

## Articles

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# Digital Technology as a Challenge to European Contract Law

From the Existing to the Future Architecture

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**Abstract:** Offering an overview of the interactions between digital technologies and contract law, we identify three pillars in this architecture: the regulatory framework; digital interventions over the life cycle of the contract; and digital objects of contracting. The regulatory framework, which itself may draw on digital technology to effectively pursue its ends, shapes, and is shaped by, the other two pillars. More specifically, on the one hand, we show how four key technologies – digital platforms, Big Data analytics, artificial intelligence, and blockchain – are being used at different stages of the contractual process (from the screening for contractual partners to formation, enforcement and interpretation) and engender novel market dynamics that, in many instances, necessitate regulatory responses. On the other hand, digitally facilitated contracting increasingly relates to digital content as the object of the contract; however, while this area has notably been the subject of the proposed Directive on Contracts for the Supply of Digital Content and thus has received some first ‘European structure’, we argue that a number of important blind spots remain that fail to be addressed by the directive. All in all, the use of digital technology in contracting will likely reinforce an adaptive, relational view and practice of contracting. This increased fluidity engenders a vast potential for preference-conforming, time-sensitive contracts; however, to the extent that it also mirrors novel asymmetries of information and power, the ordering mechanisms of the law may simultaneously be more needed than ever.

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# I Challenges and Core Features of an ‘Architecture’

Digital technology and its challenges and repercussions for contract law in Europe – or: European Contract Law – are not a narrow issue. This article is not about one particular research question – even though in a good number of single questions, we shall propose novel solutions. Rather, this article is about an overall picture, the idea being that European Contract Law and its development undergo important changes as a consequence of the mere existence of a digital arena with its particular factual problems. Digital technology is, of course, not a uniform concept; rather, it comprises a set of different technologies whose impact on contract law will sometimes be similar, but which may at other times also diverge. In this survey, we focus on the impact of digital platforms; Big Data analytics; artificial intelligence; and blockchain technology. We intend to show not only that new problems require additional solutions, but also – and more importantly – that traditional contract law concepts will have to be revisited. Thus, we do not only see the advantage of sketching out the arena for readers less ‘specialized’ in problems of digital technology and contracting, but as well in pointing to core cases where traditional contract law concepts need reconsideration, and in clarifying the interplay of the large bodies of the law pertinent to contracting and contract contents in the digital arena. This implies as well that many individual questions could and can be deepened, and that each scholar will have a slightly different opinion on the range of single questions that are paradigmatic for the overall picture and thus deserve being brought into this survey – and probably even more so on the range of literature to be selected and found helpful for further research.

It may therefore be wise to specify three things in a bird’s eye view first: (i) what kind of contract law and contract law perspective we are mainly interested in; (ii) what vision of ‘European Contract Law’ we base our discussion on; and, finally, (iii) what the main thrust of the paper is.

## 1 Which Place for Contract Law in the Digital Arena?

We see *regulation* as an (important) integrative part of contract law, while conceding that – in the *ordo-liberal* tradition that dominated the creation of the Rome Treaty system – they are quite different in aim: regulation primarily furthers the public interest, and genuine private and contract law deals primarily with the

adequate balance of individual, private party interests.<sup>1</sup> Despite this, however, we see them as strongly functionally linked. We even want to suggest that (a large part of) the regulatory body nowadays is more intimately nested into genuine private law issues or regimes than it was in the concept of the *ordo-liberal* school when the relation between contract and regulation was first conceptualised – but where both regimes were quite neatly kept apart.<sup>2</sup> Finally, not including regulation – and even not including it very prominently – would also mean not including that part of the regime where EU Law in the technical sense is strongest. In fact, if one distinguishes between regulatory parts of the regime and private law parts of it, the latter is more often still national – or mainly national –, while the former is mostly enacted at the EU level.<sup>3</sup> Furthermore, a good part of the most

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1 See references next footnote. The term of ‘regulation’ is used, of course, in different ways. In the Anglo-American tradition, namely in contract law, often it is used also more broadly in the sense that ‘regulating contracts’ is more directly focused on the impact which a particular way of shaping contract law has on society, while traditional contract law was more about system building, doctrinal explanation and individual balancing of interests. Path-breaking for this broader concept of regulating contracts: H. Collins, *Regulating Contracts* (Oxford: Oxford University Press, 1999). The sharper separation advocated by the *ordo-liberal* school has, however, not only the advantage of having influenced the shape of the Treaty of Rome so much, but as well that of a conceptual clarity with respect to one main question: which interests do particular areas of law foster primarily? As can be seen in the following paragraphs, this does, however, by no means exclude considering public interest regulation also in the context of a discussion of classical contract law, ie of making their interplay a prime topic.

2 F. Böhm, ‘Privatrechtsgesellschaft und Marktwirtschaft’ *ORDO* 17 (1966) 75–151; translation (and discussion) in S. Grundmann, H. Micklitz and M. Renner, *Private Law Theory – Global, European, Social Sciences Based* (Antwerp/Cambridge: Intersentia, 2017) chapter 6 (forthcoming); discussion and in part further development of the theory: E.-J. Mestmäcker, ‘Macht – Recht – Wirtschaftsverfassung’ *Zeitschrift für das gesamte Handels- und Wirtschaftsrecht (ZHR)* 137 (1973) 97–111; E.-J. Mestmäcker, ‘Auf dem Weg zu einer Ordnungspolitik für Europa’, in E.-J. Mestmäcker (ed), *Eine Ordnungspolitik für Europa, Festschrift für Hans von der Groeben zu seinem 80. Geburtstag* (Baden-Baden: Nomos, 1987) 9–49; translation (and discussion) of this last text in Grundmann *et al* (this note above) chapter 24; see also S. Grundmann, ‘The Concept of the Private Law Society after 50 Years of European and European Business Law’ *European Review of Private Law (ERPL)* 2008, 553–581; G. Schnyder and M. Siems, ‘Ordoliberal Variety of Neoliberalism’, in S. Konzelmann and M. Fovargue-Davies (eds), *Banking Systems in the Crisis: the Faces of Liberal Capitalism* (London / New York: Routledge Taylor & Francis Group, 2013) 250–268.

3 On this disposition of bodies of the law, see path-breaking, Ch. Kirchner, ‘Europäisches Vertragsrecht’, in L. Weyers (ed), *Europäisches Vertragsrecht* (Baden-Baden: Nomos, 1997) 103–137 at 106 (he therefore characterises European contract law as ‘harmonisation coming from the edges’); more broadly S. Grundmann, ‘The Structure of European Contract Law’ *European Review of Private Law* 2001, 505–528; Grundmann (end of next note); and also C. Quigley, *European Community Contract Law* (London *et al.*: Kluwer, 1997); J. Basedow, ‘A Common Contract Law for the Common Market’ (1996) 33 *Common Market Law Review* 1169–1195.

innovative ideas in the last half century have been developed – at least for German law – in areas which really constitute *cross-sections* of several areas. The ‘creation’ of a banking law is an example in point, the one of a capital market law another one.<sup>4</sup> Finally, when it comes to *input from the social sciences* into law, we are inclined to think that at least economic theory (information economics, game theory), new economic sociology with its network analysis,<sup>5</sup> behavioural insights (including behavioural economics)<sup>6</sup> and more generally theories of choice, namely also of collective choice are paramount – with all these theoretical

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4 One may name here competition law as well, as it really is about how to supplement contract and company law with a regime which helps to guarantee the best material freedom possible (regulation and private law); see references last footnote. For a comprehensive view on the interplay between competition law (more generally business regulation in its interplay with traditional private law): W. Fikentscher, *Wirtschaftsrecht* (Munich: Beck, 1983) (2 volumes on German and European Business Regulation Law); E.J. Mestmäcker and H. Schweitzer, *Europäisches Wettbewerbsrecht* (3<sup>rd</sup> ed, Munich: Beck, 2014); see also W. Fikentscher, Ph. Hacker and R. Podzun, *FairEconomy. Crises, Culture, Competition and the Role of Law* (Heidelberg et al: Springer, 2013). More recently and more focused on the relationship (as such) between regulation and private law: A. Hellgarth, *Regulierung und Privatrecht – Staatliche Verhaltenssteuerung mittels Privatrecht und ihre Bedeutung für Rechtswissenschaft, Gesetzgebung und Rechtsanwendung* (Tübingen: Mohr Siebeck, 2016); S. Grundmann, ‘Privatrecht und Regulierung’, in *Festschrift for Canaris II* (forthcoming, also in English in the *European Review of Private Law*).

5 On network theory and its relationship to digital technology (Internet, platforms, network effects for the digital economy like Google etc), see (with particular attention to private law and regulation) F. Idelberger, ‘Connected Contracts Reloaded’, in S. Grundmann (ed), *European Contract Law in the Digital Age* (Antwerp: Intersentia, forthcoming); A. Wright and P. de Filippi, ‘Decentralized Blockchain Technology and the Rise of Lex Cryptographia’, <https://ssrn.com/abstract=2580664>, 15–17; 30–33 and 54–56; V. Buterin, ‘DAOs, DACs, DAs and More: An Incomplete Terminology Guide’, *Ethereum Blog* (6 May 2014), <https://blog.ethereum.org/2014/05/06/daos-dacs-das-and-more-an-incomplete-terminology-guide/>; groundbreaking, of course, for the overall concept: M. Castells, *The Information Age: Economy, Society and Culture, vol 1: The Rise of the Network Society* (2<sup>nd</sup> ed, Chichester: Wiley Blackwell, 2010; 1<sup>st</sup> ed 1996).

6 On behavioural approaches to problems of the digital dimension – as dealt with in the context of contract law and regulation – see in particular: R. Calo, ‘Digital Market Manipulation’ 82 *Georgetown Law Review* 995, 1002–1012, 1015–1018 (2014); E. Mik, ‘The Erosion of Autonomy in Online Consumer Transactions’ 8 *Law, Innovation and Technology* 1 (2016); N. Helberger, ‘Profiling and Targeting Consumers in the Internet of Things’, in R. Schulze and D. Staudenmayer, *Digital Revolution: Challenges for Contract Law in Practice* (Baden-Baden: Nomos, 2016) 135–161; Y. Hermstrüwer, *Informationelle Selbstgefährdung* (Tübingen: Mohr Siebeck, 2016); Ph. Hacker, ‘The Ambivalence of Algorithms. Gauging the Legitimacy of Personalized Law’, in M. Bakhoun et al (eds), *Personal Data in Competition, Consumer Protection and IP Law – Towards a Holistic Approach?* (Springer, forthcoming); Ph. Hacker, ‘Personalizing EU Private Law. From Disclosures to Nudges and Mandates’ (2017) 25 *European Review of Private Law* 651.

approaches related to the social sciences now being supplemented, and complicated, by the technical side, including computing (algorithms) and robotics.

For the digital arena, these ideas – namely the intimate link between private law (contractual drafting), public interest regulation, and the cross-sectional character of the area – can briefly be described as follows. It is by no means a completely new phenomenon that an ‘area’ of the law has a mixed structure, with parts of regulation, parts of traditional contract or property law, parts of private ordering and standard contract terms, but also part of public supervision. Probably the most prominent of such cross-sectional system before the ‘contract law of the digital age’ is banking law, namely investment banking law (with capital market law). Banking law was of the highest practical importance, but as well a powerful source of emerging ideas and research mainly in the 1970s and 1980s – and similarly capital market law, and both certainly again in these days. Today the digital economy, and more generally digital technology, are of similar importance practically speaking – dealing with another key economic factor: information – and in their potential as a source of emerging ideas. Digital technology, of course, raises questions of regulation in many areas, in IP law,<sup>7</sup> in the law of unfair competition,<sup>8</sup> with respect to antitrust law.<sup>9</sup> Certainly, however, the relationship between contract law and public interest regulation is one of the most prominent relationships also in the digital arena. The law of the digital age – now with respect to the key factor of data and broadly available information – would seem to play a role analogous to the one which the law of banking and capital markets plays for the key factor of capital. Again, the relationship to regulation is omnipresent, and the area is highly cross-sectional. Therefore, it may also not be astonishing that a good number of very prominent developments of digital contracting stem from banking and capital market law (see below). The relationship to regulation will be taken up below in greater detail (section II). The cross-sectional character of the area, however, is similarly important. Mainly contract law, company law and some of property law come together in banking and capital

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7 See, eg, D. Liebenau, ‘What Intellectual Property Can Learn from Online Privacy, and Vice Versa’ 30 *Harvard Journal of Law & Technology* (forthcoming), <https://ssrn.com/abstract=2842447>; W. Kerber, ‘A New (Intellectual) Property Right for Non-Personal Data? An Economic Analysis’ (2016) *Gewerblicher Rechtsschutz und Urheberrecht Internationaler Teil (GRUR Int)* 989; J. Drexl, ‘Designing Competitive Markets for Industrial Data – Between Propertisation and Access’ (2016) *Max Planck Institute for Innovation & Competition Research Paper No 16–13*, <https://ssrn.com/abstract=2862975>.

8 Helberger, n 6 above, 153–160.

9 On the latter, see, eg, M. Stucke and A. Grunes, *Big Data and Competition Policy* (Oxford: Oxford University Press, 2016); A. Ezrachi and M. Stucke, *Virtual Competition* (Cambridge, MA et al: Harvard University Press, 2016).

market law, they cut across these areas – with the addition of regulation in the form of prudential supervision on the institutions and in the form of a market publicity, integrity and stability regime. By contrast, the law of the digital arena would seem to be even more multifaceted and dispersed (with elements of supervision, but more prominent with antitrust and with data protection law, perhaps also IP law, as important bodies of public interest regulation). With respect to contract law, formation, implementation, performance and interpretation, but also (digital) contents are clearly ‘specific’ whenever digital technology comes in (see below, sections III and IV).

## 2 European Contract Law in Particular

We look at digital technology more specifically in *European Contract Law*; here, three dimensions are addressed in particular.

### a) The EU Substantive Law Basis – Three Lines of Specific Legislation

The first dimension – and in the future perhaps most important one -is that of EU Law in the technical sense. There are three legal measures mainly with respect to contract law. All three have considerable importance, develop a certain model and thus can serve as an ‘anchor’ for the overall considerations on European Contract Law in the digital age.

The first legal measure is the *EC Directive on e-commerce* of June 2000 in which a certain model of formation of contract is enshrined – more specifically: those mechanisms which were seen as being necessary to adapt the general model of formation of contract (in the national contract laws) to the particular environment of electronic contracting, namely adaptations owing to the ‘fluidity’ of the clicks and expressions of will made in this context, the diminished clarity and the increased ambiguity and possibility of errors.<sup>10</sup>

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<sup>10</sup> Dir 2000/31/EC [Directive on electronic commerce]. On this measure, see, for instance, R. Brownsword, ‘The E-Commerce Directive, Consumer Transactions, and the Digital Single Market’, in Grundmann (ed), n 5 above, (forthcoming); C. Ramberg, ‘The e-commerce directive and formation of contract in a comparative perspective’, 26 *European Law Review* 429–450 (2001); M. Kightlinger, ‘A Solution to the Yahoo! Problem? The EC E-Commerce Directive as a Model for International Cooperation on Internet Choice of Law’ 24 *Michigan Journal of International Law* 719 (2003); M. Hellner, ‘The Country of Origin Principle in the E-commerce Directive – A Conflict with

The *second legal measure* – more precisely a succession of legal measures – deals with the distance character of most digital contracting. This dimension was first regulated in the so-called EC Distance Selling Directive, then reformed and integrated in the *EU Consumer Rights Directive*.<sup>11</sup> In 2015, this line of legislation became the object of a broader strategy on the digital economy – extending, however, also well beyond it.<sup>12</sup> In fact, two proposals were based on this strategy paper, both adopted by the EU Commission on 9 December 2015, the *first proposal* referring to *online sale of goods*<sup>13</sup> and thus continuing (and extending) the regime established in the EC Distance Selling and the EU Consumer Rights Directive. As the E-Commerce Directive, this line of measures mainly focuses on formation of contracts (see below section III)

Conversely, the other proposal – the *third legal measure* (to come) – goes well beyond known territory. It is based on rules on aspects of the digital arena already proposed in the project on a Common European Sales Law<sup>14</sup> and deals with the supply of *digital content* in particular – hence no longer mainly the formation, but

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Conflict of Laws' 12 *European Review of Private Law* 193 (2004); see more in detail below section III 3; see also Dir 1999/93/EC.

11 Dir 2011/83/EU [Consumer Rights Directive]; E. Hall, G. Howells and J. Watson, 'The Consumer Rights Directive – An Assessment of its Contribution to the Development of European Consumer Contract Law', (2012) 8 *European Review of Contract Law* 139–166; S. Grundmann, 'The EU Consumer Rights Directive – Optimizing, Creating Alternatives or a Dead-End?' *Uniform Law Review* 2013, 98–127; V. Mak, 'Standards of Protection: In Search of the Average Consumer of EU Law in the Proposal for a Consumer Rights Directive' (2011) 19 *European Review of Private Law* 25–42.

12 Digital Single Market Strategy for Europe, COM(2015) 192 final; on this strategy paper, see S. Arnerstål, 'Licensing digital content in a sale of goods context' 10 *Journal of Intellectual Property Law & Practice* 750–758 (2015).

13 Proposal for a Directive of the European Parliament and of the Council on certain aspects concerning contracts for the online and other distance sales of goods of 9 December 2015, COM (2015) 635 final; on this proposal (online sales), see, for instance J. Smits, 'New European Union Proposals for Distance Sales and Digital Contents Contracts: Fit for Purpose?' *Zeitschrift für europäisches Privatrecht* 2016, 319–324; F. Zoll, 'The Remedies in the Proposals of the Online Sales Directive and the Directive on the Supply of Digital Content' *Journal of European Consumer and Market Law (EuCML)* 2016, 250–254; D. Staudenmayer, 'Digitale Verträge – Die Richtlinienvorschläge der Europäischen Kommission' *Zeitschrift für europäisches Privatrecht* 2016, 801–831, 806–825.

14 On these rules in CESL (and as its model: the [Academic] Common Frame of Reference), see, for instance, H. Eidenmüller *et al*, 'The proposal for a regulation on a common European sales law: Deficits of the most recent textual layer of European contract law' (2012) 16 *Edinburgh Law Review* 301–357, 310–311 and 333; N. Helberger *et al*, 'Digital Content Contracts for Consumers' (2013) 36 *Journal of Consumer Policy* 37–57, 47–48 and 53.

the content of the contract and duties based on it.<sup>15</sup> In fact, digital content is about the problem of an object of the contract which poses considerably or even completely new problems in large quantity: namely non-rivalrous and/or non-excludable use of the good and questions of compensation; alternative modes of compensation (namely giving personal data instead of monetary payment); services which have strong IP implications, but as well network effects, etc. Digital contents pose these new problems to a degree that seem to open a truly new dimension of object of contract and questions of performance.

Besides these three specific measures, EU law for the digital economy consists, however, also of the application of ‘general’ EU law (not specifically focusing on the digital arena) – namely measures of market regulation – to digital transactions. Thus, for instance, high frequency trading can be tested against the rules on insider trading in the EU Market Abuse Regulation or rules on market manipulation in the same legal measure<sup>16</sup> or as well be subject of a particular ban under the stability rules in the new banking supervision architecture.<sup>17</sup> And, of course, high frequency trading – while difficult to understand for traditional contract law practitioners or scholars and perhaps even for those otherwise dealing with digital contracts – constitutes probably one of the most developed and – in sheer volume – one of the practically most important algorithmic automations of contract formation. Another example, crowdfunding – again a new technique of mass contracting – is mainly about adapting requirements of (EU or national) capital market law to a changed environment. This environment is characterised by smaller amounts of investment and often more direct, substantive interest in the purpose of the investment (other than just an interest in returns). Even though crowdfunding is not conditional on digital forms of marketing, these are particularly suited for the particular characteristics of this type of investment scheme

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**15** Proposal for a Directive of the European Parliament and of the Council on certain aspects concerning contracts for the supply of digital content of 9 December 2015, COM(2015) 634 final; on this proposal (supply of digital content), see, for instance G. Spindler, ‘Contracts for the Supply of Digital Content’, in Grundmann (ed), n 5 above, (forthcoming); C. Ramberg, ‘Digital Content – A Digital CESL II: : A Paradigm for Contract Law via the Backdoor?’, in Grundmann (ed), n 5 above, (forthcoming); references in n 13 above: Smits; Zoll; Staudenmayer, 825–830; see more in detail below, section IV.

**16** On the application of these two regimes to high frequency trading, see, for instance, K. Alexander, ‘Market structures and market abuse’, in G. Caprio, *The Handbook of Safeguarding Global Financial Stability* (London, Waltham, San Diego: Elsevier, 2013) 375–385; P. Kasiske, ‘Marktmissbräuchliche Strategien im Hochfrequenzhandel’ *Wertpapier-Mitteilungen (WM)* 2014, 1933–1940.

**17** On this possibility, see arts 17, 4(1)(40), 2(1)(d)iii MiFID II; and, for instance, N. Moloney, *EU Securities and Financial Markets Regulation* (4<sup>th</sup> ed, Oxford: Oxford University Press, 2014) 525–530.

(small amounts, dispersed investors who potentially should, however, be directly approached over the time of the investment). This example also shows how such an adaptation was first implemented at the national level and is now proposed at the EU level.<sup>18</sup>

## b) A Broader Concept of ‘European Contract Law’

The example given last, however, is also telling insofar as it stands for a broader concept of ‘European Contract Law’. Besides EU law measures, this broader vision encompasses at least two more types of instruments, models or perspectives.

The first is a comparative law perspective in the EU – for instance on national measures already taken with respect to crowdfunding. This can be seen as part of a ‘European Contract Law’ especially if there is an interplay with existing EU law (capital market requirements set at the EU law level, in other cases EU antitrust law requirements) or if EU law is emerging in that area (as in the case of crowdfunding). Similarly, there is a strong ‘European’ dimension whenever there is a model which may be based on one national law, but circulates in an unchanged form in all the European Union market or large parts of it. The most famous example stems probably from company law, the Company Limited by Shares (Ltd.) under English law – an example again where digital registration is paramount for the success. For contract law, Hugh Collins has spoken for such models ‘in circulation across the EU’ of a ‘freedom to circulate documents [ie models]’.<sup>19</sup>

A ‘European Contract Law’ in the broad sense may even be emerging or existing where a distinctly European way of looking at certain problems can be found or a distinctly European way of drafting particular contracts in the field can be discerned. How this integrates into a digital market which in many cases may even be global, is a delicate issue – encompassing conflict of laws issues with

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<sup>18</sup> On crowdfunding and its regulation (both at national and at EU level), see, for instance, C. Estevan, ‘Crowdfunding in Europe’, in Grundmann (ed), n 5 above, (forthcoming); overview on the crowdfunding national regulation in several EU Member States: T. Aschenbeck-Florange *et al*, ‘Regulation of crowdfunding in Germany, the UK, Spain and Italy and the impact of the European single market’, *European Crowdfunding Network June 2013*, [http://eurocrowd.org/wp-content/blogs.dir/sites/85/2013/06/20130610\\_Regulation\\_of\\_Crowdfunding\\_ECN\\_OC.pdf](http://eurocrowd.org/wp-content/blogs.dir/sites/85/2013/06/20130610_Regulation_of_Crowdfunding_ECN_OC.pdf); G. Dorfleitner, L. Hornuf, M. Schmitt and M. Weber, ‘The Fintech Market in Germany’ (2016), [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2885931](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2885931).

<sup>19</sup> H. Collins, ‘The Freedom to Circulate Documents: Regulating Contracts in Europe’, (2004) 10 *European Law Journal* 787–803; see as well S. Whitaker, ‘On the Development of European Standard Contract Terms’ (2006) 2 *European Review of Contract Law* 51–76.

respect to standard terms, private law and public interest regulation.<sup>20</sup> This clash between (partly) national legal and transnational market is omnipresent in the digital arena.

### 3 The Main Pieces of the Architecture

In the following, this wide array of (new) phenomena and – increasingly – also of rules and legal regimes is structured in a way which is aimed at furthering the perception of an ‘architecture’ by referring to known structures of contract law. A first, sharp distinction should be drawn between two different *pillars* of the architecture: (i) on the one hand, digital content as the *object* of contract and, (ii) on the other hand, the use of digital technologies in a variety of procedures during the *contractual life cycle*. Digital content, i.e. digital goods and services, data, and instruments of storage for digital information in the broader sense, may constitute the performance or the counter-performance of the contract. Irrespective of this contractual content, different digital technologies (such as digital platforms; Big Data analytics; artificial intelligence (AI); or blockchain) also intervene at different stages of the contractual life cycle: in the screening of prospective contractual parties; in drafting the contract; during contract formation; in the definition of concrete contractual obligations, their continuous development over time, and their automated enforcement; in the linkage of contracts; and, finally, in contractual interpretation. Over these different stages, the contractual basis is subjected, more than in traditional contexts, to the possibility of perpetual adaptation, revision, and renegotiation via the updating of the information, codes and methods used by contractual digital technology. These first two pillars thus stand side by side, but represent the two most important modes of influence that digital technology can have on contracting: The *formation* and subsequent development of contract can be in digital form (via e-mail, internet auction or a digital platform etc or even via an algorithm triggering transactions); and the *content* of the contract can be digital (for instance, a contract on cloud services or on software). Thus, the contract as tool of regulating the relationship can be digital, but equally its object, ie, its content.

The first two pillars of the digital architecture of contracts may, but do not have to come together in a single contract: contracts over the licensing of e-books

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<sup>20</sup> On the problems of law applicable to digital platforms and transactions, see, for instance, D. Svantesson, ‘Digital Contracts in Global Surrounding’, in Grundmann (ed), n 5 above, (forthcoming).

may be negotiated and concluded in an offline scenario; contracts governing the sale of old-fashioned, hardcopy books may be initiated, formed and enforced entirely in the digital world, using technologies that span from Big Data analytics via digital platforms to AI and blockchain. Besides these two pillars which stand largely in parallel, a *third pillar* is found – and like in good futurist architecture, this pillar does by no means just stand in parallel, but rather intersects with the first two. This pillar, equally important for an overall understanding and architecture, has to be seen (iii) in the *regulatory* framework within which private law and the law made by private parties has to take place. Only by bringing together the two most important digital phenomena in the area of contracting (the two first pillars mentioned) with the regulatory framework (also truly multi-faceted), we may create an overall picture and architecture of ‘Contracting and Contract Law in the Digital Age’. The regulatory instruments, in turn, may shape the other two architectural elements with conventional methods of regulation, but they may also actively harness digital technology to more effectively pursue regulatory aims.

We deal with the three pillars in the following order: starting out from the overall framework, ie the regulatory framework (see below section II), followed by the two – more traditionally contract law related – pillars named first: the contractual life cycle (see below section III); and the object of the contract (see below section IV). We thereby take a market approach to the conceptualization of (European) Contract Law in the digital age.

These parts are strongly interconnected between each other, most prominently in the following two respects. As already mentioned, the regulatory regime – regulation, as explained above note 1, focusing primarily on the public interest such as market structure – is nowadays often intimately nested into private law regimes. As such, it aims primarily at striking an adequate balance between the interests of individual private parties. Moreover, in contracts whose basis has been formed in the digital arena, the formation and the subsequent development of the contractual basis are often more intimately connected with one another than in traditional contracting (and in fact often cannot be separated at all).

This is particularly the case for smart contracts built on top of blockchains. A blockchain essentially is a list (called ledger) that logs transactions, or information more generally, in a decentralized way and synchronizes the ledger between those participating in the network.<sup>21</sup> There is no central authority guaranteeing

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<sup>21</sup> See the ‘founding document’ of blockchain: S. Nakamoto, ‘Bitcoin: A Peer-to-Peer Electronic Cash System’ *Bitcoin White Paper* (2008); for an overview, see also J. Witte, ‘The Blockchain: A Gentle Introduction’ *Working Paper* (2016), <https://ssrn.com/abstract=2887567>.

the validity of the information in the ledger. Rather, authenticity is secured by (i) keeping identical copies of the ledger on many participants' computers (preventing tampering with past entries); by (ii) allowing only those participants to update the list that prove (mostly by solving cryptographic puzzles) that they have invested significant time and effort; and by (iii) requiring validation of these updates by other participants (preventing tampering with novel entries).<sup>22</sup> Blockchain is the technology that famously undergirds the cryptocurrency Bitcoin, as well as a growing number of alternative cryptocurrencies such as Ethereum. Importantly, the Ethereum blockchain not only defines a virtual currency, providing a means of payment in which direct transactions between network participants are cryptographically secured; but it also enables smart contracts to run on its blockchain.<sup>23</sup> Smart contracts are computer programs that can receive information and assets, as well as send out information and assets.<sup>24</sup> Importantly, a smart contract specifies in advance the exact conditions under which assets will be distributed to recipients (using, for example, the very cryptocurrency the blockchain defines).<sup>25</sup> Hence, once the conditions are met (and this information is sent to the smart contract) – for example when a shipment has arrived at its destination – the corresponding payment is automatically executed. The 'information' for the ongoing further development of the smart contract is thus already built into the preceding phase, ie in the formation of the instrument.<sup>26</sup>

In this structure that comprises different digital technologies within the three pillars, the EU law measures named above (Part I 2 a)) – two already existing (of which one is to be amended soon), a third one just emerging – serve as 'anchors'. In fact, over the last 18 months – and certainly once the two proposals of December 2015 are adopted –, all phases and perspectives named would seem to be covered substantially also with respect to private law phenomena. This does, of course, not imply that lacunae do not remain, and even important ones, but

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**22** Cf A.M. Antonopoulos, *Mastering Bitcoin: Unlocking Digital Cryptocurrencies* (Beijing et al: O'Reilly, 2014) 26–28, 176–180.

**23** V. Buterin, 'A next-generation smart contract and decentralized application platform' *Ethereum White Paper* (2014).

**24** R.G. Brown, 'A Simple Model for Smart Contracts' (10 February 2015), <https://gandal.me/2015/02/10/a-simple-model-for-smart-contracts/>; see also Arizona House Bill 2417, Passed 2017-03-29, Chapter 97, § 2 Article 5 E 2, <https://legiscan.com/AZ/text/HB2417/id/1588180/Arizona-2017-HB2417-Chaptered.html> (providing the first legal definition of a smart contract, building on Brown's definition).

**25** T. Swanson, 'Consensus-as-a-service: a brief report on the emergence of permissioned, distributed ledger systems' (2015) 15, <http://www.ofnumbers.com/2015/04/06/consensus-as-a-service-a-brief-report-on-the-emergence-of-permissioned-distributed-ledger-systems/>.

**26** See also below, n 35 and accompanying text.

only that the overall scheme has received its contours at the EU level then as well. The regulatory side, on the other hand, is strong at the EU level. This is also true with respect to digital phenomena as in the examples of data protection law, capital market law, antitrust and unfair competition law that are broad and thorough. This does not imply that regulation for the digital arena in these areas of the law cannot be shaped in a more convincing and appropriate way – more appropriate for digital technology in particular –,<sup>27</sup> but a solid basis from which to start in this endeavour certainly already exists. These anchors – establishing a certain framework-system already at the EU level, hence for all of Europe – now allow to distribute also the phenomena accordingly. This includes national views on other legal issues (comparative law) and supranational practices (private ordering originating in business practices and terms).<sup>28</sup> The latter focus either on the individual transactions (contracts) or on the establishment and functioning of platforms on which such contracts can be entered into.

While this article is also about ‘mapping’ the area and the new challenges, we want to stress mainly the ‘architecture’ in all this. And just like real architecture (namely good architecture) is often telling a story, also the ‘architecture’ in this more virtual sense is about a ‘narrative’ of what digital technology does or will do to contract law in the larger sense. The digital perspective is certainly a cross-sectional perspective. This perspective will further enhance the view that there is not just one rather one-dimensional image of contracts – namely as contracts for exchange – but more than one,<sup>29</sup> perhaps even many. Digital technology will likely also further a less mechanical view of contracts – first formed or not formed, then properly performed or breached – in favour of a more relational view of contracting. ‘Relational contracts’ (or relational contracting) is understood in a variety of ways. The common denominator would, however, seem to be that the legal and doctrinal construction gives more easily way to the multitude of facets of the relationship between the parties into which the legal treatment is embedded. This, in our context, allows for the contractual relationship – for instance

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<sup>27</sup> See, for instance, Hacker, n 6 above; Ph. Hacker and B. Petkova, ‘Reining in the Big Promise of Big Data. Transparency, Inequality, and New Regulatory Frontiers’ *Northwestern Journal of Technology and Intellectual Property* (forthcoming), <http://ssrn.com/abstract=2773527>.

<sup>28</sup> From the abundant flow of literature on ‘private ordering’: G. Bachmann, *Private Ordnung. Grundlagen ziviler Regelsetzung* (Tübingen: Mohr Siebeck, 2006); L. Bernstein, ‘Private Commercial Law in the Cotton Industry: Creating Cooperation through Rules, Norms, and Institutions’ 99 *Michigan Law Review* 1724–1790 (2001) (still more pertinent in this respect than her more famous piece on the diamond industry of 1992); G. Teubner, ‘Societal Constitutionalism’, in Ch. Joerges, I.J. Sand and G. Teubner (eds), *Constitutionalism and Transnational Governance* (Oxford et al: Hart Publishing, 2004) 3–28.

<sup>29</sup> Dorfleitner *et al*, n 18 above.

created by a contract on digital content – to evolve over time (for instance, with updates and new documentation), and thus also to change the ‘relational’ contract from how it was initially formed.<sup>30</sup> In this relational view, the issues of constant reshaping of contracts (as an ongoing process) will play a larger role, and, of course networks<sup>31</sup> and platforms<sup>32</sup> will be paramount, including the view of contract as the basis of a (long-term) organisation.<sup>33</sup>

A particular challenge, for drafting as well as regulation, may lie in squaring this realistically relational approach with smart contracts in which, as a general rule, the terms and conditions of execution are fixed at the onset in code, allowing for automatic enforcement *irrespective* of novel factual developments outside the conditions specified in the original contract.<sup>34</sup> However, while automatic enforcement of clauses specified at the moment of the formation of the contract is the paradigmatic case in smart contracts, different strategies exist to update and

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**30** The concept has famously been coined by S. Macaulay, ‘Non-Contractual Relations in Business – a Preliminary Study’ 28 *American Sociological Review* 55–67 (1963); I. MacNeil, ‘The Many Futures of Contract’ 47 *Southern California Law Review* 691–816 (1974); I. MacNeil, ‘Relational Contract: What We Do and Do Not Know’ *Wisconsin Law Review* 483–525 (1985); also V.P. Goldberg, ‘Relational Exchange: Economic and Complex Contracts’ 23 *American Behavioural Scientist* 337–352 (1980); see broader discussion, also on the later developments Grundmann (2017), n 2 above, chapter 17 (forthcoming).

**31** G. Teubner, *Networks as Connected Contracts* (Oxford: Hart, 2011); S. Grundmann, ‘Contractual networks in German private law’, in F. Cafaggi (ed), *Contractual Networks, Inter-Firm Cooperation and Economic Growth* (Cheltenham et al: Edward Elgar Publishing, 2011) 111–162; based mainly on the groundbreaking work by: W.W. Powell, ‘Neither Market nor Hierarchy – network forms of organization’ 12 *Research in Organizational Behaviour* 295–336 (1990); Goldberg, n 30 above; more in particular with respect to *networks* with a digital contractual basis, see, n 5 above: Idelberger; Wright and de Filippi; Buterin.

**32** On digital platforms, see, for instance: Research group on the Law of Digital Services, ‘Discussion Draft of a Directive on Online Intermediary Platforms’ *Journal of European Consumer and Market Law (EuCML)* 2016, 164–169; C. Busch et al, ‘The Rise of the Platform Economy: A New Challenge for EU Consumer Law?’ *Journal of European Consumer and Market Law (EuCML)* 2016, 3–10; V. Mak, ‘Regulating Contract Platforms, the Case of Airbnb’, in Grundmann (ed), n 5 above, (forthcoming); Estevan, n 18 above; for a US perspective, see, eg, V. Katz, ‘Regulating the Sharing Economy’ 30 *Berkeley Technical Law Journal* 1067 (2015).

**33** For the sweeping importance of this other image of contract see S. Grundmann, F. Cafaggi and G. Vettori (eds), *The Organisational Contract* (Furnham et al: Ashgate, 2013) especially the introduction; more in particular with respect to contractual organisation on a *digital* basis, see: A. Norta, ‘Creation of Smart-Contracting Collaborations for Decentralized Autonomous Organizations’, in R. Matulevičius and M. Dumas (eds), *Perspectives in Business Informatics Research* (Cham: Springer, 2015) 3–17; Wright and de Filippi, n 5 above; Buterin, n 5 above.

**34** Cf H. Shadab, ‘What are Smart Contracts, and What Can We do with Them?’ (*Coincenter*, 15 December 2014), <https://coincenter.org/entry/what-are-smart-contracts-and-what-can-we-do-with-them>, Section ‘How to Improve Smart Contracts’; Idelberger, n 5 above.

partially rewrite smart contracts as well.<sup>35</sup> For example, the contract may be consensually terminated if the parties so wish, and the monetary value already exchanged be restored to the original owner. Furthermore, the original smart contract may include coding provisions that enable an updating later during the contractual relationship. Even if such updating mechanisms were not embedded initially into the smart contract, parts of it may be cancelled and rewritten after formation. Hence, the contractual base, and even the code base, of smart contracts may evolve over time as well.

Finally, digital contents shed a completely new light on the question of how to shape and characterise the object of performance – what both parties owe, namely also the user. Here again, the overall thrust may be summarized with the statement that this object is also more fluid and its definition truly challenging, from a contract theory perspective, but also very practically when it comes to personal data<sup>36</sup> – again with the exception of those smart contracts in which performance is exactly pre-specified in code.

## II Institutional Framework: Regulatory Issues, Platforms, and Global Surroundings

### 1 The Core Components and Dimensions – Survey

The substantive discussion of an ‘architecture’ is probably best approached by starting out from the institutional and regulatory framework. This is the first pillar we describe. The regulatory environment for contracts in the digital world separates into two distinct subfields. On the one hand, digital technology may be actively harnessed by legislators and regulators in order to shape a proactive, adaptive environment for contracts, both non-digital and, particularly, digitally mediated ones. Such regulation *with* algorithms may draw on the seminal work by Lessig that spells out how societal and legal values may be infused directly into code.<sup>37</sup> Recently, regulation by technology has again been recognized as a promis-

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<sup>35</sup> We would like to thank Florian Idelberger for comments on these updating mechanisms; cf also Buterin, n 23 above, 20–21.

<sup>36</sup> See, for instance, Hacker and Petkova, n 27 above, particularly 17–24; H. Schweitzer *et al*, ‘Digitale Plattformen: Bausteine für einen künftigen Ordnungsrahmen’, *ZEW Discussion Paper No 16-042* (2016), <ftp.zew.de/pub/zew-docs/dp/dp16042.pdf>, 21–23; H. Schweitzer, ‘Daten als neue Währung’ *FAZ* (24 February 2017) 18.

<sup>37</sup> L. Lessig, *Code version 2.0* (New York: Basic Books, 2006).

ing road forward for the establishment of a facilitative and effective framework for governing the digital economy.<sup>38</sup> For example, scholars have discussed the need for, and the drawbacks of, regulators creating or improving digital intermediaries that help consumers find the products best matching their preferences;<sup>39</sup> others have suggested that regulators ought to use Big Data and blockchain technology to tailor contractual (and other) rules to individual addressees in ‘personalized law’;<sup>40</sup> and finally, that central banks should build centrally-banked cryptocurrencies as tools for monetary policy, potentially enabling novel types of financial contracts and means of legal tender in the future.<sup>41</sup>

On the other hand, the digital component may reside not in the instrument, but in the object of regulation: regulation *of*, not *with* digital technologies. This is certainly the dimension of the institutional and regulatory framework on which most ink has already been spilled, and which therefore forms the centre of our overview. Concerning digital contracts, three aspects seem paramount: the first is (i) the divide between individual contracts and platforms on which masses of (typically highly standardised) contracts are prepared or formed – prepared by indication of occasions, formed when such a mechanism is part of a platform regime. Digital contracting thus is characterised by an extraordinarily intimate link between the law of contracts and the law of markets.<sup>42</sup> Equally important as a framework parameter of digital contracting is (ii) the regulatory regime and framework for both individual contracts and platforms as such. Finally, the framework is immensely conditioned by (iii) the positioning of digital contracts or of platforms for digital contracting – and their regulation – in a global environment.<sup>43</sup> As questions of their application are foundational for the effect of such regimes, this perspective would seem to be a natural starting point for a legal analysis of contract law in the digital age. With these three institutions or institu-

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38 G. Spindler, *Regulierung durch Technik*, Short Report (Berlin, 2016); Hacker, n 6 above, (forthcoming).

39 Cf R. van Loo, ‘Rise of the Digital Regulator’ *Duke Law Journal* (forthcoming), <https://ssrn.com/abstract=2902238>.

40 A. Porat and L. Strahilevitz, ‘Personalizing Default Rules and Disclosure with Big Data’ 112 *Michigan Law Review* 1417 (2014); O. Ben-Shahar and A. Porat, ‘Personalizing Negligence Law’ 91 *New York University Law Review* 627 (2016); Hacker (2017), n 6 above, 651.

41 D. Danezis and S. Meiklejohn, ‘Centrally banked cryptocurrencies’ *Working Paper* (2015), arXiv preprint, arXiv:1505.06895.

42 The link would seem much more intimate than in the traditional analogue world, see references above n 2–4.

43 On digital platforms, see, references above n 32; on digital contracting in a global environment, see, for instance, Svantesson, n 20 above; L.A. Bygrave, *Internet Governance by Contract* (Oxford: Oxford University Press, 2015).

tional divides, most of the architecture of contracting in the digital age would seem to be captured: the relevant markets, encompassing also the mass transactions; the relevant legal/regulatory regimes; and their application in a surrounding which is globalized to an extent largely unparalleled in other areas of contracting.

We shall now take up these points in turn. The regulatory component is inherent both in the discussion of the levels of regulation and in the difference between platforms and contracts; these two dimensions of the institutional framework for the digital world of contracts are thus scrutinized in greater detail in the following two sections, always with a view to the interrelations between private law and regulation.

## 2 National and Global – the Levels of Regulation

When it comes to the level of regulation, the starting point would seem to be that many phenomena of digital platforms and contracting are more decidedly cross-border than the regulation of these phenomena.<sup>44</sup> A common perception (and criticism) is therefore that phenomenon and regulation do not match, namely that regulation is territorial and the phenomenon is global – with one core consequence being that many laws may apply cumulatively.<sup>45</sup> From this perspective, it may even be doubtful whether the most important regulatory forces still take sufficient effect in the digital arena – for instance law, code, market and norms (as prominently identified by L. Lessig).<sup>46</sup>

While such concerns are well founded to some extent, and while certainly more than just an adaptation of traditional regimes for the analogue world is needed for a coherent regulatory regime for the digital arena,<sup>47</sup> two structural features should nevertheless not be overlooked. The first is about the level where regulation typically takes place. At least in the EU – but in areas such as capital

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<sup>44</sup> See, for instance, Digital Single Market Strategy for Europe, COM(2015) 192 final, 3–6; D. Svantesson, ‘Time for the Law to Take Internet Geolocation Technologies Seriously’ 8 *Journal of Private International Law* 473–487 (2012); Svantesson, n 20 above (observing as well that the digital arena produces more contracting or at least more contracting with choice of law and choice of forum clauses than analogue environments).

<sup>45</sup> See, for instance, J. Goldsmith and T. Wu, *Who Controls the Internet? Illusions of a Borderless World* (Oxford: Oxford University Press, 2006) chapter 9; Svantesson, n 20 above (‘hyperregulation’).

<sup>46</sup> Bygrave, n 31 above, 4 *et seq.*

<sup>47</sup> See, for instance, J. Kroll *et al.*, ‘Accountable Algorithms’ *University of Pennsylvania Law Review* (forthcoming), [ssrn.com/abstract=2765268](https://ssrn.com/abstract=2765268); Hacker, n 6 above.

market law, competition law and banking regulation also in the US – regulation tends to concentrate on the federal, i.e. the EU level, while national law (or state law) is dominant for the private law regime – in contract law typically default rules. Thus, public interest regulation as that part of the regime which is not open to private law contracting – and boilerplate law which can indeed largely circulate across territories and thus create a legal platform transcending state territories –, is typically designed for such large entities as the entire European internal market. Seen from this perspective, it may be less unforeseeable and burdensome to adapt to such regimes, and the impact principle which reigns supreme in business regulation<sup>48</sup> may indeed justify an application of EU Law to platforms and to contracts with EU clients (consumers). When indeed a contract is formed, the ‘genuine link’ with the market where it is formed would seem to be strong enough, and also the profit derived. Thus, while in tort law or with respect to injunctions, the territoriality principle may lead to hyper-regulation by fragmentation, in contract law the risk seems less considerable. While there may be a strong territoriality principle, it does not excessively fragment a world-wide digital arena, at least not with respect to contract law and standards of conduct relating to contracting.

The second feature which calls for some caution with respect to an allegedly excessive fragmentation is the constitutionalization of private law and private ordering. Indeed, most of the platforms are based on a legal regime combining private law rules with some regulatory content. If such legal regimes set up by private ordering constitute a significant part of a cross-border legal regime in the digital arena of contracting, one other development may become increasingly important, and discussion should focus on directing the endeavours into an adequate direction. Constitutional principles more generally speaking have indeed increasingly been used namely with respect to rule setting by private bodies (‘private ordering’), which is ultimately based on party autonomy. Here, they have been used to call for subjecting private ordering to rules such as proper representation of all parties affected, transparency, accountability. This trend is prominent namely in the conceptualization of large parts of transnational law,<sup>49</sup> and should apply to digital private ordering as well.

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**48** The so-called effects doctrine (‘impact’ principle) – as opposed to the principle of territoriality (seat of the actors or place of actions taken) –, was most prominently introduced in antitrust law: see ECJ of 27 September 1988 – joined cases 89, 104, 114, 116, 117 and 125 through 129/85 *Woodpulp* [1988] ECR 5193. It is paramount, however, also in other areas such as capital market law or unfair competition law.

**49** For all these issues, both private ordering and in particular the transnational arena, see references above n 28.

### 3 Platform Markets and Individual Contracts

The second component of the institutional framework that merits special consideration is platforms and the markets that they constitute. Regulation applies to almost all of the aspects of the intersections between digitalization and contract law. However, it seems particularly important with respect to platforms for four reasons. First, platforms are already an area of intense regulatory scrutiny in antitrust law.<sup>50</sup> The economics literature on multi-sided platforms, and the specific market dynamics they engender,<sup>51</sup> was applied to digital platforms in an attempt to analyse how far dominant platforms could potentially hinder competition, abuse competitors and customers, and forestall innovation in the long run.<sup>52</sup> An important literature has now developed on barriers to entry in the digital economy,<sup>53</sup> and platforms, precisely because they constitute the hubs, or gateways, to many services in the digital economy, figure prominently in this literature. Ezrachi and Stucke, for example, argue that data-driven platforms may apply personalized pricing schemes that not only approximate first-degree price discrimination, but that also potentially exploit consumer biases.<sup>54</sup> Such practices would clearly not only trigger antitrust, but also contractual challenges as we shall see below (Part III 1).

Second, platforms not only play a special role with respect to the maintenance of an effective or workable competition, but they also are a crucial ingredient for the environment in which digitally facilitated contracts all too often take place. They provide the framework, as it were, that shapes the way in which supply and demand are matched, in which products are perceived, and hence in

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**50** From the academic literature, see, eg, K. Devine, 'Preserving Competition in Multi-Sided Innovative Markets: How Do You Solve a Problem Like Google?' 10 *North Carolina Journal of Law & Technology* 67 (2008); D. Evans, 'The Web Economy, Two-Sided Markets, and Competition Policy' 2 *Conurrences* 57 (2010); for the investigations by the EU Commission into Google, see Case COMP/C-3/39.740, *Foundem/Google* (30 November 2010); Case COMP/C-3/39.775, *Ciao/Google* (30 November 2010); COMP/C-3/39.768, *1plusV/Google* (30 November 2010).

**51** J.-C. Rochet and J. Tirole, 'Platform Competition in Two-Sided Markets' 1 *Journal of the European Economic Association* 990 (2003); M. Armstrong, 'Competition in Two-Sided Markets' 37 *The Rand Journal of Economics* 668 (2006).

**52** See, eg, I. Lianos and E. Motchenkova, 'Market Dominance and Search Quality in the Search Engine Market' 9 *Journal of Comparative Law & Economics* 419 (2013).

**53** D. Rubinfeld and M. Gal, 'Access Barriers to Big Data' *Arizona Law Review* (forthcoming), [ssrn.com/abstract=2830586](https://ssrn.com/abstract=2830586).

**54** Ezrachi and Stucke, n 9 above, Part III; A. Ezrachi and M. Stucke, 'The rise of behavioural discrimination' (2016) 37 *European Competition Law Review (ECLR)* 485, 486–488; moreover, they argue, algorithmic decision making may lead to novel forms of digitally-facilitated collusion that is difficult to detect and prove, see *id* n 9 above, Part II.

which a vast number of individual contracts are formed. The importance of framing effects, underlined by behavioural economics,<sup>55</sup> points to the specific importance of this type of decision architecture that brings formerly diffused agents together in specific channels that must be thoroughly analysed in order to uphold basic principles of consumer or investor protection, fair and efficient exchange, as well as innovation.

Third, platforms also more concretely shape the contractual relationships and economic incentives for their users. Scholars have argued that liability of platforms may follow from the reliance of users on the predominant influence of the platform over the supplier.<sup>56</sup> Going beyond the reliance criterion, we complement this proposal by suggesting that regulation may be necessary if contractual ‘predetermination’ by the platform leads to an unacceptable imbalance in the allocation of risks between the platform users. When platforms supply default contractual terms or provide for specific support for certain users, they act as de facto ‘lawmakers’ for the platform environment: it would be rational for most users to just accept this framework and not invest time and cognitive effort to understand the terms and negotiate a better agreement with the counterparty, ie, another user;<sup>57</sup> and boundedly rational users would ignore the terms and conditions most likely, anyway.<sup>58</sup> This does not necessarily invite regulatory intervention; however, if rational (and boundedly rational) apathy leads to the adoption of a contractual framework supplied by a platform that engenders serious imbalances in the allocation of risks *and* runs counter to the legitimate expectations of users, regulatory solutions seem needed. For example, Airbnb at the moment only supplies a ‘host guarantee’ that, to a certain extent, covers damage to the host’s property caused by Airbnb guests.<sup>59</sup> There is no corresponding ‘guest guarantee’ covering damage to guests caused by the host. This does create an imbalance in the allocation of risks between hosts and guests; clearly, Airbnb wants to incentivize hosts to offer recommendations on the platform, and believes that hosts are more sensitive about damage to their property than guests are about being

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55 A. Tversky and D. Kahneman, ‘The Framing of Decisions and the Psychology of Choice’ 211 *Science* 453–458 (1981); A. Kühberger, ‘The Influence of Framing on Risky Decisions: A Meta-Analysis’ 75 *Organizational Behavior and Human Decision Processes* 23–55 (1998); overview in Ph. Hacker, *Verhaltensökonomik und Normativität* (Tübingen: Mohr Siebeck, 2017) § 4 B I 2.

56 Busch *et al.*, n 32 above, 8–9; Research group on the Law of Digital Services, n 32 above, 167–168, art 16(2)(b) and art 18.

57 Cf I. Ayres and A. Schwartz, ‘The No-Reading Problem in Consumer Contract Law’ 66 *Stanford Law Review* 545, 546–548 (2014).

58 Cf O. Ben-Shahar and C. Schneider, *More Than You Wanted to Know* (Princeton: Princeton University Press, 2014) chapter 4; Hacker, n 55 above, § 9 D.

59 <https://www.airbnb.com/guarantee>.

damaged themselves. However, this does not leave guests entirely without recourse in case of damage; rather, guests may rely on the rental contract with the hosts to seek damages from them. What is missing for guests is the *additional* benefit of the guarantee by the platform. This, in turn, does not seem to contradict legitimate expectations of users since such guarantees are not part of other rental contracts, either; a real estate broker, for example, that brings a tenant and a landlord together would never, under reasonable circumstances, offer such a guarantee to the tenant.

However, imagine that Airbnb supplied a default rental agreement that users may adopt which included a provision excluding host liability for damages to the extent legally possible, for example excluding negligent damage to guests' property. This would not only create an imbalance in the allocation of risks, but might also run counter to the legitimate expectations of guests. Here, a specific kind of control of unfair contractual terms may be needed that takes account of the multipolar relationship between users and platforms. As a result, platforms might be required by future regulation to cover the risks, vis-à-vis their users, that they inappropriately and unexpectedly shifted onto them. A crucial point, and difficulty, of such a regulatory framework would be to determine what the legitimate expectations of users are. On the one hand, a normative concept could be employed that would have to take account of both boundedly and more fully rational expectations of users.<sup>60</sup> On the other hand, an empirical concept could be used, governed by empirical surveys.<sup>61</sup>

Finally, fourth, there is the issue of innovation. As always in the regulation of novel technologies, the safeguarding of innovation must not be understood as a prohibition of regulation.<sup>62</sup> Conversely, however, regulation could also be harnessed to specifically foster innovation, for example by providing safe legal harbours for introducing novel, experimental features that, from an *ex ante* perspective, do not pose grave risks for users, but that nevertheless introduce an element of legal uncertainty, for example concerning liability. The 'regulatory sandbox' introduced by the UK Financial Conduct Authority is a case in point:

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**60** Cf, for the related issue of consumer expectations, Ph. Hacker, 'The Behavioral Divide. A Critique of the Differential Implementation of Behavioral Law and Economics in the US and the EU' 11 *European Review of Contract Law* 299, 317–318 (2015).

**61** Cf the recent proposal for interpreting contracts using empirical surveys by O. Ben-Shahar and L. Strahilevitz, 'Interpreting Contracts via Surveys and Experiments', *University of Chicago Coase-Sandor Institute for Law & Economics Research Paper No 791* (2017), <https://ssrn.com/abstract=2905873>.

**62** R. Brownsword, 'The shaping of our on-line worlds: getting the regulatory environment right' 20 *International Journal of Law and Information Technology* 249, 267 *et seq* (2012).

businesses are thus able to test innovative products under modified or waived rules, and have access to guidance by the regulatory agency.<sup>63</sup> For instance, in the present context, platforms may fear that if they offer not only mechanisms of search and matchmaking, but also advice, they may be held liable if the advice turns out to be inappropriate. Airbnb might introduce an automated piece of advice that recommends specific apartments to potential guests based on the user's previous booking and rating history. On average, users may benefit from such advice, particularly if novel techniques of automated advice (using, for example, AI agents) are employed. At least in an introductory phase (eg, beta versions), it is imaginable that regulation provides a safe harbour, shielding the platform from liability in case some pieces of advice point into the 'wrong' direction.

At the moment, the factual regulatory depth varies from platform to platform. Crowdfunding is already subject to a deep thicket of securities regulation in the EU. National legislatures have taken the first steps, and the EU legislature is about to follow.<sup>64</sup> Other platforms like Airbnb are currently operating in a regulatory blind spot that leaves most of the decisions, and allocations of risk, to the platforms and users.<sup>65</sup> While some regulatory interventions from public law, particularly addressing concerns about competition to hotels and the crowding out of rental space for local inhabitants, have started to target Airbnb, a coherent regulatory framework for the contractual interactions seems to be patently lacking at the moment.

### **III The Use of Digital Technology over the Life Cycle of a Contract – From Screening for Parties to Enforcement and Interpretation**

The regulatory framework analysed in the previous part shapes the second pillar we have identified: the incentives and possibilities for the use of digital technology at various stages of the life cycle of a contract. As we walk through these different stages, it will become apparent that the intersections between digitization and contracting draw on different technologies which, in turn, generate different contractual possibilities and regulatory challenges.

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<sup>63</sup> See <https://www.fca.org.uk/firms/regulatory-sandbox>.

<sup>64</sup> See references in n 18 above.

<sup>65</sup> Mak, n 32 above.

## 1 Finding Contractual Partners

Digital technologies are increasingly used by individuals and companies to find, screen and select potential contractual counterparties. These activities form an important first stage in the life cycle of a contract. As we have seen, platforms play a major role in this phase by providing services of matchmaking. For example, eBay provides an effective tool of channelling buyers toward potential sellers; Uber connects drivers and travellers; Airbnb links hosts and guests; and crowdfunding platforms bring issuers and investors together.

However, we would like to note that the use of digital technologies in the pre-contractual phase is not limited to platforms and the specific market dynamics they engender. Companies, including those other than platforms, are increasingly relying on data mining and scoring techniques, enhanced by machine learning, to identify targets for marketing and contracting.<sup>66</sup> As is well-known, personal data about potential addressees of marketing material or contractual offers is collected to this end by a variety of companies and advertising networks.<sup>67</sup> In this way, personal data is converted into a valuable commercial product, which pays for many of the ‘free’ services most consumers nowadays take for granted in the digital world.<sup>68</sup> The disclosure of data between data-collecting companies, such as digital platforms, data brokers or advertising networks, not only raises data protection concerns;<sup>69</sup> it also creates novel informational asymmetries between those companies having access to the relevant data and algorithms, and the data subjects who, in most cases, do not.<sup>70</sup> As a growing literature in theoretical and empirical economics shows, this leads to the possi-

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**66** See I. Witten *et al*, *Data Mining: Practical Machine Learning Tools and Techniques* (4<sup>th</sup> ed, Amsterdam: Morgan Kaufman, 2016) 26–27; F. Pasquale, *The Black Box Society* (Cambridge: Harvard University Press, 2016) chapter 2; V. Mayer-Schönberger and K. Cukier, *Big Data* (Boston: Houghton Mifflin Harcourt, 2013) chapter 6; A. Gandomi and M. Haider, ‘Beyond the hype: Big data concepts, methods, and analytics’ 35 *International Journal of Information Management* 137 (2015); for a particularly critical perspective, see, eg, C. O’Neil, *Weapons of Math Destruction* (New York: Crown, 2016).

**67** See, eg, F. Borgesius, *Improving privacy protection in the area of behavioural targeting* (PhD thesis, 2014), <http://dare.uva.nl/search?identifier=c74bdba6-616c-4cd9-925e-33a5858935e5>, chapter 2.

**68** C. Hoofnagle and J. Whittington, ‘Free: Accounting for the Costs of the Internet’s Most Popular Price’ 61 *University of California Los Angeles Law Review* 606 (2014); Hacker and Petkova, n 27 above, 17–24.

**69** Borgesius, n 67 above, 82 *et seq*; O. Lynskey, *The Foundations of EU Data Protection Law* (Oxford: Oxford University Press, 2016) 196 *et seq*.

**70** Calo, n 6 above, 1002–1012; 1015–1018; Mik, n 6 above, 12 *et seq*.

bility of so-called exploitative contracting.<sup>71</sup> In this, contractual offers are tailored, by data-savvy companies, to the behavioural vulnerabilities of current or future clients.<sup>72</sup> For example, consumers with significant present bias may be served offers for teaser rates that, for these consumers, have negative expected value. This raises the question of the enforcement of the principle of fairness at the pre-contractual stage, where on the one hand innovative contracting minimizing search costs should be facilitated, but exploitative schemes mitigated. An important avenue of future research will be to inquire how notions of fairness can be squared with automated screening procedures enhanced by artificial intelligence.<sup>73</sup> This is particularly relevant to European Contract Law where, in contrast to US contract law, notions of fair bargaining during the pre-contractual process are recognized.<sup>74</sup>

Furthermore, discrimination is a crucial concern when automated algorithmic decisions are employed to screen potential contractual parties.<sup>75</sup> For example, data mining and machine learning techniques are increasingly used to select job applicants.<sup>76</sup> As a number of articles have shown, however, bias may enter these algorithmic processes at various instances of the design and application of the algorithm – particularly in the case of self-learning algorithms.<sup>77</sup> This is a real concern when, for instance, the data of historically successful candidates constitute the training data in machine learning; if, for historical reasons, these candidates were mostly white males, the algorithm will likely find white and male

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71 B. Kőszegi, 'Behavioral Contract Theory' 52 *Journal of Economic Literature* 1075, 1104–1110 (2014); P. Heidhues *et al.*, 'Exploitative Innovation' 8 *American Economic Journal: Microeconomics* 1 (2016).

72 See again Calo, n 6 above.

73 See, eg, C. Dwork *et al.*, 'Fairness Through Awareness' *Proceedings of the 3<sup>rd</sup> Innovations in Theoretical Computer Science Conference* 214 (2012); R. Zemel *et al.*, 'Learning Fair Representations' 28 *Proceeding of the 30<sup>th</sup> International Conference on Machine Learning* 325 (2013).

74 See, for the European perspective, Study Group on a European Civil Code / Research Group on EC Private Law (Acquis Group), *Principles, Definitions and Model Rules of European Private Law*, Outline Edition (Munich: Sellier, 2009) Principles 7, 8 and 10, 65–68; for the US perspective, Restatement (Second) of Contracts § 205 cmt c (Philadelphia: ALI, 1981); § 1–304 UCC (both restricting the obligations of good faith to the performance and enforcement of a contract).

75 S. Barocas and A. Selbst, 'Big Data's Disparate Impact' 104 *California Law Review* 672 (2016); Hacker and Petkova, n 27 above.

76 P. Kim, 'Data-Driven Discrimination at Work' *William & Mary Law Review* (forthcoming), <http://ssrn.com/abstract=2801251>.

77 See, eg, T. Calders and I. Žliobaitė, 'Why Unbiased Computational Processes Can Lead to Discriminative Decision Procedure's, in B. Custers *et al.* (eds), *Discrimination and Privacy in the Information Society* (Berlin: Springer, 2013) 43.

applicants more attractive.<sup>78</sup> It remains doubtful in how far antidiscrimination law can tackle this problem.<sup>79</sup> Procedures of algorithmic fairness may offer a way forward here, a topic increasingly explored in the computer science literature<sup>80</sup> that only starts to make an impact on legal analysis.<sup>81</sup>

However, companies are not the only players using digital technology in the pre-contractual phase; increasingly, individual clients and consumers also use technical support to find contractual offers that fit their preferences, or to certify that they belong to a particular, advantageous group of consumers.<sup>82</sup> A key challenge for regulation in the digital economy is for regulators to bring about, or at least facilitate, the effective, efficient and fair functioning of such digital intermediaries.<sup>83</sup>

## 2 Drafting

The art of drafting a contract on the one hand consists in finding the right contractual clauses that fit the situational pattern. Increasingly, the identification of such clauses, and of relevant factual documents to support and complement a contract, can be delegated to AI agents.<sup>84</sup> For example, given certain parameters as to the factual environment of the contract (goods sold; quantities; time and place of performance; concrete counterparty), they could find clauses that are least likely to be litigated over, or that are least likely to trigger a longer negotiation process. Traditionally, lawyers would have consulted handbooks written by practitioners which condense the experience of many authors into practical, step-by-step drafting instructions. With the right set of training data, this experience can be ‘learned’ by an AI agent, and applied with greater speed to a given contractual situation than any human lawyer could

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**78** Cf S. Lowry and G. MacPherson, ‘A Blot on the Profession’ 296 *British Medical Journal* 657–658 (1988).

**79** See the references in n 75 *et seq* above.

**80** See references in n 73 above.

**81** Kroll *et al*, n 47 above.

**82** M. Gal and N. Elkin-Koren, ‘Algorithmic Consumers’ *Harvard Journal of Law and Technology* (forthcoming), <https://ssrn.com/abstract=2876201>.

**83** van Loo, n 39 above; O. Bar-Gill, *Seduction by Contract* (Oxford: Oxford University Press, 2012) 5.

**84** J. McGinnis and R. Pearce, ‘The Great Disruption: How Machine Intelligence Will Transform the Role of Lawyers in the Delivery of Legal Services’ 82 *Fordham Law Review* 3041, 3050–3052 (2014); H. Surden, ‘Machine Learning and Law’ 89 *Washington Law Review* 87, 110–114 (2014).

deliver.<sup>85</sup> It seems plausible that in AI agent could at least provide a decent first draft of a given contract, similarly to the one now produced by the legal associate and submitted to a partner for review. The advent of technology in the drafting sphere seems to harbinger a greater potential of personalizing contracts and adapting them to the specific circumstances of the environment; technology may thus fill some, but certainly not all, gaps in incomplete contracts by decreasing the costs of fitting contractual terms to specific parameters, and by providing estimates of the likely evolution of the contractual relationship.<sup>86</sup> Such applications of AI facilitated contractual drafting is different from the AI applications discussed in the previous section that gave rise to the problems of exploitation or discrimination: in drafting, while it cannot be excluded that issues of exploitation or discrimination may arise there as well, the focus is on the adaptation of contractual clauses to given environments. Hence, if negative externalities are a smaller problem in this context, the need for regulation would also be diminished, and the resulting legal relationships would seem to be governed to a greater extent by classical private law.

However, not only can the selection of clauses draw on digital technology; with smart contracts even the very obligations of the parties themselves can be expressed in code.<sup>87</sup> They can be written into a blockchain (particularly: the Ethereum blockchain) in order to make obligations clear, verifiable, and (partially) automatically executable. Smart contracts build on an early contribution by Nick Szabo<sup>88</sup> and are a variety of what Harry Surden later called ‘computable contracts’, ie, contracts in which obligations or conditions are specified as com-

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**85** G. Sartor, ‘Contracts in the Infosphere’, in Grundmann (ed), n 5 above, (forthcoming); for limitations, cf also Surden, n 84 above, 105–107; D. Katz, ‘Quantitative Legal Prediction – or – How I Learned to Stop Worrying and Start Preparing for the Data Driven Future of the Legal Services Industry’ 62 *Emory Law Journal* 909, 958 *et seq* (2013).

**86** On contractual gaps, see I. Ayres and R. Gertner, ‘Filling Gaps in Incomplete Contracts: An Economic Theory of Default Rules’ 99 *Yale Law Journal* 87–130 (1989).

**87** On smart contracts, see, e.g., Idelberger, n 5 above; R. Weber, ‘Contractual Duties and Allocation of Liability in Automated Digital Contracts’, in Schulze and Staudenmayer, n 6 above, 163–187; G. Peters and E. Panayi, ‘Understanding Modern Banking Ledgers through Blockchain Technologies: Future of Transaction Processing and Smart Contracts on the Internet of Money’, in P. Tasca *et al* (eds), *Banking Beyond Banks and Money* (Switzerland: Springer International Publishing, 2016) 239–278; Wright and de Filippi, n 5 above, 10–12 and 24–26; Ch. Lim *et al*, ‘Smart Contracts: Bridging the Gap Between Expectation and Reality’, *Oxford Business Law Blog* (11 July 2016), <https://www.law.ox.ac.uk/business-law-blog/blog/2016/07/smart-contracts-bridging-gap-between-expectation-and-reality>; Buterin, n 23 above.

**88** N. Szabo, ‘Formalizing and securing relationships on public networks’ 2 (9) *First Monday* (1997) <http://ojphi.org/ojs/index.php/fm/article/view/548/469>.

puter data and which were pioneered, particularly, in the financial sector.<sup>89</sup> Their implementation in code triggers a whole set of questions concerning, for example, the effect of the illegality of certain obligations on the nature of their automated execution, or the limited congruence between ‘contracts’ in a blockchain and ‘contracts’ in a legal sense. As was noted above, smart contracts may be rewritten to a certain extent if the parties so agree.<sup>90</sup> However, neither of the parties may unilaterally invalidate any of the contractual provisions even if they clearly violate the law. This poses a problem insofar as the self-executing character of the provisions means that the provision will be enforced nevertheless.<sup>91</sup> Hence, we suppose that the drafting stage in smart contracts assumes an importance that is possibly even greater than under ‘dumb’ contracts: parties must be aware of the fact that they cannot unilaterally withhold performance once it has been written into a smart contract. Whether nullity or substantive control of standard terms are instruments which will still be developed in this context is an open question. We shall come back to some of these issues in the subsection addressing performance (below, III 4). What remains clear, at this point already, is that the blockchain environment links the different stages of a contractual life cycle together in a closer way than is the case with traditional contracts.

### 3 Formation

At the formation stage, three types of digital mediation may be distinguished that run from more mainstream and established digital technology all the way to cutting-edge innovations of artificial intelligence. The first type comprises contracts formed using declarations of will that are exchanged electronically, for example by email. Since the year 2000, these practices have been governed at the European level by the E-Commerce Directive (ECD, above note 8) that, importantly, contained specific information duties meant to ensure that both parties are fully informed about the identity of the counterparty, the main parameters of the object of the contract, particularly the price (Article 5 *et seq* ECD), and the most important steps of contract formation and content (Article 10 ECD). Furthermore, the ECD ensured that national contract law allowed for the formation of valid contracts by electronic means (Article 9(1) ECD), thus treating online and offline contracts essentially similarly with respect to most legal requirements and con-

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<sup>89</sup> H. Surden, ‘Computable Contracts’, 46 *UC Davis Law Review* 629, 634 *et seq* (2012).

<sup>90</sup> N 35 above and accompanying text.

<sup>91</sup> Wright and de Filippi, n 5 above, 25–26.

sequences (other than the ones just discussed). As Roger Brownsword argues, the key aim of this provision, and a key aim of the ECD in general, was to provide certainty about the legal validity of online transactions in an early age of online contracting.<sup>92</sup> However, with the advent of the new world of profiling, scoring and personalization (above, II 1), he argues, another regime for contractual formation might be needed that clearly differentiates between the diverging challenges of offline and online contracts. To some extent, if we accept this point, it is unclear whether such a regime would best be developed at a national or a European level, or (probably) on both; nevertheless, the novel asymmetries of information and power that digital technologies give rise to have already provoked a host of regulatory ideas to re-establish a balance of interest, and the possibilities of informed decisions, at the stage of the formation of contract.<sup>93</sup> Whether this will eventually lead to an entirely separate formation, and general legal, environment for digital contracts awaits further scrutiny.<sup>94</sup>

The second type of digitally mediated contractual formation is reached where not only declarations of will are exchanged electronically, but where their exchange, and the market, is additionally structured by a digital platform that facilitates the matching of contractual parties; beyond matchmaking, the platform may also serve as a device for the formation and storage of the terms of the contract (above, II 3). While facilitating the formation of contracts, platforms also gather a number of personal data from their users, contributing to the scoring process described for the pre-contractual stage (above, III 1). Again, different stages of contracting merge.

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**92** Brownsword, n 10 above.

**93** See, eg, Sachverständigenrat für Verbraucherfragen, *Verbraucherrecht 2.0 – Verbraucher in der digitalen Welt*, Report (Berlin, 2016) 19–24 and 46–48; Hacker and Petkova, n 27 above, discussing, inter alia, mandatory data-free services, to be chosen in an active choice regime at the moment of contract formation, the control of contractual terms concerning privacy via the unconscionability / unfair contractual terms doctrine, and democratization of data collection; Calo, n 6 above, 1047, suggesting a paid-option regime; Hoofnagle and Whittington, n 68 above, 657 *et seq.*, promoting, inter alia, mandatory price setting for ‘free’ offers.

**94** The Commission seems to be taking preliminary steps towards such a separate regime in the proposed Directive on Contracts for the Supply of Digital Content, which cuts across contractual typologies and differentiates, instead, between contracts with, and without, digital content (see below, IV); however, the proposal does not include novel provisions governing the formation of contracts; similarly, rules on contractual formation are absent from the proposed Directive on Online and other Distant Sales of Goods.

The third type of digitally mediated contract formation is reached with the advent of artificial intelligence.<sup>95</sup> The acceptance of an offer, or even the formulation of a counter-offer, may be delegated to AI agents who, acting with different degrees of autonomy, conclude the contract on behalf of their principal.<sup>96</sup> While platforms, therefore, facilitate the formation of the contract, AI agents may take the very steps of contract formation themselves. Obviously, both technologies (platforms and AI agents) may come together, particularly as machine-to-machine communication becomes more important with the spread of the Internet of Things.<sup>97</sup> If intelligent, personal digital assistants take over many of the more, and increasingly perhaps even less, mundane tasks of ordering goods and services for consumption, the real challenge for contract law at the formation state will likely not involve the ‘automated consumption’,<sup>98</sup> and contracts, between these agents, but the original, ‘contractual’ acts of delegation between humans and their digital assistants. Here, we believe that concepts developed in the tradition of commercial and company law may prove fruitful that deal with the adequate empowerment and monitoring of agents in small companies, as consumers increasingly approximate principals that delegate authority and discretion to their digital agents/assistants – with the necessary adaptation of these rules from the business to the consumer world. For example, we can imagine to differentiate between types of authority of different reach (from the fully authorized signatory (*Prokurist*) to the simple shop(ping) assistant<sup>99</sup>) that are standardized as consumers choose from a menu of digital assistants they would like to ‘hire’. To facilitate this choice, the different types of authority different digital assistants imply could be marked, in a ‘traffic light system’, with different colours, spanning from green (for limited authority) to red (extensive authority). The automated transactions between digital assistants themselves might become less relevant for contract law as the focus will be on their factual implementation and execution. Meanwhile, more explicitly regulatory approaches will then be needed, where necessary, to shape the design of and the interactions between the digital assistants themselves to ensure that the very asymmetries of information and power that shape relationships between humans, and that are subject to legal review and regulation, are

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<sup>95</sup> For a primer on AI, see, eg, S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach* (3<sup>rd</sup> ed, Upper Saddle River: Prentice Hall, 2010) chapter 1; for applications, see Witten *et al*, n 66 above, chapter 1; McKinsey Global Institute, *The Age of Analytics*, Report (London, 2016) 81–93.

<sup>96</sup> Sartor, n 85 above.

<sup>97</sup> Cf Surden, n 89 above, 694 *et seq*; M. Weyrich *et al*, ‘Machine-to-Machine Communication’ 31 (4) *IEEE Software* 19–23 (2014).

<sup>98</sup> Brownsword, n 10 above.

<sup>99</sup> Cf §§ 48–58 German Commercial Code (*Handelsgesetzbuch – HGB*).

not re-created between digital assistants of various stages of development and capacities. A related challenge is presented by predatory and exclusionary conduct, or contracts, undertaken by digital assistants, to be answered by future antitrust law.<sup>100</sup>

In all of these novel methods of drafting and formation, the use of adaptive, intelligent systems seems to us to harbour the possibility of making contracts more amenable to the continuous adaptation of the terms of the contract to novel developments. If both parties so wish, they could agree on an adaptation of, for example, the coded provisions of a smart contract to reflect a change in the present state of the world, or in the estimation of the likelihood of future events. It does not even seem far-fetched to imagine that both parties to a contract could use AI agents, as legal agents, and delegate to them the task of agreeing on mutually beneficial contractual updates as new information (for example, on a shift of supply or demand in the market concerning a good that is object to a sales contract) becomes available.<sup>101</sup> This would certainly strengthen, as noted before, the relational character of the contract.

## 4 Performance

Importantly, even the performance of a contract may, partially or entirely, be delegated to digital technology. In computable or smart contracts, this goes beyond the mere payment with electronic payment systems. Rather, the fulfilment of any number of conditions upon which the performance is contingent may be electronically verified; upon verification, automated performance mechanisms may be initiated. Again, blockchain technology is particularly suitable for these tasks as it provides a consensus mechanism for the verification of certain conditions, for example the payment of specified amounts of cryptocurrency, such as Bitcoins, to the designated recipient. Similarly, the transfer of other assets may be recorded on electronic ledgers using blockchain technology. A central problem of this approach remains the verification of events that happen ‘off chain’; Ethereum, for example, has introduced so-called ‘oracles’ that could monitor and verify external events that trigger contractual consequences, similar to a panel of arbiters.<sup>102</sup>

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**100** Gal and Elkin-Koren, n 82 above, 38–47.

**101** Cf also Idelberger, n 5 above, section 4.1.

**102** V. Buterin, ‘Ethereum and Oracles’, Ethereum Blog (22 July 2014), <https://blog.ethereum.org/2014/07/22/ethereum-and-oracles/>; see also Weber, n 87 above, 166–167.

As is well-known, probably the most important technological contribution of blockchain is the solution of the problem of the trusted third-party.<sup>103</sup> Blockchains operate in a way not requiring reliance on personalized trust because of the distributed consensus mechanism that ties the verification of each additional block to a majority vote of the nodes running the chain. Hence, there is no central party that needs to be trusted to verify and guarantee the authenticity of the information contained in the blockchain. Similarly, smart contracts offer a way of mitigating the problem of trust concerning the willingness of the party to perform the contract. Since performance is enforced automatically once the conditions specified in the contract are met, there is no way for the bound party to unilaterally withhold performance.<sup>104</sup> The need for verification of off chain events does reintroduce a certain amount of necessary trust (in oracles, for example); but to the extent that verification by multiple independent nodes (oracles), rather than by the (conflicted) counterparty of a contract, is perceived as more objective, the required level of trust is still lower than in a traditional contract.<sup>105</sup> Additionally, as the transfer of more and more movable and immovable objects (such as securities; real estate; cars) is executed on blockchains, both performance and counter-performance can be verified on the chain, making trusted oracles obsolete for these purposes.<sup>106</sup> To be sure, automated enforcement potentially creates other problems in contract law, for example when the party would have a right to withhold performance even though the conditions specified in the original contract are met. Nevertheless, automated performance and enforcement generally lower the level of trust needed between the parties,<sup>107</sup> and hence make cooperation, and mutually beneficial contracts, more likely to occur.

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**103** Nakamoto, n 21 above, 2.

**104** Lim *et al*, n 87 above.

**105** Cf J. Weldon, 'Building an "Oracle" for an Ethereum Contract' *Medium* (11 October 2016), <https://medium.com/@mustwin/building-an-oracle-for-an-ethereum-contract-6096d3e39551#.f335uyw5a>; B. Arruñada, 'Blockchain's Struggle to Deliver Impersonal Exchange', *Pompeu Fabra University Economics and Business Working Paper Series 1549* (2017), <https://ssrn.com/abstract=2903857>, 31.

**106** See M. Iansiti and K. Lakhani, 'The Truth About Blockchain' *Harvard Business Review* (January-February 2017), <https://hbr.org/2017/01/the-truth-about-blockchain>, for the growing potential of transferring ownership via blockchains.

**107** Cf A. Kosba *et al*, 'Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts' *Proceedings of the 2016 IEEE Symposium on Security and Privacy (SP)* (San José: IEEE, 2016) 839; but see also Arruñada, n 105 above.

## 5 Linking Contracts

Different contracts may be linked into contractual networks using a system of smart contracts. One particular, and particularly noteworthy, instantiation of such smart contractual networks are decentralized autonomous organizations (DAOs), ie, systems written in code that function with a large degree of independence from human intervention and that are endowed with some internal capital they allocate to certain functions.<sup>108</sup> They may be used, for example, as investment vehicles that automatically collect contributions by investors, invest the collected funds, and distribute the returns according to a pre-specified algorithm. The investment decisions can be subjected, to different degrees, to the votes of investors; this promises to minimize monitoring costs for (the non-existent) human managers while, at the same time, allowing for shareholder voting to remain meaningful.

However, as the spectacular hack of the best-known DAO in June 2016 showed,<sup>109</sup> such contractual networks not only give rise to questions of the application of securities regulation, investor protection or company law, but also and prominently of the (cyber)security of invested funds. The complexity of such linked contracts therefore not only allows to offer novel forms of investment packages, and contractual networks or network contracts, but also highlights the risks of cyber security that increase with the number of attack points a complex system offers.<sup>110</sup> Given that many commentators see the core advantages of the organizational contract (long-term and typically arranged in networks) in its informality and in the role an open system of reciprocity plays,<sup>111</sup> a word of caution would seem to be required before one derives lessons from arrangements in digital networks (typically highly formalized) to those in the analogue world.

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**108** Buterin, n 5 above.

**109** J. Wong and I. Klar, ‘Everything you need to know about the Ethereum “hard fork”’ *Quartz* (18 July 2016), <http://qz.com/730004/everything-you-need-to-know-about-the-ethereum-hard-fork/>.

**110** Cf B. Schneier, ‘Click Here to Kill Everyone’ *New York Magazine* (27 January 2017), [nymag.com/selectall/2017/01/the-internet-of-things-dangerous-future-bruce-schneier.html](http://nymag.com/selectall/2017/01/the-internet-of-things-dangerous-future-bruce-schneier.html).

**111** See references above n 31 and O. Williamson, ‘Transaction-Cost Economics: The Governance of Contractual Relations’ 22 *Journal of Law & Economics* 233–261 (1979); O. Williamson, *The Economic Institutions of Capitalism – Firms, Markets, Relational Contracting* (New York / London: MacMillan, 1985) esp chapter 2.

## 6 Interpretation

A final issue that will likely arise as digitally mediated contracts become more popular is the question of interpretation. There seems to be a patent lack of literature on this issue, and we shall restrict our observations in this overview to pointing out three specific problems and avenues for future research. First, some debate exists already on whether special rules of interpretation should govern contracts concluded by (mainstream) electronic means;<sup>112</sup> this problem is exacerbated when parties simply assent to contractual terms supplied by platforms, and do not exchange declarations of will in the traditional sense; or when AI agents ‘exchange’ offer and acceptance. Second, interpretation presents a particularly thorny issue with smart contracts written entirely in code. It remains to be seen how courts will grapple with the difficulty of ‘interpreting’ a programming language that, in many respects, differs from a natural language.<sup>113</sup> Third, AI technology may be used to estimate the outcome of legal disputes, be they over smart or traditional contracts.<sup>114</sup> With increasing granularity of the prediction of the court interpretation of clauses, the results of this prospective interpretation can be fed back into the drafting stage of the contract. Hence, it becomes clear that, with the digitalization of contracting, the life cycle of a contract quite literally, in many aspects, becomes a real cycle in which beginning, end and other stages tend to overlap and mutually influence one another.

## IV Digital Objects of Contract – CESL II and More

We finally turn to the last pillar of the architecture we are describing: digital objects of contract. From a bird’s eye perspective, the following contracts with

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**112** See, eg, C. Gillette, ‘Interpretation and Standardization in Electronic Sales Contracts’ 53 *SMU Law Review* 1431 (2000); F. Schuster, in G. Spindler and F. Schuster, *Recht der elektronischen Medien* (3<sup>rd</sup> ed, Munich: Beck, 2015) § 305c BGB, para 14.

**113** See S. Grundmann and Ph. Hacker, ‘The Digital Dimension as a Challenge to European Contract Law – the Architecture’, in Grundmann (ed), n 5 above, (forthcoming), under III 6; cf also C. Prisacariu and G. Schneider, ‘A formal language for electronic contracts’, in M. Bonsangue and E. Johnsen, *International Conference on Formal Methods for Open Object-Based Distributed Systems* (Berlin: Springer, 2007) 174.

**114** D. Katz *et al*, ‘A General Approach for Predicting the Behavior of the Supreme Court of the United States, *Working Paper* (2017), <https://ssrn.com/abstract=2463244>; T. Ruger *et al*, ‘The Supreme Court Forecasting Project: Legal and Political Science Approaches to Predicting Supreme Court Decision-Making’ 104 *Columbia Law Review* 1150 (2004); overview in: Katz, n 85 above, 936 *et seq*.

digital content may be distinguished: first, the digital component may reside in the performance or in the counter-performance of a contract. The performance may, on the one hand, be related to personal or, on the other hand, to non-personal data. In the former instance, European data protection law, parts of which may be viewed as a specific regulatory framework for contracts concerning the processing of personal data, governs the legal relationships.<sup>115</sup> For example, when personal data is sold or rented to third parties by data brokers, the main questions of data protection law are now treated in the General Data Protection Regulation (GDPR). However, the object of performance may also be related to non-personal data. For example, contracts govern the download of e-books or the provision of certain digital services on the manifold platforms that constitute the backbone of the digital economy.<sup>116</sup>

It has become a common understanding, however, that digital content need not only be the object of the contractual performance, but may also constitute the counter-performance. Non-monetary forms of ‘payment’ have become particularly important whenever digital services are provided free of monetary charge.<sup>117</sup> The data transferred is almost always personal data of the users. On the one hand, this data enables the provision of targeted, personalized advertisement to these very users (above, III 1), for which providers of multi-sided platforms are able to charge higher prices to advertisers than for non-targeted advertisements.<sup>118</sup> On the other hand, the analysis of the personal data provided helps the platforms, and other companies, to continuously improve their analytic and predictive models, which may then be applied to *other* users, thus contributing to the very essence of the algorithmic prowess that makes these companies so economically valuable today.<sup>119</sup>

Hence, we want to note that whenever personal data constitutes the counter-performance, it becomes questionable what the characteristic performance of the contract is.<sup>120</sup> Traditionally, in the provision of goods or services in exchange for

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**115** See art 2, Reg 2016/679 [General Data Protection Regulation]; for an overview of European data protection law, see Lynskey, n 69 above.

**116** See, eg, Sachverständigenrat für Verbraucherfragen, n 93 above, 48; A. Metzger, ‘Dienste gegen Daten: Ein synallagmatischer Vertrag’ 216 *Archiv für die civilistische Praxis* 817 (2016).

**117** See references, n 68 above.

**118** Hacker and Petkova, n 27 above, 17–24.

**119** Cf E. Siegel, *Predictive analytics: The power to predict who will click, buy, lie, or die* (Hoboken: Wiley, 2013); Gandomi and Haider, n 66 above, 143; Mayer-Schönberger and Cukier, n 66 above, chapters 2 and 6; Witten *et al*, n 66 above, 28–30; H. Chen *et al*, ‘Business intelligence and analytics: From big data to big impact’, 36 *MIS quarterly* 1165–1188 (2012).

**120** Cf Rec 19 Reg 593/2008 [Rome I].

money, the monetary component is regarded as uncharacteristic.<sup>121</sup> However, since personal data is the very fuel that keeps the engine of the data-driven business models running, and is put to multiple kinds of analytic and predictive uses that money is not, one might be tempted to conclude that, in many cases, it becomes as, or even more, characteristic as the service for which it is exchanged. This holds particularly true when the service is quite trivial in nature, such as a simple flashlight app for a smart phone. This may have repercussions (i) within private international law as the characteristic performance determines, if no contractual type can be easily identified, how a contract is qualified and the law of what country is applicable to it;<sup>122</sup> and (ii) for the default legal regime applying to a contract that, often, will also follow the characteristic performance, particularly insofar as this regime is not fully contained in the proposed Directive on certain aspects concerning Contracts for the Supply of Digital Content (CSDC, above n. 11), to which we now turn.

Intended as a continuation of the Common European Sales Law (CESL) with other means, and with a different scope,<sup>123</sup> the two proposed directives on contracts for the supply of digital content and for online sales assimilate the framework of obligations and remedies from the Directive on the Sale of Consumer Goods<sup>124</sup> to digital contracts.<sup>125</sup> However, in sticking to (a narrowed version of) the CESL frame of specifying general rules of contractual conformity and remedies, the directives fail to address some of the biggest challenges that digital contracting poses and that were described in the previous section (second pillar). For example, the phenomenon of data as a novel currency is clearly recognized and covered by Article 3(1) CSDC. Nevertheless, none of the crucial questions following from this observation are addressed, such as: (i) What is the value of data,<sup>126</sup> and may this lead to serious imbalances in the contractual obligations? (ii) How far is data processing enabled by the exchange of data for services and goods excessive, and how can the law mitigate exploitative schemes (above, III 1)? (iii) How can issues of discrimination that arise in the pre-contractual phase be

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**121** D. Martiny, in *Münchener Kommentar*, Rom I-VO (6<sup>th</sup> ed, Munich: Beck, 2015) Art 4, para 172.

**122** Art 4(2) Rome I.

**123** This is not the place to retell the story of CESL and its predecessors; for references, see, n 14 above; for the connection of CESL to the digital era, see, eg, R. Schulze, 'The New Shape of European Contract Law' *Journal of European Consumer and Market Law (EuCML)* 2015, 139–144; for the different scope of CESL and the proposed directives, see, eg, Spindler, n 15 above, sub II and III.

**124** Dir 1999/44/EC.

**125** For differences, see, eg, Smits, n 13 above.

**126** See, eg, Hacker and Petkova, n 27 above, 17–24; A. Acquisti *et al*, 'What Is Privacy Worth?' 42 *Journal of Legal Studies* 249–274 (2013).

addressed (above, III 1)? It seems that the Commission, with its focus on spurring economic growth through the digital economy,<sup>127</sup> and by restricting its regulatory ambitions to a set of obligations and remedies mostly taken from CELS, is missing some of the important, novel dynamics that digital contracting has engendered.

Another key difficulty in the legal framework governing contracts with digital content will be the reconciliation of the CSDC with the novel EU data protection law that applies whenever personal data are processed. There are a number of palpable contradictions between the GDPR and the CSDC;<sup>128</sup> the most notable probably is the right to withdraw consent to the processing of personal data according to Article 7(3) GDPR, which seems to conflict with the enforceable duty to provide accurate personal information once personal data is perceived as the counter-performance in a contract exchanging economically valuable goods – which is precisely the perspective of the CSDC. One potential regulatory option would be to distinguish between contracts with monetary compensation (fully enforceable) and those – much more informal ones – where an online ‘service’ is rendered accessible to those who give their personal data ‘in compensation’, and deal with these situations without making recourse to the concept of a ‘binding’ contract at all (no will of being bound). As regards the law as proposed in the two regulations, it remains an open question whether Article 7(3) GDPR would mandate a right of rescission for contracts where personal data constitutes the counter-performance, and what the consequences of the use of this right would be for the contractual relationship. Article 13(2)(b) CSDC holds that, upon termination, ‘the supplier shall [...] refrain from the use of the counter-performance other than money which the consumer has provided in exchange for the digital content and any other data collected [...]’; this seems consonant with Article 7(3) GDPR which provides that ‘[t]he withdrawal of consent shall not affect the lawfulness of processing based on consent before its withdrawal’. This should, however, not contradict any improvement already made prior to termination that can still be used after termination without any impact on the personal data. The most important example might be the incrementally improved performance of the predictive model which will continue to accrue to the provider even after the contract is terminated or consent withdrawn.<sup>129</sup>

Another troubling divergence between GDPR and CSDC lies in the *extent* to which users may use personal data as a means of counter-performance.<sup>130</sup> Article 3(1) CSDC treats monetary and non-monetary forms of counter-performance

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127 Digital Single Market Strategy for Europe, COM(2015) 192 final, 3.

128 Cf Spindler, n 15 above; Metzger, n 116 above, 825–826.

129 Cf Staudenmayer, n 13 above, 819–820.

130 Cf Metzger, n 116 above, 824; Schweitzer, n 36 above.

identically; hence, one may suppose, payment with data is not subjected to any substantial limits, similar to the payment with money (except provisions in general contract law governing the adequate balance of performance and counter-performance – which again are difficult to apply when personal data with uncertain value is at stake). The novel Article 7(4) GDPR, however, stipulates that for the assessment of freedom, and hence validity, of consent to process personal data, ‘utmost account shall be taken of whether, *inter alia*, the performance of a contract, including the provision of a service, is conditional on consent to the processing of personal data that is not necessary for the performance of that contract’. The provision is meant to push back against the ever-increasing demand for more personal data on a take-it-or-leave-it basis by providers of digital content, and to limit the amount and type of personal data that can be ‘used’ as a medium of exchange (cf Recitals 42–43 GDPR): to the extent that data is not necessary for the performance of the contract, one may not, under the conditions of Article 7(4) GDPR, use it as counter-performance. To be sure, it remains highly doubtful what data exactly are necessary for the performance of a contract – as we have seen, it is increasingly difficult to attach a single, characteristic purpose to a contract in which data is exchanged against goods or services. Rather, economically speaking, the purpose of the contract precisely lies in this very exchange.<sup>131</sup> The interpretation of Article 7(4) GDPR by the CJEU therefore is difficult to forecast. Meanwhile, Article 3(7) CSDC specifies that other Union acts take precedence over the CSDC, and Article 3(8) CSDC reiterates this for EU data protection law; hence, Article 7(4) GDPR will eventually define in how far data may be used as remuneration. However, to the extent that Article 3(1) CSDC wants to subject precisely the very contracts that the GDPR governs to the CSDC regime of obligations and remedies, it would be premature to brush the differences between the two legislative acts aside by reference to the subsidiary character of the CSDC – otherwise, some of its most novel provisions would be hollowed out before even taking effect, and without a discussion of normative issues at all.

Those are only some of the problems that plague the CSDC. The future of digital contracting, and the future of the academic discussion, will tell whether it will fulfil its promise to facilitate cross-border trade and contracting.

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131 Cf A. Acquisti *et al*, ‘The Economics of Privacy’ 54 *Journal of Economic Literature* 442, 448, 477–478 (2016).

## V Conclusions

The purpose of this article is to provide an overview of the interactions between digital technologies and European Contract Law. The general architecture of these interactions rests on three distinct yet interrelated pillars: 1) the regulatory framework, which may even harness digital technology for regulatory purposes; 2) digital technology employed at different stages of the contractual life cycle, from pre-contractual search, screening and signalling to drafting, formation and performance, and even all the way to the linking and interpretation of contracts; and finally 3) digital content as the object of (traditional or, more often, digitally mediated) contracts.

We have tried to show that, as every good piece of architecture, the contractual digital architecture also subscribes to a certain narrative; it knows exceptions, but it nevertheless captures a tendency that will likely become ever more impactful as digitization proceeds. We see four main storylines in this narrative that all have to do with a growing interpenetration of different contractual parameters. First, national and global markets, contracting partners, and thus contractual regimes become increasingly interlinked as services are exchanged, and data is transferred, across borders, and as the regulatory environment is shaped by global dynamics. Second, the contractual basis is subject to ever greater modification and continuous updating over time; intelligent agents may even adapt contractual provisions in real time as new information becomes available. Third, the different stages of contracting, from the search for contractual partners to formation and enforcement, and even interpretation, are increasingly linked by digital processes in which feedback on, and predictions for, one or more of these stages is directly implemented into the other stages, bringing the contractual life cycle closer than ever to full circle. Fourth, in the supply of digital content, it is becoming increasingly unclear which contractual obligation may be deemed characteristic for the contract, and which a mere ‘counter-performance’; this holds particularly true when this counter-performance is effectuated by the provision of personal data instead of money which, amazing enough, also brings back exchange in kind in high volumes to a society which seemed to have left behind such transactions as mass transactions for a long time. The normative discussion on these transactions, particularly on the bases of evaluation, has only just started.

Regulatory challenges arise at many different stages and levels of these interlinking pieces of the architecture. We suppose that, as the processes underlying digital contracting become more fluid and interwoven, users will benefit insofar as new information can be integrated into evolving contractual arrangements; however, where this adaptive environment leads to severe imbalances of

information, power, and agency, the ordering forces of the law may be more needed than ever to provide for the safeguarding of core legal values in the digital economy. After all, many important pieces of architecture include some version of *Iustitia* in their narrative.