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Automated Mistakes: Vitiated Consent and State of Mind Culpability in Algorithmic Contracting

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I. Introduction

In this chapter, we consider the application of the doctrines of unilateral mistake and unconscionable conduct to relieve against plaintiff mistakes in what are sometimes termed 'algorithmic contracts': contracts for which formation and/or performance are automated through computer software. Current and emerging uses of computer software allow contracts to be made, processed and performed more quickly, in response to more variables and with greater accuracy than if done by human hand. This trend of algorithmic contracts seems likely to continue.[1] As software become more sophisticated, the contracting processes they may inform and operate will become more complex, and the involvement of humans in the transaction more attenuated. Humans will determine the design, development and deployment of the automated process. However, there may be no direct human involvement or intention applying to any particular transaction.[2]

It seems reasonably clear that automation does not preclude effective contract formation.[3] This is because in deciding whether the parties have made a legally binding

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[1] See LH Scholz, 'Algorithmic Contracts' (2017) 20 *Stanford Technology Law Review* 128; M Rizzi and N Skead, 'Algorithmic Contracts and the Equitable Doctrine of Undue Influence: Adapting Old Rules to a New Legal Landscape' (2020) 14 *Journal of Equity* 301. See also AJ Casey and A Niblett, 'Self-Driving Contracts' (2017) 43 *Journal of Corporation Law* 1.

[2] cf *Quoine Pte Ltd v B2C2 Ltd* [2020] 2 SLR 20 [1] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[3] E Mik, 'From Automation to Autonomy: Some Non-Existent Problems in Contract Law' (2020) 36 *Journal of Contract Law* 205.

contract and determining the scope of that contract, the law looks to the objective or inferred intentions of the parties, not whether a specific individual actually applied their mind to the transaction in question.[4] There is more uncertainty about how contractual vitiating factors apply, if at all, to such transactions. Plaintiff mistake is a factor that may vitiate contractual consent under both general law and statute. Relief in such circumstances may be premised on misrepresentation, unilateral mistake or unconscionable conduct, depending on the source of the mistake and the conduct of the defendant. For relief on grounds of unilateral mistake or unconscionable conduct, courts look to the culpability of the defendant, which commonly involves requirements of deliberateness or knowledge.

It is well understood that these concepts can have an awkward fit when dealing with transactions involving corporations. Where one party is a company, which has no natural state of mind, the mental element required to establish culpability must be found in its agents and officers or, as we have also argued, its systems, policies and practices.[5] Similar challenges are posed by developments in the field of algorithmic contracts.[6] What do ideas of consent, mistake and culpability mean when the contracting process is informed by instructions to computers? In these contracts there may be minimal direct human involvement, and so how is a culpable human or corporate mind identified? Certainly automation through software adds elements of complexity and opacity that may make the task of attributing fault when things go wrong more difficult.[7] We suggest, however, the problem is not insurmountable.

We prefer an approach that treats algorithms used in contracting as tools or, more accurately, systems of conduct. Attribution of state of mind flows from this characterisation. This approach means that the likelihood of a successful claim for unilateral mistake in algorithmic contracts is low. Relief for unilateral mistake requires the non-mistaken party to have knowledge of the other party's mistake. It is unlikely that this will be the case in a transaction that is automated to deal with many different counterparties. Moreover, in our view, it would be artificial, and indeed inconsistent with the defining character of algorithmic contracts, to somehow attribute knowledge of the circumstances of the transaction to the non-mistaken party each time a contract is entered into. This conclusion does not mean, however, that relief based on vitiating factors is necessarily precluded. It should be possible to consider the design and operation of the system that is being used to automate the transaction. If that system is by design or effect likely to take advantage of mistaken or otherwise vulnerable contracting partners, then relief on grounds of unilateral mistake or unconscionable conduct may be available on that basis.

[4] *Quoine* (n 2) [96]. See also V Ooi, 'Contracts formed by software: an approach from the law of mistake' [2022] 2 *Journal of Business Law* 97.

[5] E Bant and JM Paterson, 'Systems of Misconduct: Corporate Culpability and Statutory Unconscionability' (2021) 15 *Journal of Equity* 63.

[6] See also J Fu, 'Algorithmic Contracts: Who is to Blame?' (2020) 12 *Singapore Law Review Juris Illuminae* at www.singaporelawreview.com/juris-illuminae-entries/2020/algorithmic-contracts (accessed 19 November 2021).

[7] Noting that in many if not most cases, algorithmic contracts are expressions of coded rules determined by humans, which may perform at rapid speed but do not show the black-box hurdle to understanding their outputs found in more complex machine-learning systems. See, eg, *Quoine* (n 2).

We begin our discussion by outlining the nature of algorithmic contracts. We then turn to the conundrum of unilateral mistake in algorithmic contracting raised by the decision of the Singapore Court of Appeal in *Quoine Pte Ltd v B2C2 Ltd* (*Quoine*).[8] We consider the doctrinal elements of these claims, focusing on the requirements of defendant state-of-mind culpability, before turning back to the application of these doctrines to algorithmic contracts, starting with *Quoine* and then considering other possible scenarios where a claim to rescission on the basis of vitiated consent to automated contracting processes may arise.

II. Algorithmic Contracts

Digital technology is quickly transforming legal practice. Parties may already make use of commercial products using software to assist with contract preparation,[9] contract review,[10] due diligence,[11] contract management[12] and legal compliance.[13] The very entry into and performance of contracts is also being automated.[14] Automated contracts are not new. Early examples are vending and ticketing machines.[15] Parties have for some time used software automating aspects of contract performance, such as sending notices and making payments. The programs used in these systems rely on relatively simple commands, such as a direction to pay $X to Y on the occurrence of Z event. Contracting parties are increasingly making use of more sophisticated computing techniques for automating aspects of contract preparation, negotiation and performance. These contracts are sometimes termed 'algorithmic contracts' to distinguish them from more straightforward automated systems.[16] Parties make use of algorithmic contracts

[8] ibid.

[9] See, eg, Contract Express at https://legal.thomsonreuters.com/en/products/contract-express (accessed 19 November 2021); Donna Legal, at www.donna.legal (accessed 19 November 2021); Legal Zoom at www.legalzoom.com/country/au (accessed 19 November 2021); Neota Logic at www.neotalogic.com (accessed 19 November 2021); Docusign at www.seal-software.com (accessed 19 November 2021).

[10] See, eg, eBrevia at www.dfinsolutions.com/products/ebrevia#overview (accessed 19 November 2021); Contract Probe at www.contractprobe.com/index.php/fronts/how_its_works (accessed 19 November 2021); Kira at https://kirasystems.com/how-it-works/contract-analysis (accessed 19 November 2021); ThoughtRiver at www.thoughtriver.com (accessed 19 November 2021); Docusign (n 9).

[11] See, eg, eBrevia (n 10); Luminence at www.luminance.com (accessed 19 November 2021); Docusign (n 9).

[12] See, eg, Neota (n 9); Docusign (n 9).

[13] See, eg, Kira (n 10); Neota: (n 9).

[14] See *Quoine* (n 2) [79], [95].

[15] Often discussed as the early exemplar of the smart contract: N Szabo, 'Formalizing and Securing Relationships on Public Networks' (1997) 2 *First Monday* at https://journals.uic.edu/ojs/index.php/fm/article/view/548 (accessed 19 November 2021). For a legal analysis of vending machines, see *Thornton v Shoe Lane Parking Ltd* [1970] EWCA Civ 2, [1971] QB 163.

[16] 'Algorithmic contracts are contracts in which one or more parties use an algorithm to determine whether to be bound or how to be bound': Scholz (n 1) 134. On the sociotechnical use of the phrase 'algorithmic', see also K Yeung, 'Algorithmic Regulation: A Critical Interrogation' (2018) 12 *Regulation & Governance* 505, 506, 'social scientists typically use the term [algorithmic] as an adjective to describe the *sociotechnical assemblage* that includes not just algorithms but also the computational networks in which they function, the people who design and operate them, the data (and users) on which they act, and the institutions that provide these services, all connected to a broader social endeavour and constituting part of a family of authoritative systems for knowledge production'.

to speed up transactions, and also to aid in making more accurate decisions about whether to contract and on what terms or at what price. Algorithmic contracts of this kind are being used in high-frequency share trading[17] to buy or sell rapidly on favourable market terms, and similarly in insurance broking.[18] Algorithmic contracts are also used in online sales, including consumer transactions, utilising dynamic pricing.[19] In the context of smart contracts linked to blockchain technology, algorithmic contracts are also used in applications such as capital and derivative markets,[20] trade finance,[21] insurance[22] and shipping.[23]

Algorithmic contracts may vary in their degree of complexity. Typically, they are based on pre-programmed instructions determined by humans.[24] These kinds of algorithmic contracts may respond to a significant number of variables, perhaps programmed as expert systems or decision trees. Algorithmic contracts may also use models derived from machine-learning applications, which inform contracting decisions about pricing or terms.[25] Algorithmic contracts informed by machine learning are typically determinative – that is, working on fixed models or static data sets – rather than adaptive, in the sense of being able to vary their responses as more data are gathered.[26]

Notwithstanding their advantages in speed, volume and accuracy, algorithmic contracts may also produce adverse outcomes for one or other of the parties. There may be mistakes in the programming, bias in the data used as the basis for decisions, or unforeseen outcomes due to changes in the events that trigger performance.[27] In some

[17] See, eg, *Quoine* (n 2).

[18] See, eg, *Software Solutions Partners Ltd v HM Customs and Excise* [2007] EWHC 971 (Admin), [2007] All ER (D) 80 (May) (*Software Solutions*).

[19] See J Paterson, G Bush and T Miller, 'Transparency to Contest Differential Pricing' (2021) 93 *Computers & Law* 49.

[20] See, eg, R Clements, 'Evaluating the Costs and Benefits of a Smart Contract Blockchain Framework for Credit Default Swaps' (2019) 10 *William & Mary Business Law Review* 369. See also Australian Stock Exchange, 'About CHESS Replacement' at www.asx.com.au/services/chess-replacement.htm (accessed 19 November 2021); ISDA, 'Digital Asset and ISDA Introduce Tool to Help Drive Adoption of ISDA CDM' (Press Release, April 9 2019) at www.isda.org/2019/04/09/digital-asset-and-isda-introduce-tool-to-help-drive-adoption-of-isda-cdm/ (accessed 19 November 2021); M del Castillo, 'Citi, Goldman Sachs Conduct First Blockchain Equity Swap On Ethereum-Inspired Platform' *Forbes* (6 February 2020) at www.forbes.com/sites/michaeldelcastillo/2020/02/06/citi-goldman-sachs-conduct-first-blockchain-equity-swap-on-ethereum-inspired-platform/?sh=7816b3563694 (accessed 19 November 2021).

[21] See, eg, Deloitte, 'How Blockchain Can Reshape Trade Finance' at www2.deloitte.com/content/dam/Deloitte/global/Documents/grid/trade-finance-placemat.pdf (accessed 19 November 2021).

[22] PwC, 'Blockchain: A Catalyst for New Approaches in Insurance' (Report) at www.pwc.com.au/publications/pwc-blockchain.pdf (accessed 12 October 2020); B3i, 'Major Re/Insurers and Brokers Complete Complex Placements on B3is Blockchain Platform' (Media Release, 12 February 2020) at https://b3i.tech/news-reader/major-re-insurers-and-brokers-complete-complex-placements-on-b3is-blockchain-platform.html (accessed 19 November 2021).

[23] See, eg, J Herd, '"Blocks of Lading": Distributed Ledger Technology and the Disruption of Sea Carriage Regulation' (2018) 18 *Queensland University of Technology Law Review* 306.

[24] See, eg, *Software Solutions* (n 18).

[25] See, eg, Paterson, Bush and Miller (n 19) 49–53. See also J Meehan and E Gruyaert, '6 Disruptive Trends in Pricing' *Wall Street Journal* (2 March 2018) at https://deloitte.wsj.com/articles/6-disruptive-trends-in-pricing-1519966937 (accessed 19 November 2021).

[26] On adaptive systems, cf The Alan Turing Institute at www.turing.ac.uk/research/research-projects/adaptive-machine-learning-changing-environments (accessed 19 November 2021).

[27] cf E Snodgrass, 'The University of Kentucky Accidentally Sent 500,000 Acceptances to a Program that Usually Only Accepts 35 Students' *Insider* (9 April 2021) at www.insider.com/university-of-kentucky-sends-500000-accidental-acceptances-2021-4 (accessed 19 November 2021).

cases, these events might produce a breach of contract. In others, the complaint may be that one or other of the parties' consent to the transaction should be regarded as vitiated, such as on the basis of factors including unilateral mistake or unconscionable conduct. The essential difficulty, as we shall see in the next section, is that these kinds of doctrines require some form of culpability on the part of the defendant – typically a state of mind such as knowledge – to ground the action. The challenge raised is in how this may be attributed in an algorithmic contracting process where there may be no human or corporate mind directly involved in making or performing the contract.

Certainly, humans will make decisions about the design of the software within which an algorithmic contract operates, and the kinds of algorithms that are used. Humans may further determine the data that will inform any outcomes derived from machine learning. However, once algorithmic contracts are up and running, humans may not be directly involved in entry into the contract or its performance outputs. The humans utilising the systems may not even understand how the processes work or how the outcomes are reached. These factors have led to increased attention on governance and regulatory strategies for ensuring that both public bodies and private companies are accountable for their use of algorithmic decision making.[28] The discussion has primarily focused on risks of bias,[29] as well as technical mechanisms for ensuring the transparency, reliability and contestability of automated processes.[30] Our focus is different. We are interested in what reliance on algorithmic contracts means in analysing circumstances where the plaintiff claims their consent to contract is vitiated and the contract should be set aside on the basis of some wrongful conduct by the defendant. It is to the legal basis for such relief that we now turn.

III. Plaintiff Mistakes and Defendant Culpability

Mistake is the paradigm vitiating factor in the law of unjust enrichment, and the mistaken payment is the core case where, absent defences or other bars to recovery, the plaintiff will be entitled to restitution of the benefit.[31] However, if the parties have entered into a contract, any enrichment of the non-mistaken party is 'justified' by the contract. The contract entitles the defendant to retain the benefit. It follows from this that the contract must be set aside, or found to be void or otherwise 'negated', before the

[28] See, eg, Yeung (n 16). See also European Commission, 'On Artificial Intelligence: A European Approach to Excellence and Trust' (White Paper, February 2020); Select Committee on Artificial Intelligence, *AI in the UK: Ready, Willing and Able?* (HL 2017–19, 100).

[29] See, eg, Australian Human Rights Commission, *Human Rights and Technology* (Final Report, 2021) 105; E Jillson 'Aiming for Truth, Fairness, and Equity in your Company's Use of AI' (US Federal Trade Commission, April 2021) at www.ftc.gov/news-events/blogs/business-blog/2021/04/aiming-truth-fairness-equity-your-companys-use-ai (accessed 15 October 2021).

[30] See, eg, D Dawson et al, 'AI Ethics Framework' (Australian Government Department of Industry, Innovation and Science, 2019) at www.industry.gov.au/data-and-publications/australias-artificial-intelligence-ethics-framework (accessed 15 October 2021); Proposal for a Regulation of the European Parliament and of the Council (EU) COM(2021) 206 final laying down harmonised rules on artificial intelligence (artificial intelligence act) and amending certain union legislative acts.

[31] See generally J Edelman and E Bant, *Unjust Enrichment*, 2nd edn (Oxford, Hart Publishing, 2016) chs 7 and 8.

plaintiff is entitled to restitution of benefits transferred pursuant to the contract. This may occur where the mistake has been induced by the defendant, or where the defendant knows of and encourages, or at least fails to clarify, the mistake. In doctrinal terms, the relevant kinds of claim are potentially for misrepresentation, unilateral mistake and unconscionable dealing.

A. Unilateral Mistake

Unilateral mistake operates where, viewed in terms of their subjective state of mind, the parties are not in agreement but one party's view accords with the objective interpretation of the contract.[32] Given the objective approach to consent in contract, unilateral subjective errors on the part of the plaintiff will not normally be enough to set aside a contract and obtain restitution of benefits transferred pursuant to it. Were it otherwise, the law of unjust enrichment would contradict the law of contract. So, something more than a subjective unilateral error is required to ensure that bargains objectively struck between parties are not unduly undermined.

Relief setting aside a contract on grounds of unilateral mistake may be granted in law and in equity. In law, relief may be granted where the non-mistaken party has actual knowledge that the other party is mistaken.[33] This set of cases is sometimes described as involving 'snapping up' a bargain. In these cases, a lack of consensus (unilateral mistake) is typically inferred from the non-mistaken party's acceptance of an offer that is patently 'too good to be true'.[34] To the extent that unilateral mistake at common law results in the contract's being void, the doctrine would not seem to be recognised in Australia.[35] Rather, unilateral mistake operates to render the objectively agreed contract voidable, consistently with the equitable doctrine.

In equity, relief for unilateral mistake requires that the mistaken party be able to point to facts demonstrating it would be unconscionable to hold the parties to the contract. The parameters of the doctrine, being factually dependent, are still being developed.[36] In Australia, this required element of unconscionability will be shown where the non-mistaken party is aware of circumstances that indicate that a mistake has been made and, possibly, deliberately sets out to ensure that the non-mistaken party does not become aware of the mistake.[37] In *Taylor v Johnson*, Mason ACJ, Murphy and Deane JJ explained:

> [A] party who has entered into a written contract under a serious mistake about its contents in relation to a fundamental term will be entitled in equity to an order rescinding the contract

[32] See generally A Robertson and J Paterson, *Contract: Cases and Materials*, 14th edn (Pyrmont, Lawbook Co, 2020) ch 31.

[33] *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2005] SGCA 2, [2005] 1 SLR(R) 502 (*Digilandmall*).

[34] ibid [53] (Chao JA, Kan J and Yong CJ agreeing). See also *Hartog v Colin & Shields* [1939] 3 All ER 566, 568.

[35] Edelman and Bant (n 31) 146–47; N Seddon, R Bigwood and MP Ellinghaus, *Cheshire & Fifoot Law of Contract*, 10th edn (Chatswood, Butterworths, 2012) 12 [12.48].

[36] *Reilly v Australia and New Zealand Banking Group Limited (No 2)* [2020] FCA 1502 [143] (O'Bryan J).

[37] *Taylor v Johnson* [1983] HCA 5, (1983) 151 CLR 422 (*Taylor*).

> if the other party is aware that circumstances exist which indicate that the first party is entering the contract under some serious mistake or misapprehension about either the content or subject matter of that term and deliberately sets out to ensure that the first party does not become aware of the existence of his mistake or misapprehension.[38]

Subsequently, it has been suggested that this statement was not intended as a comprehensive description of the doctrine.[39] On this view, if the non-mistaken party knows of the mistake and omits to clarify the situation, that may be sufficient to ground relief in equity for unilateral mistake.[40] It has further been suggested that in equity it may be sufficient to show that the non-mistaken party suspected that the other party was mistaken or ought reasonably to have been aware of it.[41] In Singapore, constructive knowledge may be enough for relief to be granted in equity.[42]

Knowledge, like any other state of mind, is generally inferred from the circumstances, including from admissions, inferences from the evidence and judicial notice of notorious facts. In *Digilandmall*, knowledge of a mistake as to pricing was inferred from an obvious mistake on the part of the seller and the speed with which the buyer acted to 'snap up' the mispriced product and the volume of purchases made.[43] How would such knowledge be inferred in a process that relies on an algorithmic contract – in which contracting decisions rely on automated systems? The speed at which a contract is concluded will not be conclusive given that this is one of the purposes of automation. An overreaching response to a patently mispriced product will also not necessarily be conclusive where one of the instructions to the automated system is to 'buy' at a price less than $X. In such cases there must be some further basis for attributing knowledge of the mistake to the firm using the automated system. This kind of inquiry was raised in *Quoine*, which we shall shortly consider. First, however, we need to address the related doctrine of unconscionable dealing.

B. Unconscionable Systems and Patterns of Conduct

Unconscionable conduct 'within the meaning of the unwritten law' is recognised in equity and also in section 20 of the Australian Consumer Law (ACL).[44] The key elements of the equitable wrong is that a defendant takes unconscionable advantage of a plaintiff's special disadvantage.[45] Section 21 of the ACL contains a broader prohibition,

[38] ibid 432.

[39] See, eg, *Tutt v Doyle* (1997) 42 NSWLR 10, 14; *Blackley Investments Pty Ltd v Burnie City Council (No 2)* [2010] TASSC 48 [64]; *Chwee Kin Keong v Digilandmall.com Pte Ltd* [2004] SGHC 71, [2004] 2 SLR 594 [73].

[40] *Smith v Smith* [2004] NSWSC 663, (2004) 12 BPR 23,051 [50]. Another recent decision of the New South Wales Supreme Court held that failure to inform appears to have sufficed to satisfy the requirement that the non-mistaken party deliberately set out to ensure that the mistaken party did not become aware of the mistake: see *Moobi Pty Ltd v Les Gunn Properties Pty Ltd* [2008] NSWSC 719, (2008) 14 BPR 27,035 [55].

[41] *Taylor* (n 37) 432.

[42] *Digilandmall* (n 33) [53] (Chao JA, Kan J and Yong CJ agreeing).

[43] See generally ibid.

[44] Competition and Consumer Act 2010 (Cth), sch 2 (ACL). Note that s 20 does not apply where s 21 is applicable, and so its scope is now limited.

[45] *Thorne v Kennedy* [2017] HCA 49, (2017) 263 CLR 85.

with which this chapter is chiefly concerned. In its current form, section 21 prohibits conduct 'in trade or commerce' that is, 'in all the circumstances, unconscionable'.[46] The meaning and operation of the prohibition in section 21 of the ACL have always been contentious.[47] In 2012, section 21 was amended to introduce a set of interpretative principles to guide courts in their application of the prohibition. These interpretative principles confirm that the statutory prohibition on unconscionable conduct is not confined by the doctrine of unconscionable dealing developed in equity.[48] The principles also confirm that the 'section is capable of applying to a system of conduct or pattern of behaviour, whether or not a particular individual is identified as having been disadvantaged by the conduct or behaviour'.[49] Section 21 is supplemented by section 22, which contains a list of factors to which the court may have regard in deciding if conduct is unconscionable contrary to the statute.

Different views have been expressed by courts as to the scope of the statutory prohibition. As described by Allsop J, the statutory prohibition on unconscionable conduct requires an evaluation of

> the deep and abiding requirement of honesty in behaviour; a rejection of trickery or sharp practice; fairness when dealing with consumers; the central importance of the faithful performance of bargains and promises freely made; the protection of those whose vulnerability as to the protection of their own interests places them in a position that calls for a just legal system to respond for their protection, especially from those who would victimise, predate or take advantage; a recognition that inequality of bargaining power can (but not always) be used in a way that is contrary to fair dealing or conscience …[50]

This statement brings out the dual focus of the doctrine – in most forms it considers the element of disadvantage or vulnerability in the plaintiff that makes them unable to protect their own best interests in the transaction, and an element of culpability in the defendant that looks to take advantage of those in the position of disadvantage. It is here that unilateral mistake starts to merge with unconscionable conduct. The focus is not only on plaintiffs' mistakes but also, particularly under statute, on plaintiffs' inability to protect their own interests in the transaction.

In its most straightforward form, the prohibition on unconscionable conduct may be enlivened where one party takes advantage of another party's mistake, disadvantaged position or inexperience in the transaction. This advantage taking may be established by showing that the firm knew of the other party's position of disadvantage but proceeded with the transaction in any event, without providing the assistance that was needed to support the weaker party's decision.[51] Unconscionable conduct may also be established

[46] ACL (n 44) s 21.

[47] See AJ Duggan, 'Some Reflections on Consumer Protections and the Law Reform Process' (1991) 17 *Monash University Law Review* 252.

[48] ACL (n 44) s 21(4)(a).

[49] ibid s 21(4)(b).

[50] *Paciocco v Australia and New Zealand Banking Group Ltd* [2015] FCAFC 50, (2015) 236 FCR 199, 274 [296] (Allsop CJ), cited in JM Paterson, E Bant and M Clare, 'Doctrine, Policy, Culture and Choice in Assessing Unconscionable Conduct Under Statute: *ASIC v Kobelt*' (2019) 13 *Journal of Equity* 81, 93.

[51] *Australian Competition and Consumer Commission v Australian Institute of Professional Education Pty Ltd (in liq) (No 3)* [2019] FCA 1982 [80], [84] (Bromwich J); *Australian Competition and Consumer Commission v Cornerstone Investment Aust Pty Ltd (in liq) (No 4)* [2018] FCA 1408 [750], [751] (Gleeson J).

where the advantage taking arose 'by design', in the sense of being the kind of conduct that would only ever impact on those unable to protect their own interests or who misunderstood the transaction. *National Exchange* was essentially an example of this kind of concern.[52] There, the central complaint made was that the form of the offer to buy was set out in such a way that it was only likely to be accepted by people who misunderstood or were mistaken about its impact.

IV. Algorithmic Contracts and Plaintiff Mistakes

The challenge in applying doctrines of unilateral mistake or unconscionability to algorithmic contracts arises from the absence of direct human involvement in the contract at hand. In both unilateral mistake and unconscionability, the element of knowledge, or at least deliberate design, is central to relief. Where the stronger party has made use of an automated system or algorithmic contracting systems, it is not readily apparent how these elements are established. Entry into the contract and the terms of the contract will have been determined by computer software. An exemplar of the challenges in applying doctrines of mistake and unconscionability to algorithmic contracts is found in the decision of the Singapore Court of Appeal in *Quoine*.[53]

A. Mistake and Algorithmic Trading

In *Quoine*, the appellant, Quoine, was the operator of a cryptocurrency exchange platform. Quoine also functioned as a market-maker on the platform by placing buy and sell orders to create liquidity. The respondent, B2C2, was a trader on the platform and also a market-maker, which traded using its own automated trading software, developed by its director. Built into B2C2's trading software was a fail-safe 'deep price' of 10 Bitcoin (BTC) to 1 Ethereum (ETH), which would be invoked should input data from the platform be unavailable. In 2017, Quoine mistakenly failed to make necessary updates to the platform's critical operating systems. The failure meant that the platform could not access market information about prices and, using this information, generate new orders to keep liquidity within the trading system. This led to a failure to generate new orders. B2C2's trading software accordingly defaulted to the deep price and conducted 13 trades at a rate approximately 250 times the then going rate in the market of around 0.04 BTC for 1 ETH.

When Quoine became aware of these trades the next day, it unilaterally cancelled them and reversed the settlement transactions on the basis that the trades were concluded at highly abnormal rates. B2C2 commenced proceedings against Quoine, alleging that its unilateral cancellation of the disputed trades and reversal of the settlement transactions

[52] cf *Australian Securities and Investments Commission v National Exchange Pty Ltd* [2003] FCA 955, (2003) 202 ALR 24.

[53] *Quoine* (n 2).

were in breach of contract or breach of trust. Importantly, for our purposes, Quoine argued that the traders it represented had contracted under a unilateral mistake. At first instance B2C2's claims were allowed. Quoine appealed against the whole of the Judge's decision. The Singapore Court of Appeal (Sundaresh Menon CJ, Andrew Phang JA, Judith Prakash JA, Robert French IJ; Jonathan Mance IJ dissenting) found that the conduct was inconsistent with Quoine's own terms and conditions, and that a term that Quoine argued authorised this behaviour was not incorporated into the contract.[54] The Court of Appeal rejected Quoine's defences of unilateral mistake at common law and in equity.

Identifying the relevant mistake is not without difficulty in this scenario. In unilateral mistake, the operative kinds of mistake are usually errors as to a 'fundamental term' of the contract,[55] which may include pricing errors.[56] An operative mistake for the purposes of the doctrine in law or equity does not include a 'mistaken assumption about the circumstances under which the contract was or would be concluded'.[57] Also, mistakes as to the quality or value of the subject matter of the contract are typically not within the doctrine.[58] This is because mistakes as to quality are founded in an active exercise of judgement in which risk of error is always a key consideration. If parties wish to protect against that risk, typically the law takes the view that they should do so through a contractual warranty. More broadly, the authorities sometimes refuse relief where the plaintiff is said to have 'assumed' the risk of error or mistake.[59] Classic examples include when a plaintiff decides to pay some benefit to the defendant to settle a dispute, knowing that there is a risk that the plaintiff would have won the case; or where a plaintiff is told that they might be mistaken or doubts the fact or matter on which they are acting, and proceeds nonetheless without making further enquiries.[60]

In *Quoine*, the problem arose from Quoine's own error, in failing properly to update software. Somewhat oddly, Quoine argued that the operative mistake was between the parties on the platform and B2C2, a characterisation accepted by the court for the purpose of the appeal.[61] Even on this approach, there remains a question as to whether the alleged mistake was one that could give rise to relief. The court considered it did not. The mistake was not as to the terms of the contracts but the 'premise on which the buy orders were placed'.[62] In other words, the counterparties' mistake was over the operation of the trading platform,[63] which controlled the liquidity of the market, and through this the trading price. Software or coding errors seem an inherent risk of algorithmic

[54] ibid [66].

[55] ibid [80] (Menon CJ, Phang and Prakash JJA and French IJ agreeing), citing *Digilandmall* (n 33) [34] and [80] (Chao JA, Kan J and Yong CJ agreeing); *Statoil ASA v Louis Dreyfus Energy Services LP* [2008] EWHC 2257 (Comm) [2008] 2 Lloyd's Rep 685.

[56] See *Taylor* (n 37); *Quoine* (n 2) [91] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[57] *Quoine* (n 2) [82] (Menon CJ, Phang and Prakash JJA and French IJ agreeing). See also *Smith v Hughes* (1871) LR 6 QB 597, 606–07 (Cockburn CJ, Blackburn J agreeing), 611 (Hannen J).

[58] But cf *Quoine* (n 2) [169] (Mance IJ).

[59] Edelman and Bant (n 31) 176–79.

[60] *Lahoud v Lahoud* [2010] NSWSC 1297 [180] (Ward J); *Salib v Gakas* [2010] NSWSC 505 [333] (Ward J).

[61] *Quoine* (n 2) [78] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[62] ibid [114].

[63] ibid.

contracting, akin to a mistake as to quality, and something that should be allocated under the contracts with the platform.[64]

However, the question with which we are concerned here is less around the scope of the doctrine than its required elements of culpability when applied to algorithmic contracts. As we have seen, relief for unilateral mistake requires the non-mistaken party to know of the mistake. In the case of an algorithmic contract where the human involvement or oversight may occur in the design and deployment of the system, whose knowledge and what the nature of this intention might require are far from straightforward. Returning to the case of *Quoine*, where the problem arose in a failure of the Quoine trading platform to set a viable base price and the subsequent fortuitous trades of B2C2, how should this state of mind be attributed? The platform was trading at a rapid rate. Where might it realistically be said that a state of mind, such as knowledge, would lie?

B. Algorithms as Tools

On one approach to algorithmic accountability – that is, responsibility for decisions that are determined by software – algorithms are treated as mere tools of the firm that deploys them[65] or, in our framework of systems intentionality, a system or process.[66] Knowledge for the purpose of determining culpability then turns on two questions: Whose knowledge is considered? And at what point of time in the transaction? In *Quoine*, the majority judges identified the person holding the relevant knowledge as the 'programmer' or 'person running the algorithm'.[67] In *Quoine*, the programmer and the CEO of the company in question were the same and so looking to the programmer's state of mind was appropriate. In other cases, this divide between programmer and the firm developing or using the algorithmic contracting tool may, as Low and Mike point out, be somewhat of a distraction. It may sometimes be that the knowledge of the programmer or, more accurately, the team of programmers will be central to the design and operation of the system. In other or perhaps most instances, programmers will possess little insight into the overall operations of the program they produce, and even less of a decision-making role with respect to how the program is deployed or governed. But in both scenarios, responsibility and oversight will rest with the firm that has chosen to adopt an automated system, and it is here that the requisite knowledge of mistake must be found. In other words, accountability on this approach – including for our purposes, accountability that depends on a certain state of mind – rests with the person or firm that deploys the algorithm.[68]

[64] See also Mik (n 3) 226.

[65] 'Irrespective of their technological complexity, computers must be regarded as tools': ibid 222; cf as critical of this approach Scholz (n 1) 132, 134.

[66] cf ME Diamantis, 'The Extended Corporate Mind: When Corporations Use AI to Break the Law' (2020) 97 *North Carolina Law Review* 893, advocating a theory of extended mind.

[67] *Quoine* (n 2) [97]–[99] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[68] See K Low and E Mik, 'Lost in Transmission: Unilateral Mistakes in Automated Contracts' (2020) 136 *Law Quarterly Review* 563.

The court in *Quoine* held that the relevant time for considering what was known by the programmer/user firm was from the time of programming the automated process and up until the time the contract was concluded.[69] The relevant knowledge was not specific knowledge of the mistake at the time of concluding each individual contract. This was because the very purpose of the system was to enter into and conclude contracts without human oversight or right of review.[70] Hence, the contracting parties would not know beforehand they were going to contract and on what terms.[71] Rather, the court said the kind of the knowledge that needed to be held by the programmer was knowledge such that, in the kind of circumstances that occurred, a contracting partner would only ever contract if acting under a mistake. Thus, the court explained that the relevant question in establishing unilateral mistake was:

> When programming the algorithm, was the programmer doing so with actual or constructive knowledge of the fact that the relevant offer would only ever be accepted by a party operating under a mistake and was the programmer acting to take advantage of such a mistake?[72]

We return in section V to an alternative approach to understanding knowledge of mistake, derived from the inherent features or design of the automated process. For current purposes, it suffices to note that the court's reference to 'constructive knowledge' appears to point, consistently with our analysis, to an assessment of the inherent or patent incidents of the system. Where counterparty mistake is a necessary part of a system's design, the programmer may be taken to have knowledge of it.

We might also note that in the Australian context, as referred to earlier, it has been questioned whether the second element of deliberate advantage taking is really necessary in equity. The argument is that knowledge of the mistake, and proceeding with that contract without addressing that concern, is sufficient to establish the element of unconscionability required for relief.[73] Consistent with this approach, the court in *Quoine* considered that relief for unilateral mistake may be available where the programmer subsequently learnt of the relevant mistake and 'yet allowed the algorithm to continue running, intending thereby to take advantage of the mistake'.[74] This approach is also consistent with the approach to 'systems intentionality', whereby the ongoing tolerance of a system that generates harm may become intentional even if it was not at the outset.[75]

The court rejected Quoine's defences of unilateral mistake at common law and in equity. It concluded that when B2C2 programmed its trading software, there was no evidence it intended to take advantage of errors on the part of Quoine. B2C2 was not aware of the terms of the margin contracts that might result in opportunities for exploitation of illiquidity in the platform.[76] The court accepted the trial judge's finding that B2C2's purpose in programming the pricing strategy for the trading software was to

[69] *Quoine* (n 2) [99] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).
[70] ibid [104] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).
[71] ibid.
[72] ibid [103] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).
[73] ibid [171] (Mance IJ), discussing unconscionability for unilateral mistake arising from 'standing by'.
[74] ibid [99] (Menon CJ, Phang and Prakash JJA and French IJ agreeing). See also ibid [125].
[75] See Bant, ch 11 of this volume.
[76] *Quoine* (n 2) [119] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

protect itself against adverse consequences.[77] Accordingly, the ground of unilateral mistake was not made out. The decision appears correct to us,[78] but it is worth exploring the alternative analysis.

C. Algorithmic Agents

A different approach to accountability for decisions informed by algorithms treats the algorithm as an agent of the person who deploys it.[79] Lauren Scholtz explains that '[m]achine learning enables sophisticated algorithms to be more similar in function to a human employee with a task to achieve than a tool'.[80] The algorithmic contract in *Quoine* was, as the court stressed, 'deterministic',[81] which meant it performed precisely as programmed and did not 'have the capacity to develop its own responses to varying conditions'.[82] Nonetheless, the dissenting judgment of Mance IJ demonstrates an approach that is closer to treating algorithms as agents rather than as tools or systems.[83]

International Judge Mance justified taking a different approach from the majority on the ground that that '[t]he law should be adapted to the new world of algorithmic programmes and artificial intelligence, in a way which gives rise to the results that reason and justice would lead one to expect'.[84] International Judge Mance considered that the doctrine of unilateral mistake should not be interpreted to ignore the 'obvious' malfunctioning of a computer program.[85] This was important, because Mance IJ thought that computers should be treated as 'outworkers not overlords to whose operations parties can be taken to have submitted unconditionally in circumstances as out of ordinary as the present'.[86] Thus, Mance IJ held that relief on grounds of unilateral mistake should depend on what a person in the position of B2C2 would have 'known or perceived' if they had knowledge of the circumstances that actually occurred.[87] From this perspective, relief should be available if it would at once have been perceived by an honest and reasonable trader, given knowledge of the specific circumstances, that some fundamental error had occurred.[88] International Judge Mance justified this approach as consistent with the realities of algorithmic programs and artificial intelligence.[89] In this

[77] ibid [120] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[78] cf Low and Mik (n 68).

[79] See especially S Chopra and LF White, *A Legal Theory for Autonomous Artificial Agents* (Ann Arbor, MI, The University of Michigan Press, 2011) 6. See also M Diamantis, 'Algorithms as Employees: Holding Corporations Accountable for Their Digital Workforce' (19 October 2021) at https://ssrn.com/abstract=3945882 (accessed 19 November 2021): 'If a corporation employs an algorithm that causes criminal or civil harm, the corporation should be liable just as if the algorithm were a human employee.'

[80] Scholz (n 1) 133.

[81] *Quoine* (n 2) [15], [97], [98], [114] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[82] ibid [15] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[83] This kind of approach may or may not advocate attributing legal personality to algorithms, but doctrinally the two questions are distinct.

[84] *Quoine* (n 2) [193].

[85] ibid [193].

[86] ibid; see also ibid [200].

[87] ibid [194].

[88] ibid; see also ibid [198] (Mance IJ).

[89] ibid [193].

case, Mance IJ considered it could not be said the parties had accepted the risk of error in or affecting the computer programs making the contracts.[90]

The difference between these approaches to algorithmic contracts, and with that the issue of intention or knowledge of the parties, is significant and goes beyond the immediate dispute. The approach taken by Mance IJ effectively assimilates the algorithm to a worker or employee. This allows the court to treat the algorithm as operating in a manner akin a human agent, for which an intention can be inferred, and then attributed to the person or firm deploying it.

We agree with the majority that such an approach is 'wholly artificial' in the circumstances.[91] It assumes that the operations of an algorithmic system can be substituted with those of a person, so that a person would hypothetically be dropped into the transaction at a certain point to determine how they would have viewed the scenario. But the operations of computer software are nothing like a person.[92] Algorithms follow pre-coded instructions at high speed, including in some instances to complete or use statistical methods over high volumes of data. They do not act 'like' an agent in law: algorithms are simply instructions to a computer chosen by a human, and it is these instructions that determine the operation of the automated system.[93]

The approach suggested by Mance IJ, of considering the knowledge of a hypothetical reasonable person in the circumstances that occurred, is also in our opinion inconsistent with the core defining characteristic of an algorithmic contracting system, which is to allow a series of rapid, accurate and uniform transactions. It disrupts their intended allocation of risk. As a factual matter, the parties have chosen not to scrutinise each transaction, prioritising speed and predictability instead. To open the circumstances of each contract's formation to review undermines their intention to prefer efficiency over accuracy. By having entered into the arrangement, both parties are taken to have accepted the risks associated with the occurrence of an error in the course of performance that cannot be corrected within the time allowed. As the majority stated in the case, the parties' use of algorithmic contracting simply does not accommodate 'the court artificially (or 'equitably') interposing another last look at the proposed terms immediately prior to the algorithms concluding the contract and, for that matter, still less after'.[94]

D. Does Machine Learning Change the Analysis?

In *Quoine*, both the majority and dissenting judges emphasised that their decisions applied to a deterministic system – namely, one where the outcome was determined

[90] ibid; see also ibid [196].

[91] ibid [39] and [97], quoting the view of the trial judge. See also Mik (n 3).

[92] L Kostopoulos, *Decoupling Human Characteristics from Algorithmic Capabilities* (IEEE Standards Association, 2021) 1: 'The prevalence of attributing human traits to Artificial Intelligence-Systems in efforts to describe its capabilities and use-cases does not adequately represent the technology in a sufficient way to allow for decision makers to fully engage with the ethical questions they are accountable for.'

[93] See also DKB Seng and CH Tan, 'Artificial Intelligence and Agents' (2021) NUS Centre for Technology, Robotics, Artificial Intelligence & the Law Working Paper 21/02, at https://ssrn.com/abstract=3935446 (accessed 19 November 2021); Mik (n 3) 210.

[94] *Quoine* (n 2) [104].

exactly by the programmer's instructions.[95] The contrast is presumably with algorithmic contracting that relies on a model derived from machine learning. It is here that the black-box effect of complex machine-learning systems might be raised as a hurdle to firm responsibility. With machine learning, the decision to contract, and on what terms, may be based on models derived from correlations and patterns identified in large data sets. These models may even change over time if the system is adaptive in the sense of 'learning' from its new data. This may make algorithmic-contracting systems more opaque and difficult to scrutinise. Indeed, the officers of a firm may not understand precisely how the algorithmic-contracting system works. Nonetheless, in our view this should not make a difference in attributing responsibility or culpability for the outputs of the system.[96]

Treating an algorithmic-contracting system as deploying some form of machine learning as an agent commonly overestimates the system's capabilities. While complex, automated systems – including those that that are premised on predictions derived from machine learning, and even those that are in some way adaptive – do not exercise autonomous decision-making capacity or agency as understood by lawyers or philosophers.[97] The firm deploying the algorithmic-contracting system, acting through programmers, will determine the objectives of the system and the contexts in which it operates, as well as exercising oversight of the outputs.

Moreover, to treat the system as the equivalent to the agent of the firm means that the firm may be absolved of responsibility for unforeseen or unexpected outcomes.[98] To the contrary, we suggest that this is precisely the responsibility that is assumed in deciding to deploy such a system in the market. Moreover, as we discuss in section V, in some scenarios the firm's use of algorithmic systems will be the basis for attributing culpability for harmful outcomes.

V. Algorithmic Contracts and Systematic Wrongdoing

Like the majority in *Quoine*, we suggest that in looking for intention or other related states of mind in algorithmic processes, the requisite inquiry should be into what was known at the time of programming. The concern with this approach may be that contracting parties are left unprotected in circumstances where they make a mistake about the terms of the contract.[99] However, in any circumstance, unilateral mistake is a narrowly defined doctrine with only a few successful cases. This is largely because parties are expected to scrutinise carefully the terms of contracts they enter into, and conversely because of the fact that it is, in any event, often difficult to attribute knowledge of a mistake to a contracting counterparty due to the scale of contracting processes

[95] ibid [98] (Menon CJ, Phang and Prakash JJA and French IJ agreeing), [152] (Mance IJ).
[96] Mik (n 3) 221–22.
[97] See also Seng and Tan (n 93).
[98] Scholz (n 1) 155: 'In agency law, principal is not always bound by the actions of their agents; the agents might act in a way that goes directly contrary to the stated goals and interests of the principles [*sic*].' See also Mik (n 3) 212–13, which criticises this approach.
[99] Compare also the analysis in Ooi (n 4).

in modern times. Notably, however, we suggest that there are other perspectives that may assist: these move away from a narrow focus on knowledge of a particular mistake, towards an inquiry into the design and governance of the system being scrutinised.

In particular, different considerations will apply where a firm has designed its algorithmic contracting process specifically to create, or capitalise upon, a mistaken belief by the counterparty. In some cases, like *National Exchange* discussed earlier, the very operation of the system is premised on the existence of a mistake by the counterparty. In other cases, the very design of the system may be directed to generating counterparty mistakes for profit.[100] In both scenarios, knowledge of the mistake on the part of the firm deploying the system is readily found, without requiring identification of some natural individual, such as a programmer (or teams of programmers) bearing the requisite knowledge. In these cases, unconscionability will likely also be established, again because the system is geared to take advantage of the known error.

Consistently, relief for misrepresentation, or unconscionable conduct, for example, may lie where one party has misled the other into thinking the dealing involves an exchange between humans, who will be informed by relational values and committed to not capitalising on each other's mistakes. As recognised by the court in *Quoine*, there is scope for applying unilateral mistake in a case where the firm responsible for the algorithmic contracting system knew that a relevant offer would only ever be accepted by a party operating under a mistake, and designed its system to take advantage of that error.[101] In such circumstances, unless that other party wantonly disregarded the risk of error in these circumstances, the resultant contract may be capable of being set aside on grounds of fraud or mistake.

Similarly, consider the use of predictive algorithms to identify consumers likely to sell below market value or buy at inflated prices. In some instances, such conduct may move beyond market research to more objectionable and unconscionable conduct, such as where the sale is pursued at a grossly disproportionate price or accompanied by the digital equivalent of hectoring conduct. Where an automated system is designed for the purpose of targeting counterparties who are vulnerable to mistake or unable to protect their own interests in the transaction, the very design of the system evidences a deliberateness that establishes culpability.[102]

The element of culpability may be less evident in algorithmic-contracting processes that were not designed for deliberate advantage taking but nonetheless have the effect of targeting parties acting under some element of disadvantage. In these scenarios it may be difficult to know whether the system is systematically targeting disadvantaged parties, or whether this is an outlier effect that is unfortunate but not necessarily unconscionable. Here there is potentially relief for systematic predatory contracts through recognising the possibility of unconscionable 'systems of conduct or patterns of behaviour'.[103] At some point where the operation of a firm's algorithmic-contracting

[100] JM Paterson, E Bant and H Coone, 'Australian Competition and Consumer Commission v Google: Deterring misleading conduct in digital privacy policies' (2021) 26 *Communications Law – Journal of Computer, Media and Telecommunications Law* 136.

[101] *Quoine* (n 2) [103] (Menon CJ, Phang and Prakash JJA and French IJ agreeing).

[102] Bant and Paterson (n 5) 82–83, 89.

[103] ibid 81–91.

processes consistently impacts unfairly on the other parties to the transaction, this becomes a pattern of behaviour. The failure of a firm to respond to this pattern of advantage taking at some point becomes purposive and culpable. In such situations, responsibility for that system may be attributed to the firm, without the necessity of finding a natural person who holds a deliberate intention or even direct knowledge of this occurrence.

Another possible scenario is where the algorithmic contracting system has 'learned' to target vulnerable parties, such as through high-price, low-value contracts in order to increase sales. Here it might be objected that the firm did not design or intend such an outcome. Yet it might be argued that culpability for the purposes of unconscionable conduct may for these purposes rest on omission of governance. This might be a lack of oversight or a failure to respond when a problem was identified. A firm that implements an algorithmic process knowing of its complexity should put in place processes for reviewing its operation, auditing outcomes and responding to complaints or concerns. A firm that puts these processes in place and fails to respond to defined problems has essentially decided to sanction those outcomes. A firm that fails to put these protective mechanisms in place should not be in any better position through turning a blind eye to the risk of harm caused by algorithmic-contracting process engaging in predatory conduct.

VI. Conclusion

Contract law and associated equitable doctrines have proved remarkably resilient in responding to new technologies. Provided we do not get carried away in attributing anthropomorphic superpowers to algorithmic contracts, the challenge may lie in the technical practicalities of oversight rather than the application of the law to curb excessive self-interested and predatory behaviour by a party with stronger bargaining power.