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## **Emerging Technology's Language Wars: Smart Contracts**

Carla L. Reyes

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## EMERGING TECHNOLOGY’S LANGUAGE WARS: SMART CONTRACTS

Carla L. Reyes\*

### ABSTRACT

Work at the intersection of blockchain technology and law represents a highly interdisciplinary area of inquiry. Often, researchers, law-makers, lawyers, and other stakeholders unnecessarily debate issues because of linguistic misunderstandings. As the third of four studies examining the impact of clashes of linguistic meaning on law and policy around emerging technologies, this Essay uses smart contracts as a case study to demonstrate the real legal harm that arises from a failure to communicate. Specifically, this Essay uses techniques from corpus linguistics to reveal the inherent value conflicts embedded in definitional differences and debates as to whether the law should “accommodate” smart contracts. This Essay’s approach also further contributes evidence that corpus linguistics might be particularly effective as a tool for identifying linguistic ambiguities before they are embedded in law, rather than as a tool for resolving ambiguities after the fact. In the smart contract context, resolving such ambiguities early frees law to focus on the interesting and new issues the technology actually presents, rather than ineffectively future-casting for a use case most of industry does not actually seek to develop.

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\* Assistant Professor of Law, Southern Methodist University Dedman School of Law; Affiliated Faculty, Indiana University Ostrom Workshop on Cybersecurity and Internet Governance; Research Associate, University College London Center for Blockchain Research. I would like to extend my deep thanks to Professor BJ Ard for organizing the Wisconsin Law School Legal Institutions and Technological Change Conference, and to Professor Ard and each of the conference’s participants for very helpful feedback and encouragement. The research for this Essay was supported by a grant from the Hector Mairal Faculty Research Fund, for which I am deeply grateful. I also extend deep gratitude to Victoria Nelson, research assistant extraordinaire, for her excellent interdisciplinary research efforts over the long-haul of this project.

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## INTRODUCTION

In 2017, Arizona ignited a trend among state legislatures to signal to blockchain enthusiasts that a state takes a friendly approach to blockchain regulation by “accommodating” smart contracts with changes to its version of the Uniform Electronic Transaction Act (UETA).<sup>1</sup> Since then, seven other states copied Arizona’s approach.<sup>2</sup> Beyond the obvious problem of making a perfectly functioning uniform law non-uniform,<sup>3</sup> the statutory language made popular by Arizona suffers from a supremely significant flaw: it actually makes it impossible for that version of UETA to accommodate smart contracts at all.<sup>4</sup> Yes, you read that correctly: in an ill-advised attempt to accommodate smart contracts, the states adopting this language actually ensured that UETA does not cover smart contracts.

It would be easy to chalk up this result to an oversight, or a misunderstanding of UETA—which, admittedly lives in the domain of the now rare-breed of attorney known as a commercial lawyer. However, the true culprit lies in misunderstanding the technology

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<sup>1</sup> ARIZ. REV. STAT. ANN. § 44-7061 (2017).

<sup>2</sup> Illinois, 205 ILL. COMP. STAT. 730/5, 730/10 (2020); Iowa, IOWA CODE ANN. § 554E.3 (2022); Tennessee, TENN. CODE ANN. §§ 47-10-201–202 (2018); North Dakota, N.D. CENT. CODE § 9-16-19 (2019); Arkansas, ARK. CODE ANN. § 25-32-122 (2019); Idaho, IDAHO CODE § 28-5303 (2022); Kentucky, KY. REV. STAT. ANN. § 42.747 (West 2020); Nevada, NEV. REV. STAT. §§ 719.045, 719.090, & 719.145 (2021).

<sup>3</sup> UETA is sufficient, under its current terms, to cover electronic transactions via blockchain technology, including electronic signatures and smart contracts. *See Guidance Note Regarding the Relation Between the Uniform Electronic Transactions Act and Federal ESIGN Act, Blockchain Technology and “Smart Contracts”* UNIFORM LAW COMMISSION, (Mar. 11, 2019), <https://www.uniformlaws.org/viewdocument/guidance-note-regarding-the-relatio?CommunityKey=2c04b76c-2b7d-4399-977e-d5876ba7e034&tab=librarydocuments>. Indeed, the North Carolina legislature issued legislative findings stating as much, and declining to alter UETA to “accommodate” smart contracts. N.C. GEN. STAT. § 169-2 (b) (2021) (“The General Assembly finds that the technologically neutral drafting of the NC Uniform Electronic Transactions Act (UETA) adequately addresses the legal enforceability of smart contracts, electronic signatures, and electronic recording.”). The Texas Work Group on Blockchain Matters made similar findings in its November 2022 report to the Texas Legislature. *2022 Report to the Members of the Texas Legislature*, TEXAS WORK GROUP ON BLOCKCHAIN MATTERS (Nov. 22, 2022), <https://portal.bcwg.texas.gov/General-Documents/Texas-Work-Group-on-Blockchain-Matters-Report/wbtp-2m5k>.

<sup>4</sup> *See Guidance Note*, *supra* note 3.

the law sought to accommodate. The Arizona law, for example, defines the term smart contract as “an event-driven 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.”<sup>5</sup> The law explains that a signature or contract “that is secured through blockchain technology” is valid, and, indeed, “may not be denied legal effect, validity or enforceability solely because that contract contains a smart contract term.”<sup>6</sup> In turn, the law defines the “blockchain technology” as “distributed ledger technology that uses a distributed, decentralized, shared and replicated ledger, which may be public or private, permissioned or permissionless, or driven by tokenized crypto economics or tokenless, [where t]he data on the ledger is protected with cryptography, is immutable and auditable and provides an uncensored truth.”<sup>7</sup> No known blockchain meets that definition. Indeed, on its face, the requirement that the data secured by blockchain technology “provide[] an uncensored truth” is itself quite difficult to understand.<sup>8</sup> More to the point, however, there is no blockchain protocol that purports to provide a record of uncensored truth.<sup>9</sup>

Some scholars attribute this misunderstanding to the technologists, arguing that those developing the technology intentionally advertised it in misleading and overly hyped ways.<sup>10</sup> This Essay takes a different approach altogether, and argues that the flaws in these laws began long before drafting—rather, the flaws began in the discussion rooms where law-makers and staffers first discussed smart contracts (a technical phrase) without understanding its meaning as a term of art in the computer science context, as opposed to the legal term “contract.” To do so, in Part I, this Essay first examines anecdotal examples evidencing confusion in the dialogue between those in the legal field and those building

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<sup>5</sup> H.B. 2417, 53d Leg., 1st. Sess. (Ariz. 2017).

<sup>6</sup> *Id.*

<sup>7</sup> *Id.*

<sup>8</sup> If you, dear reader, know what this phrase means, and have an example of such a thing, the author would be very appreciative if you could point her to it.

<sup>9</sup> For an explanation of what blockchain protocols actually do, see Carla L. Reyes, *Creating Cryptolaw for the Uniform Commercial Code*, 78 WASH. & LEE L. REV. 1521, 1537–40 (2021) [hereinafter Reyes, *Creating Cryptolaw*].

<sup>10</sup> Angela Walch, *The Path of the Blockchain Lexicon (and the Law)*, 36 REV. BANKING & FIN. L. 713 (2017) (arguing technologists misuse the term “immutability” to mislead regulators and the public).

smart contracts. In Part II, this Essay applies corpus linguistics to uncover more data-driven evidence of the linguistic battle between law and smart contracts, arguing that there is more at stake than a mere definitional debate. Rather, this Essay argues in Part III that law's failure to understand smart contracts at a technical level will lead to increasingly sub-optimal outcomes for both regulation and private law, and signals the need for a deeper look at the methods used to achieve technological neutrality in law. Ultimately, lawyers and law-makers can no longer hide behind the maxim of technology neutrality to avoid learning technological fundamentals of emerging technology—rather, future-proofing the law through functional technology neutrality requires understanding how emerging technology works, right down to the very technical details.

### I. THE (LINGUISTIC) PROBLEM WITH SMART CONTRACTS

Law uses highly specialized language to achieve its ends.<sup>11</sup> Indeed law's use of terms of art—words or phrases that represent a specific idea, rule or concept<sup>12</sup>—to convey complex meaning in small packages represents a hallmark of the field.<sup>13</sup> Other disciplines also employ terms of art to convey complex meaning in shorthand.<sup>14</sup> In particular, the disciplines that research, advance, and build emerging technology—including computer science, engineering, and math, among others—use discipline-specific language as they undertake their craft. As emerging technology develops, lawyers and technologists increasingly use the same words as terms of art with very different meanings within their own fields.<sup>15</sup>

One recent example of this type of clash in linguistic meaning lies in the term “smart contract.” Lawyers and law-makers

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<sup>11</sup> Daniel Martin Katz, Michael J. Bommarito II, Julie Seaman, Adam Candeub & Eugene Agichtein, *Legal N-Grams? A Simple Approach to Track the 'Evolution' of Legal Language*, PROCEEDINGS OF JURIX 2011: THE 24<sup>TH</sup> INT'L CONF. ON LEGAL KNOWLEDGE AND INFO. SYS. (2011) (citing E. Mertz, *The Language of Law School* (2007)).

<sup>12</sup> *Id.*

<sup>13</sup> *Id.*

<sup>14</sup> See e.g., Carla L. Reyes, *Emerging Technology's Language Wars: AI & Criminal Justice*, 5 J.L. & INNOVATION 1 (forthcoming 2023) [hereinafter Reyes, *Language Wars: AI*]; Carla L. Reyes, *Emerging Technology's Language Wars: Cryptocurrency*, 64 WM. & MARY L. REV. (forthcoming 2023) [hereinafter Reyes, *Language Wars: Cryptocurrency*].

<sup>15</sup> Reyes, *Language Wars: AI*, *supra* note 14; Reyes, *Language Wars: Cryptocurrency*, *supra* note 14.

seem preoccupied with the relationship between smart contracts and legal enforceability of an agreement (a “contract” in the legal sense),<sup>16</sup> while technologists focus on building new tools and organizations using persistent scripts (a “smart contract” in the blockchain technology sense).<sup>17</sup> To begin to unpack the impact of these completely different priorities on new law related to blockchain technology and smart contracts, this Part begins by considering anecdotal evidence of the technical and legal understandings of the term. This Part then suggests the limits of those anecdotes in diagnosing the source of the communication problem, hinting at the need for a more evidence-driven evaluation.

When lawyers hear the term “smart contract,” many immediately jump to a vision of artificially intelligent, legally enforceable contracts. This leads many lawyers, and legal academics, to agonize over the details of whether, and under what circumstances smart contracts meet the classic contract law requirements of offer, acceptance, mutual consideration, and meeting of the minds.<sup>18</sup> Here’s the thing: smart contracts are not about those things at all.<sup>19</sup> Indeed, industry currently does not use smart contracts, standing alone, to create legally enforceable agreements.<sup>20</sup> As a result, many legal minds have devoted substantial time and attention to issues that do not really exist in commerce, diverting the conversation away from other interesting issues that actually exist in commerce. If, as part of our discipline and training, lawyers learned to reach across disciplines and

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<sup>16</sup> See, e.g., Kevin Werbach & Nicholas Cornell, *Contracts Ex Machina*, 67 DUKE L.J. 313 (2017); Jeremy M. Sklaroff, Comment, *Smart Contracts and the Cost of Inflexibility*, 166 U. PA. L. REV. 263 (2017); Jeffrey M. Lipshaw, *The Persistence of “Dumb” Contracts*, 2 STAN. J. BLOCKCHAIN L. & POL’Y 1 (2018).

<sup>17</sup> Allen Scott, *Vitalik Buterin: I Quite Regret Adopting the Term ‘Smart Contracts’ for Ethereum*, BITCOINIST (Oct. 11, 2018), <https://bitcoinist.com/vitalik-buterin-ethereum-regret-smart-contracts/>.

<sup>18</sup> See, e.g., Werbach & Cornell, *supra* note 16; Sklaroff, *supra* note 16; Lipshaw, *supra* note 16; CARDOZO BLOCKCHAIN PROJECT, “SMART CONTRACTS” & LEGAL ENFORCEABILITY (Oct 16, 2018); NORTON ROSE FULBRIGHT, SMART CONTRACTS (Nov. 2019) <https://www.nortonrosefulbright.com/en/knowledge/publications/1bcd200/smart-contracts#section4>.

<sup>19</sup> Carla L. Reyes, *A Unified Theory of Code Connected Contracts*, 46 J. CORP. L. 989 & n.46 (2021) [hereinafter Reyes, *Unified Theory*].

<sup>20</sup> See, e.g., J. DAX HANSEN ET AL., MORE LEGAL ASPECTS OF SMART CONTRACT APPLICATIONS 6 (Oct. 2018), <https://www.perkinscoie.com/images/content/1/9/v5/199672/2018-More-Legal-Aspects-of-Smart-Contract-Applications-White-Pa.pdf>.

understand how those from other academic backgrounds use various terms, we could provide more value to clients and better guide the path of the law.

Nick Szabo, who first coined the term smart contract as early as 1994,<sup>21</sup> once explained that lawyers who worry about the legal enforceability of smart contracts are asking the wrong questions. Smart contracts, Szabo explained, “aren’t trying to create legal[y] binding [contracts], they are doing by other means important functions formerly done by trad[itional] contracts (e.g. controlling assets and incentivizing performance).”<sup>22</sup> How do smart contracts perform these other functions? To understand that, we must understand a smart contract as the software industry generally, and the blockchain technology industry specifically, understands that term.

Szabo initially defined smart contracts as “a set of promises, specified in digital form, including protocols within which the parties perform on these promises.”<sup>23</sup> Szabo saw smart contracts as a way “to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries.”<sup>24</sup> The technology to support Szabo’s idea in its full complexity did not fully exist in 1994.<sup>25</sup> When the Bitcoin

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<sup>21</sup> S. ASHARAF & S. ADARSH, *DECENTRALIZED COMPUTING USING BLOCKCHAIN TECHNOLOGIES AND SMART CONTRACTS* 45 (2017) (“The concept of smart contracts was first formally coined by Nick Szabo in 1994.”); WILLIAM MOUGAYAR, *THE BUSINESS BLOCKCHAIN: PROMISE, PRACTICE AND APPLICATION OF THE NEXT INTERNET STRATEGY* 41 (2016) (“The concept was first introduced by Nick Szabo in 1994 . . . .”); ALEX TAPSCOTT & DAN TAPSCOTT, *BLOCKCHAIN REVOLUTION: HOW THE TECHNOLOGY BEHIND BITCOIN IS CHANGING MONEY, BUSINESS AND THE WORLD* 101 (2016) (“Szabo coined the phrase in 1994, the same year that Netscape, the first web browser hit the market . . . .”).

<sup>22</sup> Nick Szabo, TWITTER (Oct. 14, 2018, 9:23 pm), <https://twitter.com/NickSzabo4/status/1051689982270664708>.

<sup>23</sup> Nick Szabo, *Smart Contracts: Building Blocks for Digital Markets* (1996), [http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart\\_contracts\\_2.html](http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html); *see also* Nick Szabo, *Formalizing and Securing Relationships on Public Networks*, *FIRST MONDAY* 1, (Sept. 1, 1997), <http://firstmonday.org/ojs/index.php/fm/article/view/548/469>.

<sup>24</sup> Nick Szabo, *Smart Contracts* (1994), <http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html>.

<sup>25</sup> *See* J. Dax Hansen & Carla L. Reyes, *Legal Aspects of Smart Contract Applications* 1 (May 2017), <http://www.jdsupra.com/legalnews/legal-aspects-of->



blockchain emerged in 2009, so did a platform for implementing increasingly complex and interactive smart contracts.<sup>26</sup> In fact, every bitcoin transaction on the Bitcoin blockchain constitutes a very simple form of smart contract.<sup>27</sup>

In the context of smart contracts operating in connection with blockchain technology, a smart contract is computer software<sup>28</sup> that runs on a blockchain protocol or on a distributed ledger<sup>29</sup> in order to take some action upon receipt of specified data,<sup>30</sup> and writes the

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smart-contract-55492/ (citing MOUGAYAR, *supra* note 21); *see also* TAPSCOTT & TAPSCOTT, *supra* note 21, at 102 (“Back then, smart contracts were an idea all dressed up with nowhere to go, as no available technology could deploy them as Szabo described.”).

<sup>26</sup> MOUGAYAR, *supra* note 21, at 41 (“The concept was first introduced by Nick Szabo in 1994, but it underwent a long gestation period of inactivity and disinterest, because there was no platform that could enforce smart contracts, until the advent of the Bitcoin blockchain technology in 2009.”).

<sup>27</sup> HENNING DIEDRICH, ETHEREUM 115 (2016) (“Every cryptocurrency transfer is but a simple smart contract. The mechanism is one and the same, it’s just a smart contract’s simplest form: one signature and the money moves.”); Merit Kõlvart, Margus Poola & Addi Rull, *Smart Contracts*, in *THE FUTURE OF LAW AND ETECHNOLOGIES* 133, 145 (Tanel Kerikmäe & Addi Rull eds., 2016) (“Smart contracts are automated computer agents that fulfil certain tasks, for instance, transferring digital property.”).

<sup>28</sup> *See* DIEDRICH, *supra* note 27, at 167; *see also* MOUGAYAR, *supra* note 21, at 42–43 (“Smart contracts are software code representing business logic that runs a blockchain. . . .”). Others refer to smart contracts as “computer programs.” *See, e.g.*, TAPSCOTT & TAPSCOTT, *supra* note 21, at 101. I prefer computer code, as it is the building block of a computer program, and as smart contracts themselves can be used as building blocks for decentralized computer programs. *See* MOUGAYAR, *supra* note 21, at 43 (“Smart contracts are usually part of a decentralized (blockchain) application. There could be several contracts to a specific application.”). “Computer code,” or simply “code,” “is a mode of communication between computer programs, which is often described as consisting of methods, data structures, and algorithms, that allow various parties to exchange information concisely and efficiently.” Christopher K. Odet, *Bitproperty and Commercial Credit*, 94 WASH. U. L. REV. 649, 659 (2017). For further reading on computer code and other computer science terms, *see generally* CHARLES PETZOLD, *CODE* (2000) and NELL DALE & JOHN LEWIS, *COMPUTER SCIENCE ILLUMINATED* (5th ed. 2012).

<sup>29</sup> DIEDRICH, *supra* note 27, at 174 (“Smart contracts live on the blockchain. They inherit the limitation of decentralized code: Smart contracts cannot reach information outside the blockchain.”); Gideon Greenspan, *Why Many Smart Contract Use Cases Are Simply Impossible*, COINDESK (Apr. 17, 2016), <http://www.coindesk.com/three-smart-contract-misconceptions/> (“A smart contract is a piece of code that is stored on a[] blockchain . . . .”); *see also* MOUGAYAR, *supra* note 21, at 43 (“Even in the Ethereum implementation, smart contracts run as quasi-Turing complete programs.”).

<sup>30</sup> *See* DIEDRICH, *supra* note 27, at 167 (“Smart contracts are decentralized code that [executes] after a condition is fulfilled.” (emphasis omitted)); MOUGAYAR, *supra* note 21, at 42–43 (“Smart contracts are software code representing business

resulting state change from the operation of the smart contract into the blockchain protocol or distributed ledger.<sup>31</sup> “In other words, smart contracts are computer code that says, ‘if data is received that X has occurred, Y will execute.’”<sup>32</sup> This generalization that smart contracts are computer programs designed to execute Y action upon the occurrence of X is about the only generalization that can be made.<sup>33</sup> Smart contracts are not monolithic. Some smart contracts exert some control over assets digitally recorded on a blockchain protocol.<sup>34</sup> Some smart contracts function as part of a blockchain based application,<sup>35</sup> while others act as part of a decentralized

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logic that runs a blockchain, and they are triggered by some external data that lets them modify some other data. They are closer to an event-driven construct, more than artificial intelligence.”).

<sup>31</sup> Greenspan, *supra* note 29 (“A smart contract is a piece of code that is stored on a[] blockchain, triggered by blockchain transactions and which reads and writes data in that blockchain’s database. . . . A smart contract is just a fancy name for code that runs on a blockchain, and interacts with that blockchain’s state.”). Vitalik Buterin defines smart contracts as “systems which automatically move digital assets according to arbitrary pre-specified rules.” VITALIK BUTERIN, ETHEREUM, ETHEREUM WHITE PAPER: A NEXT GENERATION SMART CONTRACT & DECENTRALIZED APPLICATION PLATFORM 1 (2013). Others define smart contract as “a computerized transaction protocol to execute contract terms.” Alex Norta, *Creation of Cross-Organizational Collaborations for Decentralized Autonomous Organizations*, 14 PERSP. BUS. INFORMATICS RES. 3, 3 (2015), [https://www.researchgate.net/publication/277014751\\_Creation\\_of\\_Cross-Organizational\\_Collaborations\\_for\\_Decentralized\\_Autonomous\\_Organizations](https://www.researchgate.net/publication/277014751_Creation_of_Cross-Organizational_Collaborations_for_Decentralized_Autonomous_Organizations); Richard Gendal Brown, *A Simple Model for Smart Contracts*, RICHARD GENDAL BROWN (Feb. 10, 2015), <https://gendal.me/2015/02/10/a-simple-model-for-smart-contracts/> (“A smart contract is an event-driven program, with state, which runs on a replicated, shared ledger and which can take custody over assets on that ledger.”). This longer definition is intended to reflect, for the nontechnical, that a smart contract is not just of a singular shape and size but, rather, may be put to many uses, and, as a result, some smart contracts will emphasize certain characteristics over others.

<sup>32</sup> Reyes, *Unified Theory*, *supra* note 19, at 987 (citing RICHARD GENDAL BROWN, A SIMPLE MODEL FOR SMART CONTRACTS (Feb. 10, 2015), <https://gendal.me/2015/02/10/a-simple-model-for-smart-contracts/>).

<sup>33</sup> *Id.*

<sup>34</sup> See DIEDRICH, *supra* note 27, at 167 (“A smart contract is decentralized code that moves money based on a condition. Any decentralized code can move money, i.e., cryptocurrency, or effect some other type of exchange, e.g. of digital assets.”); MOUGAYAR, *supra* note 21, at 42 (explaining that smart contracts “control a real-world valuable property via ‘digital means’”).

<sup>35</sup> See William Mougayar, *9 Myths Surrounding Blockchain Smart Contracts*, COINDESK (Mar. 23, 2016), <http://www.coindesk.com/smart-contract-myths-blockchain/> (“Smart contracts are usually part of a decentralized (blockchain) application. There could be several contracts to a specific application. For example, if certain conditions in a smart contract are met, then the program is allowed to update a database.”).

autonomous organization.<sup>36</sup> The data that triggers execution of the smart contract can be internal to the blockchain protocol,<sup>37</sup> or the smart contract can receive the data from an outside source.<sup>38</sup> Importantly, however, smart contracts are quite passive.<sup>39</sup> A smart contract must be triggered (sent a signal) indicating that “x” has occurred; the smart contract cannot reach out to the world to uncover on its own that the event “x” occurred.<sup>40</sup>

Anecdotally, law’s concern with smart contracts seems wrapped up with legally enforceable contracts. Nine states felt compelled to clarify the status of blockchain signatures and smart contracts under UETA to “clarify” their legal enforceability.<sup>41</sup> More recently, at least two states amended their limited liability company statutes to “clarify” the enforceability of smart contracts as all or portions of the company’s operating agreement.<sup>42</sup> None of the definitions of smart contract in these laws particularly stand out for their accuracy. For example, Wyoming’s legislation on Decentralized Autonomous Organizations (“DAO”) defined smart contract as

an automated transaction . . . or any substantially similar analogue, which is comprised of code, script or programming language that executes the terms of an agreement and which may include taking custody

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<sup>36</sup> Carla L. Reyes, *Autonomous Business Reality*, 21 NEV. L.J. 437, 447 (2021) [hereinafter Reyes, *ABR*].

<sup>37</sup> DIEDRICH, *supra* note 27, at 167–68 (explaining that smart contracts move assets after a condition has been filled and that “[t]he condition can be internal to the blockchain or fed in from the outside”).

<sup>38</sup> *Id.* at 170 (explaining that relying on external data “is the usual situation for smart contracts, they will be tied to external events and they are set in motion by receiving a signed transaction expressing what the outcome of a specific event was” (emphasis omitted)). When smart contracts receive data from outside sources, those outside sources are often referred to as “oracles.” MOUGAYAR, *supra* note 21, at 43 (“Oracles are data sources that send actionable information to smart contracts.”); Werbach & Cornell, *supra* note 16, at 336 (“Sometimes a smart contract refers to facts in the world, for example, when a contract pays out if a stock exceeds a certain price on a certain date. The Bitcoin blockchain knows nothing about stock prices; it must collect that information through an external data feed. In the language of smart contracts, systems that interpret such external feeds and verify contractual performance are called ‘oracles.’”); Houman Shadab, *What are Smart Contracts, and What Can We Do with Them?*, COIN CTR. (Dec. 15, 2014), <https://perma.cc/BH6T-J6S7>.

<sup>39</sup> Reyes, *Unified Theory*, *supra* note 19, at 987.

<sup>40</sup> *Id.*

<sup>41</sup> *See supra* note 2.

<sup>42</sup> Wyoming, WYO. STAT. ANN. § 17-31-102 (2022); *see also* TENN. CODE ANN. § 47-10-202 (2018).

of and transferring an asset, administering membership interest votes with respect to a decentralized autonomous organization or issuing executable instructions for these actions, based on the occurrence or nonoccurrence of specified conditions.<sup>43</sup>

Rather than simply define the technical attributes or function of smart contracts, the definition attempts to mix the technical attributes with use cases for smart contracts within DAOs. Doing so makes the definition underinclusive, very quickly making clear the dangers of failing to write technology-neutral law.

Comparing the technical reality of smart contracts to the legal discussion about smart contracts, including the definitions of smart contracts within the UETA revisions and DAO legislation, reveals that although the term smart contract, in fact, refers to a much broader set of software programs,<sup>44</sup> lawyers seem to most frequently use the term to refer to some type of computer-coded legal contract.<sup>45</sup> Anecdotally, it appears that this somewhat arbitrary legal focus also influenced statutory changes.<sup>46</sup> Anecdote, however, likely lies at the heart of the problem. Commonly, when law and emerging

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<sup>43</sup> WYO. STAT. ANN. 17-31-102 (a)(ix) (2022).

<sup>44</sup> See Mougayar, *supra* note 35 (explaining that smart contracts are not the same as a contractual agreement, but rather, “[i]f we stick to Nick Szabo’s original idea, smart contracts help make the breach of an agreement expensive because they control a real-world valuable property via ‘digital means’”); see also DIEDRICH, *supra* note 27, at 169 (“A smart contract is not necessarily between two parties, and in reality almost never, so far, the mirror image or replacement of a legal contract.”); MOUGAYAR, *supra* note 21, at 42 (“Smart contracts are not the same as a contractual agreement.”).

<sup>45</sup> This category includes the Barclays idea of “Smart Contract Templates” as human-readable legal-prose contracts that can be enforced normally in court, but just kept and tracked on a DLT protocol.

The aim of Smart Contract Templates is to support the management of the complete lifecycle of “smart” legal contracts. This includes the creation of legal document templates by standards bodies and the subsequent use of those templates in the negotiation and agreement of contracts by counterparties. They also facilitate automated performance of the contract and, in the event of dispute, provide a direct link to the relevant legal documentation.

Christopher D. Clack, Vikram A. Bakshi & Lee Braine, *Smart Contract Templates: Foundations, Design Landscape and Research Directions*, BARCLAYS BANK PLC (Aug. 4, 2016), <https://arxiv.org/pdf/1608.00771v2.pdf>.

<sup>46</sup> At least one commentator decries this result because, in his view, the Wyoming DAO law “does not solve a problem.” Gabriel Shapiro, *Wyoming’s Legal DAO-Saster*, LEXNODE BLOG (Apr. 9, 2021), <https://lexnode.substack.com/p/wyomings-legal-dao-saster>.

technology attempt to communicate, participants in the discussion turn to metaphors and anecdotes to help convey meaning.<sup>47</sup> While often a good starting place for discussion, the limits of metaphors and anecdotes can lead discussions to deteriorate over time.<sup>48</sup>

Here, the technical community invoked the metaphor of a contract to coin a popular term for persistent scripts.<sup>49</sup> While perhaps a genius marketing play, the technical community now

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<sup>47</sup> See, e.g., T.J. McIntyre & Colin Scott, *Internet Filtering: Rhetoric, Legitimacy, Accountability and Responsibility*, in REGULATING TECHNOLOGIES 109, 112 (Brownsword & Yeung eds., 2008) (explaining the metaphorical development of the term “filtering”); Norberto Nuno Gomes de Andrade, *Technology and Metaphors: From Cyberspace to Ambient Intelligence*, 4 OBSERVATORIO J. 121, 122 (2010) (noting that the development of the Internet led to a wide array of new metaphors like “information highways,” “metaverse,” and “cyberspace”); Sam Harnett, *Words Matter: How Tech Media Helped Write Gig Companies into Existence* 1, 4 (Aug. 7, 2020) (unpublished manuscript), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3668606](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3668606) (discussing the importance of what shorthand is used in reporting).

<sup>48</sup> See, e.g., Rebecca Crootof, *Autonomous Weapon Systems and the Limits of Analogy*, 9 HARV. NAT’L SEC. J. 54, 55–56 (2018) (showing the limitations of using weapon and combatant analogies for autonomous weapons); Lex Gill, *Law, Metaphor, and the Encrypted Machine*, 55 OSGOODE HALL L.J. 440, 455–56 (2018) (noting that the metaphors used in law are emotionally and ideologically loaded, and that overtime it becomes less clear that the terms are metaphors); Ryan Calo, *Robots as Legal Metaphors*, 30 HARV. J.L. & TECH. 209, 210 (2016) (arguing that judges use the term “robot” to justify removing agency from people); Amy E. Sloan & Colin P. Starger, *New Wine in Old Wineskins: Metaphor and Legal Research*, 92 NOTRE DAME L. REV. ONLINE 1, 2 (2017) (showing the dangers of metaphor through the example of the “War on Drugs”); Neil M. Richards & William Smart, *How Should the Law Think About Robots?*, in ROBOT LAW 3, 16 (Ryan Calo, Michael Froomkin & Ian Kerr eds., 2016) (“In designing and implementing new technologies, we must be mindful of the metaphors we use to understand the technologies.”); Lyria Bennett Moses, *Recurring Dilemmas: The Laws Race to Keep Up With Technological Change*, 2007 ILL. J.L. TECH. & POL’Y 239, 242 (commenting that there is no literature to explain why the use of metaphors are appropriate to reify technology and law); I. Glenn Cohen & Jonathan H. Blavin, *Gore, Gibson, and Goldsmith: The Evolution of Internet Metaphors in Law and Commentary*, 16 HARV. J.L. & TECH. 265, 268 (2002) (“By failing to adopt appropriate metaphors in regulating new technologies, courts risk creating bad law.”); Joshua Fairfield, *The Magic Circle*, 14 VAND. J. ENT. & TECH. L. 823, 825 (2012) (arguing that it is a fallacy to distinguish between the “real” world and the “virtual” world).

<sup>49</sup> CleanApp, *Against “Smart Contracts,”* CRYPTO L. REV. (July 14, 2018), <https://medium.com/cryptolawreview/against-smart-contracts-4a1f43133215> (“The ‘smart contract’ banner is a very catchy marketing ploy. It has been instrumental as an adoption driver. It’s edgy, contrastive and highly-prescriptive: if you’re not hip to ‘smart contracts,’ well, then, maybe you’re just not...smart.”).

laments the choice.<sup>50</sup> Ultimately, who invoked which metaphor matters less than the fact that the confusion it has anecdotally sown in the legal literature evaluating smart contracts now seems to be seeping its way into statutes.<sup>51</sup> But even the claims in this Essay that the language used in those statutes will be largely unintelligible to the technical community trying to make use of the law rests on anecdote up to this point. Ultimately, without a more evidence-driven evaluation of how the various stakeholder groups understand and use the term smart contract, we simply cannot be precise about the limits of—or the harm caused by—the apparent confusion of the relationship between the term smart contract and a legally enforceable contract. Better anticipation of some of the legal challenges relating to smart contracts currently percolating into court rooms<sup>52</sup> and congressional hearings<sup>53</sup> requires a more evidence-driven understanding of the effect that the conflict between the technical meaning of smart contract and the legal meaning of contract has on law and policy-making.

## II. RECENT LEGAL INQUIRIES INTO SMART CONTRACTS MISS THE BOAT: EVIDENCE FROM CORPUS LINGUISTICS

Law and language are intricately interconnected.<sup>54</sup> In fact, “language is *the* vehicle by means of which law is transmitted,

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<sup>50</sup> Scott, *supra* note 17.

<sup>51</sup> See, e.g., Mike Orcutt, *States that are Passing Laws to Govern “Smart Contracts” Have No Idea What They’re Doing*, MIT TECH. REV. (Mar. 29, 2018), <https://www.technologyreview.com/2018/03/29/144200/states-that-are-passing-laws-to-govern-smart-contracts-have-no-idea-what-theyre-doing/>; CleanApp, *supra* note 48 (quoting Andrew Hinkes) (“Laws should not attempt to define technologies that do not have widely held definition in their relevant technical communities.”).

<sup>52</sup> Complaint, *CFTC v. Ooki DAO*, 3:22-cv-5416 (N.D. Cal. 2022) (alleging a DAO, formed by smart contracts, is an unincorporated association designed “to run a business, and specifically, to operate and monetize the Ooki Protocol”); First Amended Complaint, *Ometak et al. v. bZx DAO, et al.*, 22-cv-0618-LAB-DEB (S.D. Cal. 2022) (alleging the bZx protocol and Ooki DAO, as DAOs comprised of smart contracts, is a general partnership).

<sup>53</sup> *Hearings, Investigating the Collapse of FTX, Part I*, Fin. Servs. Comm. (Dec. 13, 2022), <https://financialservices.house.gov/calendar/eventsingle.aspx?EventID=408483>.

<sup>54</sup> Deborah Cao, *Legal Speech Acts as Intersubjective Communicative Action*, in INTERPRETATION, LAW AND THE CONSTRUCTION OF MEANING: COLLECTED PAPERS ON LEGAL INTERPRETATION IN THEORY, ADJUDICATION AND POLITICAL PRACTICE 65, 65 (Anne Wagner et. al. eds. 2004) (“Law relies on language and particularly, it relies on the performative nature of language use.”).

interpreted and executed in all cultures.”<sup>55</sup> Considered in this light, law might be viewed as a single-direction message—“from law-giver to law-taker, from sender to receiver.”<sup>56</sup> To make the message understandable, the law-taker must employ the same meaning of the words used by the law-giver when constructing the communication.<sup>57</sup> Thus, when a law maker uses the term smart contract in a new law or regulation using some idea of legal meaning (some kind of technology-enhanced legally enforceable agreement) and technologists read the law using the term’s technical meaning (a persistent script that says if X happens then Y will execute), a recipe for disaster becomes quite clear. This Part argues that using corpus linguistics during the law and policy-making process may help avoid the anecdotal problems associated with efforts to “accommodate” smart contracts. The section then offers the results from a genre variation corpus linguistic study of the term smart contract revealing that legal academics, lawyers, and lawmakers seem preoccupied with issues that technical science researchers and litigants do not view as primary issues.

#### *A. Corpus Linguistics as a Tool for Improving Policy Discussion*

Some legal scholars and judges look to the use of corpus linguistics as a mechanism for greater evidence-based application of law.<sup>58</sup> Although most attention in legal corpus linguistics centers on

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<sup>55</sup> Judith N. Levi, *The Study of Language in the Judicial Process*, in LANGUAGE IN THE JUDICIAL PROCESS, 5 L. SOC’Y & POL’Y 3, 4 (Judith N. Levi & Anne Graffam Walker eds. 1990) (emphasis in original); see also Nicola Langton, *Cleaning up the Act: Using Plain English in Legislation*, in LEGAL LANGUAGE AND THE SEARCH FOR CLARITY 361, 361 (Anne Wagner, Sophie Cacciaguidi-Fahy, eds. 2006) (“At the heart of any legal system is a legal tradition which is reflected to some degree in the language used in and the legal culture that underpins a set of rules of law, and the way in which the system manifests itself in the society within which it operates.”).

<sup>56</sup> Hanneke Van Schooten, *Law as Fact, Law as Fiction: A Tripartite Model of Legal Communication*, in INTERPRETATION, LAW AND THE CONSTRUCTION OF MEANING: COLLECTED PAPERS ON LEGAL INTERPRETATION IN THEORY, ADJUDICATION AND POLITICAL PRACTICE 3, 4 (Anne Wagner et. al. eds. 2004).

<sup>57</sup> *Id.*

<sup>58</sup> See, e.g., Stephen C. Mouritsen, Note, *The Dictionary is Not a Fortress: Definitional Fallacies and a Corpus-Based Approach to Plain Meaning*, 2010 B.Y.U. L. REV. 1915, 1919 (2010) (advocating for the use of a corpus-based approach to interpret legal language when contextual cues and legislative definitions are insufficient); Thomas R. Lee & Stephen C. Mouritsen, *Judging Ordinary Meaning*, 127 YALE L.J. 788, 788 (2018) (proposing the use of corpus

judicial determination of the ordinary meaning of an ambiguous statute,<sup>59</sup> this Essay seeks to apply corpus linguistics techniques in a different context: the law and regulation making process.<sup>60</sup> The goal of this Essay is to test more rigorously the anecdote-supported hypothesis that law's obsession with the legal enforceability of smart contracts does not match actual uses of smart contracts by those building software systems. In doing so, the Essay also hopes to contribute further evidence of the usefulness of corpus linguistics in the law-formation stage, as opposed to the law-interpretation stage.

Generally speaking, “corpus linguistics gives researchers a way to track patterns in various genres of language usage.”<sup>61</sup> Essentially, corpus linguists employ computational techniques to help them analyze a very large data set of text.<sup>62</sup> “Corpus analysis is especially useful for testing intuitions about texts,”<sup>63</sup> making it useful for testing the accuracy of an intuition about the existence of and reasons for miscommunication in specific subject matter, such as smart contracts. Corpus linguistics does not shy away from

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linguistics to resolve the indeterminacy of ordinary meaning); Thomas R. Lee & James C. Phillips, *Data-Driven Originalism*, 167 U. PA. L. REV. 261, 262 (2019) (using corpus linguistics to uncover the original communicative content of the Constitution); Jennifer L. Mascott, *Who are “Officers of the United States”?*, 70 STAN. L. REV. 443, 453 (2018) (using corpus linguistics to determine whether the term “officer” is consistent with the term’s original public meaning); Lawrence M. Solan, *Can Corpus Linguistics Help Make Originalism Scientific?*, 126 YALE L.J. FORUM 57, 57–58 (2016) (proposing corpus linguistics as a research tool to analyze the original public meaning during the Founding Era); Lawrence M. Solan & Tammy Gales, *Corpus Linguistics as a Tool in Legal Interpretation*, 2017 B.Y.U. L. REV. 1311, 1312–13 (2017) (arguing that corpus linguistics is a useful tool in constructing ordinary meaning when such meaning is legally relevant).

<sup>59</sup> See *supra* note 58.

<sup>60</sup> Indeed, this is the third in a series of four articles that argues for using corpus linguistics at this earlier stage of law formation. For the first article, see Reyes, *Language Wars: AI*, *supra* note 14; and for the second see Reyes, *Language Wars: Cryptocurrency*, *supra* note 14.

<sup>61</sup> Anya Bernstein, *Technologies of Language Meet Ideologies of Law*, 2020 MICH. ST. L. REV. 1241, 1257.

<sup>62</sup> Heather Froehlich, *Corpus Analysis with Antconc*, PROGRAMMING HISTORIAN (Nov. 5, 2020), <https://programminghistorian.org/en/lessons/corpus-analysis-with-antconc> (“Corpus analysis is a form of text analysis which allows you to make comparisons between textual objects at large scale.”).

<sup>63</sup> *Id.*



complexity or variation in language, but rather, expects it.<sup>64</sup> As a result, corpus linguistics focuses on describing language accurately.<sup>65</sup> A specific corpus linguistic technique—the genre variation study—seeks to uncover how language use differs by speaker or context<sup>66</sup> in order to better understand how language functions as a communicative tool.<sup>67</sup>

The hope of this Essay for the use of corpus linguistics at the intersection of law and emerging technology is that corpus linguistics might help uncover different uses of the same word across different genres—namely, different professional disciplines where each might employ the same term as a term of art that reflect vastly different meanings and values. Although the outcome of such analysis is descriptive, the aim is to provide deeper real-world evidence to support the normative proposition that law needs to pay attention to technological reality and the minutia of technical functionality even as law strives to remain technology-neutral. When law-makers, lawyers, and others in the legal field understand the values and important features encompassed in the terms of art used by the disciplines law seeks to regulate, they may be able to build more robust, clear, and efficient law that targets actual harms rather than imaginary ones.

Applying corpus linguistics in the legal field is not itself novel. Over the last fifteen years, a variety of legal academics advocated for the use of corpus linguistics by judges seeking to find the “ordinary meaning” or “plain meaning” of ambiguous statutory text.<sup>68</sup> Others sharply criticize such efforts,<sup>69</sup> with some arguing that

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<sup>64</sup> CHARLES F. MEYER, ENGLISH CORPUS LINGUISTICS: AN INTRODUCTION 3 (2002).

<sup>65</sup> *Id.* at 4.

<sup>66</sup> *Id.* at 18.

<sup>67</sup> *Id.* at 5.

<sup>68</sup> See, e.g., *supra* note 58; Stefan Th. Gries & Brian G. Slocum, *Ordinary Meaning and Corpus Linguistics*, 2017 BYU L. REV. 1417, 1427 (2017) (arguing that corpus analysis and similar empirical based study should be used to help judicial interpretation of legal language).

<sup>69</sup> See, e.g., Carissa Byrne Hessick, *Corpus Linguistics and the Criminal Law*, 2017 B.Y.U. L. REV. 1503, 1511 (2017) (arguing against the use of corpus linguistics as a new interpretive theory in criminal adjudication because the tool impedes the public notice requirement inherent in certain law (like criminal statutes)); Evan C. Zoldan, *Corpus Linguistics and the Dream of Objectivity*, 50 SETON HALL L. REV. 401, 430–35 (2019) (challenging the validity of speech community selection when analyzing legal text); Kevin P. Tobia, *Testing Ordinary Meaning*, 134 HARV. L. REV. 727, 753–77 (2020) (using survey results

the corpus linguistic focus on frequency of word use offers limited value,<sup>70</sup> and others arguing instead that the analytical move from frequency to plain meaning is fraught with errors and improper assumptions.<sup>71</sup> Each of these critiques points to a way in which the use of corpus linguistics to uncover plain meaning may improperly employ a linguistic tool for a legal purpose, causing the analysis to miss nuances or overclaim inferences from results.<sup>72</sup>

This Essay does not take a position in the debate over the use of corpus linguistics for statutory interpretation. Instead, this Essay uses corpus linguistics to simply identify, in an evidence-driven way, how different stakeholders use the same term—smart contract, and indeed the term contract within that phrase—without attempting to make any judgment about which use presents the “plain meaning” of that term.<sup>73</sup> Indeed, this Essay instead seeks to test the proposition

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to argue that corpus linguistics incorrectly focuses on prototypical meaning); Matthew Jennejohn, Samuel Nelson & D. Carolina Nunez, *Hidden Bias in Empirical Textualism*, 109 GEO. L.J. 767, 771 (2021) (arguing that the Corpus of Historical American English (COHA) is sexist); Francis J. Mootz III, *Corpus Linguistics and Vico's Lament: Against Vivisectional Jurisprudence*, 20 NEV. L.J. 845, 845–47 (2020) (arguing that use of corpus linguistics to devise plain meaning reinforces an incorrect theory of the relationship between law-making and law enforcement); Anya Bernstein, *Democratizing Interpretation*, 60 WM. & MARY L. REV. 435, 444 (2018) (challenging the claim that corpus linguistics eliminates all manner of discretion in determining ordinary meaning).

<sup>70</sup> See, e.g., Hessick, *supra* note 69, at 1514 (“Corpus linguistics tells us that the ordinary meaning of a statutory term ought to be resolved by looking to the frequency with which a term is used a certain way. This is a problematic theory for the interpretation of criminal laws because it creates problems of notice and accountability.”).

<sup>71</sup> Tobia, *supra* note 69, at 794–97.

<sup>72</sup> See, e.g., Bernstein, *supra* note 61 (arguing that by turning linguistics into a technology of law, the legal corpus linguistics movement misses important features of linguistic methods and overclaims the import of legal corpus linguistic studies). For a discussion of how this critique of using corpus linguistics in law reflects a broader critique of co-opting interdisciplinary tools for legal purposes, see Reyes, *Language Wars: Cryptocurrency*, *supra* note 14.

<sup>73</sup> This Essay is part of a four-part series of linguistic studies on the impact of language on the law-making process when the law relates to issues of emerging technology. My hope is that the four studies will: (1) move the discussion forward regarding the question of whether new law is required to address emerging technology, and (2) illustrate an alternative use case for corpus linguistics in law. For two of the other studies, see Reyes, *Language Wars: AI*, *supra* note 14 (investigating the misunderstandings at the intersection of AI and criminal justice around the words fairness, transparency, accountability, and transparency), and Reyes, *Language Wars: Cryptocurrency*, *supra* note 14 (investigating the misunderstandings around the term cryptocurrency and its synonyms and its impact on the development of regulation).

that the term smart contract likely does not have a plain meaning, but rather, reflects a term of art that means different things to different stakeholders. Simply by knowing that different stakeholders mean different things when engaged in a conversation using a common vocabulary can improve legal discussions around smart contracts at both the lawmaking stage and as practitioners attempt to advise clients using smart contracts in products and services.

B. *Everyone Uses the Same Words, but Nobody Means the Same Thing*

Using a common method of corpus linguistics, genre variation, this Section starts to uncover the deep disconnect regarding the term “smart contract” between stakeholders in the regulatory and policy spheres with the industry they seek to govern. Every corpus linguistic research investigation evolves out of a core research goal and linguistic hypothesis.<sup>74</sup> The discussion that follows presents the results of a genre variation study of the term “smart contract” undertaken in an effort to test the linguistic hypothesis that different stakeholders contributing to the development of law and policy related to smart contracts use the same words but mean very different things, resulting in the legal codification of significant confusion regarding the nature and purposes of smart contracts.

To test the hypothesis, I conducted a collocation analysis<sup>75</sup> and concordance line analysis<sup>76</sup> of the term smart contract using corpora representing each of six different stakeholder groups involved in the development of law regarding smart contracts: legal

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<sup>74</sup> MEYER, *supra* note 64, at 102. Corpus linguistics is often criticized for simply counting how frequently a given linguistic construction occurs in any corpus. *Id.* “To move beyond simply counting features in a corpus, it is imperative before undertaking a corpus analysis to have a particular research question in mind, and to regard the analysis of a corpus as both ‘qualitative’ and ‘quantitative’ research—research that uses statistical counts or linguistic examples to test a clearly defined linguistic hypothesis.” *Id.*

<sup>75</sup> Collocation analysis gives the linguist “a sense for which words tend to occur next to or close to your search term and sort those results by frequency.” MCGRAW CNTR. FOR TEACHING & LEARNING, QUICKSTART GUIDE TO ANTCONC, at 3, <https://mcgrawect.princeton.edu/guides/Quickstart-Guide-AntConc.pdf>.

<sup>76</sup> “A concordance lists the occurrences of certain words in the corpus ordered by how frequently those words are used as well as the context in which those terms appear.” *Id.* at 2.

academia, computer science and engineering academia, law-makers and regulators, judges, and the general public.<sup>77</sup> The collocation analysis offers insight into “which words tend to occur next to or close to [the] search term and sort[s] those results by frequency.”<sup>78</sup> The concordance line analysis, for its part, provides further insight into the collocation results by providing evidence of the context in which the words appear.<sup>79</sup>

In terms of the data studied, considering the approaches of various stakeholders requires the study of various corpora.<sup>80</sup> To uncover how legal academics use these terms, I sourced and created my own corpus. The legal academic corpus contains the text of every law review article using the term “smart contract” since 2008.<sup>81</sup> To consider the use of the term “smart contract” by researchers in the field that build blockchain protocols, smart contracts, and systems that interact with them, I conducted collocation queries against a corpus of materials written by computer science and computer engineering researchers.<sup>82</sup> To consider how law-makers and regulators use the term, I separated the inquiry between two levels—state and federal. For each level of statute and regulations, I created a corpus consisting of every

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<sup>77</sup> Every corpus linguistics investigation must begin by answering certain threshold questions: “(1) What is the relevant speech community that I want to investigate?” and “(2) What is the relevant time period I want to investigate?” Lee & Phillips, *supra* note 58, at 293–94.

<sup>78</sup> MCGRAW CNTR. FOR TEACHING & LEARNING, *supra* note 75, at 3.

<sup>79</sup> *Id.* at 2.

<sup>80</sup> MEYER, *supra* note 634, at 18.

<sup>81</sup> 2008 was chosen as the cutoff date because that was the year that the Bitcoin whitepaper was released by Satoshi Nakamoto (on October 31, 2008, to be precise). As to the mechanics of sourcing the corpus, I searched Westlaw for law review articles using the term “smart contract!” In the fall of 2022, I downloaded all of the articles that hit on that term, a total of 900 articles, as pdfs, and then uploaded them to AntFile Converter, which converted each document into a plain text format compatible with the AntConc corpus linguistics software. Laurence Anthony, *AntFile Converter Homepage*, <https://www.laurenceanthony.net/software/antfileconverter>.

<sup>82</sup> To create this corpus, I used AntCorGen to collect computer science and computer engineering research from the PLOS ONE research database. “AntCorGen is a freeware corpus generation tool. AntCorGen lets you search for documents in the PLOS ONE research database via search queries and/or subject category browsing and decide which sections (e.g., title, abstract, introduction) of those documents should be stored. AntCorGen then accesses the database, downloads the sections and save each one as a text file in an appropriate folder.” Laurence Anthony, *AntCorGen Help File Version: 001* (Apr. 12, 2021), <http://laurenceanthony.net/software/antcorgen/releases/AntCorGen120/help.pdf>.

existing statute, regulation, and administrative or regulatory guidance relating to smart contracts, as well as every statute related to smart contracts proposed in 2022 but not yet adopted.<sup>83</sup> In an attempt to see whether judges use the term smart contract in a way similar to the other stakeholders, I sourced and created a corpus containing every judicial decision, reported or unreported, that hit on that term.<sup>84</sup> Similarly, I sourced and created a separate corpus of legal newspapers, announcements, and alerts that mentioned “smart contract” in order to investigate the view of the issues triggered by smart contract technology by practicing lawyers.<sup>85</sup> The below discussion presents the results of the analysis of each stakeholder group and its related corpus, demonstrating the breadth of the linguistic misunderstandings of the term smart contract and the values reflected in each language community’s use of the term.

### 1. LEGAL ACADEMICS

A collocation analysis of the legal academic corpus, as shown in Table 1 below, evidences that when legal academics consider the technology aspect of smart contracts, the term is most frequently associated with blockchain technology, generally, and the Ethereum protocol, specifically. When legal academics evaluate

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<sup>83</sup> As to the mechanics of this, I downloaded every adopted or proposed statute, regulation, and administrative or regulatory guidance from Westlaw and Legiscan that hit on the term “smart contract” at both the state and federal levels. There existed sufficiently few such materials that I did not have to use a date cut off, but rather included in the corpus every existing statute, regulation, and administrative or regulatory guidance adopted to date. I also included every proposed, but not yet adopted, bill at the state and federal level as of the fall of 2022 that hit on a search in Legiscan. I then used AntFile Converter in the same manner as described in note 81 *supra* to convert the files from pdfs to plain text that AntConc could use. Notably, while the state corpus contains material of all of the types mentioned, the federal corpus does not contain any existing statutes or regulations—only existing administrative and regulatory guidance and proposed bills—because there were no existing statutes or regulations that hit on “smart contract.”

<sup>84</sup> I was able to pull every single judicial decision that hit on the term smart contract in Westlaw and include them all in the corpus because only thirty-eight such decisions exist. Again, to do so, I downloaded them as pdf files, and then converted them to txt files in the manner described in note 81 *supra*.

<sup>85</sup> As to the mechanics of this, I pulled every practice commentary and legal newspaper article that hit on a search of the term “smart contract” in Westlaw. With a total of 320 results without a date restraint on the search, the corpus includes all the materials that resulted from the search. I downloaded the results as pdf files, and then used AntFile Converter in the same manner as described in note 81 *supra* to convert the files to plain text that AntConc could use.

use cases, the most discussed use case is legally enforceable contracts, or terms within such contracts. The results also evidence significant use of the term “legal smart contracts,” which is a phrase used by some to refer to smart contracts intentionally built to serve as a legally enforceable contract.<sup>86</sup> In that vein, legal academics also seem concerned with the execution, transaction, and dispute resolution aspects of legal smart contracts. Finally, decentralized autonomous organizations also feature as a prominent use case of smart contracts discussed significantly in the legal literature. Ultimately, these results provide data to support the anecdotal evidence that law’s concern with smart contracts centers on their relationship with legally enforceable contracts—a potential conflation of a technical term of art with a legal term of art.

**Table 1: Discussion of “Smart Contracts” by Legal Academics<sup>87</sup>**

Smart Contracts							
657	blockchain	259	technology	199	based	137	DAO
648	contract(s)	239	ethereum	197	platform	133	execution
555	code	233	parties	163	decentralized	127	transaction
304	term(s)	205	legal	147	example	123	dispute

## 2. PRACTICING LAWYERS

As demonstrated by the results of the collocation analysis of the practitioner corpus in Table 2 below, practicing lawyers, like legal academics, associate the technical side of smart contracts with blockchain technology and the fact that smart contracts are code-based software. Practicing lawyers also focus on the use of smart contracts as legally enforceable contracts, legally recognizable documents, electronic records, and electronic signatures. While a concordance line analysis of the results suggests that some of this discussion reflects discussions about changes to UETA to “accommodate” smart contracts, other discussion reflects further consideration of whether contract law will recognize and enforce

<sup>86</sup> Indeed, a separate search of the corpus for “smart legal contract” revealed that the term is used fifty-eight times, relates to discussions of legally enforceable contracts and enforceability, and is associated with specific types of software and software providers—namely, Ricardian contracts and Consensys.

<sup>87</sup> The legal academic corpus consisted of 900 records, and the term smart contract appeared a total of 6,197 times.

promises allegedly made through smart contracts. Practicing lawyers also recognize that smart contracts power non-fungible tokens (NFTs), and some interest exists in the application of smart contracts to corporate governance.

**Table 2: Discussion of “Smart Contracts” by Practicing Lawyers<sup>88</sup>**

Smart Contracts							
69	blockchain	20	record	16	software	15	fundamentals
53	contract	19	signature	16	policy	15	futures
46	code	19	security	15	board	15	document
23	based	16	NFT	15	seat	14	establish

### 3. TECHNICAL SCIENCE RESEARCHERS

Reflecting the fact that the concept of smart contracts is not new to the technical sciences, the results of the collocation analysis of the technical science researcher corpus reveals that technical science researchers are not significantly focusing research on smart contracts—the collocation analysis simply did not return that many results to report in Table 3. The results obtained, however, evidence a discussion of blockchain, initial coin offerings, how to keep smart contracts simple, the nuances of calling (i.e., triggering the execution of) smart contracts, and exploring which types of transactions seem ripe for automation using smart contracts. Notably, the results contain no mention of smart contract use for legally enforceable contracts. Indeed, the only legal issue that appears in the technical science research collocate results reflects a concern about licensing software. While not providing conclusive evidence of anything, the results do substantiate anecdotal evidence that those developing smart contracts do not appear to worry about the legal enforceability of the software they create. Whether a smart contract is a legally enforceable contract is simply not an issue of any concern among technical science researchers.

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<sup>88</sup> The practicing lawyer corpus consisted of 320 records, and the term smart contract appeared a total of 445 times. Notably, a search for “smart legal contracts” and “legal smart contracts” evidenced a connection between the use of smart contracts as legally enforceable contracts with specific platforms and software providers—namely, Consensus and the Accord Project.

**Table 3: Discussion of “Smart Contracts” by Technical Science Researchers<sup>89</sup>**

Smart Contracts			
17	blockchain	2	primitive
4	ICOs	2	calling
4	completed	2	simplicity
4	licensing	2	automate

## 4. JUDGES

Very few judicial decisions discuss smart contracts at the time of this writing.<sup>90</sup> The collocates results for the thirty-eight decisions that were included in the corpus connect smart contracts to blockchain technology, and consider the role of developers in smart contracts. The decisions, do not, however, consider whether a smart contract represented a legally enforceable contract.

**Table 4: Discussion of “Smart Contracts” in Judicial Decisions<sup>91</sup>**

Smart Contracts							
12	blockchain	5	time	2	ledger	2	chair
6	work	4	technology	2	stopped	2	aspects
6	assembly	3	abbate	2	developers		
6	one	3	developer	2	generated		

<sup>89</sup> The technical science research corpus consisted of 418 records, and the term smart contract appeared sixty-eight times.

<sup>90</sup> In light of a variety of ongoing litigation, such as the Ooki DAO litigation and several high-profile bankruptcy cases, additional judicial decisions that address some aspect of smart contracts are likely to appear in the near term. *See e.g.*, Complaint, *CFTC v. Ooki DAO*, 3:22-cv-05416 (Sept. 22, 2022); First Amended Complaint, *Clement Ometak, et. al. v. bZx DAO et. al.*, 22-cv-0618-LAB-DEB (June 27, 2022); Complaint, *LCX AG v. John Doe Nos. 1-25*, Index No. 154644/2022 (June 1, 2022); Voluntary Petition for Non-individuals Filing for Bankruptcy, *In re Voyager Digital Holdings, Inc.*, Case 22-10943 (July 6, 2022); Voluntary Petition for Non-Individuals Filing for Bankruptcy, *In re Celsius Network LLC*, Case 22-10964 (July 13, 2022); Voluntary Petition for Non-Individuals Filing for Bankruptcy, *In re BlockFi, Inc.*, Case 22-19361-MBK (Nov. 28, 2022); Verified Petition Under Chapter 15, *In re Three Arrows Capital Ltd*, Case No. 22-10920 (July 1, 2022).

<sup>91</sup> The judicial decision corpus contained thirty-eight records, and the term smart contract appeared sixty-two times.



## 5. LAW-MAKERS AND REGULATORS

As displayed in Table 5 below, the analysis of the state law corpus provides evidence that state lawmakers focus on two main issues related to smart contracts. First, state regulators consider the use of smart contracts as legally enforceable contracts or agreements. Second, state lawmakers focus on the use of smart contracts to build and manage organizations, including the use of smart contracts as a business entity's operating agreement. A variety of commentators argue that existing business formation law already accommodates the use of smart contracts to build and manage DAOs.<sup>92</sup> It is not at all clear that new legislation is needed to accommodate smart contracts and DAOs in business formation statutes. As a result, the collocation results confirm the anecdotal intuition that state lawmakers seem to alter already flexible laws by making them less technology-neutral in order to unnecessarily accommodate technology.

**Table 5: Use of the Term “Smart Contracts” by State Law-Makers and Regulators<sup>93</sup>**

Smart Contracts							
37	organization	28	transaction	19	blockchain	16	used
34	party	27	contract	18	automated	15	operating
34	means	23	articles	17	agreement	12	conflict
33	secured	22	managed	17	created	11	decentralized

Table 6 below reflects the collocation results from the corpus of federal law and regulatory statements related to smart contracts. The results evidence a focus on blockchain technology, with

<sup>92</sup> See, e.g., Carla L. Reyes, *If Rockefeller Were a Coder*, 87 GEO. WASH. L. REV. 373 (2019); SHAWN BAYERN, *AUTONOMOUS ORGANIZATIONS* (2021); Chris Brummer & Rodrigo Seira, *Legal Wrappers and DAOs* (May 30, 2022) available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4123737](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4123737) (unpublished manuscript); David Kerr & Miles Jennings, *A Legal Framework for Decentralized Autonomous Organizations* (May 23, 2022), available at <https://a16zcrypto.com/wp-content/uploads/2022/06/dao-legal-framework-part-1.pdf> (unpublished manuscript); David Kerr & Miles Jennings, *A Legal Framework for Decentralized Autonomous Organizations Part II: Entity Selection Framework* (May 23, 2022) available at <https://a16zcrypto.com/wp-content/uploads/2022/06/dao-legal-framework-part-2.pdf> (unpublished manuscript).

<sup>93</sup> The state law-maker and regulator corpus contained twenty-one records, and the term smart contract appeared 181 times.

particular emphasis on use cases related to signing and writing transactions and contracts, tokens, and business entities. The inclusion of the token use case reflects the intense scrutiny from federal securities regulators on the initial coin offering market.

**Table 6: Use of the Term “Smart Contracts” by Federal Regulators<sup>94</sup>**

Smart Contracts							
94	code	50	digital	39	functionality	32	release
70	blockchain	44	transaction	35	tokens	29	necessary
60	signing	40	contract	34	assets	29	depositing
53	write	39	including	32	run	29	entities

Taken together, the state and federal law collocation results evidence a focus on smart contracts as legally enforceable contracts, even with the federal focus on the use of smart contracts to create tokens that might be subject to securities regulation.

## 6. LESSONS SUGGESTED FROM COMPARING THE RESULTS

The results from the corpora reflect five stakeholders in the discussion around legal issues related to smart contracts. Comparing these results leads to two interrelated conclusions. First, legal researchers and lawyers seem preoccupied with an issue—the legal enforceability of smart contracts—that technical science researchers seem to care little about and that does not yet represent a significantly disputed issue in litigation. The question becomes then, why does the law obsess over an issue that does not seem to play out in commerce? Second, despite the dearth of interest from those building smart contracts, and despite the lack of any evidence from litigation that legal enforceability of smart contracts represents an issue of concern, lawmakers at both the state and federal level also seem concerned with the legal enforceability of smart contracts, both as a matter of contract law (UETA) and business law. In that regard, the question becomes, why? Why would an issue that only seems to arise as a theoretical matter need to be addressed by changing long-standing and well-functioning statutory language?

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<sup>94</sup> The federal regulator corpus contained 149 records, and the term smart contract appeared 463 times.

### III. GOOD POLICY AND SOUND LAW INCREASINGLY REQUIRES DEEPER TECHNOLOGICAL COMPETENCE

Commonly, at the intersection of emerging technology and law, stakeholders latch onto buzz words that seem to hold common meaning as a starting point for conversation.<sup>95</sup> Moving beyond the anecdotal impressions relied upon in discussions about the language wars related to smart contracts, the linguistic evidence presented here suggests that when the legal community fails to move beyond such buzz words to a deeper technological understanding of a term like smart contracts, the legal community actually perpetuates misunderstandings and embeds them in law. As a result, and without lessening the importance of technological neutrality in law, good policy and sound law increasingly require deeper technological competence.<sup>96</sup>

The foundation of technological neutrality centers on function: description of the object of the law functionally so that the law captures activity regardless of how that activity is executed.<sup>97</sup> Although tempting to use technological neutrality as a reason not to develop deeper technical understanding of emerging technology, accurately describing activity undertaken using emerging technology requires understanding the technology, its limits, and how it functions.<sup>98</sup> Such an approach, however, unintentionally engages a heated debate around the role of lawyers in technology while simultaneously signaling a potential impact on the traditional law-making process.

Most attorneys bristle when told they need to understand technology at a deep level in order to provide sound legal analysis. Because technology neutrality represents a core principle of lawmaking,<sup>99</sup> and technology neutrality focuses on function, the

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<sup>95</sup> Reyes, *Unified Theory*, *supra* note 19, at 999; Reyes, *ABR*, *supra* note 36, at 440 (“Part of this failure to consider the full, rich tapestry of technological innovation stems from the age-old difficulty of separating hype from fiction before investigating the intersection of law and technology.”).

<sup>96</sup> Reyes, *Creating Cryptolaw*, *supra* note 9, at 1579.

<sup>97</sup> For the classic defense of this approach, see Frank Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL FORUM 207, 208–13 (1996).

<sup>98</sup> Reyes, *Creating Cryptolaw*, *supra* note 9, at 1579–80.

<sup>99</sup> See, e.g., Chris Reed, *Taking Sides on Technology Neutrality*, 4 SCRIPT-ED 263, 264 (2007) (“Technology neutrality has long been held up as a guiding principle for the proper regulation of technology, particularly the information and

legal profession tends to separate law into silos by subject matter that requires technical expertise—such as patents—and subject matter that does not.<sup>100</sup> As a result, most lawyers understand their duty of technological competence to be a very general one related to the use of technology in legal practice.<sup>101</sup> Anything beyond using technology to advance client interests while also protecting confidentiality<sup>102</sup> has traditionally been left to the realm of computational law<sup>103</sup>—an emerging area of study considered separate from law-making and legal practice.<sup>104</sup>

As a result, to suggest, based on the linguistic results presented here,<sup>105</sup> that more traditional areas of law like law creation, interpretation, and legal analysis may require deeper technological savvy represents a recipe for angry attorneys. Indeed, the suggestion that good policy and sound lawmaking for emerging technology requires technical expertise in order to maintain the highly regarded technology-neutral approach will likely cause ire on

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communication technologies.”); UNCITRAL MODEL LAW ON ELECTRONIC COMMERCE WITH GUIDE TO ENACTMENT 17 (United Nations 1996) (“The objectives of the Model law, which include enabling or facilitating the use of electronic commerce and providing equal treatment to users of paper-based documentation and to users of computer-based information are essential for fostering economy and efficiency in international trade. By incorporating the procedures prescribed in the Model Law in its national legislation for those situations where parties opt to use electronic means of communication, an enacting State would create a media-neutral environment.”).

<sup>100</sup> Reyes, *Creating Cryptolaw*, *supra* note 9, at 1580.

<sup>101</sup> Jamie J. Baker, *Beyond the Information Age: The Duty of Technology Competence in the Algorithmic Society*, 69 S.C. L. REV. 557, 557–58 (2018). In 2012, the ABA Model Rules of Professional Conduct were amended “to state that a lawyer’s duty of competence now also requires keeping ‘abreast of changes in the law and its practice, including the benefits and risks associated with relevant technology.’” *Id.* at 560.

<sup>102</sup> *Id.* at 561 (“[T]he foundation of technology competence means, in part, that lawyers are now ‘required to take reasonable steps to protect their clients from ill-conceived uses of technology.’”).

<sup>103</sup> See, e.g., Alex “Sandy” Pentland, *A Perspective on Legal Algorithms*, MIT COMPUTATIONAL L. REP. (Dec. 06, 2019), [https://law.mit.edu/pub/aperspectiveonlegalalgorithms/release/3#:~:text=Our%20faculty%20sponsor%2C%20Prof.,new%20business%20and%20opportunity%20creation.](https://law.mit.edu/pub/aperspectiveonlegalalgorithms/release/3#:~:text=Our%20faculty%20sponsor%2C%20Prof.,new%20business%20and%20opportunity%20creation.;); Daniel W. Linna Jr., *The Future of Law and Computational Technologies: Two Sides of the Same Coin*, MIT COMPUTATIONAL L. REP. (Dec. 06, 2019), <https://law.mit.edu/pub/thefutureoflawandcomputationaltechnologies/release/2.>

<sup>104</sup> Reyes, *Creating Cryptolaw*, *supra* note 9, at 1581.

<sup>105</sup> And elsewhere, see Reyes, *Language Wars: AI*, *supra* note 14, and Reyes, *Language Wars: Cryptocurrency*, *supra* note 14.

both sides of the ongoing debate around whether lawyers need to learn how to code.<sup>106</sup> The linguistic evidence presented here does not support a push for lawyers to learn to code, and this Essay does not seek to weigh in on that debate. Rather, the linguistic evidence presented here supports the growing body of literature arguing that lawyers increasingly require deeper technical savvy in order to properly perform their professional duties.<sup>107</sup>

As difficult as it may be for the legal profession to accept, a deeper technical expertise enables deeper, more appropriate legal analysis for issues presented by emerging technology. For the smart contract case study discussed in this Essay, for example, a clearer understanding of what a smart contract is, how it functions, and to which uses it is put in commerce would enable focus on questions that technical researchers building the software need resolved and about which users of smart contracts actually encounter disputes.

If the legal community embraces a process for developing new law related to emerging technology that requires pausing to investigate the different meanings conveyed by similar terminology when used by different professional disciplines, the law-making process might become better equipped to navigate linguistic differences and the values embedded within them.<sup>108</sup> If law is a one-way communication device,<sup>109</sup> and the speaker and the listener understand the same words differently, or if the speaker conveys a

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<sup>106</sup> See Mark Fenwick, Wulf A. Kaal, & Erik P.M. Vermeulen, *Legal Education in the Blockchain Revolution*, 20 VAND. J. ENT. & TECH. L. 351, 355 (2017); Mark Fenwick Wulf A. Kaal, & Erik P.M. Vermeulen, *Legal Education in a Digital Age: Why ‘Coding for Lawyers’ Matters* (2018), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3227967](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3227967); Basel Farag, *Please Don’t Learn to Code*, TECHCRUNCH (May 10, 2016), <https://techcrunch.com/2016/05/10/please-dont-learn-to-code/>.

<sup>107</sup> See, e.g., Michael Hatfield, *Professional Responsible Artificial Intelligence*, 51 ARIZ. ST. L.J. 1057 (2019); Daniel Kluttz & Deirdre K. Mulligan, *Automated Decision Support Technologies and the Legal Profession*, 34 BERKELEY TECH. L.J. 853 (2019); Frank A. Pasquale, *A Rule of Persons, Not Machines: The Limits of Legal Automation*, 87 GEO. WASH. L. REV. 1 (2019); Drew Simshaw, *Ethical Issues in Robo-Lawyering: The Need for Guidance on Developing and Using Artificial Intelligence in the Practice of Law*, 70 HASTINGS L.J. 173 (2018); Frank A. Pasquale & Glyn Cashwell, *Four Futures of Legal Automation*, 63 UCLA L. REV. DISCOURSE 26 (2015).

<sup>108</sup> Reyes, *Language Wars: Cryptocurrency*, *supra* note 14; Carla L. Reyes & Jeff Ward, *Digging into Algorithms: Legal Ethics and Legal Access*, 21 NEV. L.J. 325 (2020).

<sup>109</sup> Van Schooten, *supra* note 56, at 4.

message that makes little sense in light of the activity the listener plans to undertake, attempts to clarify law as it applies to emerging technology will fail. At some point, the lawmaking process must undertake a systematic evaluation of whether and how the assumptions and values embedded in law interact with the mechanics and values embedded in emerging technology.<sup>110</sup>

#### CONCLUSION

This Essay presented linguistic evidence confirming the anecdotal intuition that interdisciplinary miscommunication impacts the development of legal discourse among legal academics, lawyers, and lawmakers implementing changes in existing law. Importantly, although prior work in this area suggested that the fault for the miscommunication lies with the technical community building smart contracts, the linguistic evidence presented here suggests that the legal community simply imposed the meaning of the word contract as a term of art in law onto the technical development of and uses for smart contracts, a technical term of art with a different meaning. Ultimately, the legal preoccupation with its own understanding of the word contract seems to have colored law's exploration and understanding of smart contracts and the issues that may arise with their use.

The normative implication of these results is not that the technical community should be more careful in how they choose their terms of art because legal terms of art are more important, but rather, that the law and the legal community may need deeper technological competence when exploring issues at the intersection of law and emerging technology. Technology neutrality as a tool to build flexible, forward looking legal rules remains important, but the ability to neutrally describe the functionality covered by law increasingly requires deeper understanding of technical mechanics.

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<sup>110</sup> For one suggested approach to doing so, see Reyes & Ward, *supra* note 108.