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ALGORITHMIC CHALLENGES TO AUTONOMOUS CHOICE

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"I never think of the future. It comes soon enough. . ."

Albert Einstein

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I. INTRODUCTION

Human choice is a foundational part of our social, economic and political institutions. Many decisions that in the past were determined by birth, religion, or social rank are now determined by individuals, whether independently or collectively. Our political and market systems, for example, are largely based on the aggregation of human choices. This is not to say that choices are unlimited. The state places limits on some types of actions, such as how we can express our aggressions or joys, while market forces and technological limitations determine the menu of options from which we can choose. Yet human choice is an integral and fundamental part of our private and public lives.

This focus is about to be significantly challenged, at least in the marketplace. Technological advances in data collection, data science, artificial intelligence, and communications systems are ushering in a new era in which digital agents, operated through algorithms, replace human choice with regard to many transactions and actions.[1] While algorithms are given assignments, they autonomously determine how to carry them out. Indeed, scientists envision a near future "where humans do less thinking when it comes to the small decisions that make up daily life."[2]

The day when algorithms will be able to make choices for users and carry them out is already here. This digital revolution has taken place in some supply markets, such as online trading,[3] and is now fast expanding in consumption markets. This remarkable transformation is happening thanks not only to developments in technology, but also to the increasing openness among users to having digital assistants make decisions for them.[4] While the first generation of consumer-oriented algorithms suggested products, services or actions for users to choose from (e.g., Kayak, Yelp, Amazon, etc.), those in the second generation make a decisions for the user rather than merely a suggestion, and automatically proceed to execute the actions or the transactions based on the decision, on the user's behalf ("algorithmic assistants"). To give a few examples, Samsung sells a washing machine which detects when detergent levels are low and automatically orders new deter-

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1. *See* Yuval Noah Harrari, *Yuval Noah Harari on Big Data, Google, and the End of Free Will*, FIN. TIMES (Aug. 26, 2016), https://www.ft.com/content/50bb4830-6a4c-11e6-ae5b-a7cc5dd5a28c.

2. *See* Danny Yadron, *Google Assistant Takes on Amazon and Apple To Be the Ultimate Digital Butler,* GUARDIAN, (May 18, 2016), https://www.theguardian.com/technology/2016/may/18/google-home-assistant-amazon-echo-apple-siri.

3. *See, e.g.*, Gregory Scopino, *Do Automated Trading Systems Dream of Manipulating the Price of Futures Contracts? Policing Markets for Improper Trading Practices by Algorithmic Robots*, 67 FLA. L. R. 221 (2015).

4. *See* Pedro Domingos*, Get Ready For Your Digital Model*, WALL ST. J. (Nov. 12, 2015), http://www.wsj.com/articles/get-ready-for-your-digital-model-1447351480.

gent;[5] Self-driving cars, already on the road in some localities, make a full range of driving decisions, from what route to take and when to fill the gas tank to how to engage with other vehicles and road users;[6] The British application Flipper monitors prices in the energy market and automatically switches suppliers for its users when it is profitable;[7] and a Hong Kong venture fund called Deep Knowledge Ventures appointed an algorithm to its board, enabling it to vote on investment decisions alongside its five human directors.[8]

Algorithmic assistants have much to offer. They offer speed, lower transaction costs and efficiency in decision-making, thereby enabling the user to enjoy lower cost and higher quality products.[9] Furthermore, artificial intelligence coupled with the analysis of big data enables algorithms to make more sophisticated choices. Accordingly, the algorithm's choices might sometimes suit the user's needs better than his own choices, which could be biased or based on limited information. Computer scientists predict that as more data about human actions and choices is accumulated and analyzed, the algorithm might know us better than ourselves.[10]

We will (hopefully) never reach the Matrix trilogy's vision of a world in which a computer makes all the choices for us while we float in a bubble, oblivious to the true nature of our reality.[11] But like the apple in the garden,

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5. Stan Higgins, *IBM Reveals Proof of Concept for Blockchain-Powered Internet of Things*, COINDESK (Jan. 17, 2015, 7:12 PM), http://www.coindesk.com/ibm-reveals-proof-concept-blockchain-powered-internet-things; SANJAY PANIKER ET AL., ADEPT: AN IOT PRACTITIONER PERSPECTIVE 13 (Draft. Copy for Advance Review, Jan. 7, 2015), http://www.scribd.com/doc/252917347/IBM-ADEPT-Practictioner-Perspective-Pre-Publication-Draft-7-Jan-2015.

6. *See, e.g.*, JOHN MCCARTHY ET AL., CONNECTED AND AUTONOMOUS VEHICLES: INTRODUCING THE FUTURE OF MOBILITY (2015), https://www.atkinsglobal.com/~/media/Files/A/Atkins-Corporate/uk-and-europe/uk-thought-leadership/reports/CAV_A4_080216.pdf.

7. *Flipper Team and Beyond*, FLIPPER https://flipper.community/company/about, (last visited Nov. 8, 2018).

8. Rob Wile, *A Venture Capital Firm Just Named an Algorithm to Its Board of Directors — Here's What It Actually Does*, BUS. INSIDER (May 13, 2014), http://www.businessinsider.com/vital-named-to-board-2014-5.

9. ARIEL EZRACHI & MAURICE E. STUCKE, VIRTUAL COMPETITION: THE PROMISE AND PERILS OF THE ALGORITHM-DRIVEN ECONOMY 191 (2016); Michal S. Gal & Niva Elkin-Koren, *Algorithmic Consumers*, 30 HARV. J. L. & TECH. 309, 311 (2017).

10. *See, e.g.*, James Max Kaanter & Kalyan Veeramachaneni, *Deep Feature Synthesis: Towards Automating Data Science Endeavors*, IEEE INTERNATIONAL CONFERENCE ON DATA SCIENCE AND ADVANCED ANALYTICS, (Oct. 2015), http://groups.csail.mit.edu/EVO-DesignOpt/groupWebSite/uploads/Site/DSAA_DSM_2015.pdf (reporting on an experiment in which the algorithm better predicted human behavior than humans).

11. THE MATRIX (Warner Bros. 1999); THE MATRIX RELOADED (Warner Bros. 2003); THE MATRIX REVOLUTIONS (Warner Bros. 2003). Observe that in the movie human choice is revered.

once tasted, algorithmic assistants may be impossible to live without.[12] Pedro Domingo, professor of computer science, predicts that "a decade from now, your personal model will be more indispensable than your smartphone."[13] This is because "[a]lgorithms will build data-driven alter egos for us that can do job interviews [and] shop for cars."[14] Indeed, "[s]oon enough, facing the fog of life without a good model to guide you will seem unendurable."[15] Furthermore, in a competitive world, market players who prefer to exercise their own decision-making power will not necessarily always have a meaningful ability to do so, given the comparative advantages of those using algorithms. Possible expectations that humans should be aided by algorithmic decision-making—thereby replacing the "reasonable person" with a "reasonable algorithm," at least in some areas[16]—might further limit one's genuine ability to make autonomous choices. Indeed, regulators are already encouraging the use of algorithms in some fields.[17]

This technological change goes to the heart of autonomous human choice.[18] The user, voluntarily and willingly, removes himself from the decision-making process.[19] Of course, he chooses which algorithm to employ[20]

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12. Shoshana Zuboff, *Big Other: Surveillance Capitalism and the Prospects of an Information Civilization*, 30 J. INFO. TECH. 75, 83 (2015).

13. Domingos, *supra* note 4.

14. *Id.*

15. *Id.*

16. *See, e.g.*, Ryan Abbott, *The Reasonable Computer: Disrupting the Paradigm of Tort Liability*, 86 GEO. WASH. L. REV. 1 (2018) (arguing that once computers become safer than people, they should become the new standard for care).

17. *See, e.g.*, Memorandum from Cass R. Sunstein, Adm'r, Office of Info. & Reg. Affairs, Informing Consumers through Smart Disclosure 2 (Sept. 8, 2011), http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/informing-consumers-through-smart-disclosure.pdf (directing all administrative agencies to pursue "smart disclosures" that provide consumers with access to the information they need to make informed decisions in machine readable data formats, in order to fuel the creation of interactive tools for consumers).

18. Of course, the use of algorithms raises other concerns as well, such as the displacement of human workers and a more limited ability of those contracting with the algorithm to raise arguments designed to "change its mind," given that it requires going back to the algorithm's designer. These issues are beyond the scope of this article, which focuses on human autonomous choice. We acknowledge that autonomy eludes a clear definition, and is a matter of degree. *See* Yochai Benkler, *Siren Songs and Amish Children: Autonomy, Information, and Law*, 76 N.Y.U. L. REV. 23, 32-35 (2001). In this article we allude to it as concerning the degree to which a person can be the author of his life, all constraints considered. Finally, a sub-set of the issues raised in this article can be applied to corporations that use algorithmic assistants as well.

19. In this article we mainly focus on the effects on the user of the algorithm, rather than on third parties involuntarily affected or subjected to algorithmic decisions. For issues that relate to third parties, *see, e.g.*, Andrea Roth, *Trial by Machine*, 104 GEO. L. J. 1245 (2016) (arguing that the use of machines and automated processes in the criminal justice system is problematic, inter alia, since they compromise dignity, equity, and mercy); Tal Zarsky, *The Trouble with Algorithmic Decisions: An Analytic Road Map to Examine Efficiency and Fairness in Automated and Opaque Decision Making*, 41(1) SCI., TECH., & HUM. VALUES

and may set at least part of the decision parameters. But other choices then follow automatically, in which the algorithm exercises its own judgment. Furthermore, due to developments in deep learning, a process by which the algorithm's decision parameters are continuously updated and refined based on data analysis, [21] the user might have no information about which parameters underlie the algorithm's choice, or how much weight is given to each parameter. Alternatively, the user might not have the capacity or the permission to exercise effective control over the algorithm's choices. One might say that this is a significant technological nail in the coffin of human choice, which follows the previous narrowing of choice through phenomena such as choice architecture and echo chambers.[22]

It is therefore time to explore whether and, if so, under which conditions, are we willing to give up our autonomous choice, and how autonomous algorithmic assistants affect existing laws which were designed to apply to human choice. Answering the first question requires us to explore the rationales that stand at the basis of autonomous human choice, and how they are affected by algorithmic assistants; to conscientiously contend with the "choice paradox" which arises from the fact that the decision to turn over one's choices to an algorithm is, itself, an act of choice. It also requires us to think seriously about the way in which the choices we make affect our values, identities, and the meaning and content of our lives.

We then explore how autonomous algorithmic assistants affect the legal framework. Some issues challenge the very use of algorithmic assistants: Should the law place an age limit on the use of such algorithms? Should legal limits be placed on their use in certain spheres? Other issues arise from

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118, 118-19 (2016) (focusing on fairness concerns, from unfair wealth distribution, unfair different treatment, etc.); M Ziewitz, *Governing Algorithms: Myth, Mess, and Methods*, 41(1) SCI., TECH., & HUM. VALUES 3, 5-6 (2016) (concerns include "bias, discrimination, fairness, distribution of visibility, surveillance, and accountability"). Some of these issues can be solved, at least partially, by computational neutrality. Another issue relates to human decision-making. Article 22 of the EU General Data Protection Regulation provides that individuals generally have the right not to be subjected to decisions that are based solely on automated processing, when these are deemed to have a significant effect. Regulation 2016/679, of the European Parliament and of the Council of 17 Apr. 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC, 2016 O.J. (L 119) 1 (EU).

20. Observe that should the employment of an algorithm not be voluntary, a different host of issues arises, which is beyond the scope of this article.

21. *See, e.g.*, OECD, DATA-DRIVEN INNOVATION FOR GROWTH AND WELL-BEING: INTERIM SYNTHESIS REPORT 4 (Oct. 2014). For examples of machine learning already used in algorithms, *see* EZRACHI & STUCKE, *supra* note 9.

22. For some of the most notable work on choice architecture, see generally Cass R. Sunstein & Richard H. Thaler, *Libertarian Paternalism Is Not an Oxymoron*, 70 U. CHI. L. REV. 1159, 1160 (2003); Richard H. Thaler & Cass R. Sunstein, *Libertarian Paternalism*, 93 AM. ECON. REV. 175, 179 (2003).

the construction of preferences[23] by algorithms. To wit, in a market in which demand is driven by algorithms, can we necessarily regard the choices made as expressions of user preferences that serve our socio-political goals? Even if the answer is positive—does this new mode of user choice fit current legal assumptions, such as those that apply to the notions of consent or intent? And are our regulatory tools, which seek to ensure that individual consumers can make informed decisions, outmoded? It is therefore essential to determine whether the existing legal framework is sufficiently potent to deal with this brave new world, or whether we need new regulatory tools.

Despite their importance and timeliness, these questions have not been dealt with in depth. This article seeks to fill this void. It proceeds as follows. Part II explores the lure and modes of operation of algorithmic assistants, and how these characteristics may affect human choice. Part III then analyzes the rationales for such choice, and explores how these rationales are affected by the employment of autonomous algorithmic assistants. As shown, while some rationales are not harmed—and might even be strengthened—by the use of autonomous algorithmic assistants, others challenge us to reconsider the meaning and the role that choice plays in our lives and to deal with the conflict between the efficient fulfillment of short-term preferences and the long-term ability to form such preferences. Part IV analyzes the implications of these new private orderings on regulation, with a special focus on laws based on assumptions of human autonomous decision-making. We summarize our findings in a short conclusion.

II. Choice in the Digital World

How do algorithmic assistants affect individual choice? This part of the article offers a short note on the technological capabilities, as well as the potential downsides, of algorithmic assistants. It then identifies and analyzes four non-exclusive categories of algorithmic assistants, with growing effects on choice. Such an analysis is necessary in order to provide a solid basis for understanding how algorithms affect human choice.

A. *Technological Abilities of Algorithmic Assistants*[24]

Computerized algorithms are structured decision-making processes that automate computational procedures to generate decisional outcomes on the basis of data inputs.[25] The decisional parameters and rules for weighting

23. We define preferences widely to include also those based on moral, ethical or intellectual values, such as fairness, generosity, or environmental protection. Preferences can include both short-term desires as well as long-term goals.

24. Largely based on Gal & Elkin-Koren, *supra* note 9.

25. *See, e.g.*, Thomas H. Cormen et al., Introduction to Algorithms 5 (3d ed. 2009).

them can be set by the algorithm's designer. Advanced algorithms employ machine learning, in which the algorithm self-adjusts based on its own analyses of data previously encountered, freeing the algorithm from predefined preferences. For instance, based on a consumer's past actions, an algorithm may conclude that the consumer likes to purchase products similar to those bought by his close friends, and change the decisional parameters accordingly.

A wide variety of algorithms already help users make choices. At the most basic level, algorithms offer information about possible options (e.g., Travelocity or Yelp).[26] Others narrow down the options, presenting only those assumed to be most relevant (e.g., Tinder, Amazon). The new generation of algorithmic assistants takes such services a step further, making and executing decisions for the user by directly communicating with other systems through the internet. The algorithm automatically identifies a need, searches for an optimal purchase, and executes the transaction. Such algorithmic assistants can be employed by both consumers and suppliers, making or accepting offers. They can also make decisions that do not involve the marketplace, such as how to organize one's day, who to date, whether to take an umbrella, what route to follow to a given destination that would reduce CO_2 emissions, and how to drive one's car.

The rise of algorithmic assistants is facilitated and accelerated by the advantages they offer over human choice, which are at a level never reached before.[27] As elaborated below, they enable speedier, more efficient and more sophisticated decisions.[28] Furthermore, the algorithm's capacity to perform its task is limited only by technology and data; it is never tired, stressed, or sick.[29] Algorithms can also avoid users' biases and overcome manipulative marketing techniques.[30] Given these comparative advantages, large digital companies are already competing to become users' digital assistants.[31] Ex-

26. Interestingly, some administrative agencies have also created online comparison tools, such as the Consumer Financial Protection Bureau's mortgage calculator. *See, e.g.*, Rory Van Loo, *Rise of the Digital Regulator*, 66 DUKE L.J. 1275, 1280-85 (2017).

27. *See* EXEC. OFFICE OF THE PRESIDENT, BIG DATA: A REPORT ON ALGORITHMIC SYSTEMS, OPPORTUNITY, AND CIVIL RIGHTS (2016).

28. In some markets, such as online financial trading, speed creates an important advantage. *See, e.g.*, Frank Pasquale, *Law's Acceleration of Finance: Redefining the Problem of High-Frequency Trading*, 36 CARDOZO L. REV. 2085, 2110 (2015).

29. This is not to deny the potential risk of infection with software viruses or malware.

30. For sub-optimal decisions, see, for example, Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 ECONOMETRICA 263 (1979); Amos Tversky, *Elimination by Aspects: A Theory of Choice*, 79 PSYCHOL. REV. 281 (1972). For a discussion of how consumers are affected by visual stimuli, see, for example, Milica Milosavljevic et al., *Relative Visual Saliency Differences Induce Sizable Bias in Consumer Choice*, 22 J. CONSUMER PSYCHOL. 67 (2012).

31. Yadron, *supra* note 2.

amples include Google Assistant, Apple's Siri, and Amazon's Alexa.[32] The huge investments involved are based on the assumption that the use of algorithmic assistants will become commonplace and will serve as a main gateway to the internet. This does not imply that unassisted human decision-making will completely disappear. Nonetheless, even users who enjoy decision-making may prefer to employ algorithmic assistants for the purchase of certain products or services, or for other types of decisions.

At the same time, algorithmic assistants may also generate new harms and risks. A major potential harm, elaborated below, involves choices that do not accurately reflect consumers' preferences.[33] Another potential harm is users' increased vulnerability to the risks associated with the digital world, such as risks to privacy and cyber-security. Also, technology can reduce our awareness of our actions. Navigation applications which make users less conscious of their location exemplify this phenomenon. Finally, algorithmic assistants have potentially profound implications for human choice, given that the user is at least one step removed from the algorithm's decisions. This latter effect is the focus of this article.

B. *A Taxonomy of Algorithmic Assistants*

The effects of algorithmic assistants on users' choice depend on their design and technological capabilities. Two main dimensions affect the user's choice: the decision parameters employed by the algorithm, and the level of choice which remains at the hands of the user.

We identify four paradigmatic categories of decision parameters used by algorithmic assistants, with growing effects on users' autonomous choice.[34] In the first category the user sets the exact decisional parameters to be used by the algorithm as well as the weight to be given to each one (e.g., cost over quality, reliability over speed of delivery). The algorithm then chooses among the options it detects in accordance with these preferences. We call algorithms in this group "Stated Preferences Algorithms." In this scenario, the algorithm simply serves as the automated and efficient long

32. These algorithms are designed to perform multiple actions and transactions, beyond purchase decisions. An interesting recent example involves Google's Jarvis, which seeks to create a smart home based on the Internet of Things. *See* Jessica Guynn, *Morgan Freeman to Voice Mark Zuckerberg's Jarvis*, USA TODAY (Dec. 21, 2016, 11:31 AM), https://www.usatoday.com/story/tech/news/2016/12/20/morgan-freeman-voice-mark-zuckerbergs-jarvis/95656216/.

33. *See infra* Section III.B.

34. For a discussion of the various levels of automation that reflect distinct degrees of human–machine interaction, see, for example, Argyro Karanasiou & Dimitris A. Pinotsis, *A Study into the Layers of Automated Decision Making: Emergent Normative and Legal Aspects of Deep Learning*, 31 INT'L REV. OF L., COMPUTERS & TECH. 170 (2017).

arm of the user. The user and algorithm's choices completely overlap,[35] but the algorithm enables a more efficient execution of the decision.

In the second category the user chooses the decisional parameters from a fixed menu prepared by the algorithm's designer ("Menu of Preferences Algorithm").[36] Such menus—in essence not very different from menus in restaurants—generally limit the range of options that can be reached through the algorithm, even if products that fit the user's real preferences are available.[37] Sites like Travelocity and Airbnb exemplify such menus in which the user is limited to a predefined set of parameters from which he can choose. While potentially limiting choice, these menus might make the decision easier for the user. They can also create economies of scale in the analysis and the execution of the transaction by the algorithm, should it be employed in parallel by different users, for example if the algorithms can then order large quantities of the same product.

The third category is more complex yet more intriguing. In this category the algorithm applies decisional parameters which are not (wholly) based on the consumer's stated or chosen preferences. Rather, the algorithm generates a simulation which attempts to mimic and predict consumer preferences. We call this group "Predicted Preferences Algorithms."

The prediction of preferences has become one of the most important turfs of competition in the digital world, in which data on users' past choices and traits is the main currency. While demand predictions were always an integral part of the market economy (e.g., producers chose in which newspaper to advertise in accordance with the predicted preferences of readers), recent advancements in data collection and data science have made such predictions much easier and more sophisticated. To construct such predictions, data are collected from numerous sources, including the internet, as well as the Internet-of-Things via trillions of sensors placed in machines connected to the internet around the world.[38] The ability to collect data is

35. This proposition is based on the assumption that the user would have invested the necessary resources to make the most efficient decision.

36. The difference between the Stated Preferences Algorithm and the Menu of Preferences Algorithm is largely based on who determines the decisional parameters that limit the algorithm's choices in the first place. In the first category, the user sets the parameters, and can thus set them in complete accordance with his preferences, dependent, of course, on the algorithm's technological capabilities. In the second category, the designer sets the parameters, and thus they might not exactly fit those of the user (for example, I also want to give weight to the movies shown on the flight, but this is not a parameter I can choose from if it was not included by the algorithms' designer).

37. Attempts to create a more customized menu of choices can be exemplified by Google Now's new feature, "Explore Interests," which requests users actively input areas of interest. *See, e.g.*, Phil Oakley, *Google adds Explore Interests to Now with six categories to get updates on*, ANDROID POLICE (Aug. 8, 2016), https://www.androidpolice.com/2016/08/08/google-adds-explore-interests-now-six-categories-get-updates/.

38. *See, generally*, OECD, SUPPORTING INVESTMENT IN KNOWLEDGE CAPITAL, GROWTH AND INNOVATION (2013).

strengthened by what Professor Noah Harrari has called the "Data Religion"[39] which worships measuring numerous aspects of our lives (such as the number of steps we take each day) as well as the sharing and transparency of data (such as via online social networks),[40] and by the willingness of many users to share data for a small benefit.[41] Sensors which detect users' physiological reactions to events in real time also provide invaluable data to learn about users' preferences. Such sensors already exist (such as Fitbit), and more sophisticated ones are being created. This exponentially fast-growing honeycomb of data is collected, organized and stored in humongous databases. Rapidly advancing techniques of data science such as pattern recognition and machine learning, are combined with traditional tools such as statistics to mine valuable information from the data.[42] This data analysis serves as the basis for the creation of user profiles, which generally act like a "digital shadow," attempting to mimic users' preferences. The profile is based on past revealed preferences (such as that the user has read detective novels) which can be combined with the choices of others with relatively similar profiles. This, in turn, enables the predicted preferences algorithm not only to identify, but also to predict, a user's future preferences. The algorithm might even identify preferences that users themselves are unaware of (e.g., the user believes she prefers healthy food; the algorithm detects that she periodically submits to a craving for chocolate). Indeed, data scientists argue that algorithms can teach us things we don't know about ourselves.[43]

A wide variety of algorithms already use predicted preferences to guide users through decision-making processes, such as Amazon's product suggestions. As Professor Richard Ford puts it, "If I purchase a CD by Britney Spears. . . it will recommend Christina Aguilera and other prepubescent bleached blondes singing upbeat pop. . . If it's good enough, I'm likely to rely more and more heavily on the selections of the cyber doppelganger and

39. *See* Daniel Rubinfeld & Michal S. Gal, *Access Barriers to Big Data*, 59 ARIZ. L. REV. 339 (2017).

40. *See, generally*, YUVAL NOAH HARRARI, HOMO DEUS: A BRIEF HISTORY OF TOMORROW (2016). This trend is further strengthened by the externalities created when only some people reveal their information: others may find that they must also disclose private information to avoid the negative inferences attached to staying silent. *See* DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW 90 (1994); Scott R Peppet, *Unraveling Privacy: The Personal Prospectus & the Threat of a Full Disclosure Future* 105 NW. L. REV. 1153, 1156 (2011).

41. *See, e.g.*, Alessandro Acquisti et al., *What Is Privacy Worth?*, 42 J. OF LEGAL STUD. 249 (2013).

42. *See, e.g.*, Hal R. Varian, *Big Data: New Tricks for Econometrics*, 28 J. OF ECON. PERSP. 3 (2014).

43. *See, e.g.*, Nicholas Thompson, *When Tech Knows You Better than You Know Yourself*, WIRED (April 4, 2018), https://www.wired.com/story/artificial-intelligence-yuval-noah-harari-tristan-harris/.

less on my own judgment and the limited information I can gather myself."[44]

The fourth category of algorithmic assistants, which we call "Paternalistic Algorithms," is a sub-category of the third one and has the largest effect on choice, making choices for the user which are assumed to be best for him overall, even if they clash with his immediate preferences. Such algorithms may purposefully give more weight to long-term preferences over short-term ones, and to rational preferences over immediate and emotionally-driven ones. For example, although I'm in the mood to eat pizza tonight, the algorithm will order salad, which better fits my current health needs.[45] Accordingly, the user employs the algorithm to impose self-restraint upon his own choices.

Observe that a choice between algorithms which fall into the different categories, in itself, might serve as an indication of the user's preferences. A decision to use a Paternalistic Preferences algorithm signals that the user prefers long-term considerations to short-term ones, as long as the user is informed of the differences between the different algorithms and they are otherwise quite similar (e.g., in their computational powers).

The second dimension which affects users' choice is the level of control over the decision which remains in the user's hands once the algorithm is employed (human-in-the-loop), regardless of which of the four categories characterizes the algorithm. At one extreme, all potential options are presented to the user (e.g., Google Search). Even in this case the choice architecture, such as which options are presented first, may still affect the user's choice.[46] Some algorithms narrow down the options for the user, based on his digital profile, presenting only those options assumed to be most relevant. Karen Yeung argues that such algorithms create a "hypernudge effect," prodding the user to reach a specific decision.[47] Other algorithms make a choice, which is then subject to the user's approval. In all the above cases, while the algorithm may indirectly influence the choice, the ultimate decision is made by the user.

At the other end of the spectrum the algorithm automatically identifies a need, searches for an optimal purchase, negotiates and executes the transaction. The user provides second-order consent, waiving his right to choose

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44. Richard T. Ford, *Save the Robots: Cyber Profiling and Your So-Called Life*, 52 STAN. L. REV. 1573, 1575-76 (2000).

45. *See, e.g.*, Harry Frankfurt, *Freedom of the Will and the Concept of the Person*, 68 J. OF PHIL. 5 (1971) which offers a two-level model: first-order and second-order desires.

46. *See, e.g.*, Eric J. Johnson et al., *Beyond Nudges: Tools of a Choice Architecture*, 23 MARK. LETT. 487 (2012).

47. *See* Karen Yeung, *'Hypernudge': Big Data as a Mode of Regulation by Design*, 20 INFO., COMM. & SOC. 118, 118 (2017).

directly or even to approve the choice made on his behalf.[48] For example, consider the following scenario. Sensors are placed in the user's garden and in the fertilizers' storage area. Data collected from both sources are analyzed by a specialized algorithm to determine when fertilizer supply is low, as well as the actual fertilizing needs of the particular garden. Decisional parameters may also include real-time data predicting seasonal weather, temporary shortage of certain products, and price changes. Once a choice has been made, based on the data analysis, the algorithm automatically places an order and arranges for payment and delivery,[49] which it can do with the assistance of on-line software agents ("shopping bots").[50] It can even employ a robot to distribute the fertilizer in the garden. The self-executing quality of these autonomous algorithmic assistants limits the need for human intervention beyond the employment of the algorithm and the initial placement of the sensors.

Below we focus on algorithmic assistants which are either predicted preferences algorithms or paternalistic preferences algorithms. Given the way that technology is currently developing and their relative advantages, such algorithms are likely to be widely used, at least with regard to some decisions. We assume that algorithmic assistants are designed, supplied and controlled by external firms. When the algorithm is written or controlled by the user, some—though not all—of the effects on user choice analyzed below are mitigated.

C. *The Effects of Algorithms on Choice*

Autonomous algorithmic assistants affect the *act* of choice: the user chooses to employ the algorithm, and the algorithm then makes autonomous choices for the user. The choice of an algorithm might be made by an algorithm which compares algorithms that make final decisions, which, in turn, might be chosen by an algorithm which compares among comparison algorithms. Furthermore, an algorithm might set our preferences for the use by another algorithm. The user can thus be further removed from his final choice.

More importantly, algorithmic assistants may also affect the *content* of the decision made on behalf of the user. This may happen for several rea-

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48. *See, generally*, Dave Wendler, *Deception in Medical and Behavioral Research: Is It Ever Acceptable?*, 74 MILBANK Q. 87 (1996).

49. Jane L. Levere, *When a Robot Books Your Airline Ticket*, N.Y. TIMES, May 31, 2016, at B6.

50. "Agents could behave autonomously or proactively. The intelligence of an agent refers to its ability of performing tasks or actions using relevant information gathered as part of different problem-solving techniques such as influencing, reasoning, and application specific knowledge." Prashant R. Nair, *E-Supply Chain Management Using Software Agents*, COMPUTER SOC'Y OF INDIA COMM. 14 (July 2013).

sons.[51] First, the ability of algorithms to analyze substantially more information in a quick, relatively costless and sophisticated way, increases the number of possibilities that can be analyzed in a given time or cost frame, thereby increasing the number of options.

Second, when the weight to be given to different decisional parameters cannot be exactly specified by the user, and the algorithm's choice is based on machine learning analysis of the user's past choices, some level of unpredictability is almost always built into the system. This is partly because humans often are not aware of the exact weight they give to each decisional parameter they use and often cannot quantify their preferences. For instance, how might one quantify the potential increase in positive feelings and creativity that would accrue from writing with the exact same pen used by Albert Einstein? This, in turn, implies that an algorithm's choice cannot always be predicted by the user.

Third, algorithms can reduce consumer biases that negatively affect his welfare.[52] Even in the case of stated preferences algorithms, the user might not include decisional parameters that might have otherwise affected his decision (e.g., the color or font size used on the product's packaging). In both the predicted preferences algorithms and paternalistic algorithms, biases are likely to be given little weight, if any, in the decision parameters used, unless the algorithm's designer considers them part of the user's preferences and he is able to recognize such biases in the first place.[53] In all cases, the user need not be aware of such biases.

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51. Arguments that algorithms affect choice are not new. In the past such arguments centered on the fact that algorithms affected choice by showing each user the exact same results. The advent of user profiling has changed the content of the choices as well as the arguments raised.

52. For consumer biases see, for example, Benjamin E. Hilbig, *On the Role of Recognition In Consumer Choice: A Model Comparison*, 9 JUDGMENT & DECISION MAKING 51 (2014) (biases based on name recognition); Ming Hsu & Carolyn Yoon, *The Neuroscience of Consumer Choice*, 5 CURRENT OP. IN BEHAV. SCIS. 116, 118 (Oct. 2015) (biases based on product placement). For a survey of the literature on biases regarding the Free Effect—by which consumers value a free product more than its actual worth, see Michal S. Gal & Daniel Rubinfeld, *The Hidden Costs of Free Goods: Implications for Antitrust Enforcement*, 80 ANTITRUST L. J. 521, 528 (2016). Observe, however, that not all biases are necessarily welfare-reducing.

53. If we look far enough into the future, this problem might also have a technological solution. For example, the grey box may appear to us to be colorful if we look at it through our virtual reality glasses. Alternatively, our personal robot will open the package in our absence. For the ability of algorithms to limit biases, partly based on the analysis of data which indicates inefficient correlations in our decision-making, see, for example, FEDERAL TRADE COMMISSION, BIG DATA: A TOOL FOR INCLUSION OF EXCLUSION? (2016), https://www.ftc.gov/system/files/documents/reports/big-data-tool-inclusion-or-exclusion-understanding-issues/160106big-data-rpt.pdf.

Fourth, algorithms limit the cognitive overload that might have prevented the user from making an efficient choice.[54] Once the user is occupied by one decision, he might have less capacity to make another decision in an efficient manner. Furthermore, an abundance of choice might lead people to make bad choices or to not choose at all.[55] An algorithm does not suffer from such limitations, up to the extent of his technological capacities.

Fifth, algorithms may change the user's choice by overcoming manipulative marketing techniques which play on people's vulnerabilities to affect their thinking, emotions, and behavior.[56] For instance, an algorithmic assistant will not end up buying the chocolate stacked near the cashier just because it cannot fight temptation while waiting in line. In our digital world, this may create an important advantage since, as Ryan Calo argues, advancements in big data significantly increase the potential for digital market manipulations.[57]

Sixth, the use of algorithmic assistants could create incentives for suppliers to create a greater diversity of products in order to serve customers' exact preferences, thereby increasing consumer choice. Finally, paternalistic algorithms may at least partially remedy a widespread criticism of human choices: that individuals adopt preferences not because they serve their interests, but because these preferences were shaped by social and economic conditions.[58] Acknowledging such preferences, the designer of the algorithm might instead give more weight to considerations which actually serve the user's interests. Indeed, algorithmic assistants provide a market-based technological solution to some of the major problems that currently plague human choice.

At the same time, algorithmic decisions might be based on incorrect assumptions embedded in the code by the designer (such as the user always reads the same type of books) or arising from the algorithm's data analysis (such as incorrect consumer profiling).[59] Indeed, if we assume that choice is based on multiple variables that resist a straightforward or even determina-

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54. *See* Evan Selinger & Thomas P. Seager, Digital Jiminy Crickets, SLATE (July 13, 2012, 6:33 AM), https://slate.com/technology/2012/07/ethical-decision-making-apps-damage-our-ability-to-make-moral-choices.html.

55. *See, e.g.*, BARRY SCHWARTZ, THE PARADOX OF CHOICE: WHY MORE IS LESS (2004).

56. *See* Robert Epstein, *The New Mind Control*, AEON (Feb. 18, 2016), https://aeon.co/essays/how-the-internet-flips-elections-and-alters-our-thoughts (providing examples of manipulative marketing techniques and describing the way search engines affect users' perceptions).

57. Ryan Calo, *Digital Market Manipulations*, 82 GEO. WASH. L. REV. 995, 1006-18 (2014).

58. *See, e.g.*, AMARTYA SEN, DEVELOPMENT AS FREEDOM (1999).

59. *See, e.g.*, Solon Barocas et al., *Governing Algorithms: A Provocation Piece*, (Mar. 29, 2013), http://edshare.soton.ac.uk/8849/31/48-Governing-Algorithms.pdf; Langdon Winner, *Do Artifacts Have Politics?*, 109 DAEDALUS 121 (1980).

ble reduction to a predetermined decision tree,[60] then algorithms cannot always correctly predict human choice. Rather, humans often possess heterogeneous preferences which may come into conflict. Some choices might even be deliberately suboptimal from an efficiency point of view, but still increase the user's utility.[61] Furthermore, even if the algorithm recognizes and attempts to follow a user's behavioral pattern, what happens when that pattern includes a completely different choice made occasionally? How will the algorithm establish when precisely to introduce the new, spontaneous element and change the user's previously determined preference?

Moreover, choices made by the algorithm might be more self-perpetuating and path-dependent than human choices would otherwise be.[62] This is because past choices serve as signals for future ones, and also because if the user is not exposed to other options, then his predicted choices will most likely not change in the future. Furthermore, once the algorithm is employed by many users, mistaken assumptions embedded in the code can be multiplied. This could lead to limited demand for some welfare-enhancing products resulting from such mistakes.

So far we have disregarded third-party interests, assuming that algorithms simply seek to further the user's welfare. As Ariel Ezrachi and Maurice Stucke elaborate, in reality, algorithmic choices might also be affected by the interests of third parties.[63] Providers of algorithms, as well as firms which enjoy significant power in a market controlling a resource which is necessary for the operation of the algorithm, might have incentives to change users' choices in order to fit their own underlying interests or beliefs, thus generating systematically skewed decisions.[64] A provocative example involves Facebook's alleged attempt to push upwards more liberal news without user's knowledge.[65] Competition among algorithms may reduce this effect, as can information about an algorithm's decision parameters.[66]

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60. *See, e.g.*, Manuel Vargas, *If Free Will Doesn't Exist, Neither Does Water*, *in* EXPLORING THE ILLUSION OF FREE WILL AND MORAL RESPONSIBILITY 177 (Gregg D. Caruso ed., 2013).

61. Morris Altman, *Freedom to Choose and Choice X-Inefficiencies: Human and Consumer Rights, and Positive and Normative Implications of Choice Behavior*, 68 REV. SOC. ECON. 395, 399-400 (2010).

62. *See, e.g.*, BAROCAS ET AL., *supra* note 59, ¶ 33.

63. EZRACHI & STUCKE, *supra* note 9.

64. These concerns resonate with critiques which highlight how powerful internet intermediaries, such as Google, act as critical gatekeepers. *See, e.g.*, Frank Pasquale, *Beyond Innovation and Competition: The Need for Qualified Transparency in Internet Intermediaries*, 104 NW. U. L. REV. 105, 121 (2010) (exploring the regulation of search engines); Yeung, *supra* note 47, at 123-24.

65. *See* EZRACHI & STUCKE, *supra* note 9, at 198.

66. *See id.* at 202; Gal & Elkin-Koren, *supra* note 9, at 20-21.

This raises the following question: why would users choose an algorithm that does not always make optimal decisions for them? Several factors come into play. For one, the user might be unaware of the algorithm's effects on choice due, inter alia, to the limited transparency of the algorithm and its "black box" quality. A user who is unaware of the algorithm's limitations, would likely not be aware of choices he has forgone. Such a market failure would be very difficult to fix, as users cannot be expected to exercise oversight when dealing with unknown unknowns. Alternatively, users may find it increasingly difficult—or not worth their while—to exercise oversight over sophisticated and opaque systems.[67] Indeed, as algorithms become more complicated and sophisticated, even their designers might not completely understand the algorithm's decisional parameters.[68] These limitations can be partly reduced if transparency of the algorithm is required[69] or if a secondary market is created for tools for explaining the decisions of and comparing algorithms. Thirdly, the overall choices made by the algorithm may still be better than other options, including making decisions without an algorithm. This is especially true for those instances in which an algorithm serves multiple tasks which cannot be separated, most of which it performs well.[70] Finally, as Maurice Stucke and Alan Grunes note, the tyranny of the majority can dictate the choices of the minority: if you want to join an application and benefit from its network effects, you must accept the terms it offers.[71] In some cases, however, deference to human choices (e.g., the user may direct the algorithm to choose a historic novel today) may limit such vulnerabilities.

In short, not only the act of choice is affected by the use of autonomous choice algorithms, but also the content of the choice. The digitized artificial

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67. *See, e.g.*, Christian Sandvig et al., *Auditing Algorithms: Research Methods for Detecting Discrimination on Internet Platforms* (May 22, 2014), http://social.cs.uiuc.edu/papers/pdfs/ICA2014-Sandvig.pdf; Karanasiou & Pinotsis, *supra* note 34, at 182-83.

68. *See, e.g.*, Zeynep Tufekci, *We're Building a Dystopia Just to Make People Click on Ads*, TED (Sept. 2017), https://www.ted.com/talks/zeynep_tufekci_we_re_building_a_dystopia_just_to_make_people_click_on_ads/transcript#t-9834 ("We no longer really understand how these complex algorithms work. We don't understand how they're doing this categorization. It's giant matrices, thousands of rows and columns, maybe millions of rows and columns, and not the programmers and not anybody who looks at it, even if you have all the data, understands anymore how exactly it's operating"). For the effects of computational complexity on the transparency of the algorithm see also Karanasiou & Pinotsis, *supra* note 34, at 182.

69. For such suggestion see, for example, FRANK PASQUALE, THE BLACK BOX SOCIETY: THE SECRET ALGORITHMS THAT CONTROL MONEY AND INFORMATION (2015); D. K. Citron & Frank A. Pasquale, *The Scored Society: Due Process For Automated Predictions*, 89 WASH. U. L. REV. 1, 10-11, 24-25 (2015); Zarsky, *supra* note 19, at 121. Transparency is a limited tool, however, with regard to algorithms based on deep learning. *See* Karanasiou & Pinotsis, *supra* note 34, at 183.

70. *See, e.g.*, Yadron, *supra* note 2.

71. MAURICE E. STUCKE & ALLEN P. GRUNES, BIG DATA AND COMPETITION POLICY 168 (2016) (writing on privacy conditions).

hand supplements the invisible natural hand of the market. Table 1 summarizes the different effects on human choice created by the four types of algorithms.

TABLE 1: THE EFFECTS OF ALGORITHMS ON USER'S CHOICES

Algorithm/User's Actions	Stated Preferences	Menu of Preferences	Predicted Preferences	Paternalistic Preferences
User choosing to employ a certain algorithm	+	+	+	+
User defining the decision parameters	+	+ (partially)	-	-
Algorithm Limiting behavioral biases	+ (indirectly)	+ (indirectly, >)	+ (directly, >>)	+ (directly, >>>)
Algorithm's Nudge qualities	-	+ >	+ >>	+ >>
Algorithm Increasing the number and quality of choices	+	+	+	+
Algorithm's overall effects on the user's choice	+	+ >	+ >>	+ >>>

III: THE ROLE OF AUTONOMOUS CHOICE

As we have established, algorithms can significantly affect users' choices. We turn now to the rationales on which human choice is based. We then explore whether these rationales hold true for choices made by autonomous algorithmic assistants which are voluntarily employed by users. Our analysis also seeks to explore which challenges to autonomous choice are inherent to the use of algorithmic assistants, and which can be solved by technological means.

A. *Rationales for Promoting Autonomous Choice*

Ideally, autonomous human choice is assumed to be made by a mentally competent, fully informed individual, through a process of rational self-

deliberation.[72] The centrality of such self-determination is based on rationales that come from diverse fields, including economics, psychology, epistemology, metaphysics, the cognitive sciences, and political philosophy. Below we explore in broad strokes three main rationales for autonomous human choice, namely efficiency, psychological effects, and liberal political theory.[73] Some of these are consequentialist, focusing on the direct results of autonomy, and some are deontological, giving value to autonomy regardless of its consequences. These theories sometimes complement each other. For instance, the theory of utilitarianism is sufficiently wide to include psychological rationales for human choice that do not necessarily lead to the most objectively efficient choices.

We do not to argue that autonomous choice is more important than other values. Yet given its centrality in our society and our legal system, technologies that significantly affect autonomy should be analyzed, so that those who value autonomy can evaluate it in light of its effects.[74] Accordingly, we seek to analyze the direct effects of algorithmic assistants on our choices, as well as on our preference formation abilities which, in turn, affect our choices in the long-run, that is, when sub-optimal choice according to a certain criteria nonetheless increases people's well-being.

1. Efficiency Rationales

One of the most important assumptions underlying the promotion of human choice is that individuals know better than anyone else what is best for them.[75] Therefore, the decisions they make are likely to be best from their point of view.[76] This rationale focuses on the *result* of the act of choice, rather than on the act itself. It is important to emphasize that the efficiency rationale is based on the assumption that human decisions maximize an individual's subjective preferences, rather than what an outsider might think he should prefer.

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72. ISAIAH BERLIN, *Two Concepts of Liberty*, *in* FOUR ESSAYS ON LIBERTY 118, 131 (1969). In this article we assume that free choice exists, at least to some extent. Observe that if we assume that no free will exists, and that all choices are predetermined, then the analysis below is redundant. We also define autonomy to include acts reflecting consent to external inputs or inducements.

73. Given that the use of algorithmic assistants is generally voluntary, we do not relate to those justifications for autonomy that arise when choice is involuntarily limited, such as respect for one's demand to make his own choices which is part of one's dignity. *See, e.g.*, Stephen Darwall, *The Value of Autonomy and Autonomy of the Will*, 116 ETHICS 263 (2006).

74. *See* Benkler, *supra* note 18, at 41.

75. *See* Gordon R. Foxal, *The Behavior Analysis of Consumer Choice*, 24 J. ECON. PSYCHOL. 581, 582 (2003). The Kantian tradition also holds this view. *See, e.g.*, Richard H. Fallon, Jr., *Two Senses of Autonomy*, 46 STAN. L. REV. 875, 892-93 (1994) (showing that the Kantian tradition treats autonomy as a super-value, in the sense that, "because rational, autonomous agents" find these values worth pursuing, all values are worth pursuing).

76. Foxal, *supra* note 75, at 582.

The efficiency rationale is fraught with inherent limitations, such as the fact that individuals do not always make the best choices for themselves, whether because they are subject to biases and fallacies or because they give too much weight to short-term considerations.[77] In addition, individuals may not possess all the relevant information necessary to make the best choice for themselves, especially in the digital world,[78] or they may not be able to overcome collective action problems.

2. Psychological Rationales

Psychological rationales for autonomous choice generally focus on the psychological values inherent in the *act* of choice itself, regardless of the efficiency of the result. One argument centers on the connection between choice and identity. Conscious and subconscious conceptions of identity are shaped through choice, offering us opportunities to define and enhance our self-image, and to create personal meaning and responsibility. The act of choice also enables us to critically explore, reflect upon, and reform our preferences. The *result* of the act of choice can also affect one's identity. The effect can be direct; to illustrate, the choice of a book or newspaper can affect a person's views and values.[79] It can also be indirect, affecting one's self-image and personality through the reactions of others to his choices. Such social reactions, including (in)attention to and (non)appreciation of one's choices, can also affect one's well-being.[80]

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77. *See generally* Christine Jolls et al., *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1541-42 (1998); Russell B. Korobkin & Thomas S. Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 CAL. L. REV. 1051, 1055 (2000).

78. For some information limitations of consumers see, for example, Omri Ben-Shahar, *The Myth of the 'Opportunity to Read' in Contract Law*, 5 EUR. REV. CONT. L. 1, 7 (2009); Melissa T. Lonegrass, *Finding Room for Fairness in Formalism—The Sliding Scale Approach to Unconscionability*, 44 LOY. U. CHI. L.J. 1, 30 (2012); Robert A. Hillman, *Online Boilerplate: Would Mandatory Website Disclosure of E-Standard Terms Backfire?*, 104 MICH. L. REV. 837, 840–41 (2006); Margaret Jane Radin, *Boilerplate Today: The Rise of Modularity and the Waning of Consent*, 104 MICH. L. REV. 1223, 1231–32 (2006).

79. *See, e.g.*, Patti M. Valkenburg, Jochen Peter, and Joseph B. Walther, *Media Effects: Theory and Research*, 67 ANNUAL REVIEW OF PSYCHOLOGY 315 (2016). A similar line of arguments was made by C. Edwin Baker, *An Economic Critique of Free Trade in Media Products*, 78 N.C. L. REV. 1357, 1389 (2000) (arguing that the media market not only expresses preferences, but shapes them). For an argument that algorithms shape culture see, for example, TARLETON GILLESPIE, *#trendingistrending: When Algorithms Become Culture, in Algorithmic Cultures: Essays Of Meaning, Performance and New Technologies*, *in* ALGORITHMIC CULTURES: ESSAYS ON MEANING, PERFORMANCE AND NEW TECHNOLOGIES (Robert Seyfert & Jonathan Roberge, eds., 2016).

80. *See, e.g.*, Asle Fagerstrøm et al., *Implications of Motivating Operations for the Functional Analysis of Consumer Choice*, 30 J. ORG. BEHAV. MGMT. 110, 113-14 (2010).

Choice may also strengthen one's knowledge and recognition of the world and the objects in it which, in turn, affect our conceptions.[81] Furthermore, exercising choice, at least in some spheres, may itself be a source of pleasure. Indeed, some researchers argue that consumer choice has become an opiate for contemporary society, since consumption and consumerism offer immediate gratification, compensating for discontents arising from the lack of control over many aspects of life.[82] The act of choice may also create a deeper level of engagement in one's life and choices, thereby strengthening motivation, responsibility, productivity and healthy functioning.[83]

At the same time, choice can also create psychological burdens which result from the act of choice itself as well as from internal dilemmas of whether we made the right choice,[84] and from a cognitive overload arising from too many options or too much information.

The psychological effects explored are not equally strong for all the choices one makes. Some choices create much weaker psychological effects than others (such as which fertilizer to buy), and differences exist between the way individuals psychologically react to choice.

3. Liberty Rationales

Autonomous choice is an important part of the liberal political tradition's concept of human beings as free, equal and rational, in control of their own life.[85] Under this rationale, the act of choosing, in itself—not just having the ability to choose, or enjoying the objects of our choices—is intrinsically valuable. As John Stuart Mill famously argued, a person's ". . .own mode of laying out his existence is the best, not because it is the best in itself, but because it is his own mode."[86] Accordingly, acting as an autono-

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81. This argument is partly based on the theories of phenomenology (how experience shapes our consciousness) and empiricism (a branch of epistemology which assumes that most of our knowledge is experience or experiment-based rather than predetermined).

82. Yiannis Gabriel, *Identity, Choice and Consumer Freedom – the New Opiates? A Psychoanalytic Interrogation*, 15 MARKETING THEORY 25, 28-29 (2015).

83. *See* Richard M. Ryan & Edward L. Deci, *Self-Regulation and the Problem of Human Autonomy: Does Psychology Need Choice, Self-Determination, and Will?*, 74 J. PERSONALITY 1558 (2006).

84. *See* Elizabeth Nixon & Yiannis Gabriel, *'So Much Choice and No Choice At All': A Socio-Psychoanalytic Interpretation of Consumerism as a Source of Pollution*, 16 MARKETING THEORY 40, 47-49 (2016) (illuminating the discomfort and anxiety which follows many consumers in the shopping process).

85. *See* John Kleinig, *Human Rights, Legal Rights and Social Change*, *in* HUMAN RIGHTS 36 (Eugene Kamenka & Alice Erh-Soon Tah eds. 1978).

86. JOHN STUART MILL, ON LIBERTY 53-71 (Elizabeth Rapaport ed., Hackett Publ'g Co., 1978) (1859). *See also* BERLIN, *supra* note 72 ("[T]he word 'liberty' derives from the wish on the part of the individual to be his own master. I wish my life and decisions to depend on myself, not on external forces of whatever kind. I wish to be the instrument of my own, not of other men's, acts of will. I wish to be a subject, not an object; to be moved by reasons, by

mous decision-maker is not only good in its own right; it is also part of what makes the objects of our choices valuable to us and our way of making life our own. A life containing goods and pleasures which one has not in fact chosen would therefore appear alienated and incomplete.[87] But even if the choices we make do not achieve all these benefits, the ability to make our own choices is valuable in itself.

Some clarification may be in order, as the concept of autonomy used here should be distinguished from other, related moral values. Speaking about autonomy, people sometimes confuse two uses of this concept. The first is autonomy as a sort of capacity. Under this understanding, one is autonomous to the extent that one has the capacity to decide for oneself, or the ability to be the author of one's own life. The second is autonomy as an achievement: actually deciding for oneself, the actual authoring of one's own life. In this sense, to be autonomous is to *act* autonomously.[88] The former sense parallels the conceptually neighboring idea of freedom. Freedom is a capacity rather than its exercise. It consists in either the ability to act without external restraints or interference (negative freedom), or the ability to act on one's authentic or rational will (positive freedom).[89] Either way, a person may be entirely free to choose a course of action without ever exercising that freedom of choice.

Under the latter conception of autonomy, protecting and promoting personal autonomy requires more than the securing of freedoms. Freedom is of course a necessary condition. A person cannot choose without having free and acceptable choices. But autonomy can be compromised even if freedom is not: a life lived passively, without active choices being made, is not an autonomous one. And it fails to be autonomous no matter how elaborate one's freedom of choice is, or how developed her mental capacities for rational deliberation.[90]

Moreover, these considerations suggest a possible hierarchy between the freedom to choose or capacity for choice, and the actual exercise of that

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conscious purposes, which are my own, not by causes which affect me, as it were, from outside. I wish to be . . . a doer—deciding, not being decided for . . . .").

87. For a development of this view see, for example, Lee A. Bygrave & Jens Petter Berg, *Reflections on the Rationale for Data Protection Laws*, *in* 25 YEARS ANNIVERSARY ANTHOLOGY IN COMPUTERS AND LAW 3, 32 (Jon Bing & Olav Torvund eds., 1995) ("[T]he interest in non-automated decision making . . . embodies a concern for personal integrity, and ultimately a concern for human dignity."); GERALD DWORKIN, THE THEORY AND PRACTICE OF AUTONOMY (Sydney Shoemaker ed., 1988); Robert Young, *The Value of Autonomy*, 32 PHIL. Q. 35, 43 (1982). *See also* Ronen Perry & Tal Z. Zarsky, *"May the Odds Be Ever in Your Favor": Lotteries in Law*, 66 ALA. L. REV. 1035, 1062 (2015).

88. This distinction has been made famous by JOSEPH RAZ, THE MORALITY OF FREEDOM 372-73 (1986).

89. For the distinction between negative and positive freedom, see BERLIN, *supra* note 72, 118-72.

90. *Cf.* RAZ, *supra* note 88, at 204.

freedom or capacity of choice. Arguably, it is the exercise of choice that ultimately matters. The point of providing free choice and nourishing capacities is, at least in part, in the hope that these capacities will be put to good use. As Joseph Raz notes, it is "the value of the exercise which endows the capacity with what it is worth."[91] This self-authorship is the concept of autonomy which underlies political liberal theory: the individual is required to engage in the *act* of choice, regardless of whether it leads to objectively optimal choices for him.

Obviously, choices are never completely unlimited: options are often affected by natural limitations, as well as the actions and choices of others, be it the state or other individuals. Choices are also pervasively shaped by the surrounding environment including technological artifacts, which shape the relationship between humans and their world and the way they perceive and understand themselves.[92] From the liberal viewpoint, this, by itself, is not problematic, so long as choices are not artificially limited.[93]

B. *How the Rationales Are Affected by Algorithmic Assistants*

Let us now explore how these rationales are affected by choices made through algorithms. To make our case as strong as possible, we focus on an algorithm which endeavors to serve only the user's welfare, and which makes an autonomous decision once the user chooses to employ it. In doing so, we attempt to unravel the "choice paradox" identified above.

1. Efficiency Rationales

In those instances in which the algorithm reaches the same decision as the user, but simply in a more efficient way, the efficiency rationale for human choice does not stand.

The more interesting cases are those in which the algorithm significantly alters the user's choice. To determine the applicability of the efficiency rationale in these cases, one must explore the reasons for such altered choices.

As elaborated above, altered choices often reflect the comparative advantages of algorithms relative to users, either because the use of algorithmic assistants leads suppliers to create better choices for consumers, or because it allows for a more efficient choice among the available options.[94] Research on consumer choice has also shown that while people tend to base

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91. *Id.* at 372.

92. *See* John Christman, *Autonomy in Moral and Political Philosophy*, STAN. ENCYCLOPEDIA OF PHIL. (Jan 9, 2015), http://plato.stanford.edu/entries/autonomy-moral/. For an overview of internal and external limitations on autonomy, see Benkler, *supra* note 18, at 35-37.

93. *See* RAZ, *supra* note 88.

94. *See supra* Section II.

their significant decisions on rational considerations, smaller decisions are often made impulsively and are not economically rational.[95] This, in turn, might lead to a stronger justification for using algorithms for small choices.

The algorithm can also bring about strength in numbers. First, the algorithm could create buyer power, either through the creation of a strong buying platform operated by one algorithm, or through coordination among several algorithmic consumers.[96] Generally, the stronger the buyer power, the greater the benefits from the transaction that can potentially be passed on to the user. Strong algorithmic consumers might also (partly) counter the market power of suppliers. This is especially true with regard to small consumers, who could not otherwise easily protect themselves against such market power.[97] Second, the algorithm could create positive network effects. For example, where a similar decision by all users implies that their welfare would be reduced (e.g., everyone using the same road at times of heavy traffic), the algorithm might suggest an outcome that is best for all by directing some drivers to alternative roads. Third, the aggregation of users under an algorithm could reduce the ability of suppliers to discriminate among users.[98] This is because once users are aggregated into sufficiently large groups, suppliers lose the ability to collect information on users' individual preferences with regard to the products bought through the group, and to discriminate among them based on each user's elasticity of demand. This, in turn, might increase at least some users' welfare.[99] Finally, the algorithm could be designed to overcome collective action or negative externality problems (e.g., by giving more weight in the decision process to considerations such as buying from firms using green energy). It could also increase competition by taking into account long-term competition considerations, for instance by buying some portion of a certain good from new entrants in order to ensure they can grow in the market, thereby increasing overall efficiency in the long-run.[100]

Overall, where the choices made by the algorithm reflect its comparative advantages over users' choices, the efficiency rationale for human choice does not hold. Put bluntly, human choice is not a necessary constituent of efficient decisions.

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95. *See* Klaus Wertenbroch, *Self-Rationing: Self-Control in Consumer Choice*, (INSEAD, Working Paper No. 2001/63/MKT, 2001), https://ssrn.com/abstract=296954.

96. Gal & Elkin-Koren, *supra* note 9, at 23.

97. *See* Rory Van Loo, *Helping Buyers Beware: The Need for Supervision of Big Retail*, 163 U. PA. L. REV. 1311, 1324-25 (2015). Yet buyer power can sometimes have negative effects on welfare. *See, e.g.*, Gal and Elkin-Koren, *supra* note 9.

98. *See, e.g.*, Samuel B. Hwang & Sungho Kim, *Dynamic Pricing Algorithm for E-Commerce*, *in* ADVANCES IN SYSTEMS, COMPUTING SCIENCES AND SOFTWARE ENGINEERING 149 (Tarek Sobh & Khaled Elleithy eds., 2006).

99. Gal & Elkin-Koren, *supra* note 9, at 23.

100. *Id.* at 22.

Yet, as elaborated above, even an algorithm which strives to serve only the user's preferences might not always accurately reflect such preferences.[101] Microsoft's experience with its ChatBot provides an intriguing example. In 2016 Microsoft released a ChatBot called Tay.ai, designed to interact, inter alia, with Twitter users and send tweets based on such interactions. A day afterwards Microsoft had to deactivate the account, due to a large amount of offensive commentary by the ChatBot, which simply mimicked other tweets, and which clashed with Microsoft's preferences regarding the content of its ChatBot's tweets.[102] This example illustrates some of the problems involved in basing one's preferences on following the conduct of others. In addition, the fact that an algorithm makes the user's decisions—even if he chose to employ it—might reduce the user's sense of responsibility to such choices, therefore creating some negative externalities. This detachment might be strengthened if the decision to employ an algorithm is itself made by another algorithm.

Users are thus vulnerable to algorithms' limitations. Given these limitations, does the efficiency rationale lead to human choice?[103] The answer may still be negative, depending on the circumstances. As noted above, in order to be efficient, the decision of the algorithm need not be optimal, only better than[104] the decision the user would have reached without the algorithm, when taking into account all the factors involved (including the time saved). The answer also depends on whether users can differentiate between those instances in which algorithms are beneficial and those in which they are not. Yet even if users cannot differentiate between these cases, should they be aware of the algorithm's limitations they can choose not to employ algorithms—or at least not to do so without some overriding mechanism which enables them to exercise their own discretion—in those decisions where the risk to them of an inaccurate choice is high (e.g., choosing a business partner). The market could also provide a partial solution in the form of internal indicators of accuracy (such as what is the expected rate of uncertainty) or algorithms that compare the accuracy of algorithms.

Let us now briefly relate to a world in which algorithmic assistants are not benign. Here, of course, the efficiency rationale for human choice might be much stronger, given that the algorithm's decision would not strive to

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101. *Id.* at 15.

102. Sarah Perez, *Microsoft Silences Its New A.I. Bot Tay, After Twitter Users Teach It Racism*, TECHCRUNCH (Mar. 23, 2016), https://techcrunch.com/2016/03/24/microsoft-silences-its-new-a-i-bot-tay-after-twitter-users-teach-it-racism/.

103. A simplistic argument provides that the mere fact that users continue to use such algorithms is an indication of their positive welfare effects. While this is true to some degree, it does not take into account factors such as information problems and nudging effects that may explain such use.

104. Users might define a better choice in different ways. For a partial discussion *see supra* Section II.C.

serve only the interests of the user. The ability to prevent such algorithmic decisions depends, inter alia, on the user's ability to realize, in real time, that the algorithm does not serve (only) his interests. The black-box qualities of some algorithms—and especially those based on machine learning—increases information asymmetries and reduces the ability of the user to separate those actions which serve his interests from those which do not. Yet even in such cases the overall effect on efficiency is not straightforward. For example, the efficiency rationale for human choice would not hold in cases where the algorithm's functions cannot be separated, and where most of its decisions, including those that carry the most value to the user, are substantially more efficient than they otherwise would be.

To verify the overall efficiency of employing autonomous algorithmic assistants, it is also important to analyze the externalities they create on other markets and decisions. If, for example, the algorithm increases the market power of existing digital platforms, which, in turn, block new innovation, then these considerations should not be disregarded.[105]

In addition, and more importantly, there is a certain worry that our capacity for decision-making could suffer. By willingly allowing ourselves to be continuously subjected to algorithmic decisions in return for the highly tailored convenience and efficiency which they appear to offer, we may be slowly but surely eroding our capacity for internal processes of self-deliberation, as well as self-creation and development, that enable us to form preferences.[106] This argument likens our decision-making capacity to a muscle that needs to be exercised, in order to stay in shape. Furthermore, the increased usage of algorithms by others limits one's ability to deliberate and learn from others' experience with regard to the parameters that determine their choices. Finally, the user's ability to learn from mistakes may suffer if the user is not aware of all the parameters that led to the algorithm's choice—especially when the algorithm is a black-box—and especially if he is not aware of those options that were not chosen and how they compare to those that were. Should these effects impair the ability of users to make efficient decisions in other spheres of their lives, then this negative externality should also be taken into account in considering the effects of using algorithmic assistants on reaching efficient decisions.

At the same time, algorithmic assistants can create positive externalities on other decisions. Research has shown that decisions deplete individuals' internal resources of will-power and decision-making.[107] Accordingly, once we defer some decisions to algorithms, we can make better decisions in oth-

105. For similar considerations see, for example, EZRACHI & STUCKE, *supra* note 9 at 29-31.

106. *See generally*, JULIE E. COHEN, CONFIGURING THE NETWORKED SELF (2012) (supporting the claim that people need to develop their autonomy in a process of self-formation).

107. *See, e.g.*, ROY F. BAUMEISTER & JOHN TIERNEY, WILLPOWER: REDISCOVERING THE GREATEST HUMAN STRENGTH 90-93 (2011).

er spheres. This is because the algorithm's will-power is not finite and it will make the same decision late at night, after a day full of decision-making, that it would have made early in the morning. Overall efficiency may thus arise if one chooses correctly which decisions are better deferred to algorithms. In addition, by saving time on some decisions, one can spend more time making other decisions. Finally, by observing the choices that algorithms make—even if the user does not understand all the factors that came into play—the user can indirectly learn to make better choices in other spheres.

So far we have focused on the individual's efficiency. Total efficiency considerations add another important dimension to the analysis. Most decisions made by algorithms—especially those regarding regular consumption goods or services—may generally increase total efficiency. Some exceptions exist. To illustrate, should deference to algorithmic decision-makers indeed erode people's capacity for processes of self-deliberation, our political institutions might suffer if citizens are less able to make sound decisions in exercising their democratic rights.[108] This negative effect can be compounded by digital "echo chambers" strengthened by the use of algorithms, in which the information one receives simply echoes one's views, thereby indirectly limiting his ability to change his mind. While individuals may prefer such echo chambers, and regard them as subjectively efficient, their overall societal effect on democracy might be negative. Also, the use of algorithms may sometimes increase discrepancies in society, if they benefit some groups at the expense of others. This may happen, for example, where algorithms are not benign.

2. Psychological Rationales

The psychological effects of algorithmic assistants are ambiguous. On the one hand, freeing users from the need to engage in some otherwise burdensome decisions may increase their well-being. As Barry Schwartz argues, the multiple choice economy we live in today might paradoxically reduce happiness.[109] Indeed, at least in some spheres users may have a preference that decisions be made by others. The fact that interactive movies, in which the viewers choose the endings have not succeeded as well as their creators have hoped, might serve as an indirect indication of this tendency.

A related argument is that more free time may increase innovation and creativity. Apple Inc.'s founder, Steve Jobs, provides an interesting exam-

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108. *See* Antoinette Rouvroy & Yves Poulett, *The Right to Informational Self-Determination and the Value of Self-Development: Reassessing the Importance of Privacy for Democracy*, *in* REINVENTING DATA PROTECTION? 45, 46 (Serge Gutwirth et al. eds., 2009).

109. Barry Schwartz, *The Paradox of Choice*, YOUTUBE (Jan. 16, 2007), https://www.youtube.com/watch?v=VO6XEQIsCoM.

ple: he wore the exact same clothes every day. This enabled him to limit the choices he had to make on what he considered to be mundane issues, and keep his energies for more creative ones.[110] It is noteworthy that the importance of the connection between the use of algorithms and creativity extends beyond its direct psychological effects on the user. This is because we may define ourselves not only through our autonomous choice, but also through other means such as our creativity.[111]

Choices made by the algorithm, which reflect the user's preferences, can also contribute to the user's happiness. As Richard Ford puts it, "if we have given up autonomy, it was only the autonomy to make poor choices, go to bad restaurants with people we turn out not to like much, buy boring novels, listen to ear splitting music, engage in activities where costs outweigh benefits. I am actually more free now than ever before because my true self—the self that labored under misconceptions, limited information and emotional noise—is now facilitated by powerful and benevolent technology."[112] Moreover, some psychologists argue that people's ability to predict the effects of future events on their happiness is remarkably inaccurate.[113] Algorithmic assistants have the potential to reduce this problem.

On the other hand, it is not obvious that users would necessarily be happier—or have a stronger sense of self-fulfillment—in a world in which most everyday decisions were performed by algorithms. First and perhaps foremost, employment of the algorithm could reduce people's ability to define themselves through their choices. The user's identity will instead be shaped by the choices made through the algorithm, producing beliefs, goals, perceptions, and interactions other than those which would have been created by the individual making choices in an unmediated way. If an algorithm chooses the clothes I wear, the food I eat, and the books I read, on what basis do I fashion my identity? As Ford notes: "Over time, one could say that rather than the computer profile reflecting my tastes, I reflect its tastes. Of course, the profile started out trying to be as much like me as it could. So in one sense, the computer has simply helped me to be a better me—one that develops with the benefit of more information and more sound reasoning than I would have had on my own."[114] Also, if choices shape one's identity, the algorithmic tendency towards path dependency on the user's past choic-

110. *See* WALTER ISAACSON, STEVE JOBS 362 (2011). For the reduction of choice of clothing as a method to reduce decision fatigue, *see* John Haltiwanger, *The Science of Simplicity: Why Successful People Wear The Same Thing Every Day*, ELITE DAILY (Nov. 14, 2014) https://www.elitedaily.com/money/science-simplicity-successful-people-wear-thing-every-day/849141.

111. This idea is reflected in the concept of *homo faber*—man as creator.

112. Ford, *supra* note 44, at 1578-79.

113. *See* DANIEL GILBERT, STUMBLING ON HAPPINESS 24-25 (2006).

114. Ford, *supra* note 44, at 1577.

es can inhibit unconscious changes to the user's identity that would have otherwise occurred.

These effects can also completely change our existing social perceptions and interactions: What kind of signals could one use to enable others to know who he really is? If others know that some of my choices were made by algorithms, but do not know which ones—partly because such transparency would be hard to implement—how would they react to my choices? Alternatively, choices that do not mimic the user's preferences can affect the social reaction to him, in a way which is detached from his real identity. Also, if users do not know or understand the parameters underlying decisions made on their behalf, feelings such as fear of missing out and of not controlling one's life might increase.

Another point to consider is what consumers would do with the time freed up by algorithms. Would the result actually be increased innovation and creativity, or would it be laziness and complacency—and if so, what would be the consequences of such a change for the individual and for society?[115] Also, how would people be affected by loss of the social interactions that are often a by-product of shopping? Furthermore, psychological experiments have shown that many of our choices are based on opinions and information gathered from family, friends and acquaintances.[116] Such sharing of information serves a social function, beyond any efficiency considerations, which might be lost when algorithms make choices for us. In addition, people may feel less self-fulfilled if they do not "own" their choices. Put differently, the joy that comes from knowing you studied the options and made the right choice, or that you learned from mistakes, will decrease once decisions are made by algorithms. Finally, research has shown that some people enjoy the act of choosing, even when the choice is not easy.[117]

The matters raised here are beyond our expertise, but our intuition suggests that the effects of autonomous algorithmic assistants on users' well-being may not all be positive, even if our lives are more efficient and the "correct" decisions are made.[118] The balance between the above considerations may differ based on the type of choice to be made, the overall number of choices delegated to algorithms and their importance to the user, the ability of others to differentiate between choices made by the user and those made for him by an algorithm, and the user's personal characteristics. Ac-

115. Ryan & Deci, *supra* note 83, at 1564 (noting that undermining autonomy and choice might injure performance and creativity especially when it requires flexible, heuristic, creative or complex capacities).

116. *See, e.g.*, STUDIES IN DECISION MAKING: SOCIAL, PSYCHOLOGICAL, AND SOCIO-ECONOMIC ANALYSES (Martin Irle & Lawrence B. Katz eds., 1982); ROBERT E WITT, GROUP INFLUENCE ON CONSUMER BRAND CHOICE 53 (1970) (demonstrating strong correlation between knowledge of peer choce and individual choice).

117. Ryan & Deci, *supra* note 83, at 1576

118. This is a complicated issue. *See, e.g.*, Schwartz, *supra* note 109.

cordingly, while the psychological rationales for delegating some decisions to algorithms are strong, this unquestionably does not hold true for all decisions and all users.

3. Liberal Theory Rationales

As elaborated above, liberal political theory emphasizes the autonomy of the self: that is, not only the capacity and freedom to reach one's own decisions, but the supreme importance of actually doing so. Such autonomy should be based on a freedom of choice. The use of algorithmic assistants may affect freedom and autonomy in different ways.

Consider freedom first. Positive freedom requires that people be able to act on their authentic will. It can be argued that deferring to algorithms is generally compatible with positive freedom. The voluntary and informed decision to implement the algorithm is, in itself, an act of choice. As Richard Ford puts it: "Remember, it's all voluntary, I don't have to accept any of the suggestions offered by my cyber doppelganger. If the suggestions aren't good for me, I can reject them; if I really don't like the idea of taking direction from a computer on general principle, I can resist."[119] According to this view, it is limitations on our ability to use algorithms—rather than our voluntary and willful use of them—which harms positive freedom.

Furthermore, algorithms supply technological tools for making choices based on one's digital shadow. In other words, the algorithm is designed to mimic users' true preferences, thereby enabling users to more optimally fulfill their preferences. Under this view, the algorithmic assistant is simply the efficient, long arm of its user. Furthermore, if, as Isaiah Berlin suggests, a person's positive freedom consists in liberation from occasional passions, information limitations and biases, and if a free choice is one that conforms to one's higher, more rational self—to what one would choose in one of her better moments, as it were[120]—then freedom may in fact be better served by algorithms. Paradoxically, our digital assistants might be able make decisions that are truer to our authentic selves—truer even than the decisions we would in fact make on our own. Therefore, one's self does not disappear, but rather is embodied in the algorithm.

Algorithmic assistants raise an interesting question in this regard: to exercise positive freedom, must the user be aware of his self-inflicted limitations on choice, in particular the technological limitations of the algorithm and the parameters used by it to make the choice? Put differently, can a rational or authentic choice be made if one is not aware of the factors that play into the decision made on his behalf? This issue is, of course, most relevant to "black box" algorithms. A potential response is that it is sufficient that

119. Ford, *supra* note 44, at 1576.
120. BERLIN, *supra* note 72.

the user recognizes and accepts his unawareness, so long as he believes that the algorithm is indeed attempting to further his own preferences. As noted above, the market also has an important role to play here, in creating some sort of signaling system to guide users to their best choices. Greater transparency can also reduce this problem, although, as Barocas and Nissenbaum suggest, a "transparency paradox" may arise: providing the level of detail needed to enable users to provide genuinely informed consent would overwhelm even savvy users because the decisional parameters are volatile and indeterminate.[121]

The effect of algorithmic assistants on positive freedom is, therefore, dependent on their ability to reflect the user's true choices as well as on the awareness if the user of the parameters used to make the choice. Let us remember that true choices are not necessarily the optimal choices that one could make, but those that best reflect the user's preferences at the time of the decision, which may include the pursuit of immediate pleasures, desires and passions. In decisions which fall into the latter category, in which the user actually wishes to be true to himself even if the decision is not an ideal one, positive freedom will be harmed to the extent that algorithms are not able to reflect and realize such choices. There is also a certain worry that our capacity for decision-making would suffer even without positive freedom being limited, due to a limited exercise of decision-making by the individual, as elaborated above.

On the concept of negative freedom, which requires that one be able to act without external restraints or interference, algorithms once again create mixed results. On the one hand, their technological capabilities allow us to overcome external restraints, such as countering supplier power, limiting the ability of suppliers to engage in price discrimination, and opposing suppliers' manipulative selling techniques.

On the other hand, they could potentially threaten our ability and liberty to choose. One potential argument relates to the technological limitations of the algorithm, which are reflected in and restrain their choices. Yet in our view this argument should generally be rejected as an indication of harm to negative freedom, at least when the user is aware of the algorithm's limitations and still voluntarily chooses to employ it.

A more convincing argument relates to situations in which algorithmic assistants possess significant market power which, in turn, affects the content of their choices in a way which does not serve the user's interests.[122] To illustrate, consider the following example, which relates to the dominance of a handful of extraordinarily powerful transnational companies in a global

121. Solon Barocas & Helen Nissenbaum, *Big Data's End Run Around Anonymity and Consent*, *in* PRIVACY, BIG DATA, AND THE PUBLIC GOOD FRAMEWORKS FOR ENGAGEMENT 44, 59 (Julia Lane et al. eds., 2014).

122. *See* discussion *supra* Section II.B.

networked market for digital services. The comparative advantages of algorithmic assistants are often tied to their ability to access and analyze data relating to a user's preferences, in order to better mimic his preferences. Accordingly, data-driven network effects have the potential to increase entry barriers, strengthening platforms which have better access to vast amounts of data and their algorithmic assistants, and weakening the ability of independent algorithmic assistants to compete in the market.[123] This process is part of what Shoshana Zuboff calls "surveillance capitalism," in which power is identified with ownership of the means of behavioral modification.[124] Yet note that such abuses or manipulations are not unique to algorithmic assistants and can be reduced by some regulatory tools.[125]

Finally, negative freedom could be indirectly reduced when the choice not to employ an algorithm might be costly in the marketplace. For example, some sellers might offer a discount for users of algorithmic consumers. As algorithms become more efficient, some industries might indeed require some reliance on their decision-making powers, thereby reducing the freedom of users to decide whether to employ them.

The greater, more immediate concern created by algorithmic assistants to autonomy seems, however, to be the harm to the act of choosing itself. The concern is that autonomy is realized through the act of making choices, and if we delegate this responsibility to an algorithm we ipso facto relinquish that autonomy (though we retain our capacity for autonomy, which is a different matter, as discussed above). While we may have many options open to us, the choice among them is not made by the individual based on self-reflection and self-deliberation that lead to the shaping and application of his preferences, but rather through an algorithm which is assumed to be able to mimic these preferences. Note that this concern of harm of autonomy pertains even to the most benign algorithm conceivable, one which makes recommendations which exactly mirror the user's preferences. Indeed, the concern might in fact be graver in that case, because of the great temptation to rely on such algorithms. Algorithms offer a trade-off of sorts: autonomy is a price paid—freely and willingly—for superior capacity for want satisfaction and convenience.

It is important not to overstate the case. Autonomy is one value among others. This means that deference to algorithms may sometimes be worth the price we pay in personal autonomy. For example, if an algorithm could improve our accuracy in diagnosing terminal disease and offering adequate treatment, the importance of saving lives would surely be more pressing than the medical staff's interest in exercising their autonomous decision-

123. EZRACHI & STUCKE, *supra* note 9, at 191–92 (describing how algorithmic assistants can create an anticompetitive effect).

124. Zuboff, *supra* note 12, at 81.

125. One such tool is antitrust law.

making.[126] Some scholars go further and do not treat such limitations as harming autonomy. Joseph Raz, for example, argues that individual autonomy and authority do not come into conflict when the authority is used to service the individual. This may happen when the authority can better perform tasks that the individual would have performed, or when it overcomes collective action problems.[127] Gerald Dworkin suggests that decisions to limit choice in order to fulfill a greater goal do not necessarily make a person less autonomous. The examples he provides are voluntary army service and monasticism. [128]

Furthermore, while writing our own life story is of high value, do we have to color between the lines, or can we simply draw the bold ones and delegate some of our decision-making powers to others? It can thus be argued that the act of choice is at least partly exercised by such delegation, or by the choice we make of which algorithm to employ, especially if the user is aware of the parameters used by the algorithm to reach the decision. Furthermore, it can be argued that enabling the existence of a rich repertoire for the act of choosing—including choosing yourself or choosing by employing different algorithms—can sometimes induce more meaningful choice.[129] Yet to be autonomous one must identify with one's choices, and own them.[130] The question thus arises whether we will feel committed to our choices once they are made by algorithms.

This leads to another observation: there are spheres of life in which choosing is more important than arriving at the optimal outcome. For example, it might be ill-advised to use an algorithm to choose one's partner, no matter how superior the algorithm's "taste." It is also more difficult to justify the use of an algorithm in deciding whether to use lethal force in warfare,[131] or in political voting. Most cases would fall somewhere between these extremes. Furthermore, autonomy is not a dichotomous concept, and partial autonomy can also further the liberal theory rationale, at least to some extent. The thing to bear in mind is that our reliance on algorithms for decision-making, even when generally justified, has a cost. To the extent

126. For a discussion of cases somewhat analogous to this see David Enoch, *A Defense of Moral Deference*, 111 J. OF PHIL. 1, 14 (2014).

127. Joseph Raz, *Authority, Law, and Morality*, 68 THE MONIST 295 (1985).

128. GERALD DWORKIN, THE THEORY AND PRACTICE OF AUTONOMY 18 (Sydney Shoemaker ed., 1988).

129. For a similar argument with regard to contractual freedom *see* Hanoch Dagan, *Autonomy, Pluralism and Contract Law Theory*, 76 LAW & CONTEMP. PROBS., no. 2, 2013, at 19-20.

130. JOSEPH RAZ, THE MORALITY OF FREEDOM 369 (1988).

131. For a discussion see, for example, Eliav Lieblich & Eyal Benvenisti, *The Obligation to Exercise Discretion in Warfare: Why Autonomous Weapon Systems are Unlawful*, *in* AUTONOMOUS WEAPONS SYSTEMS: LAW, ETHICS, POLICY 245 (Nehal Bhuta et al. eds., 2016); ARMIN KRISHNAN, KILLER ROBOTS: LEGALITY AND ETHICALITY OF AUTONOMOUS WEAPONS 33-61 (2009).

that our autonomous way of living is worth caring about, this is a cost to be reckoned with.

To conclude, the use of algorithmic assistants can be at least partially justified by the rationales that support autonomous human decision-making. Algorithms can often reach more efficient choices; they can increase one's well-being, at least in some cases; and they do not necessarily clash with liberal political theory rationales. Yet these rationales do not hold for all decisions. Rather, some decisions are best made by individuals. Such decisions may differ from one individual to another, depending inter alia, on their effects on one's well-being (e.g., for one person it might be a choice of clothes and for another the book he reads), the accuracy of one's digital shadow, and the absolute number of other decisions made by algorithms. They can also depend on the subject matter of the decision (buying tomatoes is not the same as political voting). This implies that while algorithmic assistants may enjoy significant comparative advantages over autonomous human choice in many decisions, advantages which would most likely grow with the advent of improved methods to determine human preferences and create digital shadows, autonomous-choice rationales may still justify autonomous decision-making in some instances. Most importantly, the use of algorithmic assistants should not harm one of the basic conditions for autonomous decision-making, namely the ability of the individual to form preferences on which he can base his decisions, at least in those spheres of life in which he chooses not to employ an algorithm. The next chapter explores the legal implications of our findings.

IV: Legal Implications of Changes in Autonomous Choice

It is only a matter of time before algorithmic assistants become commonplace. Their advent raises a host of intriguing legal challenges. In this part we seek to shed light on those of challenges that result from the effects of algorithmic assistants on autonomous human choice. We first explore whether the use of algorithmic assistants should be allowed in light of their effects on human autonomous choice. We then explore whether our regulatory tools should be recalibrated or rewritten in order to deal effectively with the new challenges to autonomous choice. Our goal is not to provide definitive answers for the myriad issues that arise, but rather to identify and map them. Observe that other regulatory challenges, relating to other aspects of the employment of algorithmic assistants, which are beyond the scope of this article, may also arise.

A. *Should the Use of Algorithmic Assistants be Allowed?*

One question focuses on whether we should allow the market to take its expected course, or whether some limitations should be placed on the use of algorithmic assistants due to their effects on autonomous human choice. In

light of the conclusions reached in Part III above, several observations are in place. First, we counsel against blanket restrictions on the use of algorithmic assistants. Not only do algorithmic assistants offer many benefits, but, as shown above, at least with regard to a subset of decisions their use does not significantly clash with justifications for autonomous human choice and it sometimes even furthers them. Moreover, banning their use creates the "choice paradox" identified above, as it limits users' freedom to voluntarily employ such algorithms in order to aid them in making choices. This is strengthened by the fact that in many situations the correct balance between the autonomy to choose to employ algorithms and the autonomy to make one's own choices is not clear, and interventionary regulation can limit the benefits to be had. Finally, at least in some areas such a ban would be difficult to implement—both realistically and theoretically—if the use of algorithmic assistants was allowed elsewhere around the globe, creating comparative advantages for their users or enabling users to employ algorithms located outside their jurisdiction.

At the same time, some steps should be taken to ensure that algorithmic assistants' potential negative effects on user's choice are accounted for and justified. One major tool involves the support of market conditions that increase the incentives and the ability of providers of algorithmic assistants to increase user's utility.[132] Competition in the market for the supply of algorithmic assistants, as well as in the market for tools that compare the performance of algorithmic assistants, can potentially improve the quality of algorithms, and strengthen the incentives of providers of algorithms to ensure that the limitations they impose on human choice are justified. Competition in the market for inputs necessary to create or to operate algorithmic assistants can increase the ability of algorithmic assistants to operate efficiently.

Antitrust is an especially potent tool to advance such market conditions, as it strives to ensure that competition in the market is not limited by artificial barriers. To illustrate, a merger among producers of algorithmic assistants should be prohibited if it would significantly limit competition among algorithms, thereby indirectly limiting users' choice, without creating offsetting benefits for users. Another example involves the vertical integration of algorithmic assistants with suppliers of products necessary to create or to operate efficient digital shadows, such as data.[133] Control over sensors might be especially important, as sensors supply data that enables their controllers to observe users' conscious and unconscious behavior in the real world. For example, they might be able to monitor users' eye movements, heart rate

132. *See* EZRACHI & STUCKE, *supra* note 9, at 202; Gal & Elkin-Koren, *supra* note 9, at 2.

133. *See* EZRACHI & STUCKE, *supra* note 9, at 195-96; Gal & Elkin-Koren, *supra* note 9, at 29.

and tone of voice when users are exposed to certain products or ads. To ensure that no artificial barriers are created for competition among algorithms, regulators must recognize the unique characteristics of the relevant markets in order to deal with them effectively.

An interesting question that arises is whether, in considering the merits of a potential action by a designer or provider of an algorithmic assistant (such as a merger, joint venture or agreement with another market player), antitrust authorities should take into account the limitations that the algorithm places on users' autonomous decision-making. We suggest that the answer is negative. Antitrust authorities do not possess the necessary expertise and tools, nor the democratic mandate, to evaluate such effects and to balance them with competing considerations. Observe that while antitrust authorities have expertise in analyzing how market dynamics affect the choices open to consumers, their analysis largely takes as given that more choice implies increased consumer welfare. This does not imply, of course, that other regulators, who might possess expertise in such matters, cannot or should not take such factors into account. For example, education experts might weigh in on whether and to what extent to allow the use of algorithmic assistants by school children.

Increased competition cannot ensure, however, that algorithmic assistants are only employed where their harms to autonomous choice are offset by benefits to individual and social welfare. There are several reasons for this. First, individual decisions to employ algorithms cannot always be assumed to further the user's long-term welfare. As noted above, this may result from a combination of factors, including collective action problems, bounded rationality, limited information regarding the long-term effects of using algorithms, and prioritization of short-term benefits over future harms. Moreover, and arguably more important for regulation, the employment of algorithms cannot be assumed to always increase social welfare. This is because private decisions fail to take into account the externalities they impose on others. Social interests are thus not adequately accounted for in a system based solely on private decisions about whether and when to employ algorithms. This conclusion serves as a call for exploring the possibility to limit the employment of algorithms in some cases.

Information about the effects of algorithms can play an important role in self-regulation. Accordingly, it is suggested that the public be educated in the benefits of autonomous choice at least with regard to some decisions, as well as in the potential benefits and limitations of algorithmic assistants, in order to create such digital literacy. Exercises that emphasize the differences between the two modes of decision-making can be promoted, as should the development of a competitive market for tools used for comparing algorithms and for comparing the decisions of algorithms with those of humans. In addition, it is important to emphasize the importance of exercising one's decision-making power, at least in some spheres of one's life, in order not to

lose this ability. Such efforts would help ensure that users are informed of the costs and benefits involved in the decision to employ algorithmic decision-makers in different spheres of their lives. It does not ensure, of course, that users will make long-term efficient decisions. This may result, inter alia, from the fact that the ability to make sound decisions is one of long-term experience, while most decisions to employ algorithms involve short term benefits, and people tend to favor immediate benefits over future costs.[134] Interestingly, a technological solution can partially reduce this problem: an algorithm will determine which decisions and how many are best made by the user himself.

A difficult question arises whether, in light of the above, the use of algorithms should be prohibited—or at least limited—to certain classes of potential users. In particular, should children, who have not had much experience in exercising their "preference forming muscle," be allowed to use algorithmic assistants extensively. Children who are not exposed to a variety of options and are required to choose among them will have more limited abilities to select the option that best fits their preferences in the future. As Yochai Benkler observes, in such cases the children's ability to exercise autonomy in the long-term is harmed.[135] This question has both normative and practical aspects. At this point in time, we suggest that no such governmental restrictions be imposed, given that to our knowledge most algorithmic assistants are currently generally not made for use by children. Nonetheless, parents should be encouraged to limit the usage of algorithmic assistants by children, at least in some spheres. Also, studies on the effects on children of the use of algorithmic assistants should be performed, and parents should be informed of their results.

In addition, regulatory limitations should be placed on the use of algorithmic assistants where significant negative externalities might otherwise be created. This is strengthened by the fact that users are not always aware of or can minimize the unanticipated negative results of their use of algorithms. One tool to further this goal is to require some level of transparency from the algorithm's provider with regard to the algorithm's potential effects on the user as well as on third parties, at least with regard to some types of algorithms. Observe that such transparency, which resembles cautionary information regarding the use of medicine, is different from the type

134. *See* ALESSANDRO ACQUISTI & JENS GROSSKLAGS, *What Can Behavioral Economics Teach Us About Privacy?*, *in* DIGITAL PRIVACY: THEORY, TECHNOLOGIES, AND PRACTICES 363, 372 (Alessandro Acquisti et al. eds., 2008).

135. *See* Benkler, *supra* note 18, at 40 (using the example of Amish elders who remove their children from public school exactly at the age when they believe that education would most influence their children's preference-formation process and make them more able and likely to choose a life other than as members of their community). Note that our case is more complicated, given the Choice Paradox.

of transparency usually suggested for algorithms, which relates to their code and data sources.

Furthermore, the use of algorithmic assistants should be limited in those spheres in which it is clear that the harm to autonomous choice cannot be justified by the benefits that algorithmic assistants bring about. This justification can be particularly strong where the use of an algorithmic assistant imposes strong negative externalities on others and clashes with our social contract.[136] For example, in our view algorithms should not be allowed to choose senate members in a democratic society. Interestingly, even Isaac Asimov, in his known story "Franchise" about the all-knowing Multivac computer, did not completely eliminate the need to involve citizens in elections (although the decision involved input from one representative individual who provided the final bit of needed data).[137] We do not argue that algorithms can never make better political choices. Rather, our suggestion is grounded in the externalities political appointment decisions impose on social welfare. Should citizens prefer that important decisions that affect them as a collective be taken by humans, based on self-reflections on their convictions, then algorithmic decisions on such matters clash with those citizens' preferences, thereby indirectly negatively affecting their wellbeing and infringing the social contract on which a democratic society is based. Note that this suggestion goes beyond each individual's claim for his own individual autonomy, and is based on a demand that others in society exercise their autonomous choice in a sub-set of decisions which impose externalities on others. Our argument does not prevent individuals from making up their own mind by using algorithms.

Finally, we suggest that in order to respect the user's decision-making autonomy, algorithms should generally be mandated to include a "stop button" which enables users to override the algorithmic mechanism at any stage in the decision-making process.[138] At the very least, the providers of algorithmic assistants should be required to make available a compatible version of their algorithm which includes such a function. External regulation is needed because it cannot be guaranteed that market conditions will

136. To illustrate, the use of algorithmic assistants by consumers to find the best deal while harming suppliers they bought from in the past is legitimate. This is because part of our conception of the market rules is economic Darwinism: that these suppliers should compete more effectively and if not, exit the market. They have no established right that consumers will continue to buy from them.

137. Isaac Asimov, *Franchise*, IF: WORLDS OF SCIENCE FICTION, 5-6 (August 1955).

138. This idea partly resembles requirements for human-in-the-loop of algorithms in some areas like health informatics. While these requirements are usually included to protect third parties from decisions in which the algorithm's performance can benefit from knowledge or understandings that human intervention adds, here we suggest their application in order to protect the autonomous choices of users. Observe, however, that some decisions might take the algorithm a fraction of a second. In such cases, the only option that might be viable to the user is to overturn the decision.

always lead to the development of stop buttons in all relevant markets, especially if the algorithm is combined with other functions that make its overall use attractive, and the transaction benefits the algorithm's provider.

B. *Regulatory Challenges of Algorithmic Decision-Making*

Assuming that the use of algorithmic assistants is permitted in most spheres of our lives, the question arises whether our existing regulatory tools are sufficient to deal effectively with this technological change. In particular, we ask whether the fact that the user is one-step removed from the decision and thus does not make a direct autonomous choice, should affect the interpretation and application of existing laws or lead to the creation of new laws. This is the focus of the analysis below. In particular, we identify three major cornerstones of the law that go to the heart of human autonomous choice—namely assent, intent, and the protection of conditions for exercising one's freedom of choice (negative freedom)—and inquire how they should be applied when choices are made by algorithms.[139] Reevaluating existing legal standards in light of automated decision-making is essential for social welfare, as otherwise we might discourage the adoption or patterns of use of welfare and growth-enhancing technologies.[140] Alternatively, it might create a problem of moral hazard which can lead to excessive and socially harmful risk-taking. The importance of setting efficient legal rules that accommodate decisions made by algorithms increases in step with the delegation of more tasks to algorithms.

1. Assent

Assent is a major cornerstone of many laws. In contract law, for example, the conscious, objectively manifested agreement to contractual terms is a critical element of a contract.[141] This condition is necessary in order to ensure that the contract expresses the choices of its parties. Assent also plays a critical role in other areas of law, including antitrust, constitutional rights, tort (such as informed consent to medical procedures), and privacy.[142] In the

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139. Of course, other questions may also arise. For example, if an algorithm creates a new invention, who qualifies as the inventor under patent law? *See* Ryan Abbott, *I Think Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079, 1114-16 (2016).

140. Regarding patterns of use consider the following: A business can create and operate its own algorithm, or contract-out its design and operation. Even when the former option is otherwise efficient, the latter might be adopted if it reduces the risk of legal liability for the algorithm's actions, and such risk is sufficiently high.

141. *See*, *e.g.*, CHARLES FRIED, CONTRACT AS PROMISE: A THEORY OF CONTRACTUAL OBLIGATION 45-46 (1981); Randy E. Barnett, *A Consent Theory of Contract*, 86 COLUM. L. REV. 269, 319 (1986).

142. *See*, *e.g.*, Daniel J. Solove, *Introduction: Privacy Self-Management and the Consent Dilemma*, 126 HARV. L. REV. 1880, 1894 (2013) (writing about privacy).

previous section we dealt with the question of whether agreement to use algorithms should be the sole factor which determines whether their use should be permitted. This section focuses on whether and how the user's assent to the algorithm's decisions can be inferred.

How does the fact that a decision is reached by an algorithm affect the meeting of minds? Arguably, the contract is the result of the user's voluntary and deliberate decision to employ a certain algorithm and to allow it to make decisions for him. Therefore, a straightforward answer is that once the algorithm is set in motion by the user, it acts as the user's long arm.[143] Indeed, current contract law presumes that algorithms are mere tools which execute the will of their users directly.[144]

This assumption may be problematic with regard to some algorithms. In particular, when using predicted choice and paternalistic algorithms, which have the ability to learn, thereby divorcing critical aspects of decision-making in contractual agreements from conscious determination by any individual,[145] the user may not be aware of all the possible choices that can be made by the algorithm, let alone keep track of all the parameters that the algorithm considers on his behalf.[146] Indeed, this knowledge gap is a direct result of the algorithm's comparative advantage: as elaborated above, the algorithm can quickly consider a breadth of data that no human could, and it can sometimes predict the user's future choices better than the user himself. Furthermore, in some situations the user may not care about the actual choice made by the algorithm, so long as it makes a choice. A recent and provocative example involves the Random Darknet Shopper, a shopping bot used in an art project displayed at a gallery in St. Gallen, Switzerland, in 2015. For the duration of the exhibition, the artists sent the bot to shop on the dark web, with a weekly budget of $100 in bitcoins. The bot chose items and sent them to the artists by mail, without the artists knowing in advance what would be purchased. The orders were then displayed in the gallery.[147]

The problem, as Lauren Scholz argues, is that such algorithms stretch to its breaking point the requirement of assent, far beyond the intents and capacities of the algorithms' authorizing entities.[148] The manifested intent to

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143. *See* Lauren Henry Scholz, *Algorithmic Contracts*, 20 STAN. TECH. L. REV. 128, 165 (2017). *See also* Peter M. Asaro, *A Body to Kick but Still no Soul to Damn: Legal Perspectives on Robotics*, *in* ROBOT ETHICS: THE ETHICAL AND SOCIAL IMPLICATIONS OF ROBOTICS 169, 178-80 (Patrick Lin et al. eds., 2011).

144. Scholz, *supra* note 142 at 132.

145. *Id.*

146. *See generally*, *id.*

147. Items purchased by the bot included 10 ecstasy pills, a baseball cap-mounted hidden camera system, and a fake Louis Vuitton handbag. The exhibits were seized by authorities after the exhibition closed. Mike Power, *What Happens When a Software Bot Goes on a Darknet Shopping Spree?*, GUARDIAN (Dec. 5, 2014), https://www.theguardian.com/technology/2014/dec/05/software-bot-darknet-shopping-spree-random-shopper.

148. *See* Scholz, *supra* note 142, at 132-33.

use an algorithm to set contractual terms is not the same as objectively, manifestly assenting to the actual contract the algorithm reaches. If the instructions given to an algorithm are vague (such as find me the best deal), the instructions cannot be said to reflect the level of objectively manifested assent necessary to ground a contractual promise. The user assent to be bound was not made at a sufficient level of specificity which is necessary to form an enforceable contract.[149]

To solve this problem, Scholz suggests that algorithms be regarded as constructive agents for the purpose of contract formation.[150] Agency law allows one to impute knowledge and intent to principals who are not directly involved in tasks, including forming contracts. Principals can authorize their agents formally, by implication, or by ratification, i.e., accepting the benefits of the acts of the agent. In agency law, the principal is usually liable for the mistakes the agent makes; this is because the principal assumed such a risk by opting to use an agent in the first place. Observe, however, that even under agency law the principal cannot be assumed to agree to any action taken by the agent, and much depends on the level of knowledge required. Also, as Karanasiou and Pinotsis argue, the fact that the algorithm can take informed decisions with no user's involvement in the decision-making process or even in the goal-setting process, challenges the assumptions on which the current concept of agency is based, which relate causality and intent.[151] We might thus need to reevaluate existing doctrines of agency law, including the assumptions on which they are based, in light of technological challenges, and verify that they serve us well in their current form.

2. Intent

The fact that the algorithm engages in autonomous decision-making, which is one-step removed from the user but initiated by him, also raises issues regarding the user's mental state, ranging from recklessness, through negligence and intent, to specific intent. One's mental state is central to many areas of law, including criminal law and tort law. The question is therefore whether and when a user, who employs an algorithm that creates harm to another or to society, is legally responsible for that harm.[152] Two sets of interconnected issues arise. The first takes existing requirements for liability as a given and explores when a user can be found to meet these requirements. The second explores whether new legal tools are needed in or-

149. *Id.* at 155.
150. *Id.* at 132.
151. Karanasiou & Pinotsis, *supra* note 34, at 180.
152. Of course others may be responsible as well, including the algorithm's designer or supplier. These question are not relevant to this article.

der to effectively deal with the new realities created by algorithms. We briefly consider both, focusing on tort law.[153]

Let us first differentiate between two extreme cases: one in which the user could and should have known about the significant risk to others or to society involved in the use of the algorithm, and another in which the user was not and could not have been reasonably aware of such risk. Both are clear-cut cases: while the former generally fulfills the requirement for a mental state, the latter does not. Yet most cases fall in-between these two extremes.

The issue of a mental state is especially relevant in the case of machine learning algorithms. Such algorithms are designed to achieve a given goal. They can do so by independently determining the means to reach that goal, through self-learning and the reactions to its actions. In such cases the decision is not the fruit of explicit human design but the outcome of evolution, self-learning and independent machine execution.[154] Proof of the required mental state in such situation—unless strict liability is applied—is not simple.[155] On the one hand, the user chose to use the algorithm, and could have checked with the algorithm's provider whether a harmful or an illegal result might arise. On the other hand, once we demand that the user acquaints himself with the algorithm's potential risks and when they might occur, some of the benefits of using algorithms (saving time and effort, etc.) might be lost. Moreover, even if the user is aware of a potential risk created by the algorithm, he might not be cognizant of other market conditions which create the actual harm. Such harm would depend on factors not necessarily under the user's control, and which could change over time.[156] Furthermore, the algorithm's designers and providers might be in a better position to improve its quality and better assess its potential risks. Finally, where the algorithm generally improves the prevention of harm relative to human decision-making, this fact should be given weight.[157] We therefore suggest that the user's awareness of the potential harmful effect should not be simply inferred from his decision to use to algorithm, at least in the absence of gross negligence, and that strict liability not be applied. Where the user is demonstrably aware of the potential for harm, the fact that a sophisticated system containing an autonomous algorithm performed the actual harmful act

153. Note that similar questions arise with regard to the proof of an agreement among algorithms. *See, e.g.*, Gal & Elkin-Koren, *supra* note 9, at 44.

154. *Id.* at 22-25.

155. *See* Yesha Yadav, *The Failure of Liability in Modern Markets*, 102 VA. L. REV. 1031, 1034 (2016) (noting that the liability framework governing securities trading is unable to effectively deter and compensate harms in algorithmic markets. The framework of (i) intent; (ii) negligence; and (iii) strict liability is ineffective in markets that rely on algorithms for trading).

156. Gal & Elkin-Koren, *supra* note 9, at 14-16.

157. *See, e.g.*, Abbott, *supra* note 16, at 18-19.

should not prevent establishing a mental state.[158] Furthermore, a rule should be developed to determine the level of awareness we expect from the user. Such a rule should balance considerations such as the effects of the expected level of awareness on the technological design as well as the use of algorithms, and the expected harm to others.

Algorithms may also affect the level of duty of care. As Ryan Abbott argues, the "reasonable person" might potentially be replaced with a "reasonable algorithm" standard, at least where the use of algorithms is relatively easy and commonplace, and where it creates a much lower level of risk than comparable human decision-making.[159] This implies that the standard may be higher than before.

The second set of questions is wider, and explores whether current rules, which were created for human interactions, should similarly apply to the actions of algorithmic assistants. Suggestions have been made to recognize some types of autonomous algorithms as legal persons,[160] making sophisticated autonomous algorithms the subject of specific rights and obligations, including that of making good any damage they may cause. In our view, this is a problematic notion that inappropriately limits the liability of the designer, provider and user, and blurs the boundaries between algorithms and men.[161]

Others have suggested strict and vicarious liability for the algorithm's actions: If the algorithm's designer did not sufficiently inform users of any dangers associated with the use of the algorithm, or if the algorithm was defective, the responsibility will lie with the designer. Otherwise, responsibility will lie with the user. This, in essence, is strict liability for failure to supervise by effective oversight.[162] Along this line, the European Parliament recently issued a draft proposal for dealing with autonomous robots which, in essence, are sophisticated algorithms.[163] It recognized that the ordinary

158. Ariel Ezrachi & Maurice E. Stucke, *Artificial Intelligence: When Computers Inhibit Competition*, 2017 U. ILL. L. REV. 1775, 1798.

159. Abbott, *supra* note 16, at 39-41.

160. *See generally* Tom Allan & Robin Widdison, *Can Computers Make Contracts?*, 9 HARV. J.L. & TECH. 25 (1996); SAMIR CHOPRA & LAURENCE F. WHITE, A LEGAL THEORY FOR AUTONOMOUS ARTIFICIAL AGENTS 153 (2011); F. Patrick Hubbard, *"Do Androids Dream?": Personhood and Intelligent Artifacts*, 83 TEMP. L. REV. 405 (2011) (noting that human artifacts should be afforded legal rights if they meet certain criteria). *See also* F. Patrick Hubbard, *"Sophisticated Robots": Balancing Liability, Regulation, and Innovation*, 66 FLA. L. REV. 1803, 1863 (2014) (noting that no legal personhood suggested to artefacts).

161. European Parliament Comm. on Legal Affairs, *Draft Report with recommendations to the Commission on Civil Law Rules on Robotics*, 2015/2103(INL) (May 31, 2016).

162. This is the legal framework with regard to deficient products.

163. The characteristics of a smart robot are as follows: acquires autonomy through sensors and/or by exchanging data with its environment (inter-connectivity) and trades and analyses data; is self-learning (optional criterion); has a physical support; adapts its behaviors and actions to its environment. European Parliament Comm. on Legal Affairs, *Civil Law Rules on Robotics*, at 6-7 (2016).

rules on liability are insufficient because they "cover cases where the cause of the act or omission can be traced back to a specific human agent such as the manufacturer, the owner or the user, and where that agent could have foreseen and avoided the harmful behavior. . .[I]n the scenario where a robot can take autonomous decisions, the traditional rules will not suffice to activate liability, since they would not make it possible to identify the party responsible for providing compensation and to require this party to make good the damage it has caused."[164] It therefore suggested that a rule of strict liability should be applied to damages caused by smart robots, requiring only proof of a causal link between the harmful behavior of the robot and the damage suffered by the injured party. It also suggested the creation of an obligatory insurance scheme for the harm caused by robots.[165] Suggestion for strict liability might limit the incentives of designers of algorithms to enable the user to reprogram them to better fit his own uses, thereby potentially limiting welfare and growth. We therefore suggest a more nuanced rule, which applies strict liability only in rare cases in which the risk of harm is high and should have been known.

3. Regulatory Tools that Promote Negative Freedom

The third issue relates to the effects of algorithmic assistants on laws which are designed to promote autonomy through negative freedom. Consumer law provides a useful example since its goal is to ensure that the consumer is not restricted or misled in his decisional parameters.

Algorithmic assistants affect the application of consumer law in at least two ways. The first focuses on their potential ability to better detect misleading information or unfair contractual terms,[166] given their capacity to more efficiently analyze information than human consumers. Furthermore, this ability might reduce suppliers' incentives to engage in such conduct, thereby creating a (partial) market solution to the problem. A dynamic interaction will most likely develop: suppliers will seek ways to evade algorithms' methods of detecting misleading information, the algorithms will be programmed to overcome these evasion mechanisms, and so forth.

The second way in which algorithmic assistants might affect the application of consumer law is through their potential buyer power as noted above, which could, at least to some degree, counteract suppliers' power, and reduce the latter's ability to create one-sided boilerplate contracts. Once

164. *Id.*

165. *Id.*

166. *See*, *e.g.*, Hans Micklitz et al., *The Empire Strikes Back: Digital Control of Unfair Terms of Online Services*, 40 J. CONSUMER POL'Y 367 (2017); Marco Lippi et al., *Automated Detection of Unfair Clauses in Online Consumer Contracts*, *in* LEGAL KNOWLEDGE AND INFORMATION SYSTEMS 145, 146 (A. Wyner & G. Casini eds., 2017).

again, algorithmic assistants create market solutions that reduce the need to apply consumer law.

The above raises intriguing questions: should the enhanced ability of algorithmic assistants to detect unfair contractual terms reduce the responsibility of suppliers found to demand such terms? Put differently: Should we allow a supplier to rely on this enhanced ability of algorithms in order to claim that no harm was expected? Can a supplier claim that the mere decision to include such contractual terms in such an environment should be treated as an indication that he did not believe it to be unfair, given that using unfair contractual terms in such an environment would have been against his interest? Similarly, with regard to countervailing buyer power, does the fact that consumers may enjoy stronger buyer power through the use of algorithmic assistants reduce the need to apply limitations on boilerplate contracts? Does it change suppliers' level of responsibility?

These are difficult questions that go to the heart of the law's goals, which need to be answered in our new economy. Our basic intuition is not to allow suppliers to take a cynical advantage of algorithmic assistants. At the same time, technological developments may justifiably change regulatory priorities, especially in a world of scarce enforcement resources. One relevant factor that should be taken into account is the ability of suppliers to differentiate between those consumers who have other options and enjoy buyer power, and those who do not. In addition, new laws may need to be created to mandate suppliers to provide information about their products that can be easily readable by algorithms.[167]

At the same time, we might need to create new laws designed to curb abuses by consumers rather than by suppliers, a direct result of the increased abilities and powers of consumers operating through algorithms. This change of focus requires fresh thinking, outside the box, but can rely on some of the conceptions for abuse that apply to suppliers. Another area where fresh thinking is required is how to define manipulations and misleading information in a world in which algorithms analyze information and make decisions. To give a simple example, if an algorithm purposefully places much emphasis on the user's past decisions or on the decisions of his peers, thereby changing the user's consumption habits, would this be considered unwarranted manipulation and if so, under what circumstances?[168]

One conclusion from the discussion of the three legal challenges is that the legal consequences of the use of algorithms depend on and are affected by the level of autonomy employed by the algorithm in its decision-making process. Accordingly, algorithms based on machine learning and thereby

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167. *See, e.g.*, Sunstein, *supra* note 17.

168. Manipulation can be broadly defined as the interference with the way that the other "reaches decisions, forms preferences, or adopts goals." The legal issue is when such manipulation is or should be prohibited by law. *See*, Benkler, *supra*, note 18, at 38.

not based directly on the user's choices, while potentially increasing the benefits to users, also create the strongest challenges to legal doctrines designed to apply to human choice.[169] Another conclusion is that the knowledge and understanding of the user of the algorithm's decision-making process, as well as his potential influence over it, affect the legal result.[170]

One final observation regards freedom of speech. The First Amendment protects the expressive freedom of individuals which serves their autonomy as well as the democratic discourse.[171] Expressive freedom, in turn, is based on the exposure of individuals to information on which they can form their ideas, and on their ability to express the ideas formed. As Yochai Benkler, Owen Fiss and others have forcefully argued, limiting exposure through direct or indirect state-imposed limitations such as intellectual property rights and information laws harms the right to exercise the freedom of speech.[172] Algorithmic assistants create an even greater conflict, given that the autonomy deficit is voluntary and self-imposed.[173] Furthermore, as observed above, they may create a conflict between short-term and long-term autonomy if they diminish a person's ability to form preferences.[174] Yet while algorithmic assistants may systematically reduce the ability of users to create preferences on their own, they also increase the range of options available to users, of both final options of action as well as how to exercise their autonomy. These issues deserve a study of their own.

V. CONCLUSION

Tomorrow's cyberspace will include algorithmic assistants, which will make decisions for their users, based on users' digital profiles, selecting products services, and actions for the real world. Some of these algorithms already exist today, and others are fast-developing, as the intersection of information technology, big data, and cognitive science enables the creation of more powerful, faster, and more intelligent algorithmic decision-makers.

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169. *See* Karanasiou & Pinotsis, *supra* note 34, at 5.

170. *See also* Meg Leta Jones, *The Ironies of Automation Law: Tying Policy Knots with Fair Automation Practices Principles*, 18 VAND. J. ENT. & TECH. L. 77, 113-115 (2015).

171. *See, e.g.*, Whitney v. California, 274 U.S. 357, 375 (1927) ("Those who won our independence believed that the final end of the state was to make men free to develop their faculties, and that in its government the deliberative forces should prevail over the arbitrary.").

172. Benkler, *supra* note 18, at 27. *See also* Yochai Benkler, *Free as the Air to Common Use: First Amendment Constraints on Enclosure of the Public Domain*, 74 N.Y.U. L. REV. 354 (1999); OWEN M. FISS, LIBERALISM DIVIDED: FREEDOM OF SPEECH AND THE MANY USES OF STATE POWER 37-38 (1996); Robert Post, *Equality and Autonomy in First Amendment Jurisprudence*, 95 MICH. L. REV. 1517 (1997).

173. External forces can also lead to the use of algorithmic assistants. *See, e.g.*, Gal & Elkin-Koren, *supra* note 9, at 125-38.

174. *See* discussion *infra*; Benkler, *supra* note 18, at 34-35.

What is unique about autonomous algorithmic assistants is that they bypass the individual's autonomous decision-making process. Autonomous choice is a cornerstone of our social, economic, psychological and political systems. Therefore, it is essential to explore whether the introduction of algorithmic assistants will serve social welfare despite their limitations of human autonomous choice. Indeed, before submitting to the convenience and efficiency that algorithmic assistants may offer, we must be attentive to their effects on our choices, determining our decisions according to parameters that are sometimes outside our control and even understanding.

This was the main goal of this article. As shown, most of the rationales that hold for human autonomous choice are not significantly harmed by the employment of algorithms, at least in some sub-sets of decisions. At the same time, while algorithmic assistants may enjoy significant comparative advantages over autonomous human choice in many decisions, which grow with the advent of new methods to determine human preferences, autonomous-choice rationales may still justify human decision-making in some instances. Defining such instances is timely and essential, as otherwise we might miss the opportunity to ensure that the use of algorithmic assistants indeed fits our needs, preferences, and values. Interestingly, as shown, while some of the challenges to autonomous choice created by algorithmic consumers are inherent, others can be solved by the market or through technological means, possibly even through algorithms.

Our second goal was to identify and analyze some of the regulatory challenges that arise from algorithmic decisions in a system designed to apply to human choices. We identified three main areas of law—consent, intent, and laws that protect freedom of choice—that need to be reconfigured to deal effectively with this new technological challenge. The article argues that new forms of regulation are necessary to meet some of the new technological challenges to autonomous choice. Finally, we identified some cases in which the use of autonomous algorithmic assistants should not be allowed, in light of its relationship with autonomous choice. We hope that this article will serve as a basis for further discussions on the policy choices we make with regard to this new and fast emerging technology.