only tainted post-contract formation, what is staying equity's intervention?

103 In the peculiar context where the NMP contracts via a non-deterministic AI, and only acquires actual knowledge or suspicion of

165 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [78].

166 Andrew Phang Boon Leong, "Contract Formation and Mistake in Cyberspace – The Singapore Experience" (2005) 17 SAclJ 361 at 391.

167 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [173] and [205]–[206].

168 See para 19(c) above.

169 [1975] 1 Ch 133.

170 *Riverlate Properties Ltd v Paul* [1975] 1 Ch 133 at 141.

the mistake after the contract is formed, it is submitted that fair-minded commercial persons would deem it *unfair* for the NMP to be able to enforce the contract as if nothing was amiss. *Digiland*, tangentially, recognises as much – “[k]nowing that something could be wrong and yet to proceed[ing] to act as if nothing was amiss is conduct that strikes at equity’s conscience”.¹⁷¹ Surely *when* such actual knowledge or suspicion is acquired (*ie*, pre *versus* post-contract formation) should not be definitive of whether equity may intervene. What is staying equity’s intervention is not the absence of a shocked conscience, but the fear of excessive uncertainty which may result.

104 Nevertheless, the spectre of commercial uncertainty, which is often present, cannot impede legal advancement in all circumstances. Sometimes, the “dictates of justice” must prevail;¹⁷² for reasons set out above,¹⁷³ this is one such instance. In any event, any ensuing uncertainty may be mitigated by a strict application of: (a) the *sui generis* constructive knowledge test, *ie*, it must exist when the contract is formed; and (b) the normal bars to rescission including the intervention of *bona fide* third party interests.¹⁷⁴ For the avoidance of doubt, this author is not proposing the relaxation of the unconscionability requirement in the aforesaid manner in cases where no non-deterministic AIs are involved in contract formation.

105 Second, *Torrance v Bolton*¹⁷⁵ confirms that rescission for mistakes is rooted in equity’s jurisdiction to prevent fraud, *viz*, when it is “unconscientious for a person to avail himself of the legal advantage which he has obtained”.¹⁷⁶ However, fraud for jurisdictional purposes eludes definition; it has been described as “infinite” and flexible enough to confer jurisdiction over new schemes which “the fertility of man’s invention would contrive”.¹⁷⁷ Arguably, it is unconscientious to allow an NMP to enforce a contract which he or she, upon discovery of the transaction, at once saw could only be the result of some unilateral mistake and would be rescinded but for the usage of a non-deterministic algorithm as a means of contracting.

171 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [73].

172 *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502 at [81].

173 See at paras 81–95 above.

174 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [183]; *Snell’s Equity* (John McGhee QC gen ed) (Sweet & Maxwell, 34th Ed, 2020) at para 5-011.

175 (1872) LR 8 Ch App 118.

176 *Torrance v Bolton* (1872) LR 8 Ch App 118 at 124; J D Heydon, M J Leeming & P G Turner, *Meagher, Gummow & Lehane’s Equity: Doctrines & Remedies* (LexisNexis Butterworths, 5th Ed, 2015) at paras 1-035, 12-005 and 12-040.

177 J D Heydon, M J Leeming & P G Turner, *Meagher, Gummow & Lehane’s Equity: Doctrines & Remedies* (LexisNexis Butterworths, 5th Ed, 2015) at para 12-050.

106 What, however, makes Mance J's approach to unconscionability an acceptable incremental development as compared to his approach to *Sui Generis* Knowledge?¹⁷⁸ In the author's view, equity has demonstrated a willingness to intervene regardless of when the relevant knowledge is acquired in the transaction. A parallel, albeit an imperfect one, may be drawn to the equitable duty of confidence. Generally, an obligation of confidence arises if the defendant ought to have appreciated that the information was confidential at the time of receipt.¹⁷⁹ However, equity may impose an obligation of confidence even if the recipient was only told of or otherwise appreciated its confidential nature after receipt – “[f]rom that moment, ... [the defendant's] conscience is affected in a way which should be recognised by equity”.¹⁸⁰ Similarly, for common mistakes in equity, the unconscionability enlivening equity's jurisdiction arises post-contract formation when one party becomes aware of the mistake and seeks to take advantage of it.¹⁸¹

107 In light of the foregoing, a legislative position that adopts Mance J's view on the unconscionability requirement is an incremental development which will not be *entirely* out of step with how the courts have applied their equitable jurisdiction.

E. Summary of proposed legislative framework

108 A summary of the above is as follows:

(a) If the NMP's programmer pre-set the maximum price at which the non-deterministic algorithm may transact, the *Quoine* Majority Knowledge Test applies;

(b) If no maximum price was set, MPs may invoke s 108 of the EA to shift the legal burden to the NMP to prove the *Quoine* Majority Knowledge Test is not satisfied; although, this is unlikely to make a material difference. In such situations, ideally, a new act modifying the existing law on equitable unilateral mistakes where the NMP contracts via a non-deterministic algorithm should:

(i) render contracts voidable where: (A) a reasonable NMP, at the time of the actual trade, *should* have been

178 Cf para 65 above.

179 *Vestergaard Frandsen A/S v Bestnet Europe Ltd* [2013] 1 WLR 1556 at [23].

180 *Vestergaard Frandsen A/S v Bestnet Europe Ltd* [2013] 1 WLR 1556 at [25].

181 *Olivine Capital Pte Ltd v Chia Chin Yan* [2014] 2 SLR 1371 at [69]; Bridget McLay, “Rectification for Unilateral Mistake: Time for a Conceptual Revision?” (2016) 22 *Auckland University Law Review* 315 at 326–327; Catherine MacMillan, *Mistakes in Contract Law* (Hart Publishing, 2010) at p 316.

aware of the mistake in light of prevailing circumstances (Reform 1); (B) the MP did not expressly or impliedly consent to share the risk of the consequences of its mistake in the limited manners described above¹⁸² (Reform 1); (C) the NMP demonstrated sharp practice, motivated by actual knowledge or suspicion of a mistake post-contract formation, making enforcement unconscionable (Reform 2); (D) no bars to rescission apply; and (E) the remaining elements of the defence are satisfied (“modified Mance IJ Test”);¹⁸³ and

(ii) subject contracts, where the MP consented to sharing the risk,¹⁸⁴ to the *Quoine* Majority’s Knowledge Test. This will likely result in the contract being upheld.

V. Conclusion

109 While AI are powerful pattern-recognition tools, things can go “very wrong if [they are] faced with unexpected input” such as abnormal market data.¹⁸⁵ If non-deterministic algorithms continue to elude human comprehension, existing principles may immunise nefarious AI-users from the doctrine of unilateral mistakes. To plug the Lacuna, and to place the risk of contracting via non-deterministic algorithms on their users or developers, the modified Mance IJ Test should be codified so as to realise the *raison d’être* of unilateral mistakes in equity, that is, “achieving the ends of justice”.¹⁸⁶

182 See para 98 above.

183 See paras 96–98 above.

184 The risk alluded to at para 98 above.

185 “An Understanding of AI’s Limitations is Starting to Sink In” *The Economist* (11 June 2020) <<https://www.economist.com/technology-quarterly/2020/06/11/an-understanding-of-ai-limitations-is-starting-to-sink-in>> (accessed 2 August 2020).

186 *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 at [89].