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Regulatory digital artefacts: digital regulation with and without rules

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ABSTRACT

Regulatory digital artefacts (RDAs) are increasingly influencing daily life. Designed to guide behaviour, they structure routine actions such as scrolling through social media, where algorithmic moderation filters posts; booking a hotel on an e-commerce platform governed by contractual artefacts; or passing through automated border controls where passports are scanned and biometric data verified. While scholarship has shown growing interest in the social impact of digital technologies, a systematic analysis of these artefacts is still lacking. This article proposes a framework for investigating RDAs, drawing on the theory of regulatory artefacts. It seeks to lay the groundwork for such an analysis by identifying the main characteristics, outlining key domains of application, and examining their varied regulatory mechanisms. Such an approach is essential for understanding both the limitations and the potential of these tools of regulation.

Keywords: regulatory artefacts; digital regulation; normativity and technology; social regulation; artefacts.

WHAT ARE REGULATORY DIGITAL ARTEFACTS?

Regulatory digital artefacts (RDAs) are digital tools or systems intentionally designed to guide, constrain, or enable user behaviour in specific ways. These artefacts are playing an increasingly prominent role in daily life, as many routine actions are now shaped by tools that structure and regulate behaviour. Examples include algorithmic moderation systems that filter inappropriate posts on social media; contractual digital artefacts on e-commerce platforms that govern bookings and purchases; and automated border controls that scan passports and verify biometric data. Even seemingly minor actions—such as accepting cookies on a website—are framed by RDAs.

Although scholarship has shown a growing interest in the social impact of various digital devices, systematic analysis of these systems remains limited. More precisely, a general theory

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of RDAs has yet to be developed. This article proposes a framework for investigating RDAs, drawing on the theory of regulatory artefacts. Its aim is to lay the groundwork for such a theory by identifying the core characteristics of RDAs, outlining key fields of application, and examining their different regulatory mechanisms. Such analysis is essential for understanding both the shortcomings and the potential of these emerging regulatory tools.

Regulatory digital artefacts as a subtype of regulatory artefacts

While some theoretical approaches extend the notion of the artefact beyond the physical domain—for example, to law itself[1]—the present analysis focuses on artefacts as material entities. Following a well-established framework, artefacts are treated here as physical objects intentionally designed and constructed by agents to serve specific functions.[2] Within this broad category, a distinction may be drawn between regulatory artefacts and those serving non-regulatory purposes. Regulatory artefacts are material objects created with the express purpose of influencing or directing human behaviour.[3] They differ, therefore, from other artefacts intended to support tasks without regulating conduct. A calculator, for instance, is a cognitive artefact.[4] It enables calculations to be performed more efficiently than performing them mentally, but it does not regulate behaviour. By contrast, roundabouts, traffic lights, and speed bumps are regulatory in function: placed within road systems, they shape driver behaviour according to their designers' intentions.[5]

RDAs constitute a subtype of regulatory artefact. Beyond the material dimension present in all such artefacts, they also incorporate a digital dimension. They operate in contexts where information is stored or transmitted electronically, processed through digital technologies, and expressed as sequences of numbers, commonly in binary code.

The relevance of RDAs to the legal field is increasing in step with the rise of artificial intelligence (AI). Online dispute resolution (ODR) systems[6] and AI-based automated decision-making (ADM) tools[7] are capable of producing binding legal outcomes and, in this respect, qualify as RDAs.[8] It should be noted, however, that not all ODR and ADM systems carry binding force; some provide only advisory decisions.

Digital regulation also encompasses markup languages (such as HTML and XML) and other computational architectures that structure the digital environment and condition possible user behaviours. Research in human–computer interaction (HCI) and user interface design shows that regulation through digital artefacts is not only embedded in code or infrastructure

[1] Luka Burazin and others (eds), *Law as an Artifact* (Oxford University Press 2018).

[2] Randall R Dipert, 'Some Issues in the Theory of Artifacts: Defining "Artifact" and Related Notions' (1995) 78 The Monist 119 https://doi.org/10.5840/monist199578218.

[3] Giuseppe Lorini, Stefano Moroni and Olimpia Giuliana Loddo, 'Regulatory Artifacts: Prescribing, Constituting, Steering' (2023) International Journal for the Semiotics of Law https://doi.org/10.1007/s11196-022-09926-1.

[4] Donald A Norman, 'Cognitive Artifacts' in John M Carroll (ed), *Designing Interaction* (Cambridge University Press 1991).

[5] Lorini, Moroni and Loddo, 'Regulatory Artifacts' (n 3).

[6] See, for instance, Colin Rule, 'Online Dispute Resolution and the Future of Justice' (2020) 16 Annual Review of Law and Social Science 277 https://doi.org/10.1146/annurev-lawsocsci-101518-043049.

[7] For a reconstruction of the recent literature on ADM, see Ge Wang and others, 'What Type of Algorithm Is Perceived as Fairer and More Acceptable? A Comparative Analysis of Rule-Driven versus Data-Driven Algorithmic Decision-Making in Public Affairs' (2023) 40 Government Information Quarterly 101803 https://doi.org/10.1016/j.giq.2023.101803. On the use of artificial intelligence in the public sector, see Bernard W Wirtz, Jan C Weyerer and Carolin Geyer, 'Artificial Intelligence and the Public Sector—Applications and Challenges' (2019) 42 International Journal of Public Administration 596 https://doi.org/10.1080/01900692.2018.1498103.

[8] Some scholars have argued that blockchain platforms are regulatory artefacts. See, for example, Primavera De Filippi and Samer Hassan, 'Blockchain Technology as a Regulatory Technology: From Code Is Law to Law Is Code' (2016) 21 First Monday https://doi.org/10.5210/fm.v21i12.7113; Max Raskin, 'The Law and Legality of Smart Contracts' (2017) 1 Georgetown Law Technology Review 304 http://dx.doi.org/10.2139/ssrn.2842258. Indeed, smart contracts undoubtedly translate contractual norms by automating their execution. However, they cannot be regarded as normative, as they operate solely at the level of compliance without affecting the contractual procedure.

but also in the presentation of information to users. The interface layer can decisively shape choices, guide actions, or constrain alternatives. A paradigmatic case is the use of 'dark patterns', ie design strategies that manipulate or nudge users towards behaviours they might not otherwise choose.[9] In this sense, RDAs function not merely through their technical structure but also through semiotic and experiential dimensions, making HCI studies fundamental to understanding how digital regulation unfolds in practice.[10] Research on 'dark patterns' and manipulative design illustrates how interface design can steer user behaviour in ways that extend beyond explicit legal norms.[11]

The term 'regulatory digital artefact' is new, but scientific interest in digital regulatory tools is not. Numerous scholars have examined the interplay between the development of digital technologies and transformations in legal and social regulatory strategies, approaching the issue from a variety of disciplinary perspectives. Social scientists have sought to assess the social impact of these technologies, while information and communication technology research has explored new applications of technology in the management of public affairs. Several tools have been developed to assist legislators and judges, including systems for drafting regulations which, in some cases, may produce highly significant legal effects on citizens.

A central part of this debate concerns the forms of regulation in cyberspace. Here, it is important to distinguish between studies of the regulation *of* cyberspace and those of regulation *in* cyberspace or *through* (the architecture) of cyberspace. This article focuses on the second issue: how digital devices or the architecture of cyberspace can serve as instruments of regulation.

The early discussion of digital regulation centred on whether human behaviour in cyberspace—often perceived as virtual or unreal—could be regulated at all.[12] This debate was shaped by Lawrence Lessig's concept of 'architectures of control', applied to the digital world. Lessig rightly argued that online behaviour can be regulated by altering the architecture of the digital environment, and that computer code constitutes one of the four modalities of regulation, alongside law, market forces, and social norms.

Mireille Hildebrandt[13] acknowledges Lessig's insights into the normative impact of computer code and digital architecture, but argues that his solutions are rooted in the classical law-and-economics tradition. This approach, grounded in game theory and efficiency evaluations, treats law as a neutral instrument and assumes individuals to be rational agents maximizing utility. Hildebrandt contrasts this with behavioural economics, which recognizes bounded rationality and offers policymakers tools to address citizens' cognitive biases. In a related vein, Brownsword highlights that technological development generates new regulatory forms distinct from traditional rulemaking.[14] Replacing legal regulation with architectures of control may prove efficient and effective, particularly when regulatory mechanisms are embedded within a device's hidden structures; in such cases, individuals lack the means to contest their manipulation. These considerations are essential to understanding how RDAs operate.

[9] Colin M Gray and others, 'The Dark (Patterns) Side of UX Design' *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (ACM 2018); Harry Brignull, 'Dark Patterns: User Interfaces Designed to Trick People' <https://www.darkpatterns.org> accessed 13 August 2025.

[10] Yvonne Rogers, Helen Sharp and Jennifer Preece, *Interaction Design: Beyond Human–Computer Interaction* (3rd edn, Wiley 2011).

[11] Arunesh Mathur and others, 'Dark Patterns at Scale: Findings from a Crawl of 11K Shopping Websites' (2019) 3 Proceedings of the ACM on Human-Computer Interaction 81.

[12] In this sense, Chalmers' position asserting that virtual reality is genuine reality is particularly interesting. See David J Chalmers, *Reality+: Virtual Worlds and the Problems of Philosophy* (Norton & Company 2022).

[13] Mireille Hildebrandt, *Smart Technologies and the End(s) of Law: Novel Entanglements of Law and Technology* (Edward Elgar 2015) 165.

[14] Roger Brownsword, *Law 3.0: Rules, Regulation, and Technology* (1st edn, Routledge 2020).

Beyond these contributions, the debate on digital regulation also includes forms of regulation that arise spontaneously from data-driven processes, continuous data collection, and predictive analytics. Unlike RDAs—intentionally designed artefacts with built-in regulatory purposes—these emergent forms of regulation illustrate how binding patterns of behaviour may crystallize from data flows.[15] Whereas spontaneous regulation unfolds without being deliberately posited, RDAs embody a more purposeful and circumscribed mode of digital regulation. Although this article cannot further develop this broader paradigm, acknowledging its relevance situates RDAs within the wider landscape of digital regulation, underscoring the need for a systematic theory of digital regulation that extends beyond RDAs alone.

Three characteristics of RDAs: combining physical, social, and digital dimensions

A famous expression used by Lessig[16] to highlight the binding force of code is 'code is law'. This phrase encapsulates Lessig's central thesis that computer code can operate as a regulatory tool. As he explains: '[C]ode, or architecture, sets the terms on which life in cyberspace is experienced. It determines how easy it is to protect privacy or how easy it is to censor speech. It determines whether access to information is general or whether information is zoned. It affects who sees what, or what is monitored. In a host of ways that one cannot begin to see unless one begins to understand the nature of this code'.[17]

Yet this compelling expression may be somewhat misleading, as code itself is not inherently binding.

In RDAs, three fundamental dimensions coexist: a code, a material substrate, and a social substrate.[18]

The physical dimension of RDAs is evident. As Luciano Floridi[19] humorously notes, 'Anyone who has suffered the heat of a laptop knows too well, information is also a physical phenomenon. Storing and processing data is energy-consuming'. RDAs consume energy; they are not only constrained by the laws of physics but are also designed in accordance with them. Put differently, RDAs depend on the laws of physics for their functioning, and their potential varies according to those physical parameters.[20] Dennett[21] stresses the difference between a simple string of computer code and its embodiment in a device capable of interpreting and executing it: '[A] program—according to Dennett—is not a purely formal object at all [...], and without some details of the embodiment being fixed by the internal semantics of the machine language in which the program is ultimately written, a program is not even a syntactic object, but just a pattern of marks as inert as wallpaper'.[22] An unexecuted program is therefore a mere 'pattern of marks'. Only when embedded in hardware—a physical entity—can that pattern acquire meaning.

15 Håkan Hydén, 'AI, Norms, Big Data, and the Law' (2020) 7 Asian Journal of Law and Society 409.
16 Lawrence Lessig, 'Code Is Law' (2000) 1 *Harvard Magazine* <https://www.harvardmagazine.com/2000/01/code-is-law-html> accessed 27 August 2024; Lawrence Lessig, *Code. Version 2.0* (Basic Books 2006).
17 Lessig, 'Code Is Law' (n 16).
18 In this sense, they cannot be regarded as mere sets of data. They are not simply digital objects; rather, they are complex entities arising from the combination of a technological object with a digital object. Digital objects consist of data and metadata, structured through schemas or ontologies. These can only be conceived as components of technical systems. Accordingly, the concept of a digital object should be understood in conjunction with that of a technological object. See Yuk Hui, *On the Existence of Digital Objects* (University of Minnesota Press 2016); Gilbert Simondon, 'On the Mode of Existence of Technical Objects' (2011) 5 Deleuze Studies 407. In fact, technological objects are tangible and possess a physical dimension, whereas digital objects are constituted by relations of data. Not all technological objects are linked to digital objects, but digital objects depend upon technological objects for their existence. In this sense, RDAs can be conceived as digital technological objects.
19 Luciano Floridi, *Information: A Very Short Introduction* (Oxford University Press 2010) 54.
20 For this reason, as Floridi (*Information* (n 19) 61) points out, a computer capable of harnessing the laws of quantum physics will have greater potential than a computer based on Newtonian physics.
21 Daniel C Dennett, *The Intentional Stance* (MIT Press 1987).
22 ibid 337.

The social dimension is equally fundamental. By social substrate, we mean the institutional, organizational, and normative settings within which digital artefacts are embedded, and from which they derive regulatory force. Predictive policing software, for instance, only becomes a regulatory artefact within the institutional framework of law enforcement. Likewise, on social networks, automated content filters take on normative authority from platform community standards and external regulations such as the General Data Protection Regulation or the Digital Services Act. Beckers and Teubner argue that the social dimension of an algorithm is determined by its normative premises; only on the basis of such premises can it influence society.[23] In their account, algorithms become part of 'socio-digital institutions'—institutional arrangements where digital technologies and social practices interweave, thereby acquiring communicative and normative force. Hydén,[24] by contrast, introduces the concept of 'algonorms' to capture emergent effects: behavioural patterns and constraints arising when algorithms interact with society. These are not the algorithm's technical rules (first-order norms), but socially generated expectations (second-order norms). Both notions underline that algorithms are socially embedded, though they operate at a more general level than the approach adopted here.[25] RDAs, by contrast, represent a distinct category. Their defining feature is not the spontaneous emergence of social norms, but their intentional design to regulate conduct within institutional and organizational contexts.

Indeed, not every digital artefact with social impact qualifies as an RDA. RDAs are distinguished by their deliberate aim to directly affect human behaviour. It is therefore necessary to distinguish between artefacts intentionally designed for behavioural regulation and those that influence society only indirectly. Filter bubbles, for example, clearly shape public opinion by curating the information visible to users according to their profiles.[26] A filter bubble that tailors results to prior clicks may make opposing views less accessible, thereby discouraging exposure to contrary opinions.[27] Yet while such bubbles have significant social consequences, they do not amount to RDAs: their effect is unintentional, lacking coercive force or normative prescription. By contrast, RDAs directly prescribe conduct, define obligations, or make certain actions easier or even unavoidable. As an illustration, profiling algorithms on social networks are primarily designed to personalize content and reduce information overload, but they may unintentionally generate echo chambers—a case of algonorms. Conversely, content moderation systems such as automated filters or warning labels are explicitly normative, designed to prescribe or constrain user behaviour. In this sense, they function as RDAs situated within both organizational and legal frameworks.

Two profiles of analysis

A key aspect of analysing RDAs is distinguishing between two profiles of analysis. On the one hand, the first profile requires examining the social domains or areas of life that RDAs help

[23] Anne Beckers and Gunther Teubner, *Three Liability Regimes for Artificial Intelligence: Algorithmic Actants, Hybrids, Crowds* (Hart 2021) v.

[24] Hydén, 'AI, Norms, Big Data, and the Law' (n 15).

[25] ibid 409.

[26] It is important to emphasize that the main purpose of information-filtering algorithms is not to regulate user behaviour, but rather to help users access the information that is most relevant to their needs. In a context where the volume of data available online is huge, these tools become indispensable. Without them, users would face such an overwhelming amount of information that it would become practically unusable.

[27] Paradoxically, the more generic the profile that forms the basis of the filter bubble, the subtler the mechanism of influence on the user's choices because the link between the generic data used and the results presented is less evident. In other words, there is a difference between selection based on tastes or personal preferences for commercial purposes, which may trigger persuasion mechanisms for purchasing goods, and the deliberate exclusion or inclusion of certain content aimed at conditioning specific behaviours, such as electoral choices based on generic personal data (for example, being a US citizen and voter).

regulate. From this perspective, it is possible to identify which values and normative principles underpin the artefact under discussion. Different types of artefacts can be distinguished depending on whether they relate, for example, to the protection of property rights, the regulation of freedom of speech, road safety, dispute resolution tools that facilitate access to justice, or instruments supporting normative drafting for the management of public affairs.

On the other hand, the second profile refers to the specific mechanisms through which regulation is exercised, that is, the concrete ways in which RDAs shape, constrain, or enable user behaviour.

It is important to keep these two profiles distinct, as this allows us to differentiate between the social domains in which digital artefacts regulate behaviour and the technical or symbolic means by which they do so. To illustrate this distinction, consider the following statements.

(i) The digital intrusion detection system (IDS) is designed to protect sensitive areas, ensuring that only authorized personnel may access them.
(ii.a) When an unauthorized access attempt is detected, the IDS (A) activates an electronic lock, physically blocking entry.
(ii.b) When an unauthorized access attempt occurs, the IDS (B) emits a visual warning, such as a flashing red light, signalling that access is prohibited and restricted to authorized users.

The first statement illustrates the first profile, since it shows the device's general purpose within a normative framework (protecting property rights by restricting access). By contrast, the second and third statements illustrate the second profile, as they describe the concrete regulatory mechanisms employed: one material and physical (the lock), the other symbolic and communicative (the flashing red light).

Put differently, the first statement *identifies the device's purpose*—granting access only to authorized users—within a normative framework aimed at protecting property rights.[28] The second and third statements set out the mechanisms through which this regulation occurs. More specifically, statement (ii.a) describes a physical constraint mechanism (A), while statement (ii.b) describes a symbolic mechanism (B), in which a visual warning system communicates a normative message. This mechanism functions symbolically by communicating a clear message about access rights and restrictions. It serves to inform individuals of the rules governing entry into the area, thereby regulating behaviour through social norms and expectations.

To sum it up, these examples point to the distinction between the two profiles. Statement (i) exemplifies the profile of the social purposes and domains regulated by RDAs; statements (ii.a) and (ii.b) exemplify two different modalities of regulation: constraint-based modalities in (ii.a), symbolic in (ii.b). Building on this distinction, the following section addresses the former profile, while the subsequent one focuses on the latter.

[28] This distinction is inspired by the one highlighted by Larry Wright ('Functions' (1973) 82 The Philosophical Review 139) between the propositions 'the heart functions in this way (something about serial muscular contractions)' and 'the function of the heart is pumping blood'. On the concept of 'function', see more recently André Ariew, Robert Cummins and Mark Perlman (eds), *Functions: New Essays in the Philosophy of Psychology and Biology* (reprinted, Oxford University Press 2009).

THE IMPACT OF RDAs IN SOCIAL REALITY

In light of the above-mentioned distinction, we can attempt to outline a possible classification of digital regulatory artefacts based on their *purpose*. This classification sheds light on the possible social impact of each RDA.

In other words, at the base of classification is the question: *what does this artefact aim to regulate?*

As stated by Grimmelmann 'We are all regulated by software now. It has become possible to imagine that the most basic aspects of democracy, society, and even life itself might be regulated by software [...]. In an age when software promises to do anything, perhaps anything can be regulated by software'.[29] In this sense, the function of the digital regulatory artefact can be related to a normative principle that outlines its impact on society in general and, more specifically, on its significance for the legal sphere of users.

On this basis, we can distinguish at least seven types of RDAs in terms of their social impact, as shown in Table 1.

Considering this overview, it is possible to distinguish two broader categories of RDAs. On the one hand, there are artefacts that regulate individual or collective behaviour, either by encoding rules in software or by imposing technical and procedural constraints. On the other hand, there are artefacts that support the production and interpretation of norms, thereby intervening in processes traditionally associated with contractual, judicial, or administrative decision-making. This distinction highlights the different levels at which RDAs can exert regulatory impact on social reality.

In the following subsections, this classification will be clarified.

Artefacts regulating social behaviour through rules or technical means

The first group comprises RDAs that directly govern social behaviour. Their function is to discipline individual or collective actions either by embedding rules in software or by imposing technical and procedural restrictions. These artefacts regulate access, communication, driving, or other movement, thereby affecting core rights and freedoms in everyday life.

- Access control artefacts (ACAs)
- Algorithmic moderation artefacts
- Automotive regulatory technologies (ARTs)
- Border control technologies

Access control artefacts (ACAs)

The first class consists of ACAs. Their main purpose is to regulate the exercise of property rights in a broad sense, encompassing both physical and intellectual property. ACAs digitally transpose the conditions under which a user may access, use, or dispose of a given material or immaterial asset.[30]

Some ACAs rely on biometric authentication, which uses physical characteristics such as fingerprints, facial features, or iris morphology to control access to devices, applications, or

[29] James Grimmelmann, 'Regulation by Software' (2005) 114 The Yale Law Journal 1719, 1758.

[30] An example is the use of single sign-on (SSO), which allows users to authenticate once to access multiple services, improving security and ease of use: V Radha and HD Reddy, 'A Survey on Single Sign-On Techniques' (2012) 4 Procedia Technology 134.

Table 1. Overview of digital regulatory artefacts and their social impact.

RDA	Social impact
Access control artefacts	Property rights
Algorithmic moderation artefacts	Freedom of speech
Automotive regulatory technologies	Protection of life and physical integrity (road safety)
Border control technologies	Freedom of movement
Contractual digital artefacts	Freedom of contract
Dispute management artefacts	Equality before the law (access to justice)
Public regulation artefacts	Principle of legality

physical spaces.[31] Corporations employ ACAs to restrict access to digital resources, ensuring that only authorized users can reach specific data or applications. In this respect, role-based access control (RBAC) systems are significant. While often described as tools for managing internal workflows, RBAC can also be understood in legal terms as an exercise of property rights. Property encompasses not only the right to enjoy and dispose of an asset, but also the right to determine who may access it and under what conditions. By allocating employee access according to roles, RBAC operationalizes the owner's ability to manage private property, regulating access and use for productive purposes within the enterprise.[32]

Even more paradigmatically, digital rights management (DRM) systems represent ACAs par excellence. They play a decisive role in protecting intellectual property and regulating copyrighted digital content.[33] DRM systems prevent unauthorized use, copying, and distribution of digital works, thereby shaping how property rights are exercised in the digital domain. Streaming services such as Netflix or Spotify apply DRM to control downloads and circulation of multimedia content, ensuring that usage remains confined to authorized platforms. DRM technologies illustrate how code can act as a substitute or complement to law in enforcing copyright. In doing so, DRM systems not only protect but also reconfigure the boundaries of intellectual property rights in practice. They also raise significant issues for user autonomy and access to knowledge, giving them a central place in debates on digital regulation[34] and privacy policy.[35]

Interestingly, ACAs exhibit both a constitutive and a regulative dimension. At the systemic level, the constitutive dimension defines the necessary conditions[36] for access (for instance, entering a code to verify that a user is authorized). From the user's perspective, however, these conditions have a regulative function, as they directly affect the right to access certain goods and services.

Algorithmic moderation artefacts (AMAs)

AMAs are designed to regulate the dissemination of digital content, particularly across social media platforms. Their regulatory function lies in identifying and filtering content classified as harmful or false. The criteria for such classification are variable and often opaque.

31 For example, the use of touch ID or face ID on smartphones not only serves as a way to protect sensitive data and limit access to authorized users but also as a deterrent to device theft: TM Ibrahim and others, 'Recent Advances in Mobile Touch Screen Security Authentication Methods: A Systematic Literature Review' (2019) 85 Computers & Security 1.

32 UR Saxena and T Alam, 'Provisioning Trust-Oriented Role-Based Access Control for Maintaining Data Integrity in Cloud' (2023) 14 International Journal of System Assurance Engineering and Management 2559.

33 Grimmelmann, 'Regulation by Software' (n 29).

34 Abbas Foroughi, Marvin Albin and Sharlett Gillard, 'Digital Rights Management: A Delicate Balance between Protection and Accessibility' (2002) 28 Journal of Information Science 389.

35 Julie E Cohen, 'DRM and Privacy' (2003) 18 Berkeley Technology Law Journal 575.

36 Giuseppe Lorini, *Anankastico in deontica* (LED 2017).

The operation of these tools is closely connected to freedom of expression. On the one hand, they may appear to restrict expression; on the other hand, when used proportionately, they can enhance the reliability of the information environment by attributing greater value to content that passes the filter. In other words, the credibility of information online may depend, in part, on the presence of monitoring systems. Efforts to curb disinformation and incitement to hatred fall within the scope of protecting freedom of expression, provided that algorithmic rules are based on transparent and accountable parameters.[37]

Automotive regulatory technologies (ARTs)

ARTs encompass a wide range of digital tools designed to regulate vehicle and driver behaviour. Their underlying principle is road safety. Some ARTs influence a driver's behaviour by signalling violations through auditory alerts or normative symbols displayed on the dashboard. The lane departure warning (LDW) and lane keeping aid (LKA) systems exemplify these automotive regulatory technologies. Both can use a front-facing camera or infrared sensors to identify lane markings. Although they draw on the same input, they pursue their goals differently. The LDW system alerts the driver with an audible signal or steering wheel vibration when the vehicle crosses a lane marking, thereby relying on the driver's attention, experience, and adherence to traffic norms to encourage safe behaviour. The LKA system, by contrast, directly intervenes in steering, compelling the driver to remain within the lane. In this sense, as will be explored more fully in the next section, some artefacts operate through normative frameworks (guidance and compliance), while others impose behaviour causally, by physically constraining the agent.[38]

Border control technologies

RDAs are also deployed in the management of migration flows, affecting decisions on residence permits, visa issuance and, more generally, the exercise of the freedom to migrate. This category of border control technologies covers a broad array of digital tools regulating the movement of people across national borders.[39]

A particularly significant example is the European Travel Information and Authorization System (ETIAS).[40] Established by Regulation (EU) 2018/1240, ETIAS monitors the movement of visa-exempt third-country nationals into and within Member States, with the declared aim of enhancing European border security. Yet ETIAS has not escaped criticism. Scholars warn that its algorithmic processes may result in unjustified exclusions, adversely affecting certain groups of foreign travellers. Concerns have also been raised over the opacity of its

[37] Robert Gorwa, Reuben Binns and Christian Katzenbach, 'Algorithmic Content Moderation: Technical and Political Challenges in the Automation of Platform Governance' (2020) 7 Big Data & Society 1 https://doi.org/10.1177/2053951719897945

[38] Simon Sternlund and others, 'The Effectiveness of Lane Departure Warning Systems—A Reduction in Real-World Passenger Car Injury Crashes' (2017) 18 Traffic Injury Prevention 225 https://doi.org/10.1080/15389588.2016.1230672.

[39] A regulatory function can be complemented by a control activity also carried out with the help of AI. The iBorderCtrl program, for example, was a project aimed at improving border control. Pilot tests were conducted in Hungary, Greece, and Latvia. Migrants interacted with an avatar featuring an automatic deception detection system, capable of identifying non-verbal facial micro-expressions (such as blinking, blushing, or making certain involuntary head movements) to identify individuals providing false statements. Those considered truthful were allowed to cross the border, while those deemed suspicious had to provide further information, such as fingerprints. The accuracy rate of the decisions was around 73–75 per cent. See Agata Szwed, 'The Use of Artificial Intelligence in Migration-Related Procedures in the European Union—Opportunities and Threats' (2022) 207 Procedia Computer Science 3645 https://doi.org/10.1016/j.procs.2022.09.424.

[40] A system similar to ETIAS, but already operational in the United States and regulated by the Travel Promotion Act 2009, is the Electronic System for Travel Authorization (ESTA). See Clara Isabel Velasco Rico and Migle Laukyte, 'ETIAS System and New Proposals to Advance the Use of AI in Public Services' (2024) 54 Computer Law & Security Review 106015 https://doi.org/10.1016/j.clsr.2024.106015.

operation, the nature of the data it processes, and its reliance on AI technologies—factors that may undermine human rights protections, particularly for vulnerable groups.[41]

Notably, technologies used in ACAs are also adopted at borders. Automated border control (ABC) systems are already in operation in several international airports, such as Incheon International Airport in Seoul, South Korea; Vancouver International Airport in Canada; and Hong Kong International Airport. They are also deployed more generally across many airports within the Schengen Area. Beyond airports, ABC systems have been introduced more broadly at border crossing points in countries such as Brazil and the United Arab Emirates. At ABC e-gates, travellers present their passports or travel documents, which are scanned and assessed for security features and authenticity, often with biometric verification such as facial recognition. If authenticated, the gate opens and entry is allowed. Despite their efficiency, such systems raise concerns. Automated processes may miss context-specific circumstances best judged by humans, and automatic decisions can lead to inappropriate exclusions. The central challenge for designers of these artefacts is balancing the imperative of *public security* with the fundamental principles of *freedom of movement and migration*.[42]

Artefacts supporting normative processes

The second group of RDAs does not regulate behaviour directly but instead intervenes in the production, interpretation, and enforcement of norms. These tools increasingly support contractual, judicial, and administrative decision-making, in some cases replacing traditional human processes with algorithmic or automated methods. Their impact is profound, touching on fundamental principles such as contractual freedom, equality before the law, legality, and the legitimacy of public governance. From this perspective, three exemplary types of RDAs may be identified:

- Contractual digital artefacts
- Dispute management artefacts
- Public regulation artefacts

In the following paragraphs, each will be briefly described.

Contractual digital artefacts (CDAs)

The category of contractual digital artefacts (CDAs) includes digital tools that support the formation of contractual agreements—agreements intended to establish, modify, or terminate a legal patrimonial relationship between two or more parties. Electronic contracts exemplify this category, comprising agreements concluded and managed through digital means. Such artefacts typically operate in dedicated environments, such as e-commerce platforms or hotel reservation systems.[43]

A particular subtype of electronic contracts is the algorithmic contract.[44] These are contracts in which algorithms, understood as sets of programmable instructions, play an active role in determining the obligations of the parties. In algorithmic contracts, the algorithm

[41] Velasco Rico and Laukyte (n 40).
[42] Jose Sanchez del Rio and others, 'Automated Border Control E-Gates and Facial Recognition Systems' (2016) 62 Computers & Security 49 https://doi.org/10.1016/j.cose.2016.07.001.
[43] Alan Davidson, *The Law of Electronic Commerce* (Cambridge University Press 2009).
[44] It is worth stressing that algorithmic contracts, as described here, differ from smart contracts. While algorithmic contracts can influence the negotiation or management of agreements and thus belong to the category of contractual digital artefacts, smart contracts do not regulate contractual freedom but merely automate the execution of obligations already agreed upon. They should therefore be regarded as non-deontic enforcement tools rather than contractual regulatory artefacts.

may intervene during the negotiation or management phase of the contractual relationship after its conclusion. Additionally, it can function to automatically fill contractual gaps.[45]

Within e-commerce platforms, partial automation of negotiation may occur by delegating one party's activity to the artefact itself. For example, on a retail website, a buyer may select products, place them in a cart, and proceed through automated payment systems. In such cases, CDAs not only regulate the exercise of *contractual freedom* but also create the conditions for the meeting of contractual wills: they establish the channels for making offers, registering acceptance, and formalizing conclusion. In addition, further tools exist for executing performance, which, particularly in the case of digital services, may be achieved entirely through digital channels.[46]

Dispute management artefacts

Hans Kelsen famously stated that judicial rulings are nothing more than individual norms integrated into the hierarchy of legal sources. As he observed,[47] 'the act of the court is not merely declaratory [...], the judicial decision is itself an individual legal norm'. Building on this perspective, AI systems developed to support judicial decision-making processes can clearly be considered RDAs. Their role has significant implications for the right to a *fair trial*. By creating simplified, free (or low-cost) digital channels for dispute management, such systems may enhance individuals' access to legal protection. This is especially significant in jurisdictions where high costs and delays often prevent people from defending their rights.

There are multiple types of dispute management artefacts, classified according to heterogeneous criteria and exhibiting varied levels of transparency in their decision-making processes. It is not always clear how these artefacts contribute to the creation of norms subsequently relied upon in judicial proceedings. Some merely assist judges, outlining possible decisions. For example, the sentencing information system, used in some courts, provides recommendations on sentencing ranges derived from precedent. However, these systems can also reproduce the stereotypes or biases embedded in previous judicial decisions upon which they are trained. This concern is particularly acute in criminal law. A prominent case is the COMPAS system (Correctional Offender Management Profiling for Alternative Sanctions), created to assess defendants' risk of recidivism. In *Loomis v Wisconsin* (2016), the judge, relying on a high recidivism score generated by COMPAS, refused probation and based the sentence on the algorithmic assessment. COMPAS has since been accused of indirectly perpetuating racial bias. Such issues are directly relevant to the study of RDAs, since regulatory technologies of this kind may reinforce pre-existing inequalities[48] or even generate new forms of discrimination.[49]

Advances in technology have furthermore led to RDAs capable of producing entire judicial decisions, determining the binding outcome by which parties resolve their disputes.

45 Lauren Henry Scholz, 'Algorithmic Contracts' (2017) 20 Stanford Technology Law Review 128.

46 It is important to distinguish algorithmic contracts, where algorithms play a role in negotiating or managing contractual terms, from smart contracts, which serve primarily to automate the execution of obligations once the agreement has been concluded. While both involve automation, only the former belongs to the category of contractual digital artefacts in the strict sense.

47 Hans Kelsen, *Introduction to the Problems of Legal Theory* (Stanley Paulson and Bonnie Litschewski Paulson trs, Clarendon Press 1997) 68.

48 For instance, border control technologies might discriminate against migrant groups through algorithms that incorporate historical biases.

49 Jesper Ryberg and Julian V Roberts, *Sentencing and Artificial Intelligence* (Oxford University Press 2022); Isaac Taylor, 'Justice by Algorithm: The Limits of AI in Criminal Sentencing' (2023) 42 Criminal Justice Ethics 193 https://doi.org/10.1080/0731129X.2023.2275967; Niamh Kinchin, '"Voiceless": The Procedural Gap in Algorithmic Justice' (2024) 32 International Journal of Law and Information Technology 32 https://doi.org/10.1093/ijlit/eaae024.

Intriguingly, some ODR platforms, powered by AI, may exercise a normative effect not only by producing individual norms through their decisions but also by reshaping existing practices. By introducing new decision-making patterns, such systems have the potential to influence, and perhaps transform, the traditional methods of dispute resolution.[50]

Public regulation artefacts

RDAs are gaining significance in public service management. Although the norms generated by these artefacts do not occupy a prominent position within the hierarchy of legal sources, they can nonetheless give rise to binding provisions with substantial effects on citizens' lives. While not formally part of the recognized sources of law, such tools influence the management of everyday administrative practices and the operation of traditional public governance. This applies especially to decision-making processes based on AI systems, which produce rules intended to shape human behaviour. Some authors explicitly refer to this phenomenon as 'AI rulemaking for human behaviour' and identify it as one of the central ethical challenges associated with the use of AI in the public sector.[51]

These tools have the potential to improve efficiency and effectiveness in public service management. Yet algorithmic decision-making also raises concerns about their legitimacy, as they are often opaque and may implicitly include stereotypes and biases.[52] Virginia Eubanks, for instance, examined the use of automated systems in public administration,[53] particularly in the management of services for disadvantaged communities. She argues that although such digital tools are presented by public authorities as instruments of efficiency, they in fact perpetuate forms of discrimination by creating 'digital poorhouses' or new kinds of digital ghettoization. Eubanks contends that, given the limited resources allocated to supporting the poor, the true intent of these tools is not to alleviate poverty but rather to manage—and sometimes conceal—it. The centralization and automation of social services, far from empowering individuals, often widen the gap between institutions and those they are meant to serve.

More broadly, full delegation of administrative procedures to platforms typically results in greater rigidity. When the platform becomes the sole entry point, its architecture effectively determines the characteristics and validity of the procedure, imposing digital criteria that may be stricter than those set by legislators.

These categories can usefully be understood through H.L.A. Hart's concept of 'secondary rules'.[54] While primary rules directly regulate behaviour, secondary rules define how norms are created, modified, and applied. From this perspective, contractual digital artefacts correspond to technological counterparts of rules of change, as they redefine the modalities through which obligations and agreements are produced and validated. Dispute management artefacts resonate with rules of adjudication, since they allocate decision-making authority in conflict resolution, often via algorithmic or automated processes. Public regulation artefacts align with both rules of recognition and rules of change, because they establish standards that count as binding within a legal system and introduce new procedures for generating and implementing public policies. Yet such a technological translation of secondary rules is far from neutral:

[50] Hibah Alessa, 'The Role of Artificial Intelligence in Online Dispute Resolution: A Brief and Critical Overview' (2022) 31 Information & Communications Technology Law 319, 335 https://doi.org/10.1080/13600834.2022.2088060.

[51] Wirtz, Weyerer and Geyer (n 7).

[52] John Danaher, 'The Threat of Algocracy: Reality, Resistance and Accommodation' (2016) 29 Philosophy & Technology 245 https://doi.org/10.1007/s13347-015-0211-1; Rosanna Nagtegaal, 'The Impact of Using Algorithms for Managerial Decisions on Public Employees' Procedural Justice' (2021) 38 Government Information Quarterly 101536 https://doi.org/10.1016/j.giq.2020.101536.

[53] Virginia Eubanks, *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor* (St Martin's Press 2018).

[54] HLA Hart, *The Concept of Law* (3rd edn, Oxford University Press 2012 [1961]).

whereas Hart grounded their legitimacy in shared social practices and human institutions, digital artefacts relocate these functions within algorithmic frameworks, thereby raising questions of transparency, legality, and democratic legitimacy.

TWO MODES OF REGULATION OF RDAs

It has been convincingly argued that machines will never govern the world.[55] Yet, while they will never become rulers, digital technologies are already reshaping how governance and regulation are exercised. Our analysis will now focus on the mechanisms that enable digital artefacts to perform their regulatory purpose.

In this sense, in the literature on this subject, a distinction emerges between how legal norms usually perform their regulatory function and the new trend emerging especially in the digital world that consists of creating psychophysical obstacles that discourage violations or even make them impossible.

Interestingly, Lessig distinguishes two types of protection. The first is the traditional protection of the law: it defines the boundaries of action, forbids intrusion, and punishes transgressors. The second is protection by fence: a technological device (a line of code) that (among other things) prevents unwanted access.[56] This latter approach has been widely discussed in studies of algorithmic regulation and 'code as law', where emphasis falls on the substitutive role of technical architectures in shaping behaviour. In line with Lessig, Brownsword's distinction between *normative freedom* and *practical freedom* is illuminating. More recently, scholars have underscored how technical regulation, by constraining practical freedom, raises significant concerns around legitimacy and accountability when compared to traditional norm-based regulation.[57]

Following Brownsword, we may say that even when they achieve the same regulatory function, artefacts can affect either normative freedom or practical freedom. For instance, at the entrance to a car park, traffic lights may signal whether entry is permitted, whereas the physical barrier at the gate removes practical freedom by preventing entry regardless of the signal. As Brownsword further illustrates: 'in modern online environments, unless users click to agree to the terms and conditions for accessing a website, in many cases it will not be possible to access the site. The technology is set up in a way that regulates the practical options that are available to users. It is not merely a matter of being normatively required to agree to certain terms and conditions, the technology ensures that without the required "agreement" it is simply not possible to proceed'.[58]

Technological devices in general, and RDAs in particular, can thus contribute to both forms of protection identified by Lessig and can engage both types of freedom distinguished by Brownsword.

Some RDAs operate by imposing norms. These may be termed *deontic regulatory digital artefacts* (dRDAs). For instance, an RDA might formulate prescriptions based on pre-existing meta-rules, which could then become binding within a particular legal system. In such cases, the regulatory mechanism is directly analogous to that of legislation: a rule is validly created, it

[55] Jobst Landgrebe and Barry Smith, *Why Machines Will Never Rule the World: Artificial Intelligence without Fear* (Routledge 2022).
[56] Lessig, *Code. Version 2.0* (n 16) 169.
[57] Karen Yeung, 'Algorithmic Regulation: A Critical Interrogation' (2018) 12 Regulation & Governance 505 https://doi.org/10.1111/rego.12158; Mireille Hildebrandt, *Smart Technologies and the End(s) of Law: Novel Entanglements of Law and Technology* (Edward Elgar Publishing 2015); Roger Brownsword, *Law, Technology and Society: Re-Imagining the Regulatory Environment* (Routledge 2019).
[58] Brownsword, *Law 3.0* (n 14) 109.

may be violated, and sanctions may follow. One could imagine a State delegating not only the drafting of legal texts but the entire legislative process of a specific sector to an RDA.

Other RDAs operate instead by conditioning behaviour through architecture, causally compelling individuals to act in a certain way. These artefacts do not impose rules but exploit psychophysical tendencies to shape conduct. Such devices may be termed *non-deontic regulatory digital artefacts* (-dRDAs). In the following sections, the analysis first focuses on dRDAs and then on -dRDAs, offering a more detailed account of the distinction between them.

Deontic regulatory digital artefacts

Deontic regulatory digital artefacts (dRDAs) are RDAs that perform their regulatory purpose through rules. The term 'deontic artefacts' has been used to describe material objects capable of establishing norms (for example, traffic signs imposing obligations and prohibitions within a spatial context). Such artefacts are not only material objects but also normative entities, shaping and constituting normative states of affairs.[59]

Research into the normativity of objects has highlighted how artefacts embody and transmit rules. A deontic artefact has been defined as 'a three-dimensional material object—created to perform a normative function'. Drawing on this concept, we can speak of 'deontic regulatory digital artefacts' (dRDAs). These artefacts transmit normative content in both physical and digital environments. Their communicative dimension echoes what Cohen describes as the configurative power of networked architectures and artefacts: digital environments mediate access to norms and rights, shaping how subjects encounter and process normative information.[60] In this sense, dRDAs exemplify how code and interfaces can act as vehicles for normative communication rather than as coercive enforcement mechanisms.

For example, dRDAs may indicate what is permitted or prohibited within digital platforms. Age warnings on streaming platforms or online games illustrate this: they inform users of the age requirements for access, yet individuals remain free to disregard the warning and proceed. Similarly, e-commerce platforms may display information on tax laws or import restrictions when buying goods from abroad. Such messages guide behaviour, but buyers are free to comply with or ignore them—albeit at the risk of sanctions. In this way, dRDAs share the essential feature of rules described by Schauer: they guide behaviour while remaining violable. Their regulatory force lies not in compulsion but in confronting individuals with a normative choice: to comply or to risk sanction.[61]

In the digital sphere, dRDAs thus play a central role in communicating rules and transmitting normative content, while preserving a degree of flexibility in observance. They do not perform a 'forcing function', meaning they do not coercively enforce specific behaviours (like deleting a post), nor do they automatically trigger specific events (like assigning, deleting, or blocking a profile). Instead, they signal the existence of norms, leaving users the freedom to decide whether to comply. In this capacity, they embody a mode of regulation grounded in awareness and informed choice rather than direct coercion.

Not only do dRDAs presuppose deontologies (in Searle's sense);[62] they also exploit them to function. Consider an alert on a file-sharing platform warning a user that uploading a file

[59] Lorini, Moroni and Loddo, 'Regulatory Artifacts' (n 3).

[60] Julie E Cohen, *Configuring the Networked Self: Law, Code, and the Play of Everyday Practice* (Yale University Press 2012).

[61] Frederick Schauer, *Playing by the Rules: A Philosophical Examination of Rule-Based Decision-Making in Law and in Life* (Oxford University Press 1993); Frederick F Schauer, *The Force of Law* (Harvard University Press 2015).

[62] In Searles' lexicon, 'deontology' refers to the set of powers, obligations, permissions, and prohibitions that emerge in linguistic and social practices. See, for instance, John R Searle, *Making the Social World: The Structure of Human Civilization* (Oxford University Press 2010).

could infringe copyright. This message communicates an obligation: it informs the user of a rule and the potential sanction for violation, prompting them to choose whether to proceed. Another example is a warning on social media when a user attempts to view sensitive or restricted content. The system informs them of the nature of the material and asks them to confirm whether they wish to continue.

In both cases, the dRDA plays a norm-communicative role. It does not compel the user to refrain from action but provides normative information, thereby shaping behaviour through communication. This function has also been discussed in the literature on legal information architectures,[63] which analyse how digital artefacts embed normativity in user interfaces and mediate the relationship between the legal system and its subjects.

Paradoxically, dRDAs have spread more recently than control architectures. As Lessig observes:[64] 'To regulate well, you need to know who someone is, where they are, and what they are doing. But because of the way the Internet was originally designed […], there was no simple way to know who someone is, where they are, and what they are doing. Thus, as life moves onto (this version of) the Internet, the regulability of that life decreases. The architecture of the space—at least as it was—rendered life in this space less regulable'. The effectiveness of dRDAs therefore stems, at least in part, from the progressive de-anonymization of the internet, a phenomenon increasingly familiar to all users.

Non-deontic regulatory digital artefacts

Within the framework of the sociology of digital law, the analysis of regulatory artefacts has expanded to include a wide range of tools that are not normative in nature. Several examples can be noted. Advanced driver assistance systems, for instance, translate normative information into instructions not for users but for the electronic control system, thereby ensuring automatic compliance with rules. These systems monitor real-time road conditions and adjust vehicle behaviour accordingly. Automatic speed control adjusts a vehicle's speed to traffic conditions, ensuring compliance with the relevant speed limit. Similarly, *adaptive cruise control (ACC)* is an advanced driver assistance system that automatically maintains a safe distance from the vehicle ahead. *Identity and access management (IAM)* systems offer another example. These access controls, embedded in platform code, grant or deny access to specific sections of a platform according to predefined rules. Internet banking platforms, for instance, authenticate users so they can only access their own accounts. On social networks, algorithm-based moderation systems enforce community guidelines through non-deontic mechanisms that can automatically remove content or close accounts. In such cases, the algorithm itself performs the restrictive function, independent of the users.[65] These examples show how regulation can be achieved without the use of rules.

In -dRDAs, design itself enforces specific actions through automated processes. These artefacts condition user behaviour both online and in 'onlife' without relying on any norms. Hildebrandt[66] has emphasized that dRDAs in the digital sphere are increasingly complemented by forms of regulation that not only shape but also compel behaviour.

Similarly, with the notion of 'compliance by design', Lohmann describes systems in which 'compliance is not only detected, but actually enforced. That is, noncompliant behavior

63 Hildebrandt (n 13).
64 Lessig, *Code. Version 2.0* (n 16) 26.
65 Despite exploiting a non-deontic regulatory strategy, it does not completely take over control of the vehicle. The driver can override the system at any moment, maintaining full authority over driving decisions, while the ACC assists in regulating speed and following distance.
66 Hildebrandt (n 13).

becomes technically impossible'.[67] In this way, regulatory requirements are embedded directly in technological architectures, shifting the balance from normative freedom to practical freedom. According to Cohen's theory of *configurative power*, architectures and artefacts not only constrain or enable behaviour, they actively shape the horizons of choice and practice in which individuals operate[68]; -dRDAs embody precisely these forms of 'regulation intended to influence people's behavior without recourse to norms, and without directly altering the "normative environment."'[69]

It is important here to distinguish between the normative function, which establishes rules, and the regulatory function, which deliberately conditions human behaviour. 'Normative intervention' (via rules) and 'regulatory intervention' (via behavioural constraints) are not synonymous; regulation does not always operate through norms.[70]

As Lorini and Moroni note,[71] 'there are regulatory phenomena which are not normative […]. Speed bumps to slow traffic provide a good example. They do not signal a precise speed limit; what they do is "hamper" the transit of a vehicle, "persuading" the driver to slow down'. Indeed, a speed bump is a physical barrier that obliges drivers to reduce speed even in the absence of a posted limit.

The central distinction between deontic and non-deontic artefacts thus lies in their models of action: dRDAs rely on explicit norms, while -dRDAs impose behaviour through design. These constraints may be physical—consistent with Don Norman's concept of a 'forcing function'—or psychological, where they resemble certain types of 'nudges' identified by Thaler and Sunstein. Norman[72] defines a forcing function as a physical constraint, 'so that failure at one stage prevents the next step from happening'. For example, a lock-in forcing function may prevent a user from closing a programme before saving changes or entering a valid e-mail address.

Some of these artefacts, drawn from the digital sphere, have been described by Thaler and Sunstein as examples of nudges, while others have been identified by Norman as instances of forcing functions. For example, according to Thaler and Sunstein,[73] default options, which push the customer towards certain choices, are a type of nudge. Defaults typically exploit people's psychological tendency not to alter preset options. This perspective is developed further by Yeung, who distinguishes between automated processes, which operate as action-forcing mechanisms comparable to Norman's forcing functions, and digital decision-guidance processes, which act as nudges by directing individual choices without formally removing alternatives. The first are coercive by design, while the second embody what Yeung terms hypernudges: dynamic, data-driven architectures that personalize and continuously adapt decision environments through real-time feedback loops. Unlike the static nudges of Thaler and Sunstein, hypernudges are networked, pervasive, and opaque, prompting serious concerns over manipulation, autonomy, and democratic legitimacy. Ranchordás,[74] in her analysis of smart cities, shows that these data-driven nudges not only reshape individual decision-making

[67] Niels Lohmann, 'Compliance by Design for Artifact-Centric Business Processes' (2013) 38 Information Systems 606, 607.
[68] Cohen (n 60).
[69] Giuseppe Lorini and Stefano Moroni, 'Rule-Free Regulation: Exploring Regulation "without Rules" and Apart from "Deontic Categories"' (2022) 52 Journal for the Theory of Social Behaviour 22, 23.
[70] Giuseppe Lorini and Stefano Moroni, 'Rules without Regulation and Regulation without Rules' (2024) 54 Journal for the Theory of Social Behaviour 216 https://doi.org/10.1111/jtsb.12417.
[71] Lorini and Moroni, 'Rules without Regulation and Regulation without Rules' (n 70) 218.
[72] Donald A Norman, *The Design of Everyday Things* (Revised and expanded edn, Basic Books 2013) 141.
[73] Richard H Thaler and Cass R Sunstein, *Nudge: Improving Decisions about Health, Wealth, and Happiness* (Yale University Press 2008) 85.
[74] Sofia Ranchordás, 'Nudging Citizens through Technology in Smart Cities' (2020) 34 International Review of Law, Computers & Technology 254 https://doi.org/10.1080/13600869.2019.1590928.

environments but also raise legal and ethical concerns about privacy, transparency, and citizens' trust in institutions. The central issue is that regulatory architectures can erode autonomy and enable manipulative behavioural steering.[75]

In this regard, Floridi draws a useful distinction between *ethics by design* and *pro-ethical design*.[76] In the first approach, individuals are nudged away from defaults—they may opt out of a pre-set preference and choose another option. By contrast, strategies based on pro-ethical design require individuals to make an explicit decision on a particular issue before proceeding, without steering the choice towards a default option. In this way, pro-ethical design ensures an unbiased and informed choice, respecting the individual's autonomy in decision-making. For instance, Floridi explains:[77] 'strategies based on ethics by design may let you opt out of the default preference according to which, by obtaining a driving licence, you are also willing to be an organ donor. Strategies based on pro-ethical design may not allow you to obtain a driving licence unless you have indicated whether you wish to be an organ donor'. These forms of regulation are in themselves non-normative; that is, they are non-deontic. Artefacts exploiting such mechanisms are thus -dRDAs. They have been described as 'objects that are not inherently deontic in nature'.[78] As Lorini and Moroni observe,[79] -dRDAs perform rule-free regulation and 'can encourage or discourage behaviors without the need to rely on formal rules and sanctions'.[80] This form of regulation, which operates without reference to deontological frameworks, can nonetheless have ethical scope. In other words, -dRDAs do not need conceptual deontic structures to function, even though they are intentionally designed to influence and modify human behaviour.

The notion of regulation without rules, therefore, applies to RDAs that shape behaviour through design alone, without recourse to norms. As noted, these artefacts 'do not exploit the symbolic capacity of their recipients for their effectiveness'.[81] While many digital artefacts presuppose symbolic capacity—for instance, programming languages are symbolic by nature—they do not engage the user's ability to represent norms, to experience them as general principles, and to incorporate them into practical reasoning as a basis for conduct.

A potential criticism of the distinction between deontic and non-deontic regulatory artefacts in the digital realm is that digital artefacts can be circumvented—through hacking or by bypassing code-based forcing functions—whereas non-deontic regulatory artefacts lacking a digital component may not present the same vulnerabilities.

This consideration may be linked to a misleading use of language. It is common to speak of 'violating' code to describe the actions of a hacker. Yet the hacker does not truly violate the code but rather forces it, much as a thief might use a lockpick on the physical structure of a door, or a road pirate physically dismantles a barrier. In the same way, the hacker alters an architecture to their advantage rather than violating it.

[75] Luciano Floridi and Josh Cowls, 'A Unified Framework of Five Principles for AI in Society' (2019) 1 Harvard Data Science Review 1 https://doi.org/10.1162/99608f92.8cd550d1.

[76] Luciano Floridi, *The Ethics of Artificial Intelligence: Principles, Challenges, and Opportunities* (1st edn, Oxford University Press 2023).

[77] Luciano Floridi, *The Fourth Revolution: How the Infosphere Is Reshaping Human Reality* (Oxford University Press 2014) 190.

[78] Lorini, Moroni and Loddo, 'Regulatory Artifacts' (n 3).

[79] Giuseppe Lorini and Stefano Moroni, 'Rule-Free Regulation' (n 69).

[80] Interestingly, rule-free regulation also has the ability to generate behavioural patterns and habits that do not operate based on any norms: Lorini and Moroni, 'Rule-Free Regulation' (n 69), 27.

[81] Giuseppe Lorini and Stefano Moroni, 'Non-Propositional Regulation' (2022) 45 Philosophical Investigations 512, 519 https://doi.org/10.1111/phin.12343.

Clarifying the relationship between deontic and non-deontic RDAs

The distinction between *dRDAs* and *-dRDAs* should not be understood as suggesting that every deontic artefact has a corresponding non-deontic counterpart, or *vice versa*. Rather, different RDAs may use deontic or non-deontic modes of regulation to achieve the same purpose. This is particularly evident with the artefacts described in section 'Artefacts regulating social behaviour through rules or technical means', which regulate social behaviour (eg access, communication, and mobility). In such cases, the same regulatory goal can be achieved either through rules (deontic) or through technical and architectural constraints (non-deontic).

By contrast, the artefacts discussed in section 'Artefacts supporting the normative process', are intrinsically deontic. Their function is to establish or apply normative content, and they cannot be replaced by non-deontic mechanisms. A smart contract, therefore, should not be seen as the non-deontic counterpart of a contractual digital artefact. Smart contracts operate as non-deontic artefacts in that they automatically execute the terms of a contract once pre-set conditions are met, thereby enforcing the agreement.[82] They do not regulate the formation of contracts; they automate the execution of obligations already defined.[83]

This clarification shows that dRDAs and -dRDAs embody different logics of regulation. Some artefacts may reach the same objective by either approach, but normative artefacts in the strict sense remain irreducibly deontic.

CONCLUSIONS

Deontic artefacts guide and inform, offering users the choice to comply, whereas non-deontic artefacts enforce compliance automatically. A key point is that *the same regulatory purpose can be realized by RDAs operating in different ways*. In general, the same function may be pursued by either dRDAs or -dRDAs.

For instance, in the automotive domain, dashboards that display the current speed limit act as deontic artefacts, communicating the norm without directly compelling the drivers' behaviour. The same purpose, linked to road safety, is pursued non-deontically by ACC systems,[84] which directly adjust the vehicle's speed. Similarly, LDW systems issue alerts when drivers drift out of a lane, communicating a norm (deontic), while LKA systems physically steer the car back into the lane (non-deontic). These systems certainly improve safety but also raise ethical and legal issues, since drivers are physically compelled by these RDAs.

Other examples of how different regulatory strategies can pursue similar purposes across various domains include: identity and access management, algorithmic moderation artefacts, and border control artefacts.

IAM systems act as ACAs, regulating entry to digital spaces or resources by requiring authentication. These are deontic artefacts that ensure users access only what they are authorized to access. Similarly, automated content removal systems function as non-deontic artefacts by using algorithms to automatically detect and remove content.

[82] Among digital artefacts, *smart contracts* most closely align with the non-deontic form of digital contractual artefacts. In particular, *smart legal contracts* automate the execution of contract clauses and fulfilment of the users' obligations. Unlike brute behaviours (such as viewing content, accessing specific areas, or adjusting vehicle speed), the forcing function of a smart contract pertains to the fulfilment of an obligation that exists independently of the smart contract itself and is executed automatically by the digital device. When certain predefined conditions are met, the software autonomously executes the obligation, irrespective of the parties' will. However, this type of artefact is distinctive in that it does not compel an action but instead automates the fulfilment of obligations in line with the contractor's intentions. This insight is credited to Giuseppe Lorini.

[83] De Filippi and Hassan (n 8); Raskin (n 8).

[84] Jun Bai, Jaeyoung Lee and Suyi Mao, 'Effects of Adaptive Cruise Control System on Traffic Flow and Safety Considering Various Combinations of Front Truck and Rear Passenger Car Situations' (2024) 2678 Transportation Research Record: Journal of the Transportation Research Board 1009 https://doi.org/10.1177/03611981231223982.

Algorithmic moderation artefacts, such as automated content removal systems, manage content based on platform guidelines. These non-deontic artefacts automatically restrict content to enforce norms, while deontic strategies may involve content warnings and user acknowledgement systems that inform users of guidelines without compelling compliance. Border control artefacts include automated border control gates (e-gates) that regulate entry by verifying travel documents and biometric data. While e-gates are non-deontic artefacts that enforce entry criteria, visa and immigration systems can operate in a deontic mode by informing travellers of entry requirements and allowing human discretion in the process.

These examples underscore that the same regulatory goal may be pursued through either deontic or non-deontic strategies, depending on artefact design. Not all regulatory artefacts, however, admit a non-deontic counterpart. As discussed above, artefacts that intervene directly in the production, interpretation, and application of normative content are intrinsically deontic and cannot be replaced by purely technical mechanisms. Future inquiry should address the ethical and practical implications of choosing one strategy over another in specific domains. This article constitutes a first step towards that broader investigation. A more comprehensive study, integrating theoretical analysis with empirical evidence, would be valuable in testing the actual capacity of dRDAs and -dRDAs to influence behaviour, either consciously or unconsciously, through user interaction. Only such investigations can ensure a conscious and ethically sound use of these distinctive regulatory tools.

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