Comparative Law Review

2024 – Vol. 15 n. 2

ISSN:2038 - 8993

COMPARATIVE LAW REVIEW
The Comparative Law Review is a biannual journal published by the
I. A. C. L. under the auspices and the hosting of the University of Perugia Department of Law.

Office address and contact details:
Department of Law - University of Perugia
Via Pascoli, 33 - 06123 Perugia (PG) - Telephone 075.5852437
Email: complawreview@gmail.com

Comparative Law Review is registered at the Courthouse of Monza (Italy) - Nr. 1988 - May, 10th 2010.

COMPARATIVE LAW REVIEW

VOL. 15/2 - 2024

Contract Law for Interesting Times

***

CONTRACTUAL MISTAKE, SMART CONTRACT AND ARTIFICIAL INTELLIGENCE FROM A COMPARATIVE PERSPECTIVE*

Jacopo Fortuna **

TABLE OF CONTENTS:

I. INTRODUCTION

In a digitalised world, in which more and more human activities tend to be carried out through technological tools, issues related to the effects produced by digital systems take on increasing relevance. For the jurist, the correction or management of the consequences of a malfunction or, in any case, of unintended effects produced by a computer system used in the performance of activities with legal relevance poses new challenges and raises many points for reflection. Indeed, if we talk about the relationship between new technologies and mistake, the latter can occur not only within the computer system itself but also in man, since human beings can easily make mistakes in interpreting and predicting the behaviour and effects resulting from the activity of a machine.Digital contracting is certainly one of the most interesting areas in which the problem of mistake should be analysed and smart contracts, due to their characteristics and their peculiar self-execution, present problems of no small importance. Indeed, effects automatically produced by these softwares, which tend to be unchangeable, could be the result of the system's error[1] or could in any case be far from the will of the parties.

---

* The paper was written within the framework of the project "TRUST - digital TuRn in EUrope: Strengthening relational reliance through Technology". This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101007820. This article reflects only the author's view and the REA is not responsible for any use that may be made of the information it contains.

** Ph.D. in Legal Sciences at UNIMC and research fellow at the Scuola Superiore Sant'Anna in Pisa.

[1] On the topic of computer errors and computer errors in smart contracts: T. Huckle, T. Neckel, *Bits and Bugs: A Scientific and Historical Review of Software Failures in Computational Science*, Filadelfia (Pennsylvania), 2019; Y. Wang, X. Chen, Y. Huang, H. Zhu, J. Bian, Z. Zheng, *An empirical study on real bug fixes from solidity smart contract projects*, in The Journal of Systems & Software, 2023, (*https://www.sciencedirect.com/science/article/pii/S0164121223001826*); H. Liu, Y. Fan, L. Feng, Z. Wei, *Vulnerable smart contract function locating based on Multi-Relational Nested Graph Convolutional Network*, in The Journal of Systems & Software, 2023 (*https://www.sciencedirect.com/science/article/pii/S016412122300170X?via%3Dihub*); A. Gupta, R. Gupta, D.

Moreover, in contracts concluded by smart contracts, the most statistically plausible vice is precisely the mistake, so an analysis of the relationship between this type of vice and the self-executing software result even more relevant[2].Furthermore, when the smart contract is implemented through artificial intelligence these problems become more complex, since the autonomy that characterises AI systems not only makes it more difficult for contracting parties to interpret and predict what will be the effects produced by the system, but also makes it considerably more complex to understand if there have been and what kind of computer errors have marred the proper functioning of the AI.These issues will be dealt with in this paper through a comparison between the Italian system and the English system. Indeed, is important to observe the approach of these two states to the smart contract phenomenon given the effort made by them in recent years, in different ways, in analysing the relationship between smart contracts and law. If Italy has adopted a pioneering stance on the matter by giving a legislative definition to these digital phenomena[3], England has tackled an in-depth and multi-year study at an institutional level, offering interesting insights that help understand the issues and possible solutions[4].

Jadav, S. Tanwar, N. Kumar, M. Shabaz, *Proxy smart contracts for zero trust architecture implementation in Decentralised Oracle Networks based applications in Computer Communications*, 2023, (*https://www.sciencedirect.com/science/article/pii/S0140366423001470?via%3Dihub*).

[2] Cf., I. Martone, *Gli smart contracts. Fenomenologia e funzioni*, Napoli, 2022, p. 153 and p. 154: "Tra le forme di invalidità enucleate dal codice, limitando l'osservazione alla sfera della volizione, non sembra revocabile in dubbio che il vizio statisticamente più plausibile nell'alveo della contrattazione algoritmica sia l'errore". In the same sense, see M. Giaccaglia, *Il contratto del futuro? Brevi riflessioni sullo smart contract e sulla perdurante vitalità delle categorie giuridiche attuali e delle norme vigenti del Codice civile italiano*, in Tecnologia e Diritto, 1/2021, pp. 161-162. S. A. Cerrato*, Appunti su Smart Contract e diritto dei contratti*, in Banca Borsa e Titoli di credito, 3/2020, pp. 392-393.

[3] Decreto-Legge no. 135 of 14/12/2018, converted by law no. 12 del 11/02/2019, art 8-ter, comma 1: «si definiscono "tecnologie basate su registri distribuiti" le tecnologie e i protocolli informatici che usano un registro condiviso, distribuito, replica bile, accessibile simultaneamente, architetturalmente decentralizzato su basi crittografiche, tali da consentire la registrazione, la convalida, l'aggiornamento e l'archiviazione di dati sia in chiaro che ulteriormente protetti da crittografia verificabili da ciascun partecipante, non alterabili e non modificabili» e comma 2: «Si definisce "smart contract" un programma per elaboratore che opera su tecnologie basate su registri distribuiti e la cui esecuzione vincola automaticamente due o più parti sulla base di effetti predefiniti dalle stesse. Gli smart contract soddisfano il requisito della forma scritta previa identificazione informatica delle parti interessate, attraverso un processo avente i requisiti fissati dall'Agenzia per l'Italia digitale con linee guida da adottare entro novanta giorni dalla data di entrata in vigore della legge di conversione del presente decreto».

[4] UK Government Chief Scientific Adviser, Government Office for Science, Distributed Ledger Technology: beyond block chain, 2016, *gov.uk*.; UK Jurisdiction Taskforce Legal Statement on cryptoassets and smart contracts, November 2019, (*https://www.blockchain4europe.eu/wp-content/uploads/2021/05/6.6056_JO_Cryptocurrencies_Statement_FINAL_WEB_111119-1.pdf*); Law Commission, Smart contracts - Call for evidence, December 2020; Law Commission, Smart legal contracts - Advice to Government, November 2021. About Law Commission, see *https://www.lawcom.gov.uk/:* "The Law Commission is the statutory independent body created by the Law Commissions Act 1965 to keep the law of England and Wales under review and to recommend reform where it is needed. The aim of the Commission is to ensure that the law is: fair, modern, simple, cost effective".

From the outset, it should be pointed out that the characteristics of smart contracts seem to show compatibility, on a theoretical level, with the general principles and provisions of contract law of the legal systems under comparison[5]. Consequently, there seems to be the possibility of applying the already existing rules to blockchain-based software. Therefore, the legal traditions examined seem to already have in themselves the appropriate tools to absorb the novelties proposed by smart contracts.

Similar conclusions were reached by the Law Commission following extensive studies involving some of the UK's leading academics[6].On the basis of the previus considerations, the aforementioned and general compatibility of the discipline of contracts with the smart contract leads to deduce that the discipline of the *errore contrattuale* in Italy and the doctrine of mistake in England are also applicable to blockchain-based computer software, despite the peculiarities of the smart contract[7].

Indeed, even in the age of digital contracting, the will continues to represent the indispensable factor in legal relations[8], and it is therefore necessary for the process of its formation to be free from vices. This is true in the digital context, but tends to decline in a very peculiar manner in smart contracts, since the latter are characterised by self-executability and greater autonomy in determining the content of the contract, especially when the protocol is implemented through artificial intelligence.

After having briefly analysed the essential features of the smart contract and AI and after having recalled the discipline of contractual mistake in Italy and in England, the aim of this paper will be to observe the interaction between the same discipline and some peculiar situations that may occur in the use of the new digital tools, questioning whether or not the contractual mistake can also be applied to the algorithmic errors that occur in smart contracts implemented through AI systems, as well as questioning the possible configurability of civil liability of third parties or nodes that essentially control the blockchain platform in which the smart contract is executed if, however, it is built on permissioned blockchain (about this type of blockchain, see the following paragraph).

---

[5] On this point, allow me to refer to J. Fortuna, *Smart contract, abuso del diritto e tutela giurisdizionale: spunti di comparazione tra diritto italiano e diritto inglese,* in Rivista di Diritti Comparati, n.3, 2022, pp. 914 ff. and *Id., Smart contract e formazione del contratto: un'analisi comparatistica della nascita del vincolo giuridico*, in *Comparazione e diritto civile*, vol. II, 2021, p. 595 ff.

[6] Law Commission, Smart legal contracts - Advice to Government, Nov. 2021, op. cit. *https://www.lawcom.gov.uk/project/smart-contracts/:* "We published our advice to Government on 25 November 2021, concluding that the current legal framework in England and Wales is clearly able to facilitate and support the use of smart legal contracts". See par. 3.140: "As we have discussed in this chapter, it is clear that smart contracts used in particular ways can satisfy the requirements for the formation of a legally binding contract under the law of England and Wales. We do not think that anything further is required in law to confirm this and, as discussed briefly below, we do not think that any confirmatory legislative statement to such effect would be helpful"; par. 3.143 - 3144: "we think that, at least at the moment, legislating in this way may cause more harm than good. In particular, any legislative definition of "smart contract" (or "smart legal contract", in our terminology) may be relatively quickly rendered obsolete by technological developments.

II. A BRIEF OUTLINE OF SMART CONTRACTS

Smart contracts are software characterised by the self-execution of its terms without the need for human intervention[9] and, in general, without the possibility of interrupting such execution or modifying its content[10]. They can be written within a blockchain, i.e. a computer network of nodes capable of managing and updating a register containing data and information with security and unambiguity. Once entered, the data and operations recorded are no longer subject to changes or alterations, thus ensuring a degree of reliability such that it is conceivable to do without banks, financial institutions, notaries, or other intermediaries[11].

Alternatively, any legislative definition may have the opposite effect, and fail to allow scope for technological developments which would not benefit from the confirmatory provision"; par. 3.146 "Given our conclusion that smart legal contracts can satisfy the requirements for a contract, a legislative statement that smart contracts are capable of being legally enforced (or to confirm that a contract is not unenforceable merely because it is a smart legal contract) seems unnecessary. In the absence of a real need for legislation, we do not think it would be justified". See, also, *https://www.lawcom.gov.uk/the-law-of-england-and-wales-can-accommodate-smart-legal-contracts-concludes-law commission/*:"The Law Commission has today confirmed that the existing law of England and Wales is able to accommodate and apply to smart legal contracts, without the need for statutory law reform. The Law Commission notes that, in some contexts, an incremental development of the common law is all that is required to facilitate the use of smart legal contracts within the existing legal framework. The Law Commission's analysis demonstrates the flexibility of the common law to accommodate technological developments, particularly in the context of smart legal contracts. It confirms that the jurisdiction of England and Wales provides an ideal platform for business and innovation".

[7] Law Commission, Smart legal contracts - Advice to Government, Nov. 2021, op. cit., par. 5.44: "We agree with these observations; in the smart legal contract context, there are increased opportunities for parties to be mistaken about something fundamental or material to the performance of the contract. We do not, however, think this necessitates expanding the scope of the doctrine of common mistake. In our view, the same principles of common mistake should continue to apply to smart legal contracts as they do traditional contracts. As Allen & Overy said, "in terms of determining whether a common mistake was made when entering into a smart contract the existing law suffices"".

[8] Cf. F. Bravo, *Contratto cibernetico*, in *Dir. informatica*, fasc. 2, 2011, p. 169. ff.; M. Giaccaglia, *Considerazioni su Blockchain e smart contract (oltre le criptovalute),* in *Contratto e Impresa*, 2019, p. 957, in note (68); L. Parola, P. Merati, G. Gavotti, *Blockchain e smart contract: questioni giuridiche aperte*, in i Contratti, 2018, pp. 685-686; Law Commission, *Smart contracts - Call for evidence*, Decembre 2020, op. cit., par. 3.15, 3.16, 3.17, 3.18, 3.19; Law Commission, Smart legal contracts - Advice to Government, Nov. 2021, op. cit., par. 3.26-3.29.

[9] A.M. Benedetti, *Contratto, algoritmi e diritto civile transnazionale: cinque questioni e due scenari*, in *Riv. dir. civ.*, 2021, p. 414.

[10] Cf. A. Stazi, *Automazione contrattuale e "contratti intelligenti". Gli smart contracts nel diritto comprato*, Torino, 2019, p. 105 and see A. M. Gambino – A. Stazi, *Contract Automation from Telematic Agreements to Smart Contracts*, in *The Italian Law Journal*, 2021, p. 107 ff.; G. Remotti, *Blockchain smart contract. Un primo inquadramento*, in *Oss. dir. civ. e comm.*, 2020, p. 189 ff. To exemplify the embryonic concept of the smart contract, even if not based on blockchain, think of the functioning of the vending machine, which mechanically realises the delivery of the object upon introduction of the necessary amount of coins. The topic was studied and explored by Antonio Cicu: A. Cicu, *Gli automi nel diritto privato*, in *Il Filangieri*, 1901, p. 561 ff.

[11] Cf. C.L. Reyes, *Moving beyond Bitcoin to an Endogenous Theory of Decentralized Ledger Technology Regulation: An Initial Proposal*, in *Vill. L. Rev.*, 61, 2016, p. 191 ff.; A. Alpini, *L'impatto delle nuove tecnologie sul diritto*, 2018, in *comparazionedirittocivile.it*; M. Bellini, *Che cosa sono e come funzionano le Block-chain*, in *Distributed Ledgers Tecnology - DLT*, 2018, in *blockchain4innovation.it*; C. Licini, *Il notaio dell'era digitale: riflessioni gius-economiche*, in *Notariato*, 2, 2018, p. 142 ff.; L. Trautman, *Virtual Currencies Bitcoin*

It consists of a series of blocks, containing transactions, interconnected in such a way that the validity of each transaction must be proven by the network of nodes on which the blockchain is distributed[12]. Each node is made up (physically) of the server (computer) of each participant and contains within it the archive of the entire blockchain, i.e. of all the blocks containing transactions, of which up-to-date copies are kept[13].

The blockchain can be public or private depending on whether the content is visible and accessible only to certain users (permissioned blockchain) or to everyone (permissionless blockchain). This implies that access to the permissioned blockchain system requires authorisation and the management of the activities performed within it is reserved to certain subjects. Therefore, in public blockchains there are no identity-related restrictions for participation in the network and anyone can obtain the entire 'ledger' and view the data of completed transactions[14]. The distinction between permissioned and permissionless blockchains concerns both the rules of access to the chain[15] and the possibility for the nodes or entities managing the permissioned blockchain to intervene on the activities carried out within the ledger and performed by all other nodes. In this case, in fact, the effects of operations can be modified by those in control of the blockchain, if this is made possible by the programming rules of the platform.

& What Now After Liberty Reserve, Silk Road, and Mt. Gox?, in *Rich. J.L & Tech.*, 20, 2014, p. 13 ff., *jolt.richmond.edu*; Report by the UK Government Chief Scientific Adviser, Government Office for Science, *Distributed Ledger Technology: beyond block chain*, 2016, *gov.uk*.

12 The integrity of the chain remains intact even if a single node is modified in its contents or stops functioning for whatever reason, as all information remains stored by the other nodes that were not subject to the tampering attempt. Transactions concluded on a blockchain-based platform therefore take place in total transparency and are considered secure, since any computer attack aimed at modifying the data would presuppose a very high computational effort, as it would require tampering with the information contained in 50% plus one of the nodes storing the data and constituting the distributed ledger technology (DLT). The difference with common centralised databases is clear, since the data is not stored in servers, where there is a client-server relationship between the network participants, but each node enjoys a position of parity with the others. It should also be noted that all the data grouped in the blocks are concatenated into the ledger through a "hashing" process, where a hash consists of a kind of fingerprint representing the information in the form of a string of characters and numbers. The blocks of the ledger have among their essential components: a hash of all the transactions contained in the block, a timestamp and a hash of the previous block that allows the sequential chain of blocks to be created.

13 Each transaction consists of an exchange of assets and must be verified, approved and archived. The information collected in the virtual space is considered certain by the community sharing the communication protocol (peer-to-peer network), and the cryptographic and IT rules that determine the functioning of the blockchain instil confidence in the security of the transactions carried out in the participants of the chain: Cf. N. Szabo, *Formalizing and securing relationships on public networks*, *First Monday*, *2*(9), 1997, su *doi.org*, and L. Piatti, *Dal Codice Civile al codice binario: blockchain e smart contracts*, in *Ciberspazio e Diritto*, 17, 56, 2016, p. 326.

14 Bitcoin and Ethereum are two examples of blockchain permissionless, blockchain based platforms in which anyone can create an account using public key cryptography without the prior authorisation of an administrator. Cfr. E. Calzolaio, *Bitcon: le sfide dell'autoregolazione*, in *Osservatorio sulle fonti*, n. 3/2021, available in: *http://www.osservatoriosullefonti.it*.

15 Cf. C. Poncibò, *Il diritto comparato e la Blockchain*, Napoli, 2020, pp. 49-50.

Smart contracts, which are aimed at applying the decentralised ledger system to the exchange relationships[16], allow for the digital representation of information concerning tangible assets, personal data, rights, certificates, company balance sheets, or other, which is entered and stored through the blockchain, and which can be transferred within the decentralised platform according to programmed conditions, thus entrusting the reference network with the transaction, without the intervention of third party intermediaries.
The logic behind smart contracts is encapsulated in the 'if this then that' formula: upon the occurrence of a certain event, the protocol will execute the result desired by the participants, contained within it, automatically, without the need for parties to certify the validity of the agreement reached by the parties or to take action for the purpose of execution, as the security of the operations concluded is guaranteed by the characteristics of the blockchain[17].
By means of the so-called peer-to-peer network, the system allows the creation of protocols with prediction of terms based on elements whose occurrence is determined through the activity of so-called 'oracles'. The oracle is to be understood as an independent programme, issuing information necessary for the performance of transactions (such as the price of goods or confirmation of delivery); the software admits that the algorithm may query it to perform a part of the contract. The oracle then becomes the element external to the parties and the decentralised system, and connects the real world to the contract, and then communicates to the smart contracts (linked to distributed ledger technology) the fulfilment of the relevant conditions.
Oracles can be based on software, hardware or human intermediaries; the latter are used when the tasks required of the oracle are too costly or impossible for machines to perform (e.g. a human intermediary is able to discern the extent and degree of a physical injury following a medical examination, and to indicate this in the relevant entry within the execution of an insurance contract). While a software-based oracle can be programmed to draw from online sources and can monitor events occurring on other blockchains, hardware oracles obtain external data retrieved from sensors and the Internet of Things[18].
The digital formation and execution of an exchange through a blockchain thus theoretically minimises the risk of breach of contract, implicit in the conclusion of any contract, and trust in the spontaneous fulfilment of the counterparty loses its relevance when the execution of the agreement is entrusted to a computer network that one has no way of influencing.

---

16 Cf. P. Cuccuru, *Blockchain ed automazione contrattuale. Riflessioni sugli smart contract*, in *Nuova giur. civ. comm.*, 1, 2017, p. 110.
17 Cf. S. A. Cerrato, *Appunti su smart contract e diritto dei contratti*, in *Banca Borsa e Titoli di credito*, op. cit., p. 374; A. U. Janssen – F. P. Patti, *Demistificare gli smart contracts*, in *Oss. dir. civ.*, 2020, p. 31 ff.
18 Cf. C. Poncibò, *Il diritto comparato e la Blockchain*, op. cit., pp. 73-74 and A. Egberts, *The Oracle Problem - An Analysis of how Blockchain Oracles Undermine the Advantages of Decentralized Ledger Systems,* 2017, pp. 1-59, available in https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3382343. With regard to the "IoT" (Internet of Things), this term refers to all devices capable of communicating data streams on the basis of which analyses can be carried out and actions performed (e.g. self-driving cars, drones, home automation and industrial production plants). Cf., also, L. Vagni, *Il problema della rilevanza giuridica dell'errore nella decisione dell'oracolo della blockchain*, in *lceonline (www.lceonline.eu)*, n.2, 2022, pp. 51-59.

Once formed in the blockchain, the smart contract is therefore substantially independent of the subsequent will of the parties, who may eventually, in order to modify it, proceed to write a new smart contract whose effects modify the consequences of the previous protocol, or render it completely ineffective. The main advantages of this computerised transaction protocol can be summarised, therefore, in a greater certainty and security of the economic operations concluded with the programme in question, also given the theoretical impossibility of the breach of contract, as well as in a (at least apparent) saving of intermediation costs[19].

In view of these characteristics, the smart contract can be considered either as software containing a contract, if all the prerequisites are met and it is equipped with all the essential elements of the contract, or as the execution of the legal relationship that has already arisen[20], thus being qualified as a mere phase of the traditional contract, i.e. its execution[21]. It is in the latter phase, indeed, that the smart contract expresses its real innovative scope linked to the self-execution that characterises it[22]. It is, in fact, the architecture of the blockchain which, by its structural design, leaves no room for the voluntary violation of the terms established, so much so that the effectiveness and guarantee of execution of the relationships formalised in it derives from the technological structure that hosts them[23].

The outcome of the algorithmic elaboration within the smart contracts seems to be, then, theoretically certain and easily predictable in the face of the aforementioned 'if this, then that' rule that innervates the deterministic functioning of the software[24]. Such a

---

[19] Cf. P. Cuccuru, *Blockchain ed automazione contrattuale. Riflessioni sugli smartcontract*, op. cit, p. 111 ss. and cf. A. Stazi, *Automazione contrattuale e "contratti intelligenti". Gli smart contracts nel diritto comprato*, op. cit., p. 114. For a focus on smart contract understood, in accordance with Nick Szabo's vision, as software that reduces or eliminates the possibility of breach of contract: Cf. S. Capaccioli, *Smart contracts: traiettoria di un'utopia divenuta attuabile*, in *Ciberspazio e diritto*, 17, 55, 2016, pp. 25-45 and cf. S. Capaccioli, *Introduzione al trattamento tributario delle valute virtuali: criptovalute e bitcoin*, in *Diritto e Pratica Tributaria Internazionale*, 1, 2014, pp. 27-68; N. Szabo, *The Idea of Smart Contracts*, 1997, available in *szabo.best.vwh.net*.

[20] The automatic execution of the contract, in fact, does not necessarily require the use of DLT, but can rely on more traditional technologies, such as vending machines that deliver the goods after the money has been inserted into the machine as payment. For a critique of the autonomy of the smart contract from the traditional contract: see R. Pardolesi - A. Davola, *"Smart contract": lusinghe ed equivoci dell'innovazione purchessia*, in F. Capriglione (ed.) *Liber Amicorum Guido Alpa*, 2019, p. 297 ff. The creator of smart contracts himself, Nick Szabo, compares them to virtual vending machines: N. Szabo, *Formalizing and Securing Relationships on Public Networks*, op. cit.

[21] L. Parola, P. Merati, G. Gavotti, *Blockchain e smart contract: questioni giuridiche aperte*, in *i Contratti*, op. cit., p. 685: "si comprende, dunque, come lo *smart contract* afferisca non alla fase di formazione del contratto, che è e resta costituita dall'accordo tra le parti, ma a quella dell'adempimento, con la conseguenza che lo *smart contract* non integrerebbe neppure una fattispecie di contratto atipico ai sensi dell'art. 1322 c.c.".

[22] Cf. S. Capaccioli, *Smart contract: traiettoria di un'utopia divenuta attuabile*, op. cit., p. 25 ff.; P. Cuccuru, *Blockchain ed automazione contrattuale. Riflessioni sugli smart contract*, op. cit., p. 110 ff.

[23] Cf. P. CUCCURU, *Blockchain ed automazione contrattuale. Riflessioni sugli smart contract*, op. cit., p. 112.

[24] Deterministic systems such as smart contracts make the blockchain platform within which they are written "produces the exact same output when provided with the same input" and algorithms "do and only do what they have been programmed to do": *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA (I) 02, [89-98]. The Court also specifies that: "They are, in effect, mere machines carrying out actions which in another age would have been carried out by a suitably trained human. They are

characteristic however, *prima facie*, would seem to be not perfectly adherent with the idea of artificial intelligence, a term by which systems with a greater level of functional autonomy[25] are generally denominated, which often produce outcomes that are not perfectly predictable *ex ante*, even if they are the result of an original human input[26].
However, it is increasingly questioned that smart contracts must necessarily be deterministic systems[27]: in fact, "if" and "then" may not even be identifiable *a priori*[28]. Even the term 'smart contract' itself does not have an unequivocal meaning and experts also refer to it even to refer to AI systems in the strict sense[29]. It should also be noted that the definitions of smart contracts offered by national legal systems and institutions inevitably end up focusing on the "self-executing" aspect of smart contracts[30] rather than their deterministic nature. Furthermore, over time, blockchain has been implemented with increasingly complex functions to the point of making possible forms of admixture with what is defined as AI[31] (for some definitions of AI see *infra* in the next paragraph).
In this case, AI governs the entire contract cycle contained in the smart contract, including the execution of the performance. We thus have self-executing automated agreements, the result of the decision-making autonomy of AI, which are capable of taking even very complex decisions, particularly through the use of predictive algorithms[32].

---

no different to a robot assembling a car rather than a worker on the factory floor or a kitchen blender relieving a cook of the manual act of mixing ingredients. All of these are machines operating as they have been programmed to operate once activated".

25 For some definitions of artificial intelligence, see below in the next paragraph.

26 See below in the next paragraph and note no.42.

27 R. De Caria, *The Legal Meaning of Smart Contracts*, in *European Review of Private Law*, 6-2019, pp. 731-752.

28 T. Schrepel (EU Commission), *Smart Contracts and the Digital Single Market Through the Lens of a "Law + Technology" Approach,* 2021, in *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3947174*.

29 C. Bomprezzi, *Blockchain-based Smart Contracts e E-Justice nella proposta AI Act*, in M. Palmirani, S. Sapienza (ed.) *La trasformazione digitale della giustizia nel dialogo tra discipline*, Milano, 2022, pp. 122-124.

30 See R. De Caria, *The Legal Meaning of Smart Contracts*, op. cit., p. 736. For some examples, in addition to the definition of smart contract offered by Italian law, which has been discussed, see The European Union Blockchain Observatory and Forum in the report Legal and Regulatory Framework of Blockchain and Smart Contracts of 27/09/2019, p. 22: "In the blockchain context, it generally means computer code that is stored on a blockchain and one or more parties can access that. These programs are often self-executing and make use of blockchain properties like tamper-resistance, decentralised processing, and the like" and Arizona House Bill No. 2417: "smart contract" means an eventdriven program, with state, that runs on a distributed, decentralized, shared and replicated ledger and that can take custody over and instruct transfer of assets on that ledger".

31 C. Bomprezzi, *Blockchain-based Smart Contracts e E-Justice nella proposta AI Act*, in M. Palmirani, S. Sapienza (ed.) *La trasformazione digitale della giustizia nel dialogo tra discipline,* op. cit., p.125. To observe some ways of integration between artificial intelligence and blockchain, some use cases and some early applications, see European Union Blockchain Observatory and Forum, *Convergence of blockchain, AI and IoT*, 2020.

32 E. Battelli, *Questioni aperte in materia di contrattazione nelle piattaforme online*, *in i Contratti*, 5/2022, p. 569. F. Di Giovanni, *Attività contrattuale e intelligenza artificiale*, in Giur.it., 7, 2019, p.1677 ff., in particular p.1681; A. Carleo (ed.), *Decisione robotica*, Bologna, 2019. G. Sartor, *Gli agenti software. Nuovi soggetti di cyberdiritto?*, in *Contr. e impr.*, 2, 2002, p. 465 ff.

III. Some definitions and characteristics of AI

A brief, albeit not exhaustive, focus on the definition and essential characteristics of artificial intelligence is now useful[33].

Article 3 (1) of the AI Act[34] states that: "'AI system' means a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments".

However, other definitions have been attempted in the European context. The European Commission in its Communication on artificial intelligence for Europe noted that the term artificial intelligence refers to systems that exhibit intelligent behaviour by analysing their environment and performing actions, with some degree of autonomy, to achieve specific goals[35], while the European Commission's High-level expert group on artificial intelligence explained that "Artificial intelligence (AI) refers to systems designed by humans that, given a complex goal, act in the physical or digital world by perceiving their environment, interpreting the collected structured or unstructured data, reasoning on the knowledge derived from this data and deciding the best action(s) to take (according to pre-defined parameters) to achieve the given goal"[36].

---

33 On this point, see S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 3rd ed. Prentice Hall, 2009. A.M. Turing, *Computing Machinery and Intelligence*, in *Mind*, 49, 1950, p. 433 ff. S. Quintarelli (ed.), *Intelligenza artificiale. Cos'è davvero, come funziona, che effetti avrà*, Torino, 2020. N. Abriani, G. Shneider, *Diritto delle imprese e intelligenza artificiale*, Bologna, 2021, p. 21 ff. The expression artificial intelligence was coined in 1956 by the American mathematician John McCarthy: for a focus on the history and development of the concept of artificial intelligence, see S. Bringsjord and N. S. Govindarajulu, *Artificial Intelligence*, in *Stanford Encyclopedia of Philosophy*, 12 luglio 2018 (*https://plato.stanford.edu/entries/artificial-intelligence/*).

34 Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act).

35 European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European economic and social committee and the Committee of regions. artificial intelligence for Europe {SWD(2018) 137 final} p.1, in which the Commission thus continues: "AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications)" See the European Parliament website *https://www.europarl.europa.eu/topics/en/article/20200827STO85804/what-is-artificial-intelligence-and-how-is-it-used*, where AI is defined as "AI is the ability of a machine to display human-like capabilities such as reasoning, learning, planning and creativity. AI enables technical systems to perceive their environment, deal with what they perceive, solve problems and act to achieve a specific goal. The computer receives data - already prepared or gathered through its own sensors such as a camera - processes it and responds. AI systems are capable of adapting their behaviour to a certain degree by analysing the effects of previous actions and working autonomously".

36 The European Commission's High-level expert group on Artificial Intelligence. *A definition of AI*, 2018, p.7.

Coming to analyse some characteristics of artificial intelligence, it should first be noted that there are different types of AI; for example, one can distinguish between: so-called "strong" AI in which the machine has the ability to understand or learn any kind of 'intellectual' task that a human being is capable of understanding or learning. In this case, the machine has a kind of 'self-awareness'; so-called "weak" AI in which the system does not emulate the complexity of the human mind and only has the capacity to perform a precise and specific task entrusted to it. This type of artificial intelligence is the one that is currently in everyday use (e.g. voice assistant, image recognition, etc.)[37].

Machine Learning (ML)[38], i.e. automatic system learning, characterises AI: it is the set of methods that allows computers to learn autonomously from the examples provided to it and the environment. ML therefore allows computers to detect patterns and learn new functions without being programmed explicitly[39]. Machine learning software self-modifies according to the data it receives and redefines its behaviour, which is not preordained, depending on the feedback it is exposed to. In ML systems, inputs are therefore provided and the system returns classified outputs; however, in order for the machine to be able to perform these tasks, it must be adequately trained (so-called training phase).

The term Deep Learning (DL)[40] refers to an area of ML that utilises Artificial Neuronal Networks (ANNs), which are inspired by the way the human nervous system processes information[41]; an ANNs is made up of multiple layers interconnected by nodes, with each node performing a series of non-linear calculations from input signals and other nodes connected to it. In Deep Learning, action after action changes the strength of the connection, so that each prediction is more accurate than the previous one. However, it

---

[37] Cf. S. Mauloni, M. Mazzanti, L. Buscemi, *Focus: Nuove Tecnologie e risvolti medico legali. La nuova frontiera dell'intelligenza artificiale: profili medico-legali*, in *Rivista Italiana di Medicina Legale (e del Diritto in campo sanitario),* fasc.3, 2022, p. 682. A. Lombardi, G. Lombardi, *Intelligenza Artificiale, contratto e responsabilità civile*, Roma, 2021, p.35.

[38] A. L. Samuel, *Some studies in machine learning using the game of checkers*, in *IBM Journal of research and development*, vol. 3 (3), 1959, pp. 210-229. J. Alzubi, A. Nayyar, A. Kumar, *Machine Learning from Theory to Algorithms: An Overview*, in *Journal of Physics: Conference Series*, 1142, 2018, pp. 1-15. H. Wang, C. Ma, L. Zhou, *A Brief Review of Machine Learning and Its Application*, 2009 International Conference on Information Engineering and Computer Science, Wuhan, China, 2009, pp. 1-4, in particular p.1: "Machine learning is a subject that studies how to use computers to simulate human learning activities, and to study self-improvement methods of computers that to obtain new knowledge and new skills, identify existing knowledge, and continuously improve the performance and achievement". D. Kreuzberger, N. Kühl, S. Hirschl, *Machine Learning Operations (MLOps): Overview, Definition, and Architecture*, in *IEEE Access*, vol.11, 2023, pp. 31866-31879.

[39] Machine learning is software based on mathematical algorithms that simulate inductive reasoning, learning from information. Cf. N. Abriani, G. Shneider, *Diritto delle imprese e intelligenza artificiale*, op. cit., p. 23.

[40] Y. LeCun, Y. Bengio, G. Hinton, *Deep learning*, in *Nature*, vol. 521, n. 7553, 2015, pp. 436–444, in particular p. 436: "Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction. […] Deep learning discovers intricate structure in large data sets by using the backpropagation algorithm to indicate how a machine should change its internal parameters that are used to compute the representation in each layer from the representation in the previous layer. Deep convolutional nets have brought about breakthroughs in processing images, video, speech and audio, whereas recurrent nets have shone light on sequential data such as text and speech".

[41] Cf. N. Abriani, G. Shneider, *Diritto delle imprese e intelligenza artificiale*, op. cit., p. 25.

can be difficult to understand the internal behaviour of the system: it is possible to observe the data 'coming in' and the 'prediction generated', but it is not easy to understand how the system achieves this prediction. This means that software functions as so-called "black boxes"[42] and is able to make automatic decisions. However, the basic requirement for training a ML model is the availability of a large amount of data (Big Data)[43].

ML is characterised by a number of learning models that allow algorithms to be classified:

1) Supervised learning: the system is instructed to solve tasks autonomously, based on previously given examples represented by possible inputs and respective desired outputs. Through such learning, the system derives a general rule by which it associates a certain input with a certain output (an example is the classification algorithm).

2) Unsupervised learning: in this type of learning, it is the system that has to create a relationship between the elements and classify them, without relying on previously indicated categories. In fact, the system is provided with a series of inputs that must be classified on the basis of common characteristics, from which a rule to be applied to subsequent inputs is derived. Grouping is an example of unsupervised learning, as it can be used to group similar items together.

3) Reinforcement learning: the actions taken by the software are aimed at maximising the reward. In fact, unlike the other types of learning, no data is required for conditioning, but the system performs trial and error, learning which actions receive a greater 'reward' in the long run. Indeed, the quality of an action of the system is given by a so-called 'reward' numerical value that is intended to encourage correct behaviour by the software agent[44].

Having observed the characteristics of smart contracts and AI, it is now necessary to analyse the discipline of contractual mistake in Italian law and of mistake in English law insofar as these legal aspects will be useful for the purposes of assessing the relationship between the same discipline and the new digital tools.

IV. CONTRACTUAL MISTAKE IN THE ITALIAN LEGAL SYSTEM

In Italy, contractual mistake (*errore contrattuale*)[45] consists in a false representation by the party about the contract or its assumptions and is the cause of the invalidity of the contract

[42] The European Commission's High-level expert group on Artificial Intelligence. *A definition of AI*, 2018, p.6: "Black-box AI and explainability. Some machine learning techniques, although very successful from the accuracy point of view, are very opaque in terms of understanding how they make decisions. The notion of black-box AI refers to such scenarios, where it is not possible to trace back to the reason for certain decisions. Explainability is a property of those AI systems that instead can provide a form of explanation for their actions".

[43] S. Mauloni, M. Mazzanti, L. Buscemi, *Focus: Nuove Tecnologie e risvolti medico legali. La nuova frontiera dell'intelligenza artificiale: profili medico-legali*, in *Rivista Italiana di Medicina Legale (e del Diritto in campo sanitario)*, op. cit., pp. 684-687.

[44] N. Abriani, G. Shneider, *Diritto delle imprese e intelligenza artificiale*, op. cit., p. 24 e 27 e S. Mauloni, M. Mazzanti, L. Buscemi, *Focus: Nuove Tecnologie e risvolti medico legali. La nuova frontiera dell'intelligenza artificiale: profili medico-legali*, op. cit., p. 685-686. Cf. A. Lombardi, G. Lombardi, *Intelligenza Artificiale, contratto e responsabilità civile*, op. cit., p. 27.

[45] About Italian contractual mistake see G. Stolfi, *Teoria del negozio giuridico*, Padova, 1947, p. 140, A. Formica, *Rassegna di giurisprudenza: errore*, in *Riv. dir. civ.*, 1955, p. 1045 ff., E. Betti, voce *Errore*, in *Nov. Dig. it.*, VI, 1960, p. 662, P. Barcellona, *Profili della teoria dell'errore nel negozio giuridico*, Milano, 1962 and Id. voce "*Errore (Diritto privato)*", in *Enc. dir.*, XV, Milano, 1966, V. Pietrobon, *L'errore*

when it is essential and recognisable ex Art. 1428 of the Italian Civil Code[46]. In fact, Art. 1427 c.c. establishes that: "Il contraente, il cui consenso fu dato per errore, estorto con violenza o carpito con dolo, può chiedere l'annullamento del contratto". Importance is attributed to the mistake because it determines the ignorance or false representation of relevant elements in which one of the contracting parties incurs, due to the general interest of the system whereby the will of the parties to bind themselves to a contract must be spontaneously and freely expressed[47].

A distinction is made between so-called *errore ostativo* (mistake on declaration) and so-called *errore vizio* (mistake as vice of will).

An *errore ostativo*[48] (mistake on declaration) is, according to Article 1433 of the Civil Code[49], the mistake that falls on the declaration of the party or on its transmission when the declaration has been inaccurately transmitted by the person (*nuncius*) or the office entrusted with it[50].

In the mistake on declaration, therefore, the declarant's will is correctly formed through a decision-making process that has not run into vices, but has then been expressed or transmitted in a manner that does not reflect the contracting party's actual will[51]. This kind

nella dottrina del negozio giuridico, Padova, 1963, F. Santoro-Passarelli, *Dottrine generali del diritto civile*, nona edizione, Napoli, 1966 (rist. 1983), p.157 ff., C. Rossello, *l'errore nel contratto*, in *Il codice civile. Commentario, fondato da Piero Schlesinger diretto da Francesco D. Busnelli*, Milano, 2019.

46 See, C. M. Bianca, *Il Contratto*, in *Diritto Civile*, Ed. III, Milano, 2019, p. 601 and cf. Cass. Civ., sez. III, 01/10/2009, n. 21074, in *Giust. civ. Mass.* 2009, 10, 1397; see Cass. Civ., sez. lav., 24/08/2004, n. 16679 in *Giust. civ. Mass. 2004, 7-8*; Cass. Civ. sez. II, 19/04/1988, n. 3065 in Giust. civ. Mass. 1988, fasc.4; see, also, A. Trabucchi, voce "*Errore (diritto civile)*", in *Noviss. Dig. It.*, VI, Torino, 1960, p. 666 and V. Roppo, *Il contratto*, in G. Iudica and P. Zatti (ed.) *Trattato di diritto privato*, 2a ed., Milano, 2011, p. 730. On the recognisability of mistake, see C. Rossello, *l'errore nel contratto*, op. cit., p.39 ff.

47 C. M. Bianca, *Il Contratto,* op. cit., p. 601. F. Camilletti, *Riflessioni sull'annullabilità del contratto per errore*, in *i Contratti*, n.2, 2019, p. 225.

48 L. Ferri, *Errore ostativo e interpretazione del contratto,* in *Riv. trim. dir. proc. civ.*, 1958, p. 1505 ff.; R. Sacco, *L'alterazione intenzionale della dichiarazione contrattuale e l'art. 1433*, in *Giur. It.*, 1961, I, 2, p. 245 ff.

49 Art. 1433 c.c.: "Le disposizioni degli articoli precedenti si applicano anche al caso in cui l'errore cade sulla dichiarazione, o in cui la dichiarazione è stata inesattamente trasmessa dalla persona o dall'ufficio che ne era stato incaricato".

50 This category of mistake is inspired by the *erreur-ostacle*, developed by French doctrine. Cf. J. Ghestin, *La notion d'erreur dans le droit positif actuel: Prix Henri Capitant 1962*, Parigi, 2013. For a reflection on the reform of the *Code civil*, see A. Gorgoni, *I vizi del consenso nella riforma del Code civil: alcuni profili a confronto con la disciplina italiana*, in G. Vettori, E. Navarretta e S. Pagliantini (ed.), *La riforma del Code civil*, *Persona e Mercato*, 1, 2018, p. 88 ff. See, C. Rossello, *l'errore nel contratto*, op. cit., p. 265: "L'art. 1433 cod. civ. stabilisce che le disposizioni in materia di errore contenute nelle norme precedenti si applicano anche nel caso in cui l'errore cada sulla dichiarazione (errore nella dichiarazione), o nell'ipotesi in cui la dichiarazione sia stata inesattamente trasmessa dalla persona o dall'ufficio incaricato (errore nella trasmissione della dichiarazione)" and p. 270: "le caratteristiche di essenzialità e riconoscibilità dell'errore prescritte dall'art. 1428 cod. civ. devono sussistere anche per l'errore nella dichiarazione o nella sua trasmissione di cui all'art. 1433 cod. civ., anche se occorre convenire sul fatto che, quanto alla essenzialità, essa è spesso *in re ipsa*, dal momento che l'errore ostativo è essenziale per definizione".

51 Cf. Cass. Civ., sez. lav., 09/01/2018, n. 274 in *Giustizia Civile Massimario 2018*.

of mistake excludes awareness of the meaning of the contract, so it is no longer governed by a conscious will; even in this case the contract is voidable.
In contrast, the mistake as vice of will relates to the formation of the will of the party, since in such a case the contracting party would not have wished to conclude the contract without the mistake. Indeed, in such a case the party has not correctly ascertained and evaluated the circumstances and factual premises of the contract and the will expressed in the declaration is vitiated.
A distinction is made between the mistake of fact (*errore di fatto)*, which relates to the elements of the contract or external circumstances, and the mistake of law (*errore di diritto)*, which relates to legal rules[52]. The mistake that falls on the elements of the contract consists in the divergence between the objective meaning of the contract and the meaning attributed to it by the party. In such a case, the interpretation of the contract to determine its meaning precedes the assessment of the mistake, in order to compare the content of the contract with the meaning given to it by the mistaken party.
Pursuant to Art. 1428 of the Italian Civil Code, a contract vitiated by a party's mistake is voidable on condition that it is essential and recognisable to the other party. The first of these requirements for the relevance of the mistake, i.e. its essentiality, presupposes an objective evaluation; indeed, the contract may be avoided only when the mistake assumes an appreciable importance with respect to the balance of interests contained in the contract[53].
For the invalidity of the contract, the mistake must be recognizable as well as essential. Article 1431 cc. provides that: "L'errore si considera riconoscibile quando, in relazione al contenuto, alle circostanze del contratto ovvero alla qualità dei contraenti, una persona di normale diligenza avrebbe potuto rilevarlo", i.e., when a contracting party, using ordinary diligence, should have recognized the erroneous knowledge of the other party[54]. Each

[52] It seems useful to recall the definition of mistake contained in the Unidroit Principles of international commercial contracts 2016, contained in Art. 3.2.1 (Definition of mistake): "Mistake is an erroneous assumption relating to facts or to law existing when the contract was concluded".
[53] The Italian legislator has specifically provided for the instances of essentiality under Article 1429 of the Civil Code: 1) *Errore sulla natura* (mistake as to the legal nature) or *errore sull'oggetto* (mistake on the subject matter) of the contract (Article 1429 cc., no.1); 2) *errore sull'identità dell'oggetto della prestazione* (mistake on the identity of the object of performance) or *errore su una qualità dello stesso* (mistake on a quality thereof) which, according to common assessment or in relation to the circumstances, is to be considered decisive for the agreement (Art. 1429. cc. n. 2); 3) *errore sull'identità* (mistake as to the identity of the contracting party) or *errore sulle qualità* (mistake on qualities) of the person, assuming that one or the other has been determined for agreement (art. 1429 Civil Code, no. 3); 4) *errore di diritto* (mistake of law), when it was the sole or main reason for the contract (Art. 1429 Civil Code, no. 4). The normative definition in Article 1429 of the Civil Code does not seem to be peremptory and does not exclude that mistake on objective assumptions may also be essential if in relation to the circumstances it is determined for agreement.
[54] Cf. Cass. Civ., sez. III, 28/11/2019, n. 31078 in *Giustizia Civile Massimario* 2019: **"**La rilevanza dell'errore, come causa di annullamento del negozio, è caratterizzata dal duplice profilo della sua essenzialità e della riconoscibilità, intesa, quest'ultima, come capacità di rilevazione di esso da parte di una persona di media diligenza, in relazione sia alle circostanze del contratto che alle qualità dei contraenti […]"; cf., also, Cass. civ., 30/03/1979 n. 1843 in *Banca, borsa 1979, 398*, *(nota* of Salvestroni*),* op. cit.

contracting party, therefore, has the burden of verifying the other party's manifest mistake and the obligation in good faith to give notice of it.

The *ratio* for which the mistake is the cause of the invalidity of the contract only when it is recognizable is due to the fact that, otherwise, the contract would be unsuitable to arouse the other party's reliance on the seriousness and awareness of the contractual *declaratio*[55]. Moreover, recognizability is not relevant in the presence of common mistake for italian law since in such an eventuality each of the two contracting parties has determined the invalidity of the contract[56].

From what has been observed regarding the recognizability of the mistake, it follows logically that the actual knowledge of a party about the declarant's mistake must be determined for the purposes of the voidability of the contract[57].

The *errore sul motivo* (mistake on motive), as a rule, is not cause for the invalidity of the contract[58]. The irrelevance of the mistake on the motive is due to the normal irrelevance of the reasons, purposes and assumptions that induce the party to enter into the contract[59]. Indeed, the party cannot claim to disengage from the contractual obligation if it realizes that it has fallen into error on a circumstance unrelated to the content of the contract. Moreover, even if a party has realized the mistake about the reason this still does not justify the invalidity of the contract, since the need for certainty of contracting prevents the commitment made from being questioned for the personal reasons of the contractor[60].

With regard to the *errore di calcolo* (miscalculation), Article 1430 of the Civil Code provides that such a mistake does not give rise to invalidity but to the rectification of the contract unless, by falling the mistake on the quality, it has assumed a determinate importance[61]. For jurisprudence, the miscalculation is the mistake made in the arithmetic processing of

---

55 C. M. Bianca, *Il Contratto*, op. cit., p. 606.

56 See, Cass. Civ., sez. II, 23/03/2017, n.7557 in *de Jure, banca dati editoriale GFL*: "Allorquando […] vi siano due volontà concordi ed entrambe viziate dal medesimo errore, non può trovare applicazione il principio dell'affidamento e, quindi, non opera il requisito della riconoscibilità dell'errore ai fini dell'annullamento, perché, in tal caso, ciascuno dei due contraenti ha dato causa all'invalidità del negozio indipendentemente dall'altro (Cass. Sez. 6-2, 15/12/2011, n. 26974; Cass. Sez. 2, 12/11/1979, n. 5829; Cass. Sez. 1, 30/05/1969, n. 1923)". Against this jurisprudential orientation, see A. De Martini, *In tema di riconoscibilità dell'errore bilaterale nel contratto*, in *Foro it.*, 1952, I, p. 431 ff.

57 Cf. Cass. Civ., sez. un., 01/07/1997, n. 5900 in *Giust. civ. Mass. 1997, 1111*.

58 An exception to this rule can be found in the regulation of donation, which can be contested on the ground of *mistake on motive*, if this is apparent from the contract and is the only one that determined the donor to draw it up (art. 787 c.c.).

59 C. Rossello, *l'errore nel contratto*, op. cit., p. 90: "L'irrilevanza dell'errore sui motivi è stata tradizionalmente giustificata alla stregua della necessità di tutela dell'altrui affidamento, in considerazione dell'impossibilità da parte del destinatario della dichiarazione di valutarne obiettivamente l'influenza determinante ai fini della stipulazione del contratto"; see, F. Martorano, *Presupposizione ed errore sui motivi nei contratti*, in *Riv. dir. civ.*, 1958, I, 69 ff.

60 C. M. Bianca, *Il Contratto*, op. cit., pp. 609-610.

61 Art. 1430 cc., Errore di calcolo: "L'errore di calcolo non dà luogo ad annullamento del contratto, ma solo a rettifica, tranne che, concretandosi in errore sulla quantità, sia stato determinante del consenso"; see F. Santoro-Passarelli, *Dottrine generali del diritto civile*, op. cit., p. 163, who defines the *errore di calcolo* (miscalculation) as: "un errore accidentale rettificabile". Cf. G. Piazza, *L'errore di calcolo e l'art. 1430 del codice civile*, in *Riv. trim. dir. proc. civ.*, 1964, p. 575 ff. G. Cian, *Alcune riflessioni in tema di rettifica*, in *Riv. dir. civ.*, 2018, 1, p. 1 ff.

data exactly assumed in the contract[62] . Indeed, since the *ratio* of the rule is to make rectifiable the miscalculation that do not appear to be determined by agreement, this kind of mistake seems rather to consist in the erroneous quantitative determination resulting either from erroneous arithmetical operation or from erroneous quantification of the exactly identified good[63]. Moreover, if the contract makes no mention of the quantity of the thing the party cannot invoke the errors made in fixing the amount of the offer and claim the adjustment of the price, as in the case of the sale for a certain amount of a fungible good present in a container of which, however, the quantity was not indicated. In the latter case, however, there needs to be a concrete assessment of whether the mistake as to the quantity of the thing not indicated in the contract could constitute an essential and recognizable mistake as to the due performance.

V. MISTAKE IN ENGLISH CONTRACT LAW

In the English common law system the concept of mistake, besides having different characteristics, is not delineated and clear as in Italy. In fact, the English mistake constitutes one of the most complex areas of contract law, to the point that commentators speak of it as a subject matter that is at times 'obscure' and 'confused'[64]. Given the difficulty in dealing with the issues related to it[65], in this paper only those aspects and features of the English doctrine of mistake that are most useful and functional for the purposes of the present investigation will be considered. In addition, again with regard to the profiles of mistake to be taken into consideration, it is appropriate to follow the approach and indications provided by the Law Commission in its paper entitled "Smart legal contracts - Advice to Government" of November 2021, which in years of study has observed the relational dynamics between certain types of mistake and blockchain-based computer protocols (see *infra* §6 and 7).

In English law, a contract may be declared invalid (more precisely void[66]) under certain conditions if one or both parties have made a mistake when concluding the contract. The

62 Cf. Cass. Civ., sez. I, 03/03/2022, n. 7066 in *Guida al diritto 2022, 18*.

63 Consider the price of goods contained in a container that is calculated on the basis of an erroneous determination of the weight of the same; on this point, see C. M. Bianca, *Il Contratto*, op. cit., p. 612.

64 G. Criscuoli, *Il contratto nel diritto inglese*, second ed., Padova, 2001, p. 194. Cf., also, E. Calzolaio, *Comparative Contract Law. An introduction*, London, 2022, p.137: "Since the 19th century, however, textbook writers and judges familiar with Roman and French law began to incorporate the 'alien' doctrine of mistake, making the false assumption that the English law of contract was based upon consent and agreement. The result is that now the rules sometimes appear vague and dependent upon uncertain categorizations […] it is true that there is not a single doctrine applicable to all kinds of mistake, as in the case in the civil law tradition. […] the common law approach to mistake is much narrower than the one adopted in the civil law countries, both for unilateral and common mistakes".

65 On *mistake* in English legal system, see S. J. Stoljar, *Mistake and misrepresentation: A Study in Contractual Principles*, Sweet and Maxwell, 1968 and C. Macmillan, *Mistakes in Contract Law*, Hart Publishing**,** 2010.

66 With regard to the so-called vitating factors, the contract may be "void" or "voidable". The contract is void when it has never produced judicial effects (ineffectiveness *ex tunc*) and it is as if it had never existed. A mistake, for example, tends to render the contract void. If a contract is voidable, on the other hand, it remains valid and effective until it is "rescinded" by the party having

mistake may be described as an incorrect belief or assumption on a question of fact or law[67]. A mistake made by both parties may be a "common mistake" or a "mutual misunderstanding", whereas a mistake made by only one party is known as a "unilateral mistake"[68].

It should be noted that the doctrine of mistake in English law of contract is generally distinguished into two macrocategories: the first tends to be identified with the term "mistake as to the terms or identity", which includes "mutual misunderstanding" and "unilateral mistake"; the second concerns the common mistake on a question of fact or law, which includes the "common mistake".

In mutual misunderstanding, each party has mistaken the content of the contract as understood by the other party (see, *infra*, §5.2); in the case of unilateral mistake only one of the parties has mistaken the actual content of the contract or the identity of the other party (see, *infra*, §5.3). In such cases the mistake is in the communication between the parties, which prevents the formation of the agreement, for instance because the parties had a misunderstanding during the negotiation or because one party addresses an offer to the offeree which the latter knows does not conform to the offeror's real will but nevertheless accepts.

In contrast, in the case of common mistake the parties agree on the content of the contract (see, *infra*, §5.1), but have concluded the agreement having reached the same mistaken belief on a question of fact or law[69]. However, when only one party has made a mistake of fact for English law there is no basis for the application of the doctrine of mistake[70].

In any event, whether in the case of mutual misunderstanding, unilateral mistake or common mistake, the contract, under certain conditions may be void, albeit on different legal grounds[71].

---

the power to do so. Indeed, the effect of "rescission" is that the contract is invalid and becomes ineffective ex tunc. Examples of vitiating factors that render a contract voidable are misrepresentation, duress and undue influence. Cf. A. Burrows, *A Restatement of the English Law of Contract*, 2nd ed., 2020, pp. 178-179 and C. Mitchell, P. Mitchell, S. Watterson, *Goff & Jones: The Law of Unjust Enrichment*, 9th ed., Mytholmroyd, UK, 2016, par. 40-02.

[67] H. Beale, *Chitty on Contracts,* 33rd ed, Sweet & Maxwell, 2021, par. 5-007; Cfr. *Pitt v Holt* [2013] UKSC 26, [2013] 2 WLR 1200 from [108] to [109]. See, also, J. Cartwright, *Misrepresentation, Mistake and Non-disclosure*, 5th ed, Sweet & Maxwell, 2019, par. 12-03.

[68] H. Beale, *Chitty on Contracts*, op. cit., 2021, par. 5-001.

[69] H. Beale, *Chitty on Contracts*, op. cit., 2021, par. 5-001 – 5-002.

[70] *Statoil ASA v Louis Dreyfus Energy Service LP (The Harriette N)* [2008] EWHC 2257 (Comm), [2008] 2 Lloyd's Rep. 685.

[71] H. Beale, *Chitty on Contracts*, op. cit., 2021, par. 5-009: "The first type of mistake (termed above "mistake as to the terms or as to identity") is sometimes said to operate so as to negative consent, the second (termed above "common mistake") sa as to nullify consent. In other words, in the first case, the parties may not have in fact reached an agreement; in the second, the mistake renders the agreement ineffective as a contract. In either case, if the mistake is operative the contract in said to be void ab initio".

5.1 *Common mistake*

The doctrine of common mistake concerns the situation where the parties enter into a contract based on an erroneous belief or assumption concerning a question of fact or law[72] that is relevant to the performance of the contract. English law recognises only a very limited range of common mistakes to both parties that render a contract void. In The Great Peace, the Court of Appeal ruled that a contract is void for common mistake only if: a) the parties shared a belief in the existence of a certain situation at the time the contract was made; b) contrary to that belief, the situation did not exist; c) the non-existence of the situation makes the performance of the contract or the achievement of its purpose impossible[73].

It is therefore not sufficient to render the contract invalid the fact that the performance of the contract proves to be more onerous than intended by the parties because of a mistake made at the time of the conclusion of the contract on a certain matter. Indeed, the mistake made by the parties must relate to the very possibility of performance and thus, in The Great Peace, a contract for the provision of towing a ship to safety is not invalid if the parties entered into the contract on the basis of an erroneous assumption as to the distance between the salvage vessel and the wrecked ship. Indeed, in such a case it is still possible to execute the contract according to the terms contained therein, so the contract is not void for common mistake[74].

It is useful to give some examples of common mistakes, belonging to different types. One is the common mistake of fact as to the existence of the object of the contract: in *Couturier v Hastie*[75] the parties had agreed to sell a cargo of grain carried by a ship which the parties believed to be on a voyage from Thessaloniki to England. However, the parties were not aware that, at the time the contract was concluded, the captain of the ship had already sold the grain in Tunis, as it had begun to ferment. The House of Lords held the contract void in this case due to the parties' mistake as to the existence of the object of the sale.

Another type of common mistake is the common mistake as to the existence of facts constituting the assumption of the contract: the paradigmatic case is *Griffith v Brymer*[76] . In that case the parties concluded a contract for the lease of a room from the window of

[72] See J. Beatson, A. Burrows, J. Crtwright, *Anson's Law of Contract*, 31 st, Oxford, 2020, p. 296: "Both parties make the same mistake of fact or law relating to the subject matter or the facts surrounding the formation of the contract".

[73] See *Great Peace Shipping Ltd v Tsavliris Salvage (International) Ltd (The Great Peace)* [2002] EWCA Civ 1407, [2003] QB 679 at [76]: "the following elements must be present if common mistake is to avoid a contract. (i) there must be a common assumption as to the existence of a state of affairs; (ii) there must be no warranty by either party that that state of affairs exists; (iii) the non-existence of the state of affairs must not be attributable to the fault of either party; (iv) the non-existence of the state of affairs must render performance of the contract impossible; (v) the state of affairs may be the existence, or a vital attribute, of the consideration to be provided or circumstances which must subsist if performance of the contractual adventure is to be possible".

[74] V., *Great Peace Shipping Ltd v Tsavliris Salvage (International) Ltd (The Great Peace)* [2002] EWCA Civ 1407, [2003] QB 679 from [162] to [166].

[75] (1856) 5 H.L. Cas. 673.

[76] (1903) 19 T.L.R. 434.

which the coronation procession of Edward VII could be seen. The parties were, however, both unaware that the passing of the procession had been cancelled. The Court therefore declared the contract void because it was based on a mistake concerning the basis of the legal relationship.

Another type of common mistake is the mistake as to the quality of the object of the contract, not to be confused with the mistake as to the nature or identity of the object (see below on this paragraph); this distinction, while theoretically easy to understand, is not always immediately recognisable when the concrete case is assessed. This hypothesis of mistake, under the common law, does not lead to invalidity: in *Leaf v International Galleries*[77] a certain painting was sold without giving decisive importance to its author, despite the common belief of the parties that the latter was a great and well-known artist. In that case, the subsequent discovery that the painting is not by the painter believed to be its author does not lead to the invalidity of the contract. In fact, there has been no lack of agreement between the parties on the sale of that specific painting, the parties not having considered the author of the painting to be decisive for the agreement, notwithstanding the mistaken belief[78].

The last *species* of common mistake that it is useful to observe is the common mistake on the nature of the object of the contract. Indeed, according to common law, a contract concluded on the basis of a common mistake by the contracting parties on the nature of its object is absolutely void for lack of real agreement. On this point, for a better understanding, it is well to cite the case *Nicholson and Venn v Smith Marriott*[79], in which the defendant had offered at auction tablecloths bearing the emblem of Charles I, claiming (in full belief of the truthfulness of its declaration) that they had been owned by the sovereign. The claimant, believing the origin of the tablecloths, decided to purchase the goods for a proportionate value. However, it later turned out that both parties had been mistaken since the tablecloths were in fact from the 18th century. In the present case, the court decided that the contract was void since the parties had specifically bargained for an heirloom of Charles I and had not reached an agreement for a different object.

A careful analysis reveals the difference with the aforementioned *Leaf v International Galleries* case; in fact, in the latter the parties had agreed to sell the painting that had actually been the object of the contract, not considering the fact that it had been painted by a particular painter like decisive for its identity, despite the common misbelief as to the actual identity of the painter. In contrast, in *Nicholson and Venn v. Smith Marriott* the parties' agreement had been reached precisely in relation to the heirloom of Charles I; therefore, once the tablecloths were revealed not to belong to that sovereign, the contract had to be declared void[80].

---

77 [1950] 1 All. e.R. 639.

78 It should be noted that in equity the approach taken by the common law as described above is superseded. In fact, it is recognised that a contract, vitiated by a mistake as to the essential quality of its object, may be rendered ineffective [see *Solle v Butcher* [1949] 2 All. E. R. 1107].

79 (1947) 177 L.T. 189.

80 G. Criscuoli, *Il contratto nel diritto inglese*, op. cit., pp. 198-203.

5.2 *Mutual misunderstanding*

Mutual misunderstanding is the mistake the parties make when they misunderstand each other's true intentions, as is the case when Tizio offers to sell his petrol car while Caio believes that the offer relates to another electric car. This type of mistake, therefore, occurs when each contracting party is mistaken about the other's intention to contract on a certain object. The difference between mutual misunderstanding and common mistake is clear, since whereas the latter type of mistake is identical for both parties (whether it concerns the subject matter of the contract, its assumptions, its qualities or its legal nature), in the case of mutual misunderstanding the parties make different mistakes, misunderstanding each other's intentions. This explains why in mutual misunderstanding the mistake is in the communication between the parties and prevents the formation of the agreement. It is now useful to point out some cases where this is the case.

The first is *Raffles v. Wichelhaus*[81] , in which Wichelhaus had agreed to buy cotton from Raffles that was to arrive from Bombay on a ship called Peerless. However, by chance there were two ships with the name Peerless carrying cotton from Bombay, one leaving in October and the other in December. Since the parties were not aware of the fact that there were two vessels with the same name, the same cargo and coming from the same city, it happened that one party referred to the vessel that left in December, while the other referred to the vessel that left in October. In the present case, the contract was therefore based on a mutual misunderstanding, objectively justifiable in the eyes of a reasonable person, therefore the contract was declared void.

Another useful case for understanding is *Scriven Bros. and Co. v. Hindley and Co*[82]. Scriven had auctioned a number of bales of hemp and some bales of shives; Hindley, prior to the auction, had examined the samples and consequently decided to bid for the hemp. However, during the auction, due to the lack of clarity in the description of the lots offered for sale, Hindley offered a sum for a number of bales that she believed to contain hemp, when in fact they contained shives, a much more modest material of much less value than hemp, and the sum offered was therefore excessive and disproportionate. The auctioneer, however, accepted the offer in the belief that the participant actually intended to buy hemp, albeit for a high price that might have been justifiable on the basis of Hindley's subjective motives. In the present case, the Court denied that a valid agreement had been formed, pointing out that any reasonable buyer could have been misled by the inaccurate description of the goods in the catalogue[83].

5.3 *Unilateral mistake.*

The doctrine of unilateral mistake requires that only one of the parties be in mistake at the time of the conclusion of the contract. Normally, such a mistake does not impede the due performance but, if it can be shown that at the time of the conclusion of the contract one party was in mistake with respect to a term of the contract and the other party was aware

81 (1864) 2 H. and C. 906.
82 [1913] 3 K.B. 564.
83 G. Criscuoli, *Il contratto nel diritto inglese*, op. cit., pp. 203-205.

of that mistake, the contract may be declared void. This is because, according to English law, in such a case the parties cannot be said to have reached an agreement, which is a prerequisite for the formation of a legally binding contract[84].

A classic example of the unilateral contract doctrine can be found in *Hartog v Colin & Shields*[85]. In that case, the seller had addressed an offer to the offeree in which he offered to sell certain goods. However, by mistake, the seller had communicated an incorrect price of those goods. Taking advantage of the mistake, the buyer had pretended to accept the seller's proposal and had subsequently sued the seller when the latter had refused to deliver the offered goods. The King's Bench held that the contract was void for unilateral mistake, since the buyer knew that the seller had been mistaken about the price of the goods at the time the contract was made. Indeed, Judge Singleton observed that: "anyone with knowledge of the trade must have realised that there was a mistake" in the terms of the seller's offer and therefore the buyer "could not reasonably have supposed that the offer contained the real intention"[86]. Accordingly, there was no agreement between the parties, nor could a contract have come into existence.

It should be noted that traditionally the unilateral mistake in England, provided that it is essential in relation to the overall content of the contract, is treated differently by common law and equity depending on the position in the contractual relationship of the party not fallen in mistake. Indeed, the mistake under common law leads to the invalidity of the contract only if the party not in error knew of the mistake made by the other party and nevertheless decided to conclude the contract. In that case invalidity is determined by the fact that no agreement was reached between the parties, but also by the fact that they did not contract on an equal basis[87].

For the equity, on the other hand, the decisive factor is whether the mistake committed by one party, although unknown to the other party, would nevertheless have been recognisable on the basis of its content, the circumstances of the contract or the qualities of the contracting parties by any reasonable person with the use of ordinary diligence[88].

The unilateral mistake may also relate to the identity of the other party; this occurs when Tizio enters into a contract with Caio, believing him to be Sempronio. In many of the cases where a contracting party makes a mistake as to the identity of the other party's person, the mistake is caused by the other contracting party's misleading conduct leading to the invalidity of the contract in the face of the fraudulent, negligent or innocent

---

84 H. Beale, *Chitty on Contracts*, op. cit., par. 3-018 and cf. A. Burrows, *A Restatement of the English Law of Contract*, op. cit., p. 186.

85 [1939] 3 All ER 566. In the present case, a misunderstanding arose concerning the purchase of 30,000 Argentine hare skins which the offeror wanted to sell for 10 pence each, whereas the offeree, misunderstanding the offer, intended to buy them at 10 pence per pound, i.e. by weight (thus paying three skins with ten pence).

86 See *Hartog v Colin & Shields* [1939] 3 All ER, [566] and [568].

87 In *Boulton v Jones* (1857) 2 H. and N. 564, for instance, a contract concluded following an acceptance expressed by a contracting party who was aware that the proposal was not addressed to him was declared void.

88 According to the equity, for example, ineffectiveness was declared by the Court in *Webster v. Cecil* (1861) 30 Beav. 62.

misrepresentation[89]. Apart from cases in which the contract is rendered invalid by the misrepresentation, there are situations in which the mistake is imputable to the party and the invalidity of such contracts is only triggered by the occurrence of certain conditions. The first of these is that the identity of one of the contracting parties must be essential to the existence of the legal relationship[90]. For this reason, the mistake of a person who, having made an offer to the public, refuses to consider the contract valid because the accepting party was not the person with whom he actually wished to conclude the contract is irrelevant[91]. The second condition is that the mistake must relate to the identity of the person of the other contracting party and not to some of his qualities such as solvency or social position[92]; the third is that the party claiming the mistake as to the identity of the other contracting party must prove that the mistake he made was not due to his negligence[93].

VI. The divergence between the will and the pre-contractual declarations of the parties in smart contracts.

With regard to the relationship between contractual mistake and smart contracts, it should first be noted that in the use of these software people may mainly incur two types of mistake, which are less frequent in traditional contracting: one caused by the greater difficulty for the party to perfectly understand the content of the contract drawn up in computerised code, the other caused by the divergence between the will and what is actually transposed in the blockchain platform.

Since the real characteristic trait of the smart contract resides in the automatism of its operation, the discipline of mistake in Italy tends to apply similarly to what happens in other contracts, equally formed through digitised systems but lacking self-executability. Therefore, like normal digital contracts, in order to determine the invalidity of a smart contract, it is not sufficient to merely ascertain a wrong representation of reality, but it will be necessary for at least one of the contracting parties to have made an essential and recognisable mistake (see, Art. 1428, 1429, 1431 cc. and §4)[94].

The use of a smart contract appears apt to increase the hypotheses of application of the mistake; there is, for example, a possible number of cases in which the computer software is referable to subjects that are sometimes anonymous, sometimes covered by pseudonymy: this, inevitably, increases the possibility that the mistake may fall on the identity or qualities of the person of the other contracting party[95]. In addition, the characteristics of the smart contract also make mistakes on the legal nature or subject

89 See *Phillips v Brooks Ltd.* [1919] 2 K. B. 243.
90 See, for instance, *Boulton v Jones* (1857) 1 H. and N. 564.
91 See *Dennant v Skinner* [1948] 2 K.B. 164.
92 Cf. *King's Norton Metal Co., Ltd. v Edridge, Merrett and Co., Ltd.* (1897) 14 T.L.R. 98; *Newborne v Sensolid (G.B.) Ltd.* [1954] 1 Q.B. 45.
93 Cf., *Ingram v. Little* [1960] 3 All E.R. 332. V., G. Criscuoli, *Il contratto nel diritto inglese*, op. cit., pp. 208-210.
94 I. Martone, *Gli smart contracts. Fenomenologia e funzioni*, op. cit., p. 155. Cf., A. Lombardi, G. Lombardi, *Intelligenza Artificiale, contratto e responsabilità civile*, op. cit., pp. 207-209.
95 Art. 1429 c.c. "L'errore è essenziale […] 3) quando cade sull'identità o sulle qualità della persona dell'altro contraente, sempre che l'una o le altre siano state determinanti del consenso".

matter of the contract more frequent, as well as on the identity of the object of the performance or on a quality of the same that, according to common appreciation or in relation to the circumstances, must be considered determinant for the agreement[96], also because in the transformation of the contract into computer code strings there could be either a translation, in whole or in part, that does not perfectly adhere to the contents prepared by the contracting parties, or an incomplete translation[97].

With regard, in particular, to the possible application of the Italian legal system's rules on mistake on declaration (*errore ostativo*: see, *supra*, §4) to the smart contract, it is useful to give an example. Consider, for instance, the following case: Tizio decides to exchange a token in a blockchain permissioned for an amount of 10 cryptocurrencies. In writing the program for the exchange, Tizio makes a mistake and sets it up in such a way that the token he provides is exchanged on the blockchain platform with anyone offering a single cryptocurrency. Caio, an expert in cryptocurrencies and aware of the real value of the token made available by Tizio, imagining the latter's mistake, decides to take advantage of it and pours the wrongly requested amount of cryptocurrency, so as to allow the smart contract to self-execute and proceed with the exchange. Under Italian law, this is clearly a mistake on declaration (*errore ostativo)*, since it is, pursuant to Article 1433 of the Civil Code[98], the mistake that falls on the party's declaration or transmission thereof[99].

It is a mistake on declaration because the declarant's will had been correctly formed through a decision-making process that did not run into vices (a will to exchange the token for 10 cryptocurrencies), but was then expressed or transmitted in a manner that did not reflect the party's actual will (formulated by exchanging the token for a single cryptocurrency)[100].

In such a case it is possible to deem the mistake essential in that it relates to the subject matter or the identity of the object of the performance (see Art. 1429 cc. no. 1 and 2 and §4) and is recognisable by the other party[101]; therefore, the smart contract will be voidable if so requested by Tizio. Indeed, the doubts as to the possible essentiality of the mistake

---

96 Art. 1429 c.c. "L'errore è essenziale: 1) quando cade sulla natura o sull'oggetto del contratto; 2) quando cade sull'identità dell'oggetto della prestazione ovvero sopra una qualità dello stesso che, secondo il comune apprezzamento o in relazione alle circostanze, deve ritenersi determinante del consenso".

97 Cf. B. Cappiello, *Dallo "smart contract" computer code allo smart legal contract. I nuovi strumenti (para) giuridici alla luce della normativa nazionale e del diritto internazionale privato europeo: prospettive de jure condendo*, in Diritto del commercio internazionale, 2020, pp. 492-493 and see I. Martone, *Gli smart contracts. Fenomenologia e funzioni*, op. cit., pp.157-158.

98 Cf. Cass. Civ., sez. lav., 09/01/2018, n. 274 in *Giustizia Civile Massimario 2018,* op. cit.

99 On the applicability of the discipline of art. 1433 cc. to smart contract, see I. Martone, *Gli smart contracts. Fenomenologia e funzioni*, op. cit., p. 156: "a prescindere dalla specificità delle fattispecie concrete, si verserà per lo più in ipotesi nelle quali il vizio, incidendo direttamente sulle modalità di manifestazione dell'intento, tende ad assumere la veste di errore c.d. ostativo, con l'ulteriore effetto che la disciplina contenuta nell'art. 1433 cc. si rivelerebbe più che mai appropriata, soprattutto quando i c.d. bug di sistema inficiano la trasposizione in stringhe di codici". On this point see, also, L. Parola, P. Merati, G. Gavotti, *Blockchain e smart contract: questioni giuridiche aperte*, in *i Contratti*, op. cit., p. 686.

100 Cf. Cass. Civ., sez. lav., 09/01/2018, n. 274 in *Giustizia Civile Massimario 2018,* op. cit.

101 See C. Rossello, *l'errore nel contratto*, op. cit., p. 265 and p. 270.

in the case taken as an example are dispelled by the fact that the requirements of essentiality under Art. 1429 cc are not peremptory.
There is abstractly the possibility that some interpreters consider that in the present case the contract would not be voidable but rectifiable since the defect would consist in a mere miscalculation (see §4 above). In fact, Art. 1430 cc. provides that such a mistake does not give rise to invalidity but to rectification of the contract unless, since the mistake has been made in respect of quality, it has assumed decisive importance[102]. While it is true that for jurisprudence the miscalculation is that mistake made in the arithmetical elaboration of the exact data assumed in the contract[103], since the *ratio* of the rule is to make rectifiable errors of calculation that do not appear determined by agreement, part of the doctrine considers that the miscalculation consists in the erroneous quantitative determination deriving either from an erroneous arithmetical operation or from an erroneous quantification of the precisely identified good[104]; a situation, the latter, which seems to occur in the case presented.
However, it is precisely the self-executiveness of the smart contract that seems to push towards the necessity of recognising the invalidity of the contract executed by the programme, so as to determine the restitution of the patrimonial performances. In fact, since the latter have already been executed, a rectification seems difficult to hypothesise, unless the parties have agreed *ex ante* to include a clause in the smart contract that allows for a rectification in the event of an erroneous determination of the quantity of a cryptocurrency paid and the consequent automatic retraction of the effects of the computer software.
A case such as the one described above, in English law, entails the application of the discipline of the unilateral mistake (see, supra, §5.3) which renders the smart contract void for the same reasons that determined the invalidity of the contract in the aforementioned case *Hartog v Colin & Shields*[105] (see, supra, §5.3). In fact, after Tizio had written his offer

[102] Art. 1430 cc., Errore di calcolo: "L'errore di calcolo non dà luogo ad annullamento del contratto, ma solo a rettifica, tranne che, concretandosi in errore sulla quantità, sia stato determinante del consenso"; see F. Santoro-Passarelli, *Dottrine generali del diritto civile*, op. cit., p. 163, who defines the miscalculation as "un errore accidentale rettificabile".
[103] Cass. Civ., sez. I, 03/03/2022, n. 7066 in *Guida al diritto 2022, 18,* op. cit.
[104] Consider the price of goods contained in a container that is calculated on the basis of an erroneous determination of the weight of the same; on this point, see C. M. Bianca, *Il Contratto*, op. cit., pp. 612.
[105] [1939] 3 All ER. The facts are briefly recalled here: the seller had addressed an offer to the offeree in which it offered to sell certain goods. However, by mistake, the seller had communicated an incongruous price for those goods. Taking advantage of the mistake, the buyer had pretended to accept the seller's proposal and had subsequently sued the seller when the latter had refused to deliver the offered goods. The King's Bench decided that the contract was void for unilateral mistake, since the buyer knew that the seller had been mistaken about the price of the goods at the time the contract was made. Judge Singleton observed that "anyone with knowledge of the trade must have realised that there was a mistake" in the terms of the seller's offer and therefore the buyer "could not reasonably have supposed that the offer contained the real intention" (on this point, see *Hartog v Colin & Shields* [1939] 3 All ER, cit., [566] and [568]). Consequently, there was no agreement between the parties, nor could a contract have come into existence. See also, *Chwee Kin Keong and others v Digilandmall.com Pte Ltd* [2005] 1 SLR(R) 502.

in the blockchain platform, committing a mistake in writing it with regard to the amount of cryptocurrency, Caio, despite knowing of the other party's mistake, decided to accept the offer anyway. In accordance with English law, it could be argued that Caio's acceptance is not valid for the purpose of giving rise to a legally binding contract, which would end up being irretrievably void for failure to reach an actual agreement. Moreover, even if in some cases the unilateral mistake in England may constitute the basis for requesting the rectification of the contract[106] instead of its invalidity, given that the code has already been self-executed by the smart contract, as hypothesised above for the Italian context about miscalculation, the preferable solution for Tizio would seem to be that of claiming the invalidity of the contract on the basis of the unilateral mistake and consequently requesting the restitution of the token or, if impossible, a sum of money corresponding to the value of the same[107].

VII. THE RELEVANCE OF MISTAKE AS VICE OF WILL

The mistake of those who use a blockchain platform may also relate to the defect of correct knowledge of what will be the effects produced by the smart contract. In this case, the will to conclude a contract is vitiated by the wrong interpretation of the meaning of the computer code of the software and the consequent erroneous belief in what will be the determined result of the self-execution of the smart contract. This type of mistake seems likely to become frequent in a context where contracts are concluded directly on a platform and in computer language. It is no coincidence that one of the greatest difficulties associated with the use of smart contracts is precisely the lack of knowledge of this language, which inevitably affects most users of blockchain platforms.

Thus, it is necessary to investigate the relationship between the mistake on the effects produced by the software and the application of both the discipline on the mistake as vice of will (*errore vizio*) of the Italian legal system and the doctrine of mistake of the English legal system. However, it is first necessary to clarify one aspect: in the present case, is not illustrated a situation in which the effects of the smart contract are the result of an algorithmic error, but rather a situation in which the smart contract produces the effects for which it was programmed. A mistake by the parties in adhering to such a software, therefore, is only relevant for the purposes of the vice of agreement, as it is not the result

[106] See, for instance, *FSHC Group Holdings Ltd v GLAS Trust Corp Ltd* [2019] EWCA Civ 1361, [1998] 1 WLR 896 a [105]. Rectification is a remedy by which the court orders that the terms of a written contract be amended to be consistent with what the parties have agreed. Since rectification is an equitable remedy, the court has the discretion to refuse to grant rectification; Cf. H. Beale, *Chitty on Contracts*, 34th ed., 2021, op. cit., par. 5-057; C. Mitchell, P. Mitchell, S. Watterson, *Goff & Jones: The Law of Unjust Enrichment*, 9th ed, op. cit., par. 40-32; v., *Lyme Valley Squash Club Ltd v Newcastle-under-Lyme BC* [1985] 2 All ER 405, 413. One of the cases in which rectification is permissible, however, is where one of the parties makes a mistake as to the meaning of a term of the contract and this mistake is known to the other party at the time of the conclusion of the contract. The Court, in such a case, may order rectification on the ground that it would be unfair to enforce a contract that the non-mistaken party knew to be inconsistent with the economic transaction that the other party believed it was entering into at the time of the conclusion of the contract. Cf. *FSHC Group Holdings Ltd v GLAS Trust Corp Ltd* [2019] EWCA Civ 1361, [2020] Ch. 365 from [103] to [104].

[107] Law Commission, Smart legal contracts - Advice to Government, Nov. 2021, op. cit., par. 5.53.

of a malfunction of the blockchain. It should be noted that the content of the contract resulting from the negotiations between computer systems, especially between deterministic computers, is the result of what the parties accepted at the time of registration and agreement with the platform[108]. The latter "produces the exact same output when provided with the same input" and the algorithms "do and only do what they have been programmed to do"[109].

Consider the case in which Tizio and Caio conclude a smart contract involving the exchange of cryptocurrency X with cryptocurrency Y on the Alfa platform, with transactions executed according to instructions given by algorithms. Software is installed in the Alfa platform to ensure that the transactions are concluded by identifying the applicable market prices from external cryptocurrency exchanges. However, Tizio and Caio make the same mistake regarding the parameters set by the platform to execute cryptocurrency exchange transactions. In the face of this common mistake, Caio obtains a patrimonial advantage from the execution of the operations performed by the smart contract, an advantage far greater than that which both he and Tizio expected, since it is the result of a factual mistake shared by the contracting parties on the operating criteria of the blockchain.

If in the present case the invalidity of the contract does not seem to be in doubt for the Italian legal system given the essential nature of the mistake (recognisability of the same does not even seem to be necessary since the mistake is common to both parties[110] - see, *supra*, §4) questions arise as to the applicability of the English common mistake discipline (see, supra, §5.1).

Indeed, although common mistake concerns the situation where the parties enter into a contract based on an erroneous common belief concerning a question of fact (or of law)[111] relevant to the performance of the contract, English law recognises only a very limited range of common mistakes that render a contract void. Indeed, it is necessary to refer once again to The Great Peace, in which the Court of Appeal held that a contract is void for common mistake only if: a) the parties shared a belief in the existence of a certain situation at the time the contract was entered into; b) contrary to that belief, the situation did not exist; c) the non-existence of the situation makes the performance of the contract or the attainment of its purpose impossible[112]. It is therefore not sufficient to render the contract

---

[108] A. Alpini, *I vizi del consenso fra contratto e trattamento dei dati: la riconoscibilità dell'errore*, in *Persona e Mercato*, 2/2022, pp. 211-212; A. Alpini, *I vizi del consenso fra contratto e trattamento dei dati: la riconoscibilità dell'errore*, in *lceonilne*, 2/2022, pp. 45-46.

[109] *Quoine Pte Ltd v B2C2 Ltd, 2020*, [89-98].

[110] It should be noted that recognisability is not relevant in the presence of a mistake common to both parties since in such a case each of the two contractors has caused the invalidity of the contract: see, Cass. Civ., sez. II, 23/03/2017, n.7557 in *de Jure, banca dati editoriale GFL*. Against this jurisprudential orientation, see A. De Martini, *In tema di riconoscibilità dell'errore bilaterale nel contratto*, in Foro it., 1952, I, op. cit., p. 431 ff.

[111] See, J. Beatson, A.Burrows, J. Crtwright, *Anson's Law of Contract*, op. cit., p. 296: "Both parties make the same mistake of fact or law relating to the subject matter or the facts surrounding the formation of the contract".

[112] See, *Great Peace Shipping Ltd v Tsavliris Salvage (International) Ltd (The Great Peace)* [2002] EWCA Civ 1407, [2003] QB 679 at [76]: "the following elements must be present if common mistake is

invalid the fact that its performance proves to be more onerous for a contracting party than that envisaged by the parties because of a mistake made at the time of the conclusion of the contract, nor is it relevant that such greater onerousness is due to the parameters adopted by the platform for the purpose of exchanging cryptocurrencies. The mistake made by the contracting parties must, in fact, concern the very possibility of performance in order to be able to determine the invalidity of the contract, whereas, in the case taken as an example, the self-execution of the software is not prevented by the mere fact that Caio obtains an unexpectedly high pecuniary advantage to the detriment of Tizio. Not dissimilar conclusions were also reached by the Law Commission[113].

However, it must be noted how, even in the English legal system, in the event that the code does not produce the effects desired by the parties, this situation may admit the applicability of the common mistake if the code is not capable of self-execution. In this case, in fact, the impossibility of the execution of the performance that is the object of the smart contract can be equated to the non-existence of the subject matter of the contract, rendering the latter void[114].

Keeping in mind the example in which Tizio and Caio are involved, it is possible to think about the case in which the mistake on the parameters adopted by the software of the Alfa platform is not common to both parties, but unilateral. If for the English legal system such a mistake by only one party will in all probability be irrelevant, since when only one contracting party has made the mistake in fact or in law there is no basis for resorting to the application of the doctrine of mistake[115], for the Italian legal system different considerations can be made. Indeed, where the mistake is not only essential, as appears to be the case here, but also recognisable by the other contracting party, the contract will be voidable. The declaration of invalidity of the contract will therefore depend on whether Caio was able to recognise the mistake into which Tizio had fallen. It should be noted that the computer language by means of which the smart contract is concluded does not facilitate the recognisability of the mistake, therefore, the existence of the prerequisites for

to avoid a contract. (i) there must be a common assumption as to the existence of a state of affairs; (ii) there must be no warranty by either party that that state of affairs exists; (iii) the non-existence of the state of affairs must not be attributable to the fault of either party; (iv) the non-existence of the state of affairs must render performance of the contract impossible; (v) the state of affairs may be the existence, or a vital attribute, of the consideration to be provided or circumstances which must subsist if performance of the contractual adventure is to be possible".

113 Law Commission, Smart legal contracts - Advice to Government, Nov. 2021, op. cit., par. 5.40: "[…] In other cases, even where the parties have made a mistake, the code might perform in such a way as to demonstrate the possibility of performing the contract, so that the mistake in question is not sufficient to vitiate the contract. It is only where the code operates in such a way that achievement of the purpose of the contract is impossible that common mistake may operate"; see, also, par. 5.41 and 5.42.

114 Cf. Law Commission, Smart legal contracts - Advice to Government, Nov. 2021, op. cit., par. 5.40: "[…] it is conceivable that where the code, as written at the time the contract is entered into, is faulty and will fail to perform as the parties intend, such an instance may be regarded as a mistake as to a current state of affairs. In this regard, we think an analogy can be drawn with the situation where, unbeknownst to the parties at the time of conclusion of the contract, the subject matter of the contract does not exist"; 5.44.

115 *Statoil ASA v Louis Dreyfus Energy Service LP (The Harriette N)* [2008] EWHC 2257 (Comm), [2008] 2 Lloyd's Rep. 685, cit.

invalidity due to the party's defect of will will mostly have to be assessed in concrete terms, on a case-by-case basis.

VIII. SMART CONTRACT MALFUNCTIONING: THE CASE QUOINE PTE LTD V B2C2 LTD.

The Quoine case[116], decided by the Singapore Court of Appeal, is useful for studying the relationship between mistake and computer contracts affected by a system malfunction.
The decision concerns transactions involving the exchange of Ether for Bitcoin on the platform operated by Quoine, carried out according to instructions given by algorithms. Quoine had installed software to ensure that transactions were concluded by identifying applicable market prices from external cryptocurrency exchanges. The company B2C2, a user of the platform, had in turn installed a so-called 'fail-safe deep-price' in the system equivalent to 10 Bitcoins in exchange for 1 Ether. However, due to an error in the platform's system, the exchange rates were not updated and some transactions were executed at an exchange rate approximately 250 times higher in favour of B2C2 with the disadvantage of two other companies with which it had concluded smart contracts for the exchange of cryptocurrencies. This was because the operator of the Quoine platform had carried out password updates of certain operating systems, as a result of which access to external data on the platform by the programme had been interrupted for a certain period of time. This had caused an alteration in the exchange rate of cryptocurrencies, as the scarcity of data on the platform had led to a decrease in market liquidity, thus generating offers to sell cryptocurrencies at abnormally high prices compared to other markets[117].
Upon learning of the error, Quoine had decided to cancel all transactions concluded by B2C2 with the other two companies, describing the incident as a mere software problem; B2C2, on the other hand, had considered the cancellation of the transactions to be a violation of the legal relationship between the user and the platform. For its part, Quoine had argued that B2C2 was aware that it was a software error and had therefore also requested the application of the unilateral mistake[118] and common mistake[119] rules to the contracts underlying the exchange transactions.
The Court, however, in its decision holds that the transactions were not voidable in the first place because Quoine had breached the terms of the contract between user and platform according to which once the fulfilment of the order has been communicated, the action is irreversible (The Irreversible Action Clauses). It also clarifies that in the present

[116] *Quoine Pte Ltd v B2C2 Ltd SGHC(I) 03[2019] e SGCA(I), 02 [2020],* cit.
[117] L. Vagni, *Il problema della rilevanza giuridica dell'errore nella decisione dell'oracolo della blockchain*, in *lceonline (www.lceonline.eu)*, op. cit., p. 57.
[118] *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA, op. cit., [4]: "A central plank of Quoine's defence both at trial and on appeal was the contention that the contracts underlying the Disputed Trades ("the Trading Contracts") were void or voidable for unilateral mistake".
[119] *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA, op. cit., [31] and [129]. See, also [47]: "The issues that arise in this appeal and that we will address in this Judgment are the following: […] (b) Was Quoine contractually entitled to cancel the Disputed Trades by reason of any express or implied terms of its contract with B2C2? (c) In relation to Quoine's defence of unilateral mistake, did the Judge err in finding that Mr Boonen did not have actual or constructive knowledge of a relevant mistaken belief on the part of the Counterparties in relation to the Disputed Trades? (d) Were the Trading Contracts void on the basis of common mistake at common law? […]".

case the contracts had been concluded without intermediation between the users, even though they were also contractually obliged to Quoine on the basis of the conditions of use of the Platform (the Agreement) and in particular of the aforementioned Irreversible Action Clauses, by virtue of which a fulfilled and notified order is deemed irreversible. The same Court further observes that the clause allowing Quoine to cancel the transaction, in the event that the transaction was carried out at an abnormal value (Aberrant Value Clause), was neither included in the Agreement nor adequately brought to the attention of the parties[120].

Moreover, the transactions were not legitimately removed even with the application of the doctrine of unilateral mistake, since the invalidity of the contract between B2C2 and the two companies for mistake should have concerned an essential element, also taking into account the knowledge of the mistake by the contracting parties at the time of the conclusion of the contract[121]. However, since in the present case there was no human intervention at the time of the execution of the transactions, the Court considers that the error to be assessed concerns B2C2's programmer[122] but, according to the same Court, the intention of the same programmer at the time of the elaboration of B2C2's transaction algorithm was to protect against the risk of any unjustified exposure and not to manipulate the exchange rate by exploiting Quoine's software error[123]. The Court argues, in fact, that B2C2 could not have known about the alleged mistake of the two companies with which it had traded cryptocurrencies, so Quoine had no reason to cancel the transactions[124].

120 It should be noted that the disclosure on the risks of virtual currency transactions warned that if Quoine detected that a transaction was the effect of an abnormal value, the company could cancel the transaction, as this was an obvious system error. However, this provision was not part of the agreement as it was inserted after the user's registration without being brought to the knowledge of the parties. What is of interest here is that if that provision had been included in the agreement, the recognisable mistake could have been decisive for the invalidity of the contract, since the information notice warned that the algorithmic error made recognisable by the evident abnormality of the price could have led to the cancellation of the transaction; see, *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA, op. cit., [25]: "Please be aware that in the event that a customer loses any opportunity (e.g., the Company is unable to receive a customer's order and the customer therefore loses the opportunity to place the order, losing profits that he or she ordinarily would have earned) due to emergency system maintenance or a system failure, the Company will not be able to execute a process to fix the error because it will be unable to identify the order details that the customer intended to place (the original order). The system may produce an aberrant value for the buy or sell price of the virtual currency calculated by the system. Please be aware that if the Company finds that a transaction took effect based on an aberrant value, the Company may cancel the transaction. Your understanding is appreciated".

121 B. Lomfeld, *Structured Error. Case Study on a Discourse Logic of Comparative Law*, in *The Italian Law Journal*, 2015, v. 1, n. 2, p. 249 ff.

122 The Court therefore considers it necessary to understand whether B2C2, by programming the algorithm and installing the "fail-safe deep price", had knowledge that the offer would be accepted due to the influence of a mistake and whether it acted with the intention of taking advantage of it.

123 A. Alpini, *I vizi del consenso fra contratto e trattamento dei dati: la riconoscibilità dell'errore*, in *Persona e Mercato*, op. cit., pp. 210-211 e A. Alpini, *I vizi del consenso fra contratto e trattamento dei dati: la riconoscibilità dell'errore*, in *lceonline* op. cit., pp. 44-45.

124 It should be noted that part of the doctrine has criticised the Court's argument, based on the non-recognisability of a mistake as a cause preventing the annulment of transactions, pointing out that the subject who installs an artificial intelligence programme to contract adheres in any case to a sort of open offer, and therefore ends up agreeing to conclude the transaction on any condition

According to the Court, moreover, the contracts were not vitiated by mistake either at common law or in equity, as the mistaken belief of the counterparties that they were exchanging cryptocurrency at close to the market price could not be regarded as a mistake on a decisive element of the contract, but rather as a mistake on an assumption on the basis of which the transactions had been carried out, or at most as an (erroneous) assumption that the Platform would work properly[125].

Therefore, the Court excludes that the malfunctioning of the programme can be attributed to a contractual mistake since is missing the element of recognisability of the mistake by B2C2, which did not have the possibility of knowing the other party of the contract nor did it have the possibility of fully evaluating the conditions of the contract, the result of algorithmic operations[126]. It also excludes the common mistake of the

provided by the system: see, M. Oliver, *Contracting by artificial intelligence: open offers, unilateral mistakes, and why algorithms are not agents*, in *Australian National University Journal of Law and Technology*, Vol 2(1) 2021; in particular, see p. 85: "Now suppose that the AI program makes a mistake and agrees to a bad deal. The person has clearly made a mistake - they should have done a better job programming their AI program - but that is not the kind of mistake that makes a contract voidable. It is a mismatch between what they did and what it would be prudent to do. There is no lack of consent, because the person clearly intended to enter into contracts on whatever terms their AI program agreed, and the resulting contract was on the terms their AI program agreed".

[125] Cfr. *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA, op. cit., [82] and [115].

[126] *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA [39] – [43], op. cit. However, it is interesting to read the dissenting opinion of Justice Mance IJ at par. [183]: "There was a fundamental mistake, in that Quoine's system operated (and led to the sale of BTC on terms) in a way that was not conceived as possible and would never have been accepted by Quoine or the counterparties in the prevailing circumstances. Further, although B2C2 had no knowledge of the mistake as and when it occurred, the position is that, as soon as it inspected the computer print-outs next morning, it knew at once that there had been such a mistake. […] For the reasons I will give, in my opinion, the law should and can in such circumstances hold that the contract is voidable, as Quoine claims."; [192]: "The Judge's approach involves omitting a usually important element in any appraisal of such a situation, namely (here) whether there was anything drastically unusual about the surrounding circumstances or the state of the market to explain on a rational basis why such abnormal prices could occur, or whether the only possible conclusion was that some fundamental error had taken place, giving rise to transactions which the other party could never rationally have contemplated or intended"; [201]: "In the present case, there can only be one answer to the question of what any reasonable trader with knowledge of the market circumstances would have thought. There was not and never has been any suggestion that Mr Boonen's very unusual or unfathomable market developments occurred. The only explanation of the transactions, whether hypothesised in advance, observed concurrently or considered early next morning, was and is major error – as B2C2 at once saw". On this point, cf. K. Nathaniel - S. Tey, *Can Smart Contracts Outsmart the Law: The Law of Contract in Light of Smart Contracting*, in *Singapore Comparative Law Review*, 2022, pp. 110-111.

parties[127], since there was no intention between them to conclude contracts at the market exchange rate[128].

In the light of the foregoing, if the Quoine case had been decided according to the provisions on mistake of the Italian legal system, it is unlikely that the software malfunction would have been qualified as an recognisable mistake pursuant to Article 1431 of the Italian Civil Code by the party that benefited from it, therefore the contract, in all likelihood, would not have been voidable for mistake pursuant to Articles 1427 and 1428 of the Italian Civil Code.

IX. ALGORITHMIC ERRORS IN SMART CONTRACTS IMPLEMENTED THROUGH AI SYSTEMS

As noted, it is not always possible to recognise the future computer error that the blockchain platform will make, nor is it always easy to immediately notice the algorithmic error that has occurred[129]. This is even more the case if the platform is implemented through AI, as its characteristics allow the AI a great autonomy in determining the computer code containing the contract. Moreover, the operating mechanisms of the AI system are often difficult to understand (on this point, see above, §3), making it even more difficult to recognise the error committed by the digital tool.

For these reasons, it is necessary to address the hypothesis in which a computer error occurring in the platform causes results that are unintended (or at least unexpected) by the parties and this error is not detectable by the contracting parties.

Algorithmic errors can be of various types and among these there is the bug, i.e. an objectively incorrect line of code[130]; it is a deterministic type of error, therefore both during the reading of the source code and during its execution it is theoretically possible to identify the presence of an error (and possibly correct it) through so-called de-bugging.

---

127 *Quoine Pte Ltd v B2C2 Ltd* [2020] SGCA, op. cit., [129]: "Quoine also argued that the Trading Contracts were void for common mistake, since B2C2 and the Counterparties had entered into the Disputed Trades under a shared mistaken assumption that they were transacting at or around the going market rate for ETH. However, B2C2 could not have been labouring under such an assumption, given that it had placed its sell orders for ETH at prices of 9.99999 BTC and 10 BTC to 1 ETH on the Platform because the intentionally pre-programmed deep price of 10 BTC to 1 ETH in the PureQuote strategy took effect (see [117(a)] above). Therefore, Quoine's defence of common mistake at common law fails".

128 L. Vagni, *Il problema della rilevanza giuridica dell'errore nella decisione dell'oracolo della blockchain*, in *lceonline (www.lceonline.eu)*, op. cit., pp. 57-58.

129 See *ex multis*, as examples, on the topic of *computer errors* and *computer errors* in *smart contract:* T. Huckle, T. Neckel, *Bits and Bugs: A Scientific and Historical Review of Software Failures in Computational Science*, op. cit.; Y. Wang, X. Chen, Y. Huang, H. Zhu, J. Bian, Z. Zheng, *An empirical study on real bug fixes from solidity smart contract projects*, in *The Journal of Systems & Software*, op. cit., (*https://www.sciencedirect.com/science/article/pii/S0164121223001826*); H. Liu, Y. Fan, L. Feng, Z. Wei, *Vulnerable smart contract function locating based on Multi-Relational Nested Graph Convolutional Network*, in *The Journal of Systems & Software*, op. cit. (*https://www.sciencedirect.com/science/article/pii/S016412122300170X?via%3Dihub*); A. Gupta, R. Gupta, D. Jadav, S. Tanwar, N. Kumar, M. Shabaz, *Proxy smart contracts for zero trust architecture implementation in Decentralised Oracle Networks based applications in Computer Communications*, op. cit., (*https://www.sciencedirect.com/science/article/pii/S0140366423001470?via%3Dihub*).

130 A. Amidei, *Le responsabilità da intelligenza artificiale tra product liability e sicurezza del prodotto*, in U. Ruffolo (a cura di), *XXVI lezioni di diritto dell'intelligenza artificiale*, Torino, 2021, p.149 ff.

A further type of error is that determined by the probabilistic nature[131] of classification algorithms, i.e. those types of algorithms that place a given input within a given class and that are subject, however, to a margin of error that can be reduced, but not completely eliminated. In fact, even a system with a very high degree of precision in the execution of its task, perhaps close to certainty, expresses its result as a percentage probability. Moreover, even by increasing the percentage of correctly performed tasks, the probabilistic nature of the algorithm can give rise to misclassifications (so-called false positives and false negatives).

In AI systems, a peculiar error is the error arising from the evolution of the system itself. In this case, such a possibility could only occur in systems based on a reinforcement learning approach (see, supra §3), i.e. capable of modifying its output in the face of interaction with the environment.

In the case of the probabilistic error, unlike in the case of the bug, the system executes code that is free of inaccuracies that could affect the system's performance, and the classification error could be related neither to forms of bias[132] that instruct the AI during training nor to interaction with the environment[133].

Now, especially algorithmic errors of a probabilistic nature or linked to the evolution of the system seem not to be reasonably recognisable by those who conclude a smart contract.

In such a case, inevitably, the error must be imputed to the platform in which the computer software blockchain based is concluded (or rather to the external subjects or nodes that govern the same), and this especially in the case of blockchain and smart contracts implemented through AI systems, in the face of the greater freedom in the executive phase proper to artificial intelligence and the less predictability in the outcomes of the system's activity, also due to the so-called black boxes (see, *supra*, §3 note no. 42).

Therefore, the discipline of contractual mistake does not appear to be applicable to the types of algorithmic errors described that occur in the execution phase of the contract drafted through smart contracts. It is therefore necessary to understand which legal instruments should be applied to redistribute the negative consequences of the malfunctioning and, to this end, the best way forward seems to be that of contractual liability.

Indeed, if the contract drafted on a smart contract cannot be invalidated due to contractual mistake, it seems possible to mitigate any negative consequences suffered by the parties

131 U. Ruffolo, *La macchina sapiens come "avvocato generale" ed il primato del giudice umano: una proposta di interazione virtuosa*, in U. Ruffolo (ed.), *XXVI Lezioni di diritto dell'intelligenza artificiale*, Torino, 2021, p. 206.

132 The evolution of algorithms and their ability to process large amounts of data means that their outputs are becoming increasingly accurate and reliable. However, there is a risk that the data used for the development of artificial intelligence tools are vitiated by prejudices. These are precomprehensive mechanisms that affect the very datasets intended to "feed" artificial intelligence machines and are summarised under the term "bias". See N. Abriani, G. Shneider, *Diritto delle imprese e intelligenza artificiale*, op. cit., p. 39.

133 C. Bomprezzi, S. Sapienza, *Algorithmic justice e classificazione di rischio nella proposta AI Act*, in M. Palmirani, S. Sapienza (ed.), *La trasformazione digitale della giustizia nel dialogo tra discipline*, Milano, 2022, pp. 98-101.

due to algorithmic error by recognizing the liability of the permissioned blockchain platform (or, better, of third parties or nodes governing it), especially if implemented through AI systems.

On this point, it is worth noting that since the 1980s there has been discussion about liability for damages caused by software[134], and new insights into liability inevitably arise when the software has a certain degree of decision-making autonomy or when the effects of the program's activities are not entirely predictable[135], as is the case when artificial intelligence is involved.

However, in the case of permissioned-based blockchain smart contracts implemented through AI, the subjects liable for algorithmic errors in the platform are either third parties or the nodes that essentially control the platform, which enables both parties to negotiate and the self-execution of the contract content[136].

X. CONCLUSIVE REMARKS

The rules on contractual mistake in Italy and England tend to apply to smart contracts similarly to other computer contracts, which are equally formed through digitized systems, even if without self-executability.

Consequently, both the Italian and English approaches to contractual mistake are applicable to situations where the will of the parties does not correspond to the pre-contractual declaration in the face of the mistake made by them in programming the smart contract (see, *supra*, §6).

In analyzing the relationship between smart contract and mistake, it is important to identify cases in which the mistake coincides with an incorrect foreshadowing of the effects produced by the smart contract (see, *supra*, §7). In such a case, the will to conclude a contract is vitiated by the misinterpretation of the meaning of the protocol computer code and the consequent mistaken belief in what will be the result of the self-execution of the smart contract. If the mistake has been made by both parties of the smart contract, the invalidity of the contract does not seem to be in doubt for the Italian legal system in the case of mistake as vice of will, while the same cannot be said about the applicability of the English common mistake discipline. In fact, although common mistake concerns the situation in which the parties enter into a contract based on an erroneous common belief concerning a matter of fact (or law), English law recognizes only a very limited range of common mistakes that render a contract void, and it is not sufficient to render the contract invalid if its performance proves more onerous for a contractor than the parties had intended because of a mistake made at the time the contract was concluded (see, *supra*, §5.1).

---

134 C. Rossello, *La responsabilità da inadeguato funzionamento di programmi per elaboratore elettronico: aspetti e problemi dell'esperienza nordamericana*, in G. Alpa (ed.), *Computers e responsabilità civile*, Milano, 1985.

135 G. Finocchiaro, *Intelligenza Artificiale e responsabilità*, in *Contratto e Impresa*, 2020, p. 713 ff.

136 On the difficulties and issues related to judicial remedies in the case of smart contracts written on permissionless blockchain, allow me to refer to J. Fortuna, *Smart contract, abuso del diritto e tutela giurisdizionale: spunti di comparazione tra diritto italiano e diritto inglese,* in *Rivista di Diritti Comparati*, op. cit., pp. 915-916.

Moreover, in the case of a mistake made by only one party in the incorrect foreshadowing of the effects produced by the smart contract, if for the English legal system such a mistake will in all likelihood be irrelevant, since when only one contracting party has incurred the mistake in fact or in law there is no basis for resorting to the application of the doctrine of mistake, for the Italian legal system different considerations can be made. Indeed, in the event that the mistake, as well as being essential, is recognizable by the other contracting party, the contract will be voidable. The declaration of invalidity of the contract, therefore, will depend on the possibility that one contracting party had of recognizing the mistake into which the other fell.

In order to study the relationship between the doctrine of mistake and computer contracts affected by a system malfunction, the Quoine case, decided by the Singapore Court of Appeal, is of great interest (see, *supra*, §8). Indeed, the Court excluded the possibility that the program malfunction could be brought under the discipline of contractual mistake because it lacked, in particular, the element of recognizability of the mistake by one of the contracting parties (B2C2) who had neither the possibility of knowing who the other contracting parties would be nor had the possibility of fully assessing the terms and conditions under which the contract would be concluded, especially in the face of the software malfunction. Furthermore, if the Quoine case had been decided according to the provisions on mistake peculiar to the Italian legal system, the software malfunction would hardly have been qualified as a mistake recognizable by the party that benefited from it under Article 1431 of the Civil Code, so the contract, even in Italy, would in all probability not have been voidable for mistake under Articles 1427 and 1428 of the Civil Code.

On the other hand, the discipline of mistake does not seem to be applicable in the case of algorithmic error occurring in smart contracts implemented through AI, due to the difficult detectability of the error by the contracting parties, the greater freedom in the execution phase provided by AI, and the less predictable outcomes of the system's activity, even in the face of so-called black boxes. The error must be attributed to the platform in which the smart contract is concluded or, rather, on the external parties or permissioned blockchain nodes that govern it.

It will then be necessary in the future to thoroughly investigate the nature of the liability of the subjects controlling such blockchains.

Indeed, it seems clear that a contractual relationship is established between users and the blockchain, in which the platform assumes the obligations to enable the conclusion of the contract drawn up by smart contract, to ensure that the content of the contract corresponds to the will of the parties, and to execute the contract, producing the effects desired by the contracting parties. In the absence of any of these performances, the platform will have caused the breach of contract.

Consequently, AI's algorithmic error in the execution of the contract, when it will not have been recognizable to the parties, will not cause the application of the discipline of contractual mistake, but that of the contractual liability, attributable to the blockchain

platform implemented with AI. The parties of the contract could, therefore, sue the subjects who provided the AI system for breach of contract[137].

[137] Moreover, in addition to the blockchain platform, there could be various subjects in the supply chain that contribute to the realisation of the AI system and between the various subjects further contractual relationships could exist. The parties harmed by the algorithmic error, therefore, could sue for non-contractual civil liability against these. With regard to the regulatory and doctrinal framework on the issue of AI liability, a different direction can be observed between non-contractual and contractual civil liability. In fact, while for the former there are concrete attempts at regulation (e.g. AI Liability Directive and the new Directive on defective products - Proposal for a Directive of the European Parliament and of the Council on adapting non-contractual civil liability rules to artificial intelligence (AI Liability Directive) {SEC(2022) 344 final} - {SWD(2022) 318 final} - {SWD(2022) 319 final} - {SWD(2022) 320 final}; Proposal for a Directive of the European Parliament and of the Council on liability for defective product {SEC(2022) 343 final} - {SWD(2022) 315 final} - {SWD(2022) 316 final} - {SWD(2022) 317 final}) for the latter there as yet no legislative initiative; hence it is still necessary to resort to the application of internal and supra-national norms and principles as regards liability for breach of contract; on this point, see G. Proietti, *Responsabilità civile, inadempimento e sistemi di intelligenza artificiale (approfondimento del 07 febbraio 2023)*, in *Giustizia Civile*, n.2, 2023, p. 1 ff.