Missing Circles: A Dignitarian Approach to Doughnut Economics Through AI Applications

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Abstract This contribution aims at providing a more concrete and accurate understanding of Doughnut economics, its model, and its ideas. In doing so, it provides a comprehensive description of the Doughnut and its connection with the Sustainable Development Goals. Then, it inquires into the philosophical background of Doughnut economics, elucidating its existential rationale that relies on human dignity. Further, examples of four AI applications are used to showcase how the Doughnut model would address their use and challenges that arise thereof. From this testing exercise transpires the understanding that another limitation is required in the Doughnut model, pursuant to its philosophical background. Therefore, besides economic activities that may breach the ecological ceiling or the social foundation, activities that infringe human dignity, without breaching any of the boundaries, are also incompatible with the Doughnut model. This complementing proposal is conceptually represented within the model of Doughnut economics.

Keywords Sustainable development · Doughnut economics · Dignity · Ethics · Artificial intelligence

1 Introduction

The nineteenth century saw the emergence of sustainable development policy from a union of economics with environmental sustainability. This led to slow but steady initiatives that aimed at incorporating sustainable criteria to economic development (Spindler 2013). Rooted in all cultures (Schreiber 2004), sustainable development made its way to policy firstly through the German Forestry Industry (Schulze and Schretzmann 2006, 68) and then through the United Nations' (UN) Environmental

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Policy, which has produced today's Sustainable Development Goals (SDGs). A lake in South America named Manchau gagog changau gagog chaugo gagog amaug, which means "We fish on our side, you fish on your side and nobody fishes in the middle", perhaps succinctly evidences the old origins of sustainable development as a concept.

Doughnut economics is a recent idea that aims at providing a model for sustainable development. The Doughnut model can be perceived as a conceptual representation of a seemingly straightforward idea: the outcome of our activities must be subject to two constraints, ensuring a social foundation of human wellbeing and protecting the ecological ceiling of planetary boundaries (Raworth 2017b). So long as our activities do not fall short of the social foundation or over the ecological ceiling, the model suggests that we are operating within the safe and just space for humanity. These two constraints are drawn based on prior research and widely accepted social objectives. The threshold of the social foundation is comprised of minimum needs that any society must meet for all humans. The needs included in the social foundation are visible in Fig. 1 and are drawn from the SDGs as developed in 2015 by the UN (UNDP 2022). The ecological ceiling is drawn based on the research that identifies the – originally 9 (Rockström et al. 2009) and then 12 (Steffen et al. 2015) – planetary boundaries, the crossing of which is expected to lead to irreparable damage on the planetary scale. As shown in Fig. 1, there are 12 planetary boundaries that jointly form the ecological ceiling.

The Doughnut Economics Action Lab (DEAL) is where the ideas and model of the Doughnut are further explored and operationalised. Cities like Amsterdam have taken proactive steps towards the application of Doughnut economics (Amsterdam 2022). However, despite the steps taken towards operationalisation and specification of how the model would work in practice, the Doughnut and its ideas bear a metaphysical nature, insofar as they are too broad and hermeneutic to qualify or (to use a Popperian term) be demarcated as a scientific theory. The ideas behind Doughnut economics are framed in opposition to the prevailing neoclassic account of economics based on the *homo economicus* and mechanical equilibrium, offering a claim to paradigm-shifting concepts like distributive-by-design and regenerative-by-design. However, these ideas are not empirically analytical and often raise more questions than they answer (Schokkaert 2019).

It is, therefore, necessary to further elucidate the meaning of Doughnut economics and its model, particularly its philosophical background. This elucidation is not only useful in and of itself, but especially in order to enable further empirical analysis and falsification. If one inquires into its philosophical background, Doughnut economics refer to SDGs and human dignity as its existential and justificatory rationale. SDGs, in turn, also refer to human dignity as a basis for their development (May and Daly 2020). However, the concept of human dignity takes different meanings throughout the history of philosophy (Lebech 2009), so the reference to human dignity by Doughnut economics and SDGs begs the question: what does human dignity mean in this context? Hence, in order to elucidate the philosophical background of Doughnut economics and SDGs, it is necessary to elucidate and

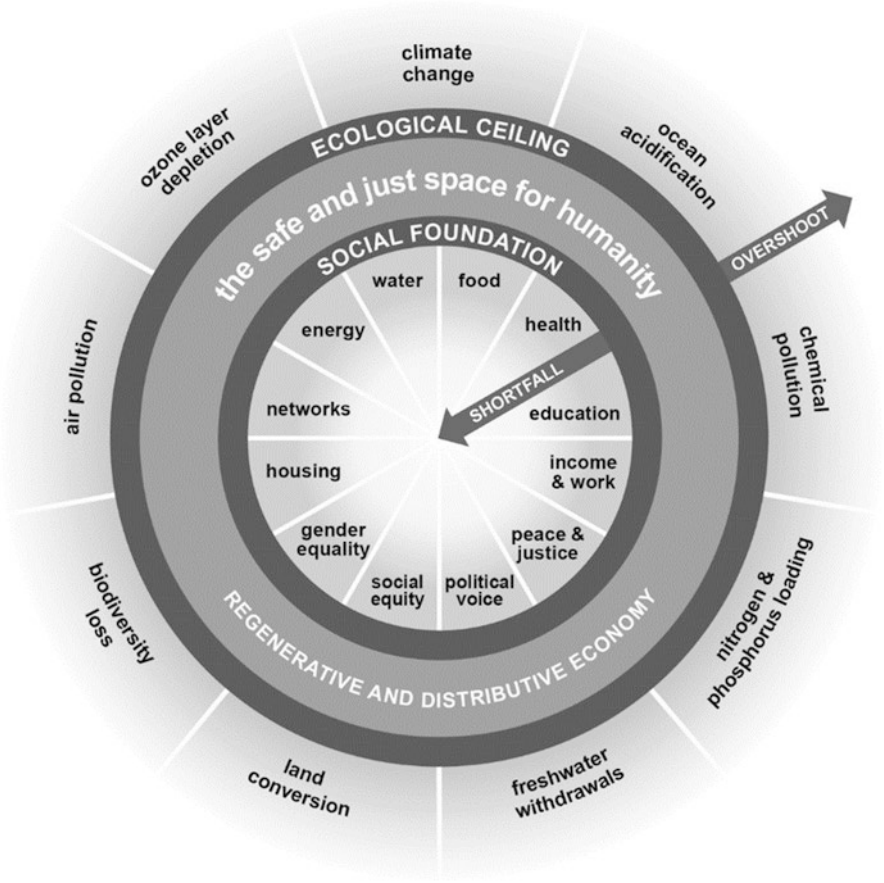

Fig. 1 Doughnut economics illustration. (Raworth 2017b)

operationalise the meaning of human dignity for purposes useful to Doughnut economics. This is one of the aims of this contribution.

Moreover, in line with the pragmatist maxim that concepts are properly understood when tested (Peirce and Eisele 1985, 266), the model of Doughnut economics is tested through four examples of AI applications: AI applications that may violate the social foundation, AI applications that may violate the ecological ceiling, AI applications that support one threshold but violate the other, and AI applications that support both thresholds but may violate human dignity. Accordingly, the analysis shows that a third constraint is required within the Doughnut model, pertaining human dignity.

Section 2 describes Doughnut economics, its ideas, and its model in more detail, explicating its connection with the SDGs. In Sect. 3 the chapter explores various conceptualisations of human dignity throughout different philosophical eras, clarifying which "version" of human dignity fits the requirements of Doughnut

economics and SDGs. Section 4 offers an analysis of the Doughnut model through four examples of AI applications, whereas Sect. 5 concludes.

2 The Doughnut Model

If a society manages to not fall under the social foundation or over the ecological boundaries, it is operating under a safe and just space for humanity – so does the Doughnut profess. Figure 1, in the introductory section, gives a picture of the Doughnut model. While a picture generally speaks for a thousand words, in this case it speaks precisely of seven ways to think like a twenty-first-century economist. In what follows, the ideas and the model of the Doughnut are presented descriptively. Then, the relevance of the Doughnut model for the SDGs and their operationalisation is discussed. This section traces these seven ways as a structured method to describe the Doughnut model and its ideas. The reader will notice that the essence of each seven ways is a critique to neoclassic economics, which this section is bound to follow descriptively.

(i) Instead of the GDP: The first shift in thinking like a twenty-first-century economist is to question the use of GDP as a measure of economic health. Instead, progress ought to be measured by whether we are operating inside the Doughnut, i.e., if the social foundation and the ecological boundaries are respected. In this sense, the safe and just space of humanity, the space between the two concentric circles, is the measure of success for the economy.

(ii) Instead of (only) the market: Economics is typically concerned with the role of the market and its close allies: business, finance, and trade. However, the Doughnut suggests that there are other relevant, often neglected, actors, such as the state, the household, society, the commons, the environment, etc. The example of a mother caring for a child, a type of caring work that is unaccounted for by the market, shows that not all economic relations are handled within the market. That is why the Doughnut calls for the inclusion of other actors and for an "embedded economy".

(iii) Instead of the *homo economicus:* The economic man, having complete rationality, perfect information, fixed preferences, and being guided by narrow self-interest, is the abstracted image of humanity that guides today's prevailing economic models. However, many limitations and critiques exist for this abstracted image, especially in the field of behavioural economics (Simon 1986). The Doughnut suggests that homo economicus must reflect the nature of humans, which is social, interdependent (Veblen 1898), approximating, fluid in values, and dependent upon the living world (Gigerenzer 2010).

(iv) Instead of economy-as-machine: Most of the economic models used today are based on a mechanical equilibrium, the most prominent example of which is the supply and demand diagram. The mechanical equilibrium is a simplification of the many variables that exist in reality. Simplification is necessary, lest

one be disabled from making any predictions. On the other hand, if one simplifies "too much", thus removing uncertainties, one risks having erroneous predictions. This worry is not novel in the Doughnut; in fact it is explicated by many economists. The Doughnut suggests that the insufficiency, or inadequacy, of using models based on mechanical equilibriums ought to be replaced, through a shift in thinking, by focusing on systems and their complex dynamics. Thinking in reinforcing and balancing feedback loops, the Doughnut calls for an "economy-as-organism", instead of an "economy-as-machine".

(v) Instead of poverty-as-feature: Pareto's claim that redistribution is counterproductive and that the worse off can be helped only by expanding the economy, along with Kuznets' U-shaped curve, which claims that rising inequality is inevitable for economic success, have been the guiding principles of economics, especially for development economists. The Doughnut firstly highlights that these claims are refuted by economic analysis, which have shown that inequality undercuts, rather than boosts, GDP growth (International Monetary Fund 2014). Further, the Doughnut suggests that instead of expecting economic growth to reduce inequality, we ought to create an economy that is distributive by design, structuring the economy as a distributed network.

(vi) Instead of growth-as-cleaner: An inverted U-shaped curve between pollution and GDP represents the discovered pattern that in the beginning pollution rises, then falls, while GDP increases. This pattern formulates the hypothesis that growth will clean after itself (Grossman and Krueger 1995). This hypothesis, supported by data on water and air pollution but not on biodiversity and wider ecological impact, has opened the way for macroeconomic models that are typically degenerative (the produced material becomes waste after consumption). The Doughnut counters this approach by promoting a paradigmatic shift towards an economy of regenerative design. To describe in a few words, an economy based on regenerative design is cyclical, minimising lost matter and heat, and focusing on renewable materials.

(vii) Instead of the addiction to growth: In order to fulfil human needs and end deprivation, poverty, and hunger, the economy must grow. This is important in order to realise that the Doughnut does not object to growth and its benefits. On the other hand, it highlights that growth alone cannot solve our problems, especially those ecological ones. Growth is neither intrinsically good nor intrinsically bad – that is why we ought to be agnostic about it. By agnostic, the Doughnut means an economy that measures its success based on human prosperity, regardless of whether GDP is increasing.

Operating within the Doughnut requires a conceptual shift, in accordance with these seven ways. The reasoning and justification behind these ideas is sound; however, many times they raise more questions than they answer. For instance, how does one measure human prosperity (Schokkaert 2019)? Many of the concepts comprising Doughnut economics, like embedded economy, regenerative design, distributed networks, and economy-as-organism, bear a metaphysical nature because they are too

broad, sometimes undefined, and (only) hermeneutically refutable. This is a fundamental shortcoming that Doughnut economics must overcome.

It is relevant, in such regard, to understand if the connection between Doughnut economics and SDGs yields any fruits for Doughnut economics. This relationship is comprised of at least two dimensions. Firstly, the social foundation of the Doughnut, which includes the human needs (food, health, education, income and work, water and sanitation, energy, network, housing, gender equality, social equity, political voice, and peace and justice), is drafted based on the work of the United Nations with the SDGs, as Raworth (2017a) also stresses. In fact, SDGs 1–10 and 16 correspond to the elements of the social foundation that the Doughnut promotes. Besides the SDGs that fit within the social foundation, SDGs 11–15 fit with the ecological ceiling of planetary boundaries, whereas SDG 17, partnerships for the goals, can be placed as an intrinsic part of the Doughnut itself. Secondly, the Doughnut can be perceived as a conceptual representation of the aims behind the SDGs, balancing social, economic, and environmental sustainability. In summation, the connection between Doughnut economics and SDGs is strong, comprised of the fact that SDGs fill the semantics of some concepts within the Doughnut and of the fact that the Doughnut offers a conceptual frame and claim to operationalisation for the SDGs. However, we know that SDGs, too, face conceptual and structural challenges (May and Daly 2020), similar to those of the Doughnut. Such an understanding leads to two conclusions. Firstly, SDGs do not serve any elucidating role for the shortcomings of Doughnut economics. Secondly, the conceptual elucidation, which this chapter aims to perform for Doughnut economics, serves also to clarify the philosophical background of SDGs, since they also rely on human dignity for their existential rationale.

So far, this section describes the ideas behind the Doughnut, tracing the required conceptual shift that a twenty-first-century economist should adopt. These ideas are presented as a critique to some elements of neoclassic economics, although they are shown to bear a metaphysical nature. Lastly, the connection between the Doughnut and the SDGs is accounted for. The next section questions the philosophical rationale of the Doughnut, in an attempt to offer a scientific explanation for its existential rationale.

3 Dignity, But Which One

The aim of this section is to understand the philosophical background of Doughnut economics. The theory behind the Doughnut often refers to human dignity as its existential rationale, but this reference begs the question: what does human dignity mean? This section shows that there are a few answers to this question, but only one satisfies the conditions and ideas of the Doughnut model. That is the patient-oriented, ontocentric conceptualisation of human dignity that information ethics offers.

3.1 Traditional Conceptualisations of Human Dignity

The semantics of human dignity have been subject to change, pursuant to various historical and philosophical eras. We have had different ideas about our value as human beings (Lebech 2009). In antiquity, the concept of human dignity was used to explain the superiority of humans in comparison to the animal world, based on human abilities. Humans have dignity because, unlike animals, they have the ability to be virtuous (Crisp 2014, 23–37), or because, unlike animals and like gods, they have the ability to reason and manage their impulses (Cicero and Laser 2014). Being justified by a superiority of some sort, virtue or reason, dignity was not intrinsic to all humans equally, but only to those deserving it. Aristotle did not consider all humans to have dignity (e.g. slaves and women) and Cicero believed that some ranking of dignity and respect should exist, where the more superior ones have also "more dignity" (Cicero and Laser 2014).

Another influential approach that justifies and fills the semantics of human dignity is the religious one. Typically for monotheistic religions, humans have dignity because they are created by God. The religious account seemingly opposes the previous version of antiquity in terms of differences between humans because, since we are all created by God, humans are equal and deserve the same amount of dignity, provided they are theists. However, it still relies on a superiority claim, effectively because humans are the vicegerent of God on earth. This is evident in Islamic teaching (Quran; Mozaffari 2011) and in Christian theology (Aquinas 1486).

In the Enlightenment Age, the basis for human dignity was reason. Some scholars refer to this as the logo-centric approach (Lebech 2004), precisely for the importance of human rationality as a justification for the intrinsic value of humans. The focus on rationality is characteristic of the Enlightenment Age and it resonates with Kantian philosophy and deontology ethics, despite Kant's valuable critique on the limits of human reasoning. Kant is often cited claiming that humanity itself is dignity (Kant and Klenner 1988, 38; Lebech 2004), which he bases on the justification that the ability of humans to reason and self-legislate moral laws through their autonomy is what dignifies the nature of being human. In this sense, human dignity is based on autonomy, which in turn is based on rationality. As such, the superiority claim persists, since dignity is perceived as logically subsequent to rationality, an ability that distinguishes humans from other beings.

The modern conceptualisation of human dignity that was developed in the Enlightenment Age was challenged in post-modern philosophy, according to which human dignity served an enabling purpose for a democratic society (Lebech 2009). As such, human dignity adopts a relational, or functional, nature. Based on dialectical reasoning and opposing the objectively true point of view, post-modernism values human dignity as a function of social relations, which in turn enable the functioning of a democratic society (Lebech 2009). It must be noted that the difference between modernism and post-modernism in conceptualising human dignity is highly disputed (Habermas and Ben-Habib 1981) since the post-modernist account is based also on rationality, albeit focused on dialectic reason.

These accounts of the semantics of human dignity can be understood as the traditional approaches. They have their differences, but they agree with each other in that humans have dignity because they are superior in a certain way – compared to animals, birds, rivers, and robots. There is a shift in philosophical and ethical thinking that challenges the traditional conceptualisation and which has an impact in how we understand human dignity. This is explained in the next sub-section.

3.2 A Shift in Ethics: From Agents to Patients

The traditional conceptualisations of human dignity rely on a kind of human special ability, either due to virtue, likeness to God, or reason. Traces of this understanding can be found in so-called traditional macro ethics, such as virtue ethics, deontology, and consequentialism. Essentially, if one questions the morality of an action according to these ethical frameworks, one must ask if the *agent* took the morally right action. That means traditional macro ethics have an agent-oriented approach, which fits with the virtuous, rational, God-like conceptualisations of the human agent.

This approach is challenged by (relatively) recent developments in ethics. Bioethics (Beauchamp and Childress 2019), feminist, and care ethics (Tronto 1993), among others, have shifted the focus of ethical judgement from the agent to the *patient* – the receiver of the action. In essence, instead of asking what the morally right thing that the agent should do is, these patient-oriented approaches to ethics ask what the morally right action is, for the patient to receive. While the actions of the agent are still relevant, the focus is on the wellbeing of the patient. Therefore, these approaches challenge the superiority claim based on special abilities, found in traditional macro ethics, since, here, humans are perceived in need of care, rather than armoured with some divine or natural ability that justifies their dignity – fragile as a plant, not precious as a jewel, as Nussbaum (2001) would say. Notwithstanding the change of focus from agent to patient, the shift towards an anthropo-eccentric conceptualisation of human dignity is not yet complete, since even in bioethics, feminist ethics, and care ethics, humans as living things are still in the centre of the ethical universe.

Information ethics (Floridi 2013) joins these patient-oriented approaches, offering some novelties. Aligned with bioethics, feminist ethics, and care ethics, the orientation of information ethics is not focused on the agent, but on the patient. However, information ethics further challenges the biocentrism of morality with an ontocentric version. The infosphere, comprised of resources, targets, and products of information, is ontologically informational, making information the centre of moral claims. As a result, any informational entity (e.g., a tree) has a moral claim to fulfil the purpose of its existence, albeit overridable. In this ontocentric account, humans are but one of the informational entities and agents that impact the infosphere. Dignity is thus perceived similarly as for other informational entities: a prerequisite that enables humans as informational entities to flourish, to improve and enrich their existence. Along with humans, also rivers, trees, animals, birds, and

robots have a claim to fulfil the purpose of their existence and have, as such, dignity (again, overridable). This new account presented by information ethics offers a truly patient-oriented and anthropo-eccentric approach to ethics and dignity (Floridi 2013). The next part explains why this is the conceptualisation of human dignity that fits with the ideas behind the Doughnut.

3.3 The Doughnut's Allegiance

The Doughnut's ideas cannot be based on traditional macro ethics because the humans of the Doughnut model are not perceived as having special abilities that make them worthy of having dignity. They are not presented as virtuous, God-like, rational, or in any way supreme. They are instead presented as agents that must have their needs fulfilled and for whom the economy must care. This perception of humanity draws the Doughnut away from traditional conceptualisations of the virtuous, God-like, or rational human agent, who has dignity because she is special, due to her abilities. As a result, the Doughnut is aligned with a patient-oriented approach in ethics. In Raworth (2017b, 61) there are four ethical principles that a twenty-first-century economist must consider: (i) act in service to human prosperity, (ii) respect autonomy, (iii) be prudential in policymaking in order to minimise harm, and (iv) work with humility. These principles resemble the four well-known principles of bioethics, respectively, beneficence, non-maleficence, autonomy, and justice (Beauchamp and Childress 2019). In fact, the first three principles are almost identical; hence, they are substantially patient-oriented approaches. The fourth principle, working with humility, comes closer to an agent-oriented approach, aligned with virtue ethics or deontology ethics. Nonetheless, the agent is portrayed as fragile, not as virtuous or rational, since working with humility relies on accepting and explicating our limitations as humans.

This analysis brings the ethical background of the Doughnut closer to the patient-oriented approaches of bioethics and feminist care ethics. There is, however, a substantial misalignment in the fact that neither of these ethical frameworks is able to place the environment as a patient, because they are morally anthropocentric or biocentric, despite being patient-oriented. In simpler words, the receiver of the moral action, the patient, is always "a living thing" according to bioethics, feminist ethics, and care ethics.

Information ethics, as a kind of environmental ethics, offers an ethical shelter for Doughnut economics, considering the above. Since information ethics perceives a universe (infosphere) that is ontologically informational, the receiver of the moral action is information itself. As a result, all informational entities, humans, trees, rivers, and robots are included as potential patients. Such a conceptualisation enables the ethical claims, which the Doughnut advances through economic concepts, that aim at protecting both humans and the environment.

Clarifying the philosophical and ethical background of the Doughnut addresses the metaphysical nature of the ideas behind Doughnut economics, making the

concept more accurate and facilitating its analysis and operationalisation. The following section offers an analytical perspective to the model offered by Doughnut economics, through the use of examples of AI applications.

4 The AI and the Doughnut

The purpose of this section is to understand, by way of examples, how the Doughnut, its ideas, concepts, and model would approach and deal with particular activities. Examples of AI are used because of their relevance and threat to both foundations of the Doughnut model. So far, a methodological challenge arises, particularly due to the fact that the Doughnut does not offer concrete models that can be empirically tested, but rather suggests a few ways that facilitate a paradigmatic conceptual shift in thinking about economics. The metaphysical nature of the Doughnut constitutes intrinsic conditions in the type of analysis one can use to test it. Hence, this section is based on hermeneutical analysis. However, the purpose of the previous section was to construct a more accurate and testable conceptualisation of the ideas behind the Doughnut, which in turn offers this analysis a claim to accuracy. A second methodological challenge relates to the fact that the Doughnut, as it is constructed and presented, is not meant to be used for determining the validity of individual economic activities, but rather of the economy itself. Any attempts to determine how individual economic activities would interact with the Doughnut are bound to an interpretative approach.

4.1 Threatening the Boundaries

The essence of the Doughnut is the two concentric rings, which represent two boundaries: the social foundation and ecological ceiling. Therefore, an activity that threatens even one of the elements that comprise these boundaries is deemed unethical, according to the Doughnut. Let us take two examples to showcase this understanding.

One fundamental normative problem of AI derives from the bias inherent in the dataset with which the algorithm is trained to learn (Morley et al. 2020). This problem may be represented through the example of AI applications that predict the length of stay for each patient in the hospital. Aiming for efficiency as a goal, hospitals would benefit from knowing which patients are likely to have a shorter stay, thereby prioritising their care in order to free hospital spaces for new patients (Abd-Elrazek et al. 2021). In order to learn and make such predictions, the AI application is given medical data of a large number of patients. Through supervised learning techniques, the AI would trace the length of stay of patients with other correlated data in their files and therefore "learn" that, for instance, people aged 18–24 have shorter lengths of stay for acute diseases (Abd-Elrazek et al. 2021). In this case,

length of stay is correlated with age. However, data may show various correlations, some of which manifest their inherent discriminatory bias. When such AI applications were experimented in the University of Chicago academic hospital system, the AI application "learned" from the dataset that people from certain postal codes were likely to have shorter stays (Nordling 2019). Those postal codes transpired to belong to areas populated primarily by white upper-class people. The implication of this bias for healthcare is that people would get prioritised care depending on where they live or to which racial or ethnic group they belong (Garattini et al. 2017). Such a result, from the use of AI applications aimed at efficiency, would threaten the social foundation boundary, since it conflicts with at least one of the elements that comprise it, namely, ensuring healthy lives and wellbeing for all. It is important to point out that this conclusion does not imply that the AI application is incompatible in and of itself; efficiency is a worthy pursuit, just like bias in data can be useful (Gigerenzer and Brighton 2009). However, this AI application, operating based on this bias, would be incompatible with the Doughnut.

With regard to the ecological ceiling, machine-learning AI applications may pose a serious threat. The computing power required by machine learning has increased 300,000-fold from 2012 to 2018. Seemingly simple AI applications may consume approximately 3 gigawatt-hours of electricity for their learning process, the same amount of energy needed to fuel three nuclear power plants for 1 h (Knight 2021). For this example, the case of Bitcoin, a digital currency, proves useful. Bitcoin is the world's largest cryptocurrency, utilising a proof of work (PoW) algorithm and relying on blockchain as a database technology. Digital and decentralised, Bitcoin is used primarily for its novelty of providing transparency and trust among its users, due to its verifiable system. However, it is this capability that makes Bitcoin consume 0.55% of the electricity of the planet, matching the electrical consumption of Poland, the carbon footprint of Oman, and electronic waste of the Netherlands (Digiconomist 2022). Moreover, the energy consumed comes primarily from non-renewable and polluting resources, such as fossil fuels. Therefore, the operations of Bitcoin pose a threat to the ecological ceiling that the Doughnut aims to protect. Such an understanding does not imply that technologies like Bitcoin would be banned under the model of the Doughnut, but that, considering the threat towards the ecological ceiling, it would be necessary to address the unsustainability of the system.

Moreover, some type of economic activities may support one boundary but threaten the other. Such is the case of smart grids – an AI technology that offers a promise towards protecting the ecological boundary but presents a threat to the social foundation. Smart grids are an AI solution that aims at efficiency, particularly of the energy and water grids. Their main capability is to integrate the behaviour and actions of all the users connected to it, through data-driven and other grid-related technical solutions. The smart grid's promise to make the grid more efficient is based on lower consumption of energy; their capability to integrate users with new requirements offers the possibility to include distributed energy sources, like renewable energy sources, as well as provide stronger control over these sources. Moreover, by involving consumers in the energy market and improving the market

functioning in general, they offer incentives for consumers to produce and trade energy from renewable sources (European Commission 2011). As such, smart grids offer a substantial promise to the protection of the ecological ceiling. Less consumption, higher use of renewable resources, and less wasted energy contribute to the preservation of the planetary boundaries, especially combatting climate change.

However, reports and studies have raised concerns over the impact that the implementation of smart grids would have on vulnerable consumers (Sovacool et al. 2019). Vulnerable consumers may have more difficulty becoming price-sensitive or engaging with the market, either because they may not possess the knowledge or the time or because of the stress and anxiety created by the quantity of information that smart grid technologies generate. Another concern for vulnerable consumers is the necessity to update their electrical appliances so they can be integrated within the smart grid. While the EU and member states are expected to bear the costs for the implementation of smart grids, consumers must bear their own costs to update their electrical appliances in order to support smart grids (Milchram et al. 2018). A heavier burden is therefore placed on vulnerable consumers, triggering a threat to the social foundation and the fulfilment of human needs thereof. As a result, smart grids pose a question to the Doughnut, insofar as they offer a promise to protect the ecological ceiling and a threat to breach the social foundation. The Doughnut would have to provide an answer. The safe and just space for humanity is comprised of economic activities that *simultaneously* do not threaten the social foundation or the ecological ceiling. In other words, economic activities that threaten one of the foundations would already step outside this safe and just space. It follows that, according to the Doughnut, smart grid technologies may be implemented in support of the ecological ceiling only if they do not infringe the social foundation. So far, the Doughnut would, for instance, impose that measures must be put in place to ensure that vulnerable consumers do not share a heavier burden as a result of the implementation of the technology.

4.2 The Missing Circles

Having explored how three AI applications would interact with the Doughnut, this part focuses on a fourth and final example: social credit systems (SCSs). SCSs are AI applications that rely on big data, used to rate citizen trustworthiness, among other objectives. The predecessors of SCSs are credit scoring, used geographically widely but limited only to financial use and regulated by law. An SCS goes beyond financial matters and offers the possibility to rate social aspects of business entities and individuals. A concrete case of SCSs can be traced to the People's Republic of China (State Council 2014), where a planning outline aims at assessing the trustworthiness of individuals with respect to legal, social, and ethical standards (Chen and Cheung 2017). Summarised in a few words, the SCS would collect data about how individuals act and rate their behaviour according to the desired standard. Rewards for complying with the standard might involve fast-track promotions,

whereas individuals that fall under the designated standard may be denied certain perks or even rights. Fuelled by big data, SCSs may become an efficient tool for extended control from the government to its citizens. Big data sources may be administrative, transactional, sensor, tracking, behavioural, and opinion data (Chen and Cheung 2017). In the draft regulation published in April 2021, the European Commission proposes an outright ban to SCSs in the European Union, which indicates the potential for harm that this technology bears.

How does the SCS fare within the Doughnut? The first test is to understand if the SCS would breach either of the boundaries that comprise the Doughnut. If we firstly consider the ecological ceiling, comprised of 12 planetary boundaries, the SCS presents an opportunity to safeguard the ceiling if such objectives are included in the rating criteria of the system. For instance, citizens may be rated depending on how well they care for the environment, how much waste they recycle, or how much plastic they use. Businesses may be rated depending on how much carbon dioxide they emit, or if they use regenerative practices. As such, the SCS would be operating safely without breaching, and perhaps also supporting, the ecological ceiling.

If we consider the social foundation, the SCS presents another opportunity to advance the social goals thereof. The rating of the SCS may depend on how well individuals respect gender equality in their life (SDG 5) or if they share resources, like food or energy, with the poor (SDGs 1 and 2). The SCS rating might depend on how good the individual is behaving as a landlord (SDG 11), how they address education in their family and community (SDG 4), and so on. The goals for peace and justice promote strong institutions and combatting corruption (SDG 11), goals that may be supported, perhaps even promoted, by SCSs. By complying with the two limitations of the Doughnut, SCSs would thus be operating under the safe and just space for humanity. At the same time, the SCS may function so that neither of the other elements of the social foundation are breached. Clearly, certain uses of SCSs may breach these standards, for example, if a low rating means losing access to healthcare or being denied a job. However, an SCS can also operate without denying basic rights to citizens, specifically those laid down in the social foundation. As a result, it seems the SCS would not breach, and perhaps also support, the social foundation along with the ecological ceiling. This understanding implies that the operation of an SCS would fall within the safe and just space of the Doughnut.

However, this conclusion is not supported by the philosophical background of the Doughnut. The SCS operates on the ability to collect and aggregate personal information of individuals, which is then used to rate their social credit score. These sources do not include only publicly known personal information, but also private personal information, like shopping activity and daily habits. As a result, individuals would have the impression that they are always under the surveillance of Lacan's Big Other, the Orwellian Big Brother, or Bentham's Panopticon applied in large scale. Such a feeling or impression has considerable effects on the individual's right to form their own personality (van der Sloot 2015) and pursue their right to flourish and fulfil the purpose of their existence (Floridi 2013), since the individual is conditioned by externally mandated interferences. As a result, such a use of SCSs would be unethical and would breach the concept of human dignity that ethics of

information advances and upon which the ideas of the Doughnut rely. Therefore, the conceptual model of the Doughnut offers a considerable shortcoming.

As this example shows, there can be economic activities that abide by both boundaries that form the Doughnut, yet still violate human dignity. This shortcoming relates to a broader discussion on the positive and negative dimension of protecting human dignity (Whitman 2004). The continental European tradition, unlike that of common law, influenced by German and French legal traditions, adopts a constitutional perspective of human dignity being comprised of both positive and negative liberties. A positive liberty is the right to have a need fulfilled, e.g. the right to education, the right to food, the right to energy, and more. The social foundation of the Doughnut is comprised of such positive liberties, conceptualised as needs that all humans must be afforded. However, there is another dimension of human dignity, that of being free from external obstacles (Berlin 1969). A prominent case of negative liberty is the right to privacy, conceptualised as the right to form one's own personality (van der Sloot 2015), free from external obstacles.

The importance of this dimension is clear, yet missing from the conceptual model of the Doughnut. It would be necessary, pursuant to the Doughnut's own philosophical background, to remedy this shortcoming. One option would be to modify the elements of the social foundation, by including negative liberties. However, preserving the positive nature of the elements comprising the social foundation, another alternative would be to introduce this addition within the safe and just space for humanity. Accordingly, the safe and just space for humanity would slightly shrink from the original conceptualisation, so besides economic activities not shooting above the ecological ceiling or below the social foundation, safe and just economic activities must also steer away from some new small circles within the safe and just space. The result would be a complete conceptualisation of how our economic activities protect human dignity, and a completed dignitarian approach to Doughnut economics.

5 Conclusions

This contribution aims at providing a more concrete and accurate understanding of Doughnut economics and its model and ideas. In doing so, it provides a comprehensive description of the Doughnut and its connection with the SDGs. Then, it inquires into the philosophical background of Doughnut economics, questioning its existential rationale that relies on human dignity. Further, abiding by the principle that a concept is understood properly only when tested, examples of four AI applications are used to showcase how the Doughnut model would address their use and challenges.

Doughnut economics is conceptually represented by two concentric circles, each standing as the boundary for the social foundation and the ecological ceiling; the space between the circles is the safe and just space for humanity, according to the Doughnut. Living in this space implies a paradigmatic shift in thinking like a

twenty-first-century economist, including shifting from mechanical equilibrium to systems thinking and being agnostic about growth by not using GDP as a measure of economic success. The chapter showed that the Doughnut relates to SDGs in two ways. Firstly, the SDGs fill the semantics of the concepts comprising Doughnut economics; secondly, Doughnut economics offers a conceptual frame and claim to operationalisation of SDGs.

The Doughnut claims that the fundamental reason for its existence is dignity, which the chapter questions in relation to the various conceptualisations of dignity. Tracing the semantic evolution of this concept since antiquity, the chapter shows that the Doughnut fits with the concept of dignity advanced by information ethics, which is the anthropo-eccentric, patient-oriented, and ontocentric concept that perceives dignity as a prerequisite for flourishing and enriching the existence of any informational entity.

Equipped with this new conceptual frame, the Doughnut model and its ideas are tested through four examples of AI applications: healthcare AI operating on unfair bias as a threat to the social foundation, Bitcoin energy expenditure threatening the ecological ceiling, smart grids offering to aid the protection of the ecological ceiling but threatening the social foundation, and SCSs which may abide by both boundaries yet threaten to infringe the concept of dignity as described above. From this testing exercise transpires the understanding that another limitation is required in the Doughnut model, pursuant to its philosophical background. Hence, besides economic activities that may breach the ecological ceiling or the social foundation, activities that infringe human dignity should be incompatible with the Doughnut model. Pursuant to the playfully serious nature of the Doughnut, these limitations may be perceived as chocolate chip additions to a more nuanced Doughnut model.

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