From Recycling to Recoupling: Towards a Philosophy of the Circular Economy in the EU

A Master Thesis

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This is mortality: to move along a rectilinear line
in a universe where everything moves in a cyclical order
Hannah Arendt, *The Human Condition*, 1958

If Georgescu-Roegen's thermodynamics
made us ware of our irreversible path to death,
Bataille's reminds us that in the meantime
we are tormented to do something without lives.
Life and death are two sides of the same coin in the universe
Giorgos Kallis, *Degrowth*, 2018

Summary

The Circular Economy (CE) is a promising economic policy for the transformation to a more sustainable society. The CE has been a hallmark of European Union (EU) environmental policy for two legislative periods and is the economic model which underpins its recent European Green Deal because the CE promises sustainability without sacrificing economic growth (COM 2015; 2019b; 2020). However, the plausibility of this promise and the efficacy of the CE is highly contested not only on empirical grounds, but its sustainability remains questionable even on a conceptual level (Geissdoerfer *et al*. 2017; Korhonen, Honkasalo, and Seppälä 2018). In this thesis, I investigate how far the EU's CE contributes to sustainability and whether it could be improved conceptually. Methodologically, my approach bridges the disciplines of policy analysis and philosophy discourse analysis following Robert Hoppe (2011), Adam Briggle (2016) and Alexandria Poole (2018): I employ hermeneutic and normative reasoning in dialogue with analysis of concrete CE policy to develop philosophy from and for policy; it is located in the EU.

I conduct a discourse analysis of central EU documents such as the most recent CE action plan, and show that trends of previous CE policy still hold (Kovacic, Strand, and Völker 2019; Calisto Friant, Vermeulen, and Salomone 2021): While the ecological ambition of the policy has increased significantly, this increase is not matched by action. Even on a conceptual level, the action plan relies on vague means such circularity. Understood as closing material loops, and implausible goals such as decoupling economic growth from environmental pollution. I critique these concepts and reframe them in the following chapters by connecting them to underlying philosophical issues.

I argue that circularity could and should be understood as biomimicry. This captures the naturalistic language and thinking which is characteristic of the CE in the EU and enhances its sustainability. Biomimetic approaches are philosophically contentious (Blok and Gremmen 2016) but, drawing on environmental philosophy and ecology (Pickett and Ostfeld 1995; Callicott 1986; 2017; Dicks 2017b), I defend a version that is based on imitating ecological principles or values – an ecomimetic ethics – against such criticism. The implications of this ethics for EU policy are that that the CE should employ a holistic or systemic approach, must be relational and open for consequences beyond its borders, and may not grow indefinitely.

Especially letting go of economic growth is a major upset of EU CE policy. Therefore, I argue that the CE can and should be understood to aim for recoupling economy with ecology, rather than decoupling. Such linking of economy with ecology scales the ecomimetic approach to the level of the economy. Drawing on conceptual framework in ecological economic (Spash 2012; 2020), I defend this linkage against philosophical objections such as the ontological heterogeneity of the economy and ecology (Veraart and Blok 2021) as well as granting justification to ecofascist population thinking (Dyett and Thomas 2019; C. Thomas and Gosink 2021). I finally argue that there is a path toward such philosophy of the CE in the EU that is sustainable if it follows the criteria I outline: Adapting the parallel bioeconomy strategy provides a pathway for ecomimicry and since the importance of economic growth is slowly waning, there is a window for CE policy beyond growth. However, this path is not easy, and the EU must remain wary of the dangers of ecofascism that come with it. But if the CE is to fulfill to its own ecological ambition, such struggle and risk cannot by avoided.

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Chapter 1. Ready for Take-off?
The Circular Economics of the Present Space-Ship Europe

The closed economy of the future might … be called the "spaceman" economy,
in which the earth has become a single spaceship,
without unlimited reservoirs of anything, either for extraction or for pollution,
and in which, therefore, man [sic] *must find his* [sic] *place*
in a cyclical ecological system which is capable of continuous reproduction.
Kenneth Boulding, *The Economics of the Coming Space-Ship Earth*, 1966

1. Introduction

There are gyres of plastic the size of Europe in the Pacific (Hunt and Kovaleva 2021). By some estimates, the total amount of plastic in the oceans will outweigh fish by 2050, because production is expected to increase drastically, and also because plastic particles are deadly to marine life (Lebreton *et al.* 2018). We are amidst an ecological and climate crisis, characterized by a sixth mass-extinction and increasing extreme weather events everywhere. Even in supposedly less climate-change affected areas, last July (2021), heavy rains caused flashed floods which ravaged western Germany, the Netherlands, and Belgium, while a heat wave and ensuing wildfires devasted southern Italy, Greece, and Turkey, in August. The underlying diagnosed that we[1] live in a "cowboy economy" and falsely assume that the planet to consists of "illimitable plains" where we can consume and pollute without consequences. In 1972, based on intricate mathematical models, the Limits to Growth report by the Club of Rome confirmed that a continuously increasing use of finite resources is not sustainable indefinitely (Meadows, Randers, and Meadows 1972). Yet, we continued to use ever more finite resources, such as fossil fuels, not only depleting their limited stock, but also polluting the planet through greenhouse gas emission. This pollution has recently led the highest authority in climate science, the Intergovernmental Panel on Climate Change (IPCC) to report that avoiding the worst impacts of this crisis would "require rapid, far-reaching and unprecedented changes in all aspects of society" (Masson-Delmotte *et al*. 2018). So even though we knew better, we have entrenched the cowboy economy in our society and Boulding's spaceship has not taken off. Now, face to face with the consequences, we need to act faster and more comprehensively than ever before to achieve environmental and climate justice and maybe even ensure humanity's survival on the planet.

[1] This 'we' here needs significant qualification. By far and large it only applies to affluent people in the global North. Given that this is master thesis written in the Netherlands, I am willing to take my chances that you, dear reader, mostly likely belong with me in this category. If I am mistaken, I ask for your apologies and patience: I offer a more qualified statement below but did not want to complicate matters too quickly.

In this thesis, I will philosophize about the way the European economy could change to become more sustainable. European countries are disproportionally responsible for the climate and ecological crisis.[2] Moreover, the European Union (EU) has signaled willingness to take significant action with the recent European Green Deal, which Commissioner von der Leyen (2019) has called Europe's "man on the moon moment". I will take this commitment seriously. My philosophical approach not only envisions the deep and holistic changes required by the IPCC, but also sets aside cynical sentiments about the political unwillingness to realize it, suggested by the long history of (in)actions against better knowledge. As engineer and entrepreneur Saul Griffith has pointed out in regard to the sustainability transition: "we knew how to build rockets, and we knew where the moon was. We don't know all the answer where we are going" (as quoted in Klein *et al.* 2021). (As you may be starting to notice, for some reasons,[3] the political discourse around sustainability is riddled with space-exploration rhetoric. I will use this rhetoric as an expositional device, which ties together various thematic streams and aesthetically frames my thesis.[4]) My philosophy aims to provide some orientation, where we should go and how that is possible.

Arguably, few institutions influence our lives as universally and directly as our systems of production, distribution, and consumption. Therefore, my focus is on the economy because it is central to the way we live collectively in a society As Boulding noticed over half a century ago, these systems are also intimately tied to the ecological problems adumbrated above. This is evident from the present long list of proposals that should make them more sustainable: Doughnut Economics, Performance Economy, Sharing Economy, Steady-State Economy, Green Economy, Blue Economy, Bio(-Based)-Economy, Circular Economy. So, when envisioning a societal change towards sustainability, the economy is a good place to start. I will specifically engage with the circular economy, because it has gained traction in EU policy and constitutes the economic model which underpins its Green Deal.

The circular economy (CE) envisions a shift away from the current linear economy. In a linear economy, resources are extracted, then used for production, and finally discarded after consumption; it follows a 'take-make-waste model', or linear flow of resources and energy.

[2] The EU is historically (Mitchell 2011; J. Moore 2015; Mendieta 2019) as well as presently one of the largest emitters of carbon (Chancel and Piketty 2015; Timothy Gore 2015). Especially in comparison to population size this is striking as "people in the EU consume more than whole of Asia put together" (Salleh 2010, 206). For practical as well as for reasons of justice, it appears thus necessary to change the EU economy.

[3] I can only speculate to why, maybe it is a way to take the planetary challenge seriously, maybe it speaks to some hidden escapist fantasies, or maybe it reveals a hidden Western (techno-optimist and colonial) frontier mentality.

[4] It is not central to my argument but frames it in the literal, decorative sense: the spaceship will be discussed in the introduction and conclusion, thus ornamentally bookending the thesis. Moreover, each chapter will be headed by relevant quotes in the epigraph, and some space/earth related will be pursued in footnotes.

This model is at the root of the ecological problems and the climate crisis, because we take fossil fuel, use it to make things, and then discard its waste, such as plastic in the oceans or CO^2 in the atmosphere. In contrast, the CE, and what Boulding termed "the closed economy", follows a circular model: It seeks to keep energy and materials circulating through various loops in the economy. These loops range from recycling as opposed to extracting, over remanufacturing rather than producing, to reusing, repairing, or refusing instead of consuming and wasting. Given this broad range, the CE is a rather generic concept and mostly characterized by not being linear. The precise positive content, what the CE is, will only become clear at the end of this thesis, but the move away from the linear economy conveys that the CE is supposed to be a shift towards sustainability. It could mean that Boulding's space-ship is about to take-off.

The main question of this thesis is, does the CE in the EU provide an answer to the problems of unsustainability in the linear economy? This has a practical sense, whether EU policy already takes the necessary steps towards a sustainable economy. It also has a more philosophical side, if it does not, how could EU policy be conceptually improved? To add a little spoiler here, my analysis will show that the answer to the first question is a resounding no, the space-ship is not about to take-off. With the CE, the EU tries to achieve implausible goals, such as decoupling economic growth from ecological pollution, through inadequate means, such as increasing circularity, best understood as closing material loops or recycling.[5] Therefore, I propose a new way according to which we could and should understand the CE, namely not just in terms of recycling, but as recoupling economy with the environment or ecology.[6] I will ground this philosophical argument about the CE in EU policy. Such approach is needed because we need far-reaching changes, which requires fundamentally rethinking the economy, but must also enact them rapidly. Still, the combination of philosophy and policy analysis is unconventional and warrants further justification and explanation. I will briefly

[5] The best understanding results from my charitable interpretation of circularity in the following chapter. It is not explicated as an approach by the EU, which, if at all, often just refers to recycling. Because of this, and because of the aesthetic reasons of constituting a more palpable concept, I will use recycling synecdochally for closing material loops.

[6] These terms do not necessarily mean the same: environment usually refers to a more anthropocentric perspective (because it is what *environs* human) and is related to weak sustainability that can be exchanged for other resources, whereas ecology is often used in less a anthropocentric sense (because it studies relations between species in a less hierarchical sense), and proposes a stronger non-fungible definition of sustainability (Callicott and Mumford 1998, 36; Morelli 2011). But this distinction is far from clearly delineated, ecocentric philosophy is still called environmental philosophy (Callicott 1986), scientific ecologist often take an anthropocentric perspective (Ghazoul 2020), environmental economics may adopt a strong view on sustainability (Goodland and Daly 1996) and ecological economics a weak one (Spash 2013b). Since this difference is only tangentially relevant to my argument, I use both terms interchangeably and clarify what I mean when it matters.

review the literature on the CE, in the next section, to argue that there is a lack of such needed approaches between philosophy and policy analysis. In the third section, I will then explain what such interdisciplinary approach entails, before outlining my argument in the fourth.

2. State of the Field(s): The CE in Policy and Philosophy

The CE constitutes by no means a new idea. As the epigraph to this chapters shows, closed or cyclical economical system can be traced back at least to Kenneth Boulding's (1966) space-ship earth. Circularity discourses haven even far deeper roots (Ghisellini, Cialani, and Ulgiati 2016; Calisto Friant, Vermeulen, and Salomone 2020). However, in its most recent iteration as a business and economic model, the CE has gained significant popularity among sustainability professionals – scholars, entrepreneurs, and policy makers – during the last two decades (Stahel 2016; Merli, Preziosi, and Acampora 2018; Henry *et al*. 2021). Despite its popularity and common usage (or maybe because of it), the CE is a vague concept. It seems that one of the only points of scholarly consensus is that there is little agreement about what the CE is or ought to be. A widely cited study has identified 114 different definitions (Kirchherr, Reike, and Hekkert 2017). Another one diagnosed it as an "umbrella concept", bridging various heterogeneous ideas (Blomsma and Brennan 2017). A last one characterizes it as an "essentially contested concept" to illustrate how far the definitions pull apart (Korhonen *et al*. 2018). However, the disagreement cuts even deeper than definitional issues. It is also contested what the CE ought to achieve and how: there are separate types relying on distinct means and goals (Calisto Friant, Vermeulen, and Salomone 2020), widely diverging scenarios for where the CE could go, depending on which path is chosen (Bauwens, Hekkert, and Kirchherr 2020), and opposing visions with contradictory values (Genovese and Pansera 2021). These recent studies have stressed the depth of the struggle or contestation about the CE. They highlight, it may not be *one* concept anymore; bridges and umbrellas are ripping apart.

There are two lessons to take from this initial overview. First, it is crucial to choose a particular version of the CE rather than treat it as a generic or universal concept. Different actors mean widely different things when they talk about it and have their own type, scenario, or vision in mind. Therefore, I will focus on the CE of the EU. However, this focus does not eliminate the conflict, because there is neither agreement on the CE's means nor values. The transition away from a linear economy is what the policy theorist Robert Hoppe (2010, 73)

calls an "unstructured problem".[7] Even when focusing on the EU, it is unclear what ought to be done and how, which makes it necessary to go beyond analyzing evidence. Unstructured problems require fundamental rethinking of the given assumption. This can done by what Hoppe (2010, 190) calls an argumentative style, which intertwines "normative analysis through clarification of norms and values with evidence-oriented research and analysis" and is characteristic for "policy philosophers".

To make no mistake, there have been excellent analyses of EU CE policy on which I will rely extensively (Kovacic, Strand, and Völker 2019; Calisto Friant, Vermeulen, and Salomone 2021; Domenech and Bahn-Walkowiak 2019). But these were limited by methodological requirements, such as conducting time consuming interviews and long-term or large-scale quantitative approaches, and far-reaching institutional analyses, to the previous action plan. So, until there will be comparable insights to the most recent policy, it might be too late to change it. But these analyses are reactive in an even more basic sense: they criticize that the CE policy cannot achieve what the EU wants it to do or point out inconsistency in these ambitions. These critiques are important; it is essential to know how far policy is falling short of its ecological goals. They also discuss how to concretely improve the CE in the EU, by developing "less ambitious more sensible policies" (Kovacic, Strand, and Völker 2019, 168), providing policy recommendation (Calisto Friant, Vermeulen, and Salomone 2021, 349), and discussing how to include and coordinate needed actors more effectively (Domenech and Bahn-Walkowiak 2019, 16–17). However, given the scale of the sustainability problems, we must proactively rethink it at a fundamental level, rather than critically analyze it piece by piece.

There have been insightful philosophical engagements with underlying issues related to the CE, but they remain impracticable. Philosopher of technology Jochem Zwier and his colleagues (2015) have provided "reflection on the demand for a bio-based economy" for which they use a Bataillean framework to explore, the larger implication of circularity for a zero-waste humanity. In series of articles, environmental philosopher Henry Dicks (2017a, 256; 2016; 2019) developed a philosophy of biomimicry which he takes to "underpin the transition to a circular, biobased, solar economy" and situates it within the context of human-nature relations more generally. Finally, in a recent paper Roel Veraart and Vincent Blok take steps "Towards a philosophy of the biobased economy" and shine "a Levinassian perspective on the relation between economic and ecological systems". These papers at the intersection of

[7] This concept and argument will be elaborated in the following chapter.

philosophy of technology and environmental philosophy help to locate the philosophy of the CE. All of them offer intriguing insights which will be valuable for my own argument. But the insights are developed through theories that are alien to EU economic and environmental policy. George Bataille and Emanuel Levinas thought comes at the cost of heavy phenomenological and post-structuralist theoretical baggage. Moreover, even though philosophers such as Zwier, Dicks, and Blok engage with topics related to policy, this engagement is sometimes overly general or abstract and not always careful enough to distinguish between various (admittedly messy and entangled) policies: for instance, they aggregate the zero-waste, solar, bio(-based), and circular economy even though these constitute different policy initiatives. Such philosophy rethinks the CE at a required fundamental level, but in a way that is too disconnected from policy to be put into practice, at least any time soon.

Hence, there is a gap in the research on the CE in between the fields of policy analysis and philosophy.[8] While the criticism of the policy analysis does not go far enough, the philosophical engagement fails to be actionable. Yet, we need rapid *and* far-reaching change. How the CE can make European society more sustainable is a question that is both philosophical and relevant to policy. Having identified this gap, how it be approached?

3. My Approach: A Philosophy in the EU

My approach is located between the disciplines related to policy and philosophy. So how do I intend to develop a philosophy of the CE in the EU or at least come closer towards it? Hoppe provides a starting point with the argumentative style by highlighting the interlinkage between normativity and analysis. Moreover, he argues policy philosophers are "mega-policy strategist[s]" who "keep a distance from politics and "make others aware of other possible worldviews and their implications" (Hoppe 2010, 190). The emphasis on being both analytic

[8] To be clear, this intersection is not vacuous. Policy oriented approaches undertake conceptual work: they constructed the underlying socio-technical imaginary (Kovacic, Strand, and Völker 2019) or related them to a wider discourse (Calisto Friant, Vermeulen, and Salomone 2020; 2021). Likewise, the philosophical approaches refer to policy (Zwier *et al.* 2015, 374; Veraart and Blok 2021, 190); if a somewhat precursory manner. But there are few studies that put this intersection center-stage, especially in relation to sustainability:[8] For instance, Korhonen, Honkasalo, and Seppälä (2018) who conceptualize the CE and its limitations and Geissdoerfer *et al.* (2017) investigates the relation between sustainability and the CE both empirically and conceptually. This conceptual work is philosophical -- philosophy is not only done by philosophers – and it is conducted in relation to policy. However, it is far from conclusive and in the quickly evolving research on the CE these studies are somewhat dated already as they make no reference to the most recent EU policies. Moreover, both find that the relation between CE and sustainability is severely limited but provide little indication how to overcome these obstacles.

as well as normative, formulating overarching strategy, as well as extrapolating and interpreting worldviews provides some clues on how to bridge this disciplinary gap. However, this is mainly directed at policy analysts who take a more philosophical perspective and does not tell philosophers how to fruitfully engage with policy.

A second clue about the reverse perspective is provided by the philosopher Adam Briggle (2016), who advocates for a policy turn in the philosophy of technology. He argues that the current paradigm of the empirical turn does not go far enough. It challenged "what philosophers talk about", concrete technologies in the plural, but not "who philosopher talk to"_- other philosophers (Briggle 2016, 170): philosophers learn from other disciplines, such as engineering, but they do not give back because they fail to engage with stakeholders in ways that would be relevant to them. According to Briggle (2016, 172), drawing implication for policy from philosophical engagement is a good way of making philosophy relevant for stakeholders. Hoppe's and Briggle's complementary perspective provide a theory on how to bridge policy and philosophy from either side: by developing philosophy from policy, in a normative and analytic way, but also deriving policy-relevant implication from philosophy. This provides grounding for my approach at the intersection of philosophy and policy, yet it is too theoretical to be put to practice.

A concrete example, which provides a blueprint for my approach, can be found in the work of environmental philosopher Alexandria Poole's (2018b; 2018a) on the United Nations (UN) Sustainable Development Goals (SDGs). She analyzes the 17 SDGs, which were developed out of the prior Millennium Development Goals (MDGs) with the intention to address their socio-ecological deficits, from a justice standpoint. This comparative analysis also highlights the continuous shortfalls of the MDGs and SDGs. Even though the SDGs add a focus on ecological sustainability to the socio-economic development agenda of MDGs, she argues, causes of unsustainability are still falsely divided into direct, natural, and indirect, human, drivers. According to her, "SDGs are missing language that reflects … the inextricable link between cultural, linguistic and biological diversity even as they focus on refining the goals towards sustainability" (Poole 2018b, 56). Moreover, the SDGs also continue the trend in UN development policy of falsely universalizing human experience and overlooking cultural diversity. While they purport to be inclusive, "the inclusivity that is stated in the SDGs contributes to a culture of sustainability through assimilation, thereby threatening cultural sovereignty" (Poole 2018b, 70). Such cultural hegemony also disregards local and traditional ecological knowledge that could contribute to sustainability. In order to be truly sustainable, the SDGs need an additional 18th goal, which protects and promotes biocultural heritage (Poole

2018b, 74). This goals not only highlights the importance of diversity, but also conceptualizes humans and nature as intrinsically connected.

The reason why this is a useful blueprint for my approach is that Poole's work showcases how to bridge the fields of policy analysis and philosophy. Her analysis of UN development policy is sound in itself, but at the same time connected to larger philosophical issues which are then linked back to policy. For instance, she questions the distinction between direct and indirect drivers of unsustainability as relying on a false division between humans and nature. *Vice versa*, she ties larger philosophical issues such as epistemic or environmental justice and political autonomy, to the language in the documents (e.g. inclusivity and diversity) to show how they concretely affect policy. Policy is thus not taken merely as policy, but also to have philosophical implications. By themselves, policy documents may lack the consistency to constitute a philosophy, a system of thought, but neither are they empty or thoughtless words. Policy expresses and performs fundamental worldviews. Through paying close attention to the language in the documents, policy philosophers can develop systems of thought from policy which allows to understand and criticize the worldviews inherent to them. For it to be convincing, the philosophy must be grounded in the policy rather than imposed on it. This also allows to draw implication for policy from philosophy, like Poole does: The philosophical upshot is expressed in terms of an additional, 18th goal. In this way, the policy analysis can be philosophical, while the philosophy remains relevant to policy, which combines both Hoppe's and Briggle's suggestions. This is the general approach which I will employ in this thesis and build steps towards a philosophy of the CE from and for EU policy.

A couple of methods lend themselves to such approach, which can be loosely captured under the umbrella term discourse analysis. Poole's comparison of the MDGs and SDGs allows to identify trends and shortfalls from within the policy. She takes the internal goal of sustainability seriously rather than arguing development policy should be sustainable for external reasons. Furthermore, close reading, paying attention to the language of the policy documents in detail, allows her to develop philosophical concepts in dialogue with them. The frequent usage of inclusive is not a rhetoric quirk but indicative of a hegemonic worldview in need for diversity. In my policy analysis, I will also employ these concrete methods such as comparison and close reading of policy documents to conduct a discourse analysis and build the philosophy from and for the policy.

However, the underlying methodological point is that this approach is both prescriptive as well as analytical or hermeneutic. The 18th goal is something that the UN *should* adopt for normative reasons of being sustainable, but it is also something that it *could* adopt because it

fits the purpose of the SDGs (Poole 2018b, 70). These two points are dialectic: policy can have ambiguous meanings and which should be dominant is matter of normative reasoning. Yet the normative part is also a matter of analysis and interpretation. The goal 18 is developed by Poole, drawing on outside sources, such as sustainability scholars and indigenous people. However, it is conditional on the interpretative analysis that the purpose of the SDGs is to rectify the MDGs (Poole 2018b, 56). This dialectic back and forth is suitable for making philosophy relevant to stakeholders. My approach will follow this general methodological structure. I offer a new interpretation of the CE, what it could mean, and defend this interpretation as something that it should mean. This is what I mean by a philosophy in the EU.[9]

I hope to have initially motivated that such approach is a plausible choice. Given the urgent and deep problems of unsustainability we face, the research on the CE is in need for a middle-ground between policy analysis and philosophy. I will approach this middle-ground using a methodology which I have adapted based upon Poole's (2018b; 2018a) work as described above, and synthesized with Hoppe's (2010) as well as Briggle's (2016) theoretical accounts. But with such middle-ground come compromise and trade-offs. For instance, because it is a paradigmatic example of multi-level governance, policy-making in the EU is as complex as it gets (Hooghe, Marks, and Marks 2001). My analysis of 'EU' CE policy will center around the action plans by the European Commission, which is only one initiative by one of the legislative branches (albeit an important one). On the philosophical side, I will come across the is/ought problem and the distinction between humans and nature. These problems will not be solved so much as circumvented. I simply cannot satisfy all requirements of these diverse fields to the fullest and pursue every string, in one thesis; I am only moving towards a philosophy of the CE in the EU.

To delimit my research, I will focus on ecological sustainability. My argument is about what the CE could and should be in order to become ecologically sustainable. While I touch

[9] Besides defining the scope and opening-up a methodological middle-ground, grounding philosophy in policy has an ethical purpose, too. Contrary to other disciplines, Philosophers seldomly restrict their arguments to specific times, places, or people, and rather aim for universal truth. Accordingly, a philosophy of the CE would appear to apply for all people around the world. This is not my intention. China for instance has implemented their CE policy already in 2004, based on the ideal of harmony that is of central importance in Chinese philosophy (Ghisellini, Cialani, and Ulgiati 2016, 12,24; Yong 2007; Naustdalslid 2014). To impose a universal philosophy onto the world, would neglect these already existing policies with their own rich intellectual context. As response to climate change, this would add insult to injury (see fn. 2 above), especially, when these philosophies come from white European men. The geographical limitation to the EU thus not only concerns the CE policy, but also the philosophy thereof; in this thesis I make no claim beyond Europe and refer by the philosophical 'we' to (affluent) Europeans only (see fn. 1).

upon some socio-ethical implications, this discussion will be far from conclusive and there are many questions of justice, related to distribution and participation, which I do not ask, l*et al*one answer, in this thesis. This might appear like a major liability for a (partially) normative approach, why focus on sustainability when one could talk about justice and democracy? But my understanding of sustainability runs counter the common notion as technical or even technocratic. Following Poole further, I take sustainability as a philosophical or political concept which has deep socio-ethical implications. Like most political concepts, it intersects with other ones, however my focus is on such deep, political sustainability which is not only worthy but in dire need of philosophical inquiry: it concerns how we Europeans should fundamentally relate to nature. The CE is best understood as offering an opportunity to rethink this relation but for that it has to be considerably more than recycling.

4. Outline of my Argument: From Recycling to Recoupling

I argue in this thesis that the CE in the EU is best understood in a strong biomimetic sense, as an economy based on ecological principles. The most recent EU action plan cannot achieve its own ecological ambitions: it relies on vague and inadequate approaches, such as the recycling circularity of closing material loops, and aims for delusional goals such as decoupling economy growth from ecological harms. Therefore, I build upon and reframe these concepts, arguing that we could and should understand circularity as imitating ecological principles, and decoupling as recoupling economy with ecology. I defend a philosophy of the CE as a recoupled, ecomimetic economy, which will require to reorient EU policy but constitutes an economic model more appropriate for its sustainability goals.

In the second chapter, consistent with the methodology outlined above, I start from policy and conduct a discourse analysis of central EU CE documents. After introducing the CE as a policy concept in the EU, I identify from previous analyses the trends that the (ecological) ambition of the policy is increasing but not matched by action which could achieve this ambition. Comparing the 2015 action plan to the 2020 one, I argue that there is increasing mismatch between means and goals for the EU's CE policy. This indicates that it is in the process of unstructuring: the CE is not only in practical terms unequipped to do what the EU wants it to do, but the economic model which should underpin and drive the transformation towards ecological sustainability is inadequately conceptualized. In a second analytic step, I zoom in on the concepts of circularity and decoupling. Circularity appears to be understood in

terms of closing material loops such as recycling, which cannot achieve what the plan intends for it. Similarly, against all evidence, the EU aims with the CE to decouple economic growth from ecological harms. If we take the ecological ambition of the EU seriously, these two concepts need to be reframed, which I will do in the following chapters.

The third chapter focuses on circularity and connects policy to philosophy. I outline a new interpretation of circularity as a biomimetic approach rather than closing material loops. Biomimicry has been criticized as either being a weak source of inspiration, and thus no reliable approach toward sustainability, or a strong ethics, which invites philosophical objections of committing the naturalistic fallacy and falsely presupposing a perfection of nature. I argue however that on an ecological understanding of nature, these problems can be overcome and defend a strong version, an ecomimetic ethics, which achieves sustainability by adopting ecological principles or values, according to which we could and should understand circularity. To flesh out what an ecomimetic ethics means for the CE, I discuss the ecological values of holism, relationality, and limitedness as well as their implication for EU policy. A major implication of limitedness as an ecomimetic value is that the economy cannot grow indefinitely.

Therefore, In the fourth chapter, I expand on the philosophical discussion and scale this ecomimetic approach to the level of the economy by reframing decoupling: the CE should aim to recouple economy with ecology. Drawing on a conceptual framework from ecological economics, I argue recoupling can be achieved by basing economy on ecology. This however is philosophically contentious because economy and ecology are conceived of as ontologically heterogenous. Moreover, basing economy on ecology implies natural limits which invites immoral ecofascist Malthusian population thinking. I respond to these objections, that on the conceptual framework of ecological economics these problems are negligible, and ecomimetic economy could be placed in ecology according to ecological principles as an act of intentional self-limitation. Finally, I relate back to policy and argue that there is a path toward such philosophy of the CE in the EU which could be pursued by the parallel bioeconomy strategy because the hegemony of growth in economic policy is waning.

I will conclude in the final chapter by reflecting upon the implications of the CE as an ecomimetic economy, highlighting areas for future research, as well as upon the strengths and weaknesses of my policy-philosophy approach.

Chapter 2: The CE as a Policy in Europe – The Engine of a Moonshot?

This is Europe's man on the moon moment
Urusula von der Leyen, President of the European Commission, 2019

Some structured problems are extremely complex,
like putting a man on the moon
Robert Hoppe, *The Governance of Problems*, 2011, 76

1. Introduction: The CE in the EU -An Economic Heart and Backbone of Industry

On March 11, 2020, European Commission under Urusula von der Leyen introduced the European Union (EU)'s New Circular Economy (CE) Action Plan. The policy document proposes 35 actions, to be rolled out over four years, in order to transform economy and industry and "provide a future-oriented agenda for achieving a cleaner and more competitive Europe" (COM 2020, 2).[10] With this plan, the European Commission intends to achieve various environmental goals, such as decrease waste pollution and carbon emission, while creating jobs and growing the economy. While it constitutes a major policy initiative, it is not a standalone strategy. Rather it "aims at accelerating the transformational change required by the European Green Deal, while building on circular economy actions implemented since 2015" (COM 2020, 2–3). The action plan is embedded in two other major EU policy projects and needs to be seen in their context.

As a *new* action plan, this policy initiative follows up and builds on the previous CE policy by the Junker Commission. This mainly consisted of the first CE action plan form 2015: "Closing the Loop – A circular economy action plan for Europe" (COM 2015). Its 54 actions were enacted over 4 years and thus seamlessly transition into the CE policy of the current commission. Indeed, the new action plan was released only a week after the commission reported on the implementation of the first, concluding that "the circular economy is now an irreversible, global mega trend. Yet, much is still needed to ... fully close the loop and reap the competitive advantage it brings to EU businesses" (COM 2019a, 10). Generally, this major project worth €10 billion of public funding was considered a success, that has led to investments of €17.5 Billion and generated €147 Billion in value (COM 2019a, 1, 8). This is taken to constitute a 'global mega trend'. However, the project of the plan to close the loop, is also seen as unfinished, which is why the report suggests continuing this path by making the CE "a backbone of the EU industrial strategy" (COM 2019a, 10). With the new action plan, the von der Leyen Commission continues and finishes what the Junker Commission has started.

[10] To signal references to policy documents, I will use the official abbreviation COM rather than European Commission. For the sake of readability, I have not included the document numbers in the text but in Figure 1.1.

The new CE action plan must also be seen in the context of the European Green Deal (COM 2019b), which constitutes the EU's response to the climate crisis and is supposed achieve climate-neutrality by 2050. Even though it was proposed shortly after it took office, it can already be considered as von der Leyen's commission signature project: totaling investments of €1 Trillion over 10 years, it is a behemoth of a policy initiative. In her press-statement, Ursula von der Leyen called it "Europe's man of the moon moment", proposing to write history by radically altering the way we live to "reconcile the economy with the planet" and create "a new growth strategy … that gives more back than it takes away" (2019). The CE plays a central part in this radical proposal: the longest section of the European Green Deal is about the CE (COM 2019b, 6–8), and upon its release has been called "an economic heart of the Green Deal", by the commissioner for the Environment Virginijus Sinkevičius (2020).

The context of the first action plan and the Green Deal highlights how central the CE has become to EU policy making. Even though it is a new idea (see Figure 2.1 for a timeline below), the metaphors of backbone and heart suggest that it is already vital for industry and economy. However, it also indicates a tension between continuation with the old and radical change. On the one hand, the new plan should build on and finish the work of the first action plan that started under the Junker Commission. On the other hand, it embodies the radical change envisioned by the von der Leyen Commission with the European Green Deal. As I am going to argue in greater detail below, the CE is precisely the new growth strategy the Green Deal envisions. So can the CE 's old heart and bones support such new growth spurts?

The central question, for this chapter is how this tension plays out in the EU's new CE policy. To answer it, I will comparatively analyze the 2015 and 2020 CE action plan in the second section and investigate whether continuity or change prevail. Drawing on analyses of previous EU CE policy, I will argue that the answer is both: The established trends of formulating more ambitious goals which are not matched by appropriate means still hold and there is a significantly widening gap between words and actions in the new CE action plan, which makes for an unstructuring of the policy problem with disagreement on both means and ends. In sections 3 and 4, I will then zoom in on two concepts that are new to EU CE policy, circularity and decoupling. I will analyze what role each plays in the 2020 action plan, to criticize that circularity is a particularly inadequate means and decoupling and an especially implausible goal for the CE. This will not only concretize my general criticism of EU CE policy, but also allow me to make it more constructive, in the following chapters where I reframe for both concepts. In this chapter, however, I focus on how short the EU falls with its moonshot, because the CE is seen as an easy solution to new problems.

Figure 2.1: Timeline of EU CE Policy

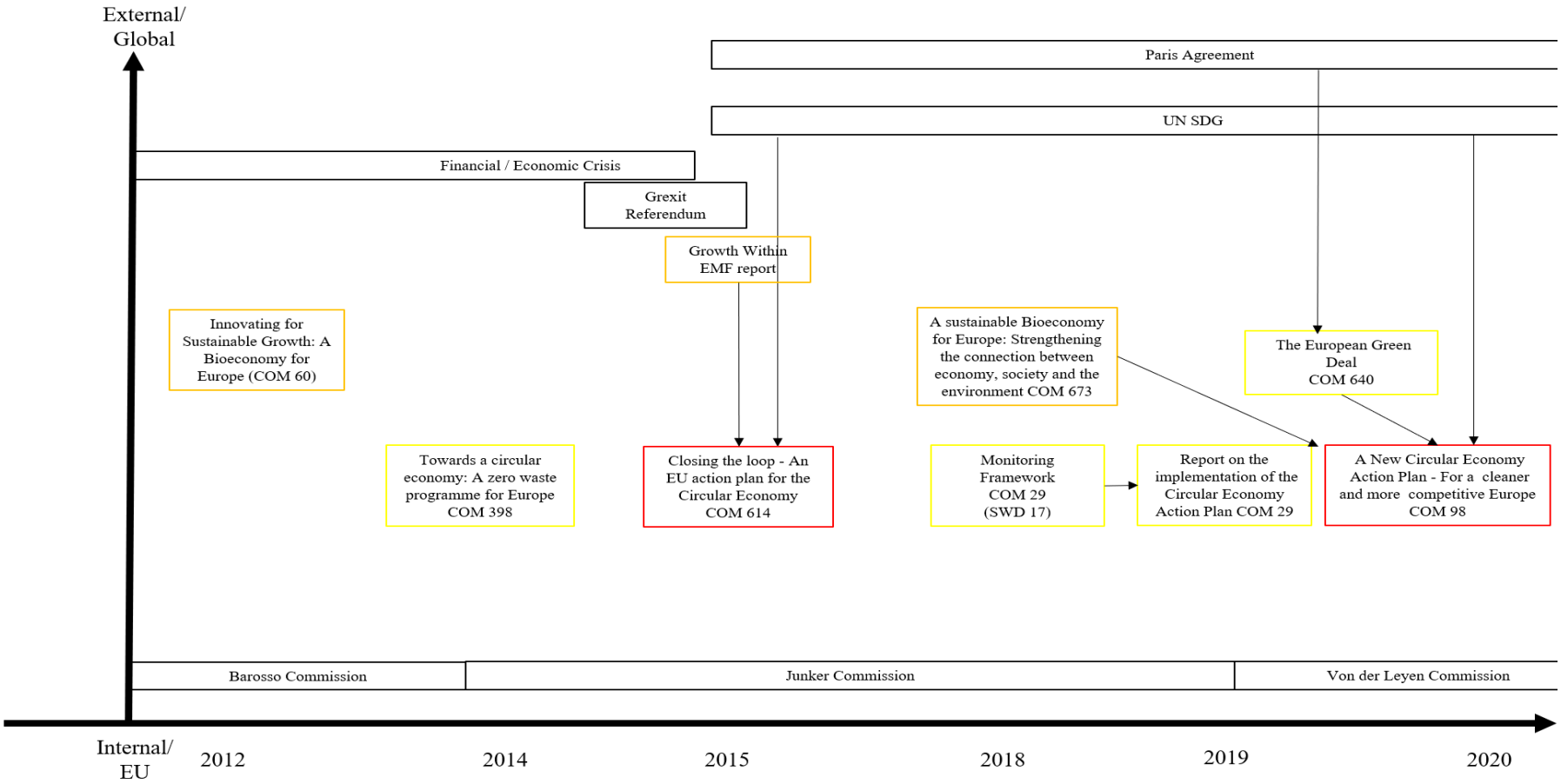

Figure 2.1 graphs of EU CE policy and background events. X-Axis is a timeline, and Y axis (roughly) organizes events and documents spatially from internal to EU CE policy to external or global. Policy documents are labelled according to EU convention and color-coded: red primary analyzed, yellow secondary analyzed, and orange tertiary or third-party documents used in following chapters. Arrows indicate explicit influence or references.

2. Analyzing EU CE Policy: A Comparison of the 2015 and 2020 Action Plan

In this section, I will compare the EU's 2015 and 2020 CE actions plan. While my interest is in the most recent EU CE policy, the older action plan provides the necessary backdrop against which the newer plan can be analyzed. This not only allows me identify changes or continuation in the policy process of the CE in the EU, but also to use insights from analyses of previous policy and extend them to the new action plan, which has not been analyzed so far. In particular, I will draw on two larger analyses both studied the EU's CE policy up until 2019. The first is a narrative of the policy by Kovacic, Strand, and Völker (2019) and the second a discourse analysis by Calisto Friant, Vermeulen, and Salomone (2021). After briefly introducing the results of their analyses, I will in the next subsection compare the introduction of the two plans to juxtapose their respective definitions of CE, goals for it, and by what it is motivated. Then, I will analyze the proposed actions in the second subsection. Lastly, I will evaluate these analyses conjointly as well as draw implications from such evaluation in the third subsection.

The first analysis is offered by interdisciplinary policy scholars Kovacic, Strand, and Völker (2019, chap. 3) who employ a narrative approach which traces the development of the CE in the EU over time in its institutional context. The CE started off as a modest proposal to re-insert environmental concern in post-economic crisis EU and focused on economic benefits to gain consensus. In 2014, the European Commission proposed it as a "development strategy that entails economic growth without increasing consumption, deeply transform production chains and consumption habits and redesign industrial systems" (as cited in Kovacic, Strand, and Völker 2019, 38). "The circular economy was a realistic goal, a moderate goal", which did not count on deep transformation or systemic change and rather stressed the mutual environmental and economic benefits (Kovacic, Strand, and Völker 2019, 39). The initial idea of the CE was to realize small scale environmental goals without making economic sacrifices.

Under the Junker Commission, this ambition increased. The 2015 action plan envisioned "the transition to a *more* circular economy, where the value of products, materials, and resources is maintained in the economy for a long as possible, and the generation of waste minimized, [which] is an essential contribution to the European Union's effort to develop a sustainable, low carbon, resource efficient and competitive economy" (as cited in Kovacic, Strand, and Völker 2019, 40). Their analysis shows that while win-win conditions are still prevalent, the stakes are much higher: the goals of value maximization and waste minimization are much more ambitious than not increasing consumption. Moreover, they argue, the plan now counts on transition and transformation, even though the systemic change is softened through

the locution that the economy has to become *more circular,* implying that it already is so to a degree (Kovacic, Strand, and Völker 2019, 40–41). Kovacic and colleagues (2019, 55) explain this change, through the shifting institutional context: Due the Paris agreement and the UN Sustainable Development Goals, in 2015, there was a reemergence of global climate governance which granted further weight to environmental concerns. According to them, the fading of economic crisis from as well as the reemergence of climate change on the governance agenda enabled a trend of increasing ambition for the CE in the EU.

The second analysis stems from environmental policy scholars Calisto Friant, Vermeulen, and Salomone (2021) who conducted a quantitative discourse analysis of CE documents from the Junker Commission (2014-2019). This operationalized their previous conceptual typology, which categorized CE discourses along two axes: optimistic or skeptical about technological solutions as well as holistic or segmented in it is approach (Calisto Friant, Vermeulen, and Salomone 2020): This makes for four types: *reformist* (holistic, optimistic), *technocentric* (segmented, optimistic), *fortress* (segmented, pessimistic), *transformational* (holistic, pessimistic) (see Figure 2.2 below). Their analysis reveals a "dichotomy between EU discourse (talk) and EU policies (actions) on the CE" – The EU talks about a holistic, reformist version of the CE but mainly enacts segmented, technocentric policies (Calisto Friant, Vermeulen, and Salomone 2021, 346). Based on their typology, they develop a strong critique of the EU who claims with its CE policy to be "a global leader in environmental policy making, while doing little to seriously disrupt linear business-models and practices within its borders" (Calisto Friant, Vermeulen, and Salomone 2021, 350).

Based on these previous analyses, I identify two trends in the EU CE policy. First, there is an increase of ambition – the CE in the EU has shifted from a modest attempt reinstate some environmental concerns in the agenda to a central environmental governance instrument. However, second, this ambition is mainly based in the discourse or claims, and the EU does little to enact such ambitious CE. To see whether these two trends also hold in the case of the new action plan, I will compare the introduction and the body of the two major policy documents, the 2015 and 2020 action plans.

Figure 2.2: CE Discourse Typology

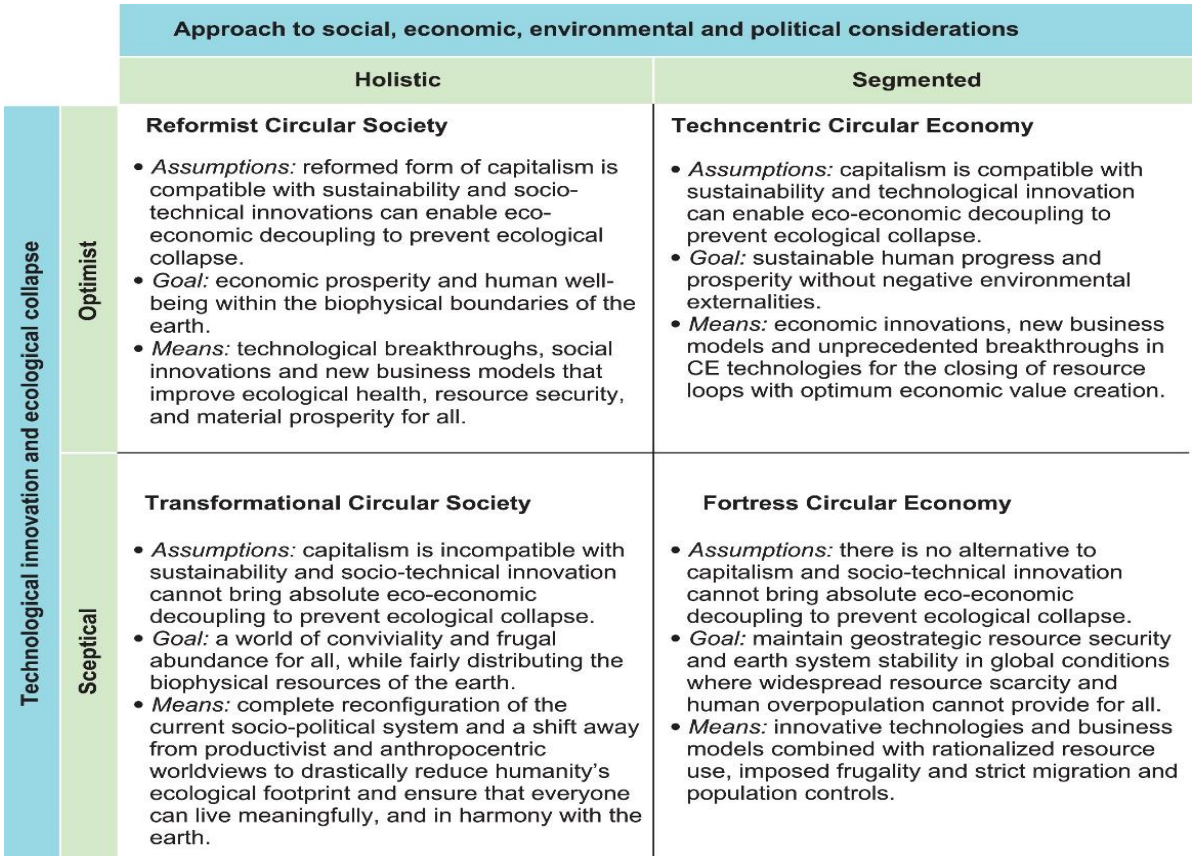

Figure 2.2 adopted from Calisto Friant, Vermeulen, and Salomone (2020, 10) *depicts four different types of CE which arise from a position along two axes: They are either* holistic *or* segmented *in their approach to social, economic, and political consideration and* optimistic *or* skeptical *about technological innovation and ecological collapse.*

2.1 Comparing the Introductions: Outlining a More Ambitious CE

The introductory sections of the EU action plans provide context for the policy. They outline where it comes from and give an orientation where it should go. A comprehensive narrative or discourse analysis is beyond the scope of this thesis. Because of a lack of data resulting from the early stages of implementation, I compare the CE policy along three important facets that are outlined in the introductions: how it is defined, what it should achieve, and why it is needed (see Table 2.1 below). These three dimensions provide an approximate idea of the CE's general orientation and can thus be used as an indicator to see whether it has increased in ambition.

Table 2.1: Orientation of EU CE Policy 2015 and 2020

EU CE Policy	2015	2020
Definition	Retaining "Resource Value… Minimizing Waste"	"Regenerative" and Restorative "give back more than it takes"
Goals	1. Economic 2. Environmental "low carbon"	1. Environment "climate neutrality" 2. Economic 3. Social
Motivation	Local economic opportunity	Global environmental necessity

Table 2.1 Compares the EU's definitions, goals, and motivations for the CE, in the 2015 and 2020 action plan. Direct quotes are in quotation marks; the rest is paraphrased.

Already in its definition of the CE, the 2020 action plan is much more ambitious than the 2015 one. The older plan defined it as an economy "where the value of products, materials and resource is maintained in the economy for as long as possible, and the generation of waste minimized" (COM 2015, 2). This contrasts with the most recent definition of a CE as "a regenerative growth model that gives back to the planet more than it takes" (COM 2020, 2). The older definition focused on retaining as much as possible, so not even everything, whereas the newer one emphasizes regeneration and continuous viability.[11] Additionally, the issue of reducing waste pollution has been exchanged for restoring the planet in general. While according to the 2015 definition, a CE would minimize a specific kind of environmental harm according to the 2020 plan, a CE should give back to the planet. Clearly, the newer definition is more ambitious: it takes more effort to restore everything, than to retain partially. The difference in what the CE is (or should be) also points to a shift in what it should achieve.

The goals of the 2020 plan have also increased in scope and depth from the 2015 plan. For once, this is reflected in their varying priorities. The older plan starts "the circular economy will boost the EU's competitiveness" and then adds, "at the same time, it will save energy and avoid the irreversible damages by using up resources" (COM 2015, 2). The new one highlights the CE's ecological importance first, and afterwards addresses benefits "for businesses" and "for citizens" (COM 2020, 2). It adds the societal benefits, but more importantly shifts environmental goals to the forefront. But not only their order has changed, also the quality of the environmental goals, especially related to climate change, increased in ambition. In the old

[11] As mentioned in the introduction, this definition also coincides with the growth-model envisioned by the European Green Deal. It also corresponds to the Ellen MacArthur Foundation's (2013) definition of CE as regenerative and restorative by design. Moreover, it employs the biological language of regeneration, a feature which I will explore in the third chapter, where I interpret circularity as a biomimetic approach.

plan, the CE was supposed to create a "low carbon" economy (COM 2015, 2), whereas the new one should achieve "climate neutrality" (COM 2020, 2). This widens the climate goals from only carbon-based ones to all greenhouse gases and raises the bar from low to no pollution.

Lastly, the motivation for the 2020 plan has become more ambitious as the problems it should tackle are far graver than in the 2015 (see Figure 2.3 below). The older plan started with the statement that "the transition to a more circular economy… is the opportunity to … generate new and sustainable competitive advantages for Europe" (COM 2015, 2). In 2015, the motivation for the CE was a local economic opportunity. This motivation has shifted drastically in the 2020 plan, which starts off with the completely different problem setting: "global consumption" will exceed the boundaries of "planet Earth" if nothing changes. It also mentions "greenhouse gas emission" and "biodiversity loss" at the beginning (COM 2020, 2). The problems that provide the backdrop of the newer plan have become much more severe: something has to happen, or resources will be depleted, the climate will change, and biodiversity lost. Rather than being an economic opportunity, the transition is a now framed as an ecological necessity. Moreover, the local context of Europe has given away to a global or planetary scale. Given such pressing problems, the CE almost has to be more ambitious.

Figure 2.3: Introductions of 2015 and 2020 Action Plan

Introduction

The transition to a more circular economy, where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised, is an essential contribution to the EU's efforts to develop a sustainable, low carbon, resource efficient and competitive economy. Such transition is the opportunity to transform our economy and generate new and sustainable competitive advantages for Europe.

1. INTRODUCTION

There is only one planet Earth, yet by 2050, the world will be consuming as if there were three[1]. Global consumption of materials such as biomass, fossil fuels, metals and minerals is expected to double in the next forty years[2], while annual waste generation is projected to increase by 70% by 2050[3].

As half of total greenhouse gas emissions and more than 90% of biodiversity loss and water stress come from resource extraction and processing, **the European Green Deal**[4] launched a concerted strategy for a climate-neutral, resource-efficient and competitive economy. **Scaling up the circular economy from front-runners to the mainstream**

Figure 2.3: Screenshots of the introductory paragraphs in the EU's 2015 (above) and 2020 (below) CE action plan's that showcase their varying initial problem settings. The footnotes refer to (1) UN Sustainable Development Goals, (2) the OECD, and (3) the World Bank.

The comparative analysis of the general orientation for the EU's CE in 2015 and 2020 yields a clear outcome. The new plan outlines a CE that is much more ambitious in its definition, in what it should achieve (especially in environmental terms), and much more urgently needed. The first trend I identified based on Kovacic, Strand, and Völker's (2019) analysis still holds: the CE policy of the EU has become more ambitious in 2020. In this case, I can draw on the explanation that Kovacic, Strand, and Völker's (2019) offer: the internal and external institutional context of the EU has shifted. The 2020 action plan, due to greater temporal distance, is even less constrained by the financial crisis. At the same time it is much embedded in global climate governance, as its first three references to the UN sustainable development goals, an OECD report, and the World Bank report indicate (see Figure 2.3 above) (COM 2020, 2). This is also reflected internally through the European Green Deal. The CE appears to be the EU's main tool to realize the ambitious environmental policy: its definition of a regenerative and restorative growth model is exactly what the European Green Deal should achieve according to von der Leyen (2019). So far, I discussed only the first trend in EU policy.

2.2 Comparing the Bodies: The (Un)Surprising Absence of Change

The second trend in EU CE policy is the mismatch between words and actions, which Calisto Friant, Vermeulen, and Salomone (2021) identified. Again, I cannot replicate their comprehensive analysis for the new action plan here, not least because most of the actions have not been implemented or even drafted so far. But since their analysis has established that there was such mismatch for the 2015 action plan and my foregone analysis has shown that the 2020 action plan is considerably more ambitious, an obvious deviation from the old plan is needed in order to bridge the already existing the gap between words and actions. Therefore, I compare the content of both plans to see whether the actions proposed under the 2020 plan have changed significantly. An extensive section by section comparison is provided in Appendix 1;[12] this section summarizes the main findings and discusses illustrative examples.

For the most part, the 2020 action plan is in clear continuation with the 2015 one. The majority of changes are to "KEY PRODUCT VALUE CHAINS" (COM 2020, 6–9),[13] which now includes "Electronics and ICT", "Batteries and vehicles", and "Packaging". All of these are valuable additions which were not listed in the "PRIORITY AREAS" of the older plan (COM 2015, 13–18). However, these additions only apply the same policy more broadly and

[12] The upshot is that there is no significant increase in the bodies and actions. Because demonstrating absence is a tedious task and makes for a boring read, I relegated this to the appendix.
[13] Section headings are capitalized in the action plans which is mirrored in my directed quotes here.

do not change it significantly. Further, most other sections are adopted from the older plan with minor revision. For example, the first two sections "PRODUCTION" and "CONSUMPTION" in the older plan (COM 2015, 3–8), have been combined into a "A SUSTAINABLE PRODUCT POLICY FRAMEWORK" in the newer one (COM 2020, 3–6). Likewise, the previous section 3 "WASTE MANGEMENT" and 4 "FROM WASTE TO RESOURCES" (COM 2015, 8–11; 11–13), correspond to the 2020 section, "LESS WASTE, MORE VALUE" (COM 2020, 12–15). Such combination might create the impression that the new action plan is more comprehensive by providing a unified framework or symbiotically synthesizing sections, which would make for a significant shift in action.

However, such appearance is misleading. The combined frameworks are not more comprehensive. To start with, both are considerably shorter (by about half), which is also not compensated by greater density of actions or increased precision: the 2020 plan proposes 19 actions fewer than the 2015 one and 5 times as many reviews (see Table A1.3 in the Appendix). Moreover, it is in many cases much more vague: To take an example from the waste and value sections, the older plan includes concrete statistics on recycling: "only around 40% of the waste produced by EU households is recycled ... with rates as high as 80% in some areas, and lower than 5% in others"(COM 2015, 8–9). Based on such data, it proposes to put nuanced "waste hierarchy [which] establishes a priority order from prevention, preparation for reuse, recycling and energy recovery through to disposal, such as landfilling" (COM 2015, 8). By contrast, the newer plan states the ambitious goal of "decoupling of waste generation from economic growth" and acknowledges that this "will require considerable effort across the whole value chain and in every home" (COM 2020, 12). But it leaves unclear what decoupling is and where such effort will come from.[14] Combining waste management and value generation is not more comprehensive, but shorter and less precise.

Also the sustainable product policy framwork does not consitute a comprehensive addition. According to the new action plan,

> [t]he core of this legislative initiative will be to widen the Ecodesign Directive beyond energy-related products so as to make the Ecodesign framework applicable to the broadest possible range of products and make it deliver on circularity (COM 2020, 4)

While this appears like a comprehensive idea, it is not new and goes back to 2015:

> the Commission will emphasise circular economy aspects in future product design requirements under the Ecodesign Directive, the objective of which is to improve

[14] The issue of decoupling will be discussed in greater detail below in section 4.

> the efficiency and environmental performance of energy-related products. To date, ecodesign requirements have mainly targeted energy efficiency (COM 2015, 4)

The core idea of the 'new' policy framework is almost identically stated in the older action plan. Besides exchanging circular economy aspects for circularity,[15] the main difference is that it applies somewhat more broadly. In other words, the 2020 action plan may expand the scope of action but does not shift it significantly. At best this is a quantitative difference, but not a difference in in kind, which is required to bridge the gap between actions and words.

An exception to this is the social dimension of the EU CE policy where such qualitative difference can be found. In section 5, the 2020 action plan intends, "MAKING CIRCULARITY WORK FOR PEOPLE, REGIONS AND CITIES", which includes a discussion of "social rights" and a "just transition" (COM 2020, 15). Moreover, in section 7, "LEADING EFFORTS AT A GLOBAL LEVEL". It also addresses the issues of illegal waste-exports to countries outside Europe and how to prevent it (COM 2020, 14–15). The point is not that these additions are perfect or conclusive, much remains to be criticized about them.[16] It rather serves as an example of genuine change. The 2020 policy adds societal issues in the introductions and then addresses these both domestically as well as globally in its actions, however imperfectly. Unfortunately, a similar significant addition is not apparent in the ecological dimension.

Indeed, the 2020 plan at times appears less developed in this dimension. The 2015 plan includes various economic entities, such as consumption, consumers and, production, besides products, whereas the 2020 conceptualizes the economy almost exclusively in terms of products (see Table A1.4. in the Appendix). Hence, the latter proposes a sustainable *product* policy framework as the main legislative contribution. Instead of 'priority areas', it discusses 'key *product* value chains'. The new plan moves the focus away from a more holistic economic perspective, which leads to a neglect of large parts of the economy. For instance, the old plan discusses "innovative forms of consumption", such as the "collaborative economy" (COM 2015, 7, 8), which are absent from the new plan. This is problematic from the perspective of ecological sustainability (Geissdoerfer *et al*. 2017; Korhonen, Honkasalo, and Seppälä 2018): Sustainability is influenced through manifold processes related to production and consumption;

[15] I will return to the concept circularity shortly, in the next section 3

[16] For instance, they might be criticized as a neoliberal. The just transition focuses on "skills and job creation"(COM 2020, 15) which conceives of individuals as self-optimizers and fairness as employment. Moreover, leading efforts of a global level, also include a focus on "free trade agreements" (COM 2020, 18). characterizes These criticisms are all valid and important, yet apply to a wide-range of cases such as global climate governance (Oels 2005), global development policy (Sending and Neumann 2006) as well as EU economic policy (Biebricher 2020, sec. 2). The CE at least is not a negative outlier.

more sustainable products are unhelpful if they have secondary impacts such as transportation or if we consume more of them. The focus on products constitutes a narrowing of scope which could be counterproductive to the ecological ambitions.

Based on this preliminary analysis, it is hard to say what the precise effects of this reduction in scope will be, as its precise realization in the following actions and their impact cannot be considered yet. Nonetheless, it raises at least further doubts whether the new plan takes more ambitious and comprehensive actions. Combined with the overall continuation of the 2015 policy, it seems implausible that the 2020 plan has the potential to bridge the gap between words and actions that Calisto Friant, Vermeulen, and Salomone (2021) diagnosed. If anything, the opposite appears to be the case. In the concluding part of this section, based on the outcome of my analysis, I will evaluate the EU CE policy and discuss recommendations from the literature.

2.3 Evaluating EU Policy: The Unstructuring of the CE

It seems as if both trends, which I identified from the literature on EU CE policy, still hold. In section 2.1, I have demonstrated that the 2020 action plan is considerably more ambitious than the 2015 one, especially in its environmental goals. In line with Kovacic and colleagues' (2019) observation, the EU CE policy continues to increase in its ambition. However, as Calisto Friant *et al*. (2021) have argued, there has been a mismatch between "words and actions", and the ambition was limited to the discourse, what the EU says about the CE rather than what it does to realize it. As I argued in section 2.2, there is nothing that would suggest a clear break with this trend: the 2020 action plan is not significantly more ambitious in its actions than the 2015 one, which would have been required to bridge this gap. So, if these observations are taken together, the new EU CE policy is characterized by a widening gap between ambitious words and lackluster actions.

A problem-structuring perspective is helpful to understand and evaluate such changes in EU CE policy. In this book, *The Governance of Problems: Puzzling, Powering, and Participation* policy theorist Robert Hoppe (2010, 1) outlines a perspective on governance or policy-making as problem-structuring. While policy is generally concerned with problems, that is "non-acceptable discrepancies between real situations and desired future situations" (Hoppe 2010, 30), the distance between present is and future ought - their structure - matters and varies: there are structured problems with agreements on means and ends, moderately structured problems, where there is agreement on either (means or ends), and unstructured problems with agreement on neither (Hoppe 2010, 73–76). However, these are not static types. The point of a

structur*ing* perspective is to highlight the process in policy-making through which problems are constituted and their structure changes. Hoppe's (2010, chaps. 1, 3), theory is in opposition to traditional policy-analysis, which conceptualizes this as a linear process: from unstructured to structured, of discovering problems and finding solutions. According to him, problems and solutions, means and ends, dynamically interact, which allows for problems to become less structured.

In the case of the CE in the EU, we can observe such problem de-structuring. The policy started off as more or less structured problem: the CE was as a plausible way to reintroduce some environmental values into the economic debate, "a realistic goal, a moderate goal" (Kovacic, Strand, and Völker 2019, 39). However, when the ambition of these values increased, in 2015, the problem became less structured: it became highly contested whether the old action plan could achieve its goals. The mismatch between words and action is typical for moderately structured problems, because there is agreement on the stated values, but not the on the enacted means. My analysis of a widening gap affirms this. Indeed, the process of unstructuring appears to be intensifying: the distance between the desirable goals and the proposed actions has increased. Moreover, the shift of priorities in the goals, the additions of societal benefits, and the recasting of environmental goals in terms of regeneration and restoration (rather than minimizing harm) appears to indicate changes and conflict in the values themselves. It thus seems that EU CE policy is now dealing with an unstructured problem.

What are we to make such unstructuring CE? At first, it appears to be a negative take. Unstructured problems, often also called wicked, are usually seen as unattractive (Hoppe 2010, 88). Moreover, the process of becoming unstructured appears to go in the wrong direction. Clearly, there is something to this. It would be great, if it was clear what the CE should achieve and certain that it could do so. However, there is little use to such criticism. It might be good to know how far the EU policy falls short off its own targets, but this comes as little surprise. Being entangled in the climate crisis, which is one of the paradigmatic examples of unstructured or wicked problems (Hoppe 2010, 74; Gardiner 2006), such criticism amounts only to a platitude – we (should) have known and expected such shortcoming. Moreover, such critique misunderstands Hoppe's (2010, chap. 1) theory: policy making, according to him is best conceived of as engaging with problems, rather than solving them. Problem solving is only one aspect of good governance. Others are acknowledging and puzzling about problems, through finding, defining, and framing them in the right way (Hoppe 2010, 30). Unstructured problems are not *per se* worse than structured ones.

Issues arise when problems are treated as having the wrong structure, and it is assumed

that unstructured problems are (moderately) structured. This applies to EU CE policy. The new action plan "aims at accelerating the transformational change required by the European Green Deal, while building on circular economy actions implemented since 2015" (COM 2020, 2–3). The European Commission appears oblivious to the mismatch between building on (and thus continuing) the same means, while setting new goals which by their own admission are transformational. It operates under the paradoxical assumption that transformation can be achieved by continuation. The policies are troublesome not because they target an unstructured problem, but because they do not target it *as* an unstructured problem. This is even evident from the moonshot rhetoric quoted in the epigraph to this chapter. I don't think this is intended. Hoppe (2010, 88) mentions putting a man on the moon because it is often falsely assumed to be a structured problem. Von der Leyen's quote is more indicative of an unconscious false understanding of the kind of problems at stake. So, the issue that EU CE policy operate under the wrong problem type.

Interestingly, this wrong-problem-structure-issue also applies to the critical recommendations policy analysts make. Calisto Friant, Vermeulen, and Salomone (2021, 350) propose to use the "influence and power of the Commission" to put their money where their mouth is and have more ambitious actions. In contrast, Kovacic, Strand, and Völker (2019, 168) argue for "less ambitious, more sensible policies". According to them, "[c]ircular economy policies would be a success even though the economy cannot be circular" (Kovacic, Strand, and Völker 2019, 169). While both offer directly opposing recommendations, they attempt to solve the problem or make it more structured: Calisto Friant by strengthening the means and Kovacic by weakening the ends. This might be helpful in the case of a moderately structured problem, but both fall short in case of an unstructured one. Of course, the European Commission could do more, but there are also pragmatic constraints to their ability. Moreover, if there was already a prior mismatch between the words and actions, doing more of same will not address the current far more significant gap. But I also do not agree with Kovacic and colleagues that we can lower our ambition. Against the background of the ecological and climate crisis, we should aspire to be much more sustainable because the discrepancy between the desired future and the present state is real and large. Given the changing problem structure for the EU CE policy, criticism and recommendations need to take another approach in order to remain constructive.

In Hoppe's theory unstructured problems present an opportunity, if they are approached in the right way. Unstructured problems arise through disagreements or uncertainty about both means and ends. This means that one must work from both ends, rather than attempting to have

one match the other. Indeed, for unstructured problems the distinction between values and knowledge itself is often questionable, because it is unclear what counts as a value or constitutes (legitimate) knowledge.[17] Therefore, the argumentative style, which "intertwines … clarification of norms and values with evidence-oriented research", is appropriate for unstructured problems (Hoppe 2010, 190). This style belongs to puzzling rather than powering: it does not attempt to "speak truth to power", but amounts to what Hoppe (2010, 167) calls "making sense together". Unstructured problems offer an opportunity for, and should be engaged by, rethinking assumptions about means and ends.

Broadly speaking this is what I will do in the remainder of this thesis. Treating it as an unstructured problem, I will attempt to make sense of the EU's most recent CE policy and take their ecological ambitions seriously. Instead of attempting to solve or structuring it, I will rethink core assumptions and clarify both means and ends. This chapter continues critically by pointing out what needs to be rethought. In the following two sections, I will zoom in on two concepts, that are significant additions to the 2020 action plan and which I only mentioned in passing so far:[18] circularity and decoupling. I will analyze the former as an inadequate approach and the latter as an implausible goal, even though they are both ambiguous in this regard: Circularity could be a value and decoupling an approach. This ambiguity not only further indicates CE as an unstructured problem, but also speaks to the intellectual inconsistency in the policy. My conceptual analysis not only adds depth and detail to my criticism of the EU CE policy, but it also highlights specific conceptual areas in which the new plan can be improved so that its ambitions make sense.

3. Critiquing the Concept of Circularity: Loops do not Fill the Frame

In this section, I will continue my analysis and criticism of the EU CE policy, by zooming in on the new concept of circularity.[19] Circularity can be seen as an approach or means for the CE, however in a highly abstract form that is supposed to be conducive to the goal of sustainability. First, I will demonstrate this by analyzing its use in the new action plan, drawing on the policy analysis concept of framing, to argue that that 2020 plan frames circularity as sustainable. While framing is a necessary strategy, much depends on the precise frame that is

[17] I might remark here that it is unclear whether the CE constitutes means or ends. While it appears to be a solution to the problems of unsustainability, it also posits new goals, such as giving back to the planet or becoming regenerative. This ambiguity is a further supports my analysis that the CE has become an unstructured problems.
[18] See fn. 14 and 15 above.
[19] I discuss below how and where this concept occurs for first time EU CE policy in section 3.2 below

employed. So secondly, I will demonstrate that circularity in CE policy is conceived of in terms of material flows, and then critique this conception by arguing that it cannot achieve what the EU wants it to do. Circularity needs further conceptual work to be conducive to the ambitious environmental goals.

3.1 Analyzing of Circularity: Building a Frame of Sustainability for the CE

One major difference between the 2015 and 2020 action plan is the concept of circularity. This noun does not exist in the older action plan, whereas it occurs 28 times in the newer one – 5 times already in headings: as briefly mentioned above, it is supposed to "deliver on circularity", because , "circularity is an essential part of a wider transformation of industry towards climate neutrality" (COM 2020, 4, 6). It even goes so far to consider "circularity as a perquisite for climate neutrality" and intends to increase "circularity of carbon" (COM 2020, 16). However, the use of circularity goes beyond climate neutrality. The 2020 plan also aims at "making circularity work for people, regions and cities", because "circularity can be expected to have a positive net effect on job creation" (COM 2020, 15). Circularity appears to be a desirable concept that denotes the positive effect the CE will have or at least is prerequisite for it, but it is also something that the CE does, that is part of the transformation it proposes and that can be put to work or delivered on. This double sense leads to a wide array of usages which makes it hard to pin circularity's precise meaning down. Such loose usage makes it also appear as natural or organic rather than technical vocabulary, even though it is a new concept.

To understand this conceptual phenomenon, the notion of framing is helpful. As politically-minded linguists, George Lakoff (2010, 71) or linguistically-minded policy scholars Martin Rein and Donald Schön (2013, 147) define them, frames are unconscious mental schemas that help to interpret, evaluate, and construct policy situations. They constitute heuristics in which facts and values are inseparably bound together. Due to their bounded-cognition, humans always employ frames to make sense of complex realities, but they can also be used intentionally to frame and trigger a specific evaluation (Lakoff 2010, 73–74; Rein and Schön 2013, 146). For instance, by framing the stance against abortion as an issue of pro-life, the value of life is bound-up with the fact that the baby is alive. This example also highlights the importance of language because frames are activated and created through language. As Lakoff (2010, 73) argues, "if the hearer has no such frames, then you have to choose your words carefully to build up those frames". With regard to policy making, Rein and Schön (2013, 153) add that naming is a crucial strategy for framing, because "once a policy terrain has been named, the name seems natural".

I argue that the 2020 action plan builds a frame of circularity. It names a new policy terrain – circularity – that wasn't there before and now appears natural. While there were CE policies before, circularity as a terrain is larger than and disconnected from these individual policies. To achieve this effect, it is crucial that circularity is used as a noun. Like the linguist Kroskrity (2010, 199) points out, "nouns, our 'words for things' display an unavoidable referentiality". Circularity is something that can be referred to independently from the CE. This is not idiosyncratic wording but marks the outline of a circularity frame. But as Lakoff (2010, 73) cautions, individual "[w]ords themselves are not frames." Frames come in referential systems of meaning. The creation of the system of meaning for the circularity frame is aided by two other rhetoric strategies or phenomena in the 2020 action plan.

First, there is the use of the adjective circular. In the 2015 plan, circular is used exclusively in the conjunction of 'circular economy'. But in the new plan, circular describes a variety of things "materials" (2), "products" (3)," sectors" (6),"initiatives" (7), "business models", and even "approach" (12) and "applications" (17) (COM 2020). This wider usage supports the idea that circularity is disconnected from specific CE policies, because not only the specific economic policy is circular, but many things. This phenomenon constitutes a more systematic use of circularity, in which there are references between various circular entities. Still, this leaves unclear what circularity means, besides being something in itself.

The meaning of 'circularity' is created by a second rhetoric phenomenon in the EU's most recent CE policy. It is referred to in the general context of sustainability to see whether products "become sustainable and stand the test of circularity" (COM 2020, 3), as well as specific environmental goals, such as "waste prevention and circularity", "circularity in toxic-free environment", or "circularity and reduction of greenhouse gas emissions" (COM 2020, 12,13,16). Circularity is used in conjunction with environmentally desirable goals. In the case of the adjective 'circular', this phenomenon is even more striking: there are multiple instances of conjunctions such as "sustainable and circular" (COM 2020, 6,10,11) or "climate-neutral, resource-efficient and circular" (COM 2020, 3,18). On the surface, these locutions do not make sense and raise many questions. Isn't the goal of the CE to reduce waste and toxicity, and to improve climate-neutrality or resource-efficiency? But if the CE should be the means to achieve these very goals, why is it listed along with them? Is it bad, if the outcome is an economy which is sustainable but not circular?

From the perspective of framing, these questions disappear. Frames do not distinguish between facts and values or means and ends but are based on their inseparability. They are not intended to convince by rational argumentation but rather appeal to intuitive reasoning. So, by

using ‘circularity’ or ‘circular’ broadly and independently from the CE, the new action plan creates the impression that there is such independent concept of circularity. Moreover, by listing it frequently in conjunction with adjectives that are desirable from the perspective of sustainability, it charges this independent concept semantically as sustainable. By using the words in this way, the action plan creates a frame of circularity, where people will hear ‘circular’ and think ‘sustainable’.

What are we to make of this framing of circularity? An obvious response would be to criticize it as yet another instance of ambitious rhetoric *in lieu* of action. However, as I argued in section 2.3, we rather should ask if there is way to make sense of circularity as an intrinsic sustainable approach. To evaluate this, I must scrutinize what precisely the circular frame entails and what circularity means to the EU. Given the loose meaning and lack of definition in the 2020 plan, this requires some more exegetical work in the next subsection.

3.2 Evaluating Circularity: The Limits of Loops

As a start towards a better understanding of circularity, it is helpful to look at first usages of it by the EU. To the best of my knowledge, [20] this occurs in the Staff-Working Document (SWD) 28, from 2018 (COM 2018b) (see Figure 2.1 above). This internal working paper was developed into the Monitoring Framework for the CE (COM 2018c) which served as the basis to evaluate the implementation of the first action plan (COM 2019a). In a footnote to the SWD 28, the EU refers to it by citing an article of Haas *et al*. (2015), who provide “a rough but comprehensive assessment of the *circularity* of an economy at the level of material groups” (COM 2018a, n. 4, my emphasis). While the EU did not adopt this precise assessment, circularity as a circular flow of materials significantly impacted the further development of this concept. Because “there is no one universally recognised indicator of ‘circularity’” (COM 2018c, 2), the ten criteria in the monitoring framework come closest to a definition.

Before analyzing this list, it is useful to recognize circularity as a case of “policy-based evidence” (Kovacic, Strand, and Völker 2019, 46). The notion of policy-based evidence is a twist on the EU paradigm of evidence-based policy, according to which policy making should be guided by scientific evidence (Saltelli and Giampietro 2017). This twist critiques that in reality often the reverse holds: evidence is collected afterwards in a way that supports policies

[20] I string-searched all available policy documents on the web page of the CE 2015 action plan (European Commission n.d.) for ‘circularity’ (case-insensitive), including but not limited to the documents on the timeline in Figure 2.1 above. It is possible of course that circularity was used outside the CE policy initiatives before, but then the basic fact that this is a major addition to the most recent action plan and that it is conceptually developed as a closing material loops in the in the monitoring frameworks remains.

that were made before. Since the indicators to monitor the first action plan were released three years after it, this critique appears to apply in this case. However, besides providing a post-hoc justification, Kovacic, Strand, and Völker (2019, 46) argue that such policy-based evidence "indicators have an instrumental role [and] indicate the way forward". These indicators are thus likely to impact the current notion of circularity.

The indicators are mostly based on measuring materials flows (see Figure 2.4 below): They measure the amount of raw material produced within the EU (indicator 1), the amount of waste and food was generated (3 and 4), how much waste is recycled (5 and 6), and how much of this recycling enters the economy as secondary materials again (7 and 8). Only indicator 2 about public procurement, as well as 9 and 10, which consists of economic measures, do not mention material flows directly. As also visualized by the perfect circles in middle, circularity consist of materials flow in closed loops

Figure 2.4: The EU CE Monitoring Framework

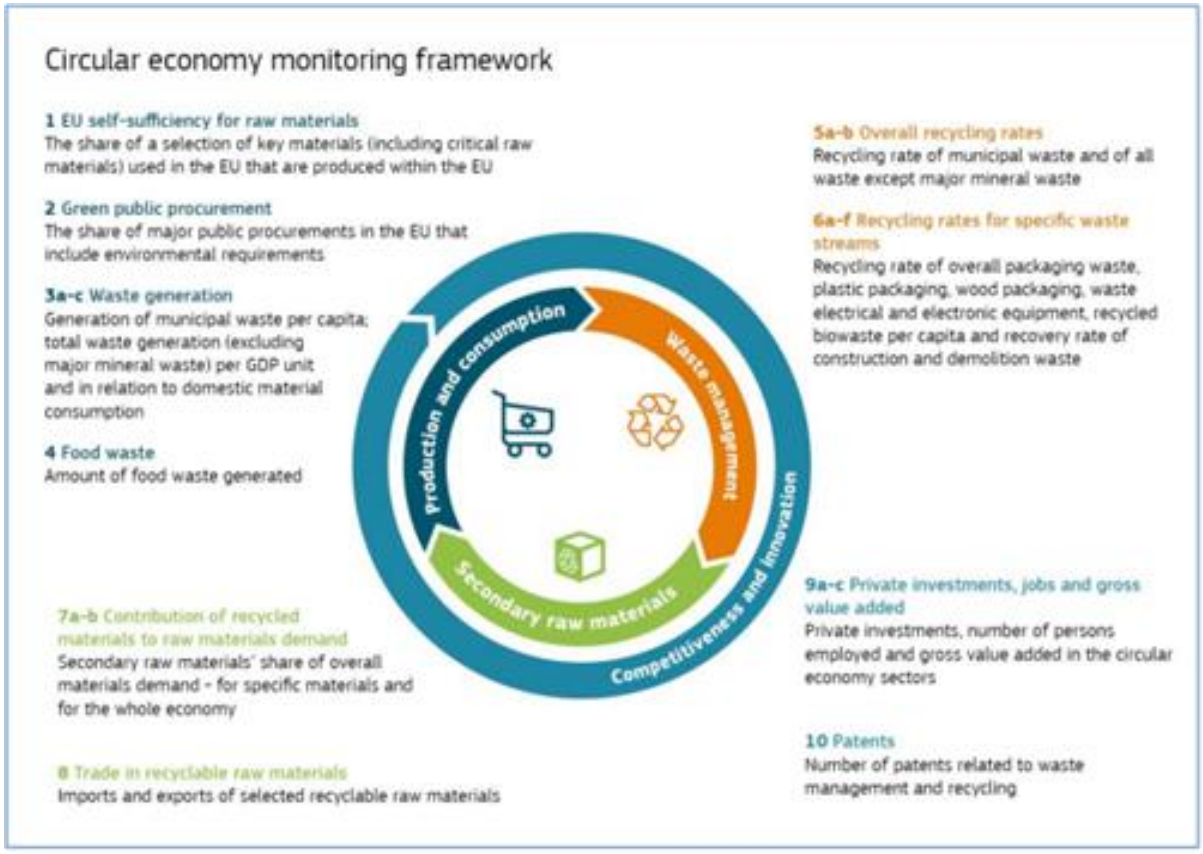

Figure 2.4, adopted from COM (2018c, 3)*, depicts the 10 indicators of monitoring framework*

The interpretation of circularity as closed material loops with desirable economic effects carries through to later EU CE policy. The report on the implementation of the first action plan concludes that "the circular economy should be made a backbone of the EU industrial strategy, enabling circularity in new areas and sectors" (COM 2019a, 10). Enabling "circularity also means adapting industrial processes" according to "circularity aspects (energy consumption and material use, waste prevention, recycling and reduction of hazardous chemicals)" (COM 2019a, 3). All of these aspects are concerned with what kinds and how much of materials or energy flow in which ways. The report is adamant about the direction the EU should take: aim for "full circularity" (COM 2019a, 1), so "fully close the loop" (COM 2019a, 10). Circularity, for the EU, describes the flow of materials and energy in loops, the more stays in the loop, the more is recycled, the greater the circularity. While there are many kinds of loops, I will refer metonymically to these as recycling.

First, closing materials loops does not constitute an approach for the current CE. The point of creating a frame of circularity is that it raises the impression that circularity is an independent concept from the CE. It is something that can be referred to in itself and be made to work for people, cities and region through creating jobs or transforming industry and products towards greater sustainability. Circularity should lead to "circular approaches" and a "circular business model", which build a CE (COM 2020, 17). But if circularity boils down to recycling, the amount of materials or energy that flow in loops, then it merely results in a description or measure of the CE defined in terms of material loops. This alone defeats the purpose of creating a circularity frame, but worse still, it is the wrong description of the CE. Closing material loops might have been suitable for the 2015 action plan, which defined the CE in terms of retaining value and reducing waste. Yet, it is conceptually at odds with the 2020 plan's definition of the CE in terms of regeneration and restoration and requires open loops to give back to the planet.

Secondly, the relation between material loops and sustainability is questionable. In the 2020 plan, circularity is framed as sustainable, suggesting that it is the same as being waste-preventing, resource-efficient, non-toxic, and climate-neutral. However, material loops in themselves do not lead to such positive ecological outcomes. Consider that the plastic gyres in the pacific circulate materials and are fairly closed (at the output end) – that is part of the problem. On a more general level, the ecological economists Jouni Korhonen, Antero Honkasalo, and Jyris Seppälä (2018) provide two important conceptual arguments for the limits loops face in terms of sustainability. One, complete circulation is impossible. Materials degrade with each cycle and energy strictly speaking can only be cascaded according to laws of

thermodynamics, as less and less becomes available with increasing entropy (Korhonen, Honkasalo, and Seppälä 2018, 39–40). At best, improving material loops will enhance the ecological efficiency, that is reduce the amount of pollution which is created by economic activity. But it is physically impossible to close a loop completely.

Two, eco-efficiency is not the same as sustainability. Its positive impact of ecoefficiency can be off-set by greater economic activity (Korhonen, Honkasalo, and Seppälä 2018, 43–44). Loops might be more efficient in each cycle, but if they turn faster and faster, they are not more sustainable. Such increase is known as the rebound-effect because greater eco-efficiency usually correlates with increased economic activity. There may be nothing about loops themselves that would necessitate this effect, but there is also nothing that prevents it either. At best they would be ambivalent, but the 2020 plan envisions circularity to create jobs and stimulate economic growth. So, it is supposed to lead to precisely the kind of increase in economic activity that would undermine the eco-efficiency provided by material loops. Circularity, understood in terms of material loops is not the same as sustainability, nor can it lead to the kind of ecological outcomes suggested by the frame.

The EU thus lacks an adequate understanding of what circularity means. Closing material loops is inadequate because it does not result in an approach independent from the CE. Such recycling is not even an accurate description of the current CE, nor can it make good on the framing of circularity as sustainable. Both of these points are perhaps unsurprising as this interpretation of circularity was derived from the context of the older action plan. However, the EU has not offered an alternative interpretation of circularity that would be more conducive to sustainability. So far, we cannot make sense of this circularity. Fortunately, it does not have to stay this way. To make good on my promise of delivering a more constructive critique, I will explore an alternative framing of circularity in the next chapter. Before, I will analyze a second new concept in CE policy.

4. Dispelling Decoupling: An Absolutely Wrong Concept for the CE

Another central concept of the new action plan, absent from the old, is decoupling. In the context of economics and ecology, this concept concerns the link between economic growth and ecological harms (such as pollution), which since modern times have generally increased together (Costanza *et al*. 1997; Vadén *et al*. 2020); the more economies have grown, the more they polluted the environment. According to the 2020 plan, the CE should reverse this trend, which would be highly desirable because it allows to take the ecological crisis seriously without

yielding the benefits of economic growth. However, the possibility of decoupling is extremely contentious on empirical and theoretical grounds. Decoupling is thus one of the new overly ambitious goals of the CE which needs to be rethought. I will first analyze the concept of decoupling in EU CE policy, and then apply empirical and theoretical criticism to show that it is an ill-conceived goal, in the second subsection.

4.1 Analyzing Decoupling in the CE: From Relative to Absolute and Beyond

It is not an overstatement to describe decoupling as the central issue for the EU's CE. The CE is supposed to enable economic growth, while reducing or reversing harm to the environment. For instance, according to the 2015 plan, the CE was defined by maximizing economic value from resources and minimizing their negative environmental impact of waste generation. While this action plan neither mentions decoupling explicitly and nor asserts that the link between economic goods and environmental harms can be severed, it still attempts to affect this relation positively. In the new action plan, there is a shift of gear, as it states:

> [s]caling up the circular economy from front-runners to the mainstream economic players will make a decisive contribution to achieving climate neutrality by 2050 and decoupling economic growth from resource use, while ensuring the long-term competitiveness of the EU and leaving no one behind (COM 2020, 2).

The explicit mention of decoupling is accompanied by a stronger version, as the 2020 plan also drops the qualifiers of maximization and minimization. This may be explained by its greater environmental ambition: In accordance with the European Green Deal, the new action plan starts from the premise that human economies rapidly encroach on environmental limits. Its first sentence of the new action plan emphasizes, that "there is only one planet Earth, yet by 2050, the world will be consuming as if there were three" (COM 2020, 2). The answer the circular economy provides to this urgent problem is not, reduce consumption, which would lower economic growth and undermine competitiveness, but decouple it from resource use.

In this way, economies could keep growing without depleting resource and polluting the environment. Decoupling is a popular idea, precisely because it requires no trade-off between economic and environmental goods and allow the EU to stay competitive. It is also not a new idea, but rather dates back to the debate between the Cornucopians and Neo-Malthusians in 1970s (Næss and Høyer 2009): the latter stressed the environmental problems of economic growth and argued for "limits to growth" (Meadows, Randers, and Meadows 1972). Whereas the former maintained, because of technological improvements "the world can,

in effect, get along without natural resources" (Solow 1974, 11). This old idea, maybe most manifest in 'sustainable development' has recently resurfaced as 'green growth'.

Its historicity makes it necessary to define decoupling a little more closely, because it has meant different things at different times. According to a recent meta-study by ecological economists Vadén *et al.* (2020, 240), it is possible to distinguish decoupling along 4 dimensions (see Table 2.2 below): the kind of decoupling can be *relative*, where pollution still increases but slower than economic growth or *absolute* decoupling, in which environmental degradation, such as CO^2 emissions, decrease while the economy grows. Its scope can apply only *sectoral* or *economy-wide.* They also distinguish between decoupling, that is *temporally* limited *geographically and limited,* or occurs *long-timescale, globally.* The upshot of their categorization is that the latter kinds are significantly harder to achieve than the former.

Table 2.2: Dimensions of Decoupling

	Easier	*Harder*
Kind of decoupling	Relative	Absolute
Economic scope	Sectoral	Economy-wide
Timescale	Limited timescale	Longer timescale
Geographical scope	Geographically limited	Global

Table 2.2 adopted from Vadén et al. (2020, 240), compares easier and harder decoupling.

What kind of decoupling is envisioned by the EU's CE? To answer this question, I will again draw on a comparison of the 2020 plan with older CE policy, because the concept has evolved also within the EU. I understand the 2015 plan as an implicit attempt of relative decoupling: value maximization and waste minimization would slow pollution relative to economic growth. In the 2020 plan, the ambition is much higher. The economy should become climate-neutral and stay within planetary boundaries. Since we are currently on course for global warming and overconsumption, as the new plan acknowledges itself (COM 2020, 2), an absolute decrease of CO^2 and resource extraction is needed to achieve that. The goal of absolute decoupling is further underlined by the definition of the CE "a regenerative growth model that *gives back* to the planet *more than it takes*" (COM 2020, 2, my emphasis). According to the new plan, the CE should not pollute less than it grows in economic terms and decouple relatively. Indeed, it should not even decrease pollution while growing and decouple absolutely but restore pollution, which goes beyond absolute decoupling.

I will return to this point below, but first I want to dig a little bit deeper into this shift

from relative to absolute decoupling and see how it relates to the other dimensions. Curiously, like in the case of circularity, the first explicit usage of decoupling occurs in the SWD 28, which served as the basis or the CE monitoring framework:

> In the circular economy, waste generation is decoupled from GDP growth, i.e. waste generated increases less rapidly than GDP (relative decoupling) or decreases even when the economy is growing (absolute decoupling) (COM 2018b, 13).

This document links decoupling intrinsically to the CE, because, apparently by definition, it *is* decoupled from GDP. But it also distinguishes explicitly between relative and absolute decoupling and remains ambiguous to which applies. Even though decoupling is not mentioned explicitly in the final monitoring framework, the report concludes that "the data on total waste generation … per unit of GDP shows a decrease of 11 % since 2006" (COM 2018c, 6). If this data is correct,[21] this would mean that the EU (CE) achieved absolute decoupling. Yet, this decoupling would still be partial, pertaining only to waste production, as well as geographically limited to the EU.

The 2020 action plan is far less cautious about sectorial and geographic limitation. Its actions seem only targeted at partial decoupling and consider regulatory measure which are supposed to "decouple the purchase of chargers from the purchase of new devices" or somewhat more ambitiously, the decoupling of domestic "waste generation from economic growth" (COM 2020, 7, 12). This would suggest only partial decoupling, both in terms of sectors and the area. However, towards the end the plan reaffirms the ambition of "decoupling economic growth from resource use and its impacts in the EU and beyond"(COM 2020, 19). Such conclusion leaves no doubt about the commitment to decoupling on a global scale for the whole economy, rather than only sectors, related to waste.

This paints a clear picture of decoupling in the EU's most recent CE policy. In contrast to the 2015 plan, decoupling is not supposed to be relative anymore, but absolute. Opposed to the 2018 monitoring framework, absolute decoupling is also not limited to specific sectors or geographic areas. Moreover, because there is no discussion of a timeline, I take it to be temporally unlimited. The 2020 plan which embraces this concept centrally for the first time,

[21] This is far from certain. It has been criticized that the data is inconclusive, because of the reliance of municipal waste as a proxy "it is difficult to know if the European Commission is monitoring 10% or 80% of its waste production" (Kovacic, Strand, and Völker 2019, 119). Others maintain that the main driver was no the CE but the economic recession and that only relative decoupling has occurred (Alcay, Montañés, and Simón-Fernández 2021) Indeed, even the EU appears unsure about this claim, because the monitoring framework states right before the positive assertion that the data varies significantly from country to country and that "quantity of waste generated still correlates to a certain degree with GDP per capita" (COM 2018c, 6). This foreshadows empirical intricacies of measuring decoupling.

takes a highly ambitious stance on decoupling – along all dimensions it proposes to realize the harder versions. Given the urgency of the climate and ecological crisis as well as the EU's sturdy commitment to economic growth, this may be unsurprising. However, as I will show in the following sections, harder versions of decoupling are highly implausible. But before turning to the criticism, I will briefly take up the conceptual additions the EU CE policy makes to absolute decoupling.

As mentioned above, at two points the 2020 action plan goes beyond absolute decoupling. In the first instance, economic growth is not only supposed to take less, but give back more to the planet. I will call this 'restorative' decoupling. A second instance is the conjunction 'resource use *and* its impact'. Absolute decoupling is usually understood to decrease the negative impacts *of* resource use (such as pollution). So, by including the impacts explicitly, the 2020 plan appears to aim for decoupling economic growth also from resources in themselves, not only their impacts. This version of decoupling appears to come very close to Solow's (1974, 11) original view that "the world can, in effect, g*et al*ong without natural resources". I will call this free-coupling, because it creates a free-floating economy, independent from its environment. These additions conflict with each another. The first affirms that economies must not only protect the planet but should restore it. Thereby, it also reemphasizes the mutual dependence between economy and ecology. This contrasts with the second instance, where the decoupling is so successful that the economy does not need nature. Which of these new kinds of decoupling is more plausible or desirable, is an important conceptual question that I will pursue further, in the fourth chapter. Before that I will argue in the next section that these are not merely quirky formulations but required additions, because absolute decoupling cannot work for the CE.

4.2 Delusional Decoupling: Faith in the Wrong Concept

Decoupling, despite its popularity and longevity, has not become less contentious. In fact, the endurance of the debate should give reason to pause – if decoupling has happened, why still talk about whether it is possible? But there is no need to rely on speculation, the empirical evidence is crystal clear. The decoupling of the ozone-damaging CFCs from economic growth is usually used as the historical example to show that decoupling has happened (Azar, Holmberg, and Karlsson 2002). There are also some reports which find that absolute decoupling of material extraction from GDP in a few countries is happening (Panel 2011) and the odd article which celebrates decoupling of CO^2 emission a few countries (Aden 2016). However, these are limited to a specific sector or pollutant and do not take trade or global

supply chains into account. Peer-reviewed meta-studies in ecological economics concur that that there is no empirical evidence for absolute decoupling on a global scale across sectors (Næss and Høyer 2009; Parrique *et al.* 2019; Hickel and Kallis 2020; Vadén *et al*. 2020). Even the European Environmental Bureau, one of the closest advisors of the EU in ecological matters, concludes their report on decoupling:

> there is no empirical evidence supporting the existence of a decoupling of economic growth from environmental pressures on anywhere near the scale needed to deal with environmental breakdown, but also, and perhaps more importantly, such decoupling appears unlikely to happen in the future (Parrique *et al.* 2019, 3)

A large part of the problem with decoupling in the CE stems from the fact, that based on empirical observation, the idea of decoupling appears ill-founded: there is no evidence of it happening.

These arguments are tricky however, because proponents usually claim that decoupling might not have happened but will do so any minute now against all odds because of new technological improvements. Since these technologies are usually not specified it is difficult to counter this argument. Decoupling in general thus constitutes a "theoretical" (Hickel and Kallis 2020, 483) or "abstract possibility […] that no empirical evidence can disprove (Vadén *et al.* 2020, 243). It may be a leap of faith, rather than act of reason, but decoupling in general obviously remains logically possible, even if it is improbable. However, in this particular case things are clearer still. Because the action plan formulates also the means for decoupling: "Scaling up the circular economy from front-runners to the mainstream economic players" (COM 2020, 2). The relevant question is thus if the CE can achieve decoupling.

Given its embryonic state, there is little empirical evidence regarding the efficacy of circular decoupling. The EU claims to have absolutely decoupled waste generation from GDP, but this would be limited to a specific sector and geographic area.[22] So, what can be said about this possibility on conceptual grounds? If as commonly imagined material and energy could be circulated in a closed system, the economic value would increase with each loop without using more resources. This would decouple environmental harms from economic goods. However, as the industrial ecologist Jonathan Cullen (2017, 483) argues

> this is, in any practical sense, impossible. Every loop around the circle creates dissipation and entropy … New materials and energy must be injected into any circular material loop, to overcome these dissipative losses.

[22] Even this evidence is highly contested, see fn. 21 above.

Decoupling through circularity contradicts the laws of thermodynamics. This is why the famous ecological economist Nicholas Georgescu-Roegen (1971; see Korhonen, Honkasalo, and Seppälä 2018, 41–42) argued that complete recycling is impossible: If the amount of energy remains constant in a closed-system, as the first law states, and each action leads to greater entropy as required by the second law, then recycling would not be possible in the long-run. More recently, ecological economist have rejected this fourth law however, because the earth is not a closed-system and the sun provides a constant inflow of energy that can be used to power recycling (Ayres 1999; Korhonen, Honkasalo, and Seppälä 2018, 42). So, with the help of solar energy, complete recycling is possible in theory, but does this mean that the CE can decouple economic growth from the negative impacts of resource use?

This remains highly questionable for two reasons. First, the action plan does not refer to solar energy. Indeed, it does not mention renewable energy at all. The closest its comes to discussing it are "renewable bio-based materials" through a parallel bioeconomy strategy (COM 2020, 12). But the needed transition to decoupling resource from growth would require far reaching changes in an economy and industry based on fossil fuels towards renewables and would need to happen rapidly in light of the climate crisis (Masson-Delmotte *et al*. 2018). From a practical viewpoint, this omission is damming.

This relates to the second, more conceptual problem: this argument is about recycling not decoupling. Recycling might reduce the negative impacts of resource use, but it does not preclude them, as it can be energy and thus CO^2 intensive. If the CE was based completely on solar energy without negative side effects, then it is not so much the CE that would achieve the decoupling, but the transition to renewables. Conceptually, there is nothing about the CE that appears to lead to absolute decoupling. *Vice versa*, there is also nothing about decoupling through solar energy that would realize the specific circular version of it. A complete transition to solar energy would require massive amounts of additional resources, to create the infrastructure of panels, which runs counter CE imperatives. So not only is there no practical connection between the CE and decoupling, even the conceptual link is weak.

All in all, absolute and unlimited decoupling is a particularly implausible goal of the 2020 CE action plan. It takes a moderate ambition like relative decoupling or limited absolute decoupling from previous policies and turns it into an exorbitantly more ambitious version, without doing the practical or intellectual work that would be required for this. Rather, the EU counts on the thin theoretical possibility of an effect which has not been observed on any relevant scale, in spite of the urgency. Even if this possibility was real, it would require massive efforts which are and have not been part of the EU CE policy actions or even concepts. As an

evaluation of the policy, it would be an overstatement to say that absolute unlimited decoupling by the CE is a leap of faith. A leap of faith implies the exertion of considerable effort towards an unknow outcome, with the possibility of failing and falling. The outcome is indeed unknown, it would require unprecedented effort, the possibility of failing is high, and the way down is long. However, with their CE policy the EU makes no effort to get up and jump. While this critique is harsh, it is necessary to avoid delusional goals. Moreover, it can be made more constructive as the CE offers rich conceptual additions beyond absolute decoupling on the relation between economy and ecology, which I will pursue further in the fourth chapter.

5. Conclusion: A Moonstruck Enterprise

In this chapter, I have analyzed the EU's most recent CE policy. The new action plan is embedded in a tension of continuation with the previous one well as transformation proposed by European Green Deal. By comparing the 2020 plan to the 2015 one and policy analyses thereof, in the first step I established that trends in EU CE policy still hold: the ambition as formulated in the introduction increased dramatically but is not matched by similar increase in content or body of plan. Rather, given the simultaneous influence of the European Green Deal and the previous CE action plan which pull in opposite direction, there is a widening gap between words and actions, an unstructuring of the problem. Because the EU does not acknowledge that it is dealing with an unstructured problem in in its CE policy, it does not undertake the necessary rethinking of means and ends.

So, in a second step, I analyzed two new concepts, a means and an end, in EU CE policy. My analysis showed that circularity is framed as an intrinsically sustainable approach for the CE; however, in the EU's interpretation of closing material loops, this is implausible. Likewise, my analysis showed that the goal of decoupling increased in the new action plan from previous CE policy's relative or partial, to absolute and complete, against all empirical and theoretical evidence; it is therefore an especially far-fetched goal of EU CE policy. As these examples shows, the EU has not even undertaken the intellectual work to conceptualize an appropriate CE. However, it does not have to stay this way. I have already hinted at the conceptual richness of the CE. In the next two chapters, I will expand on this and make my criticism more constructive, by offering alternative interpretations of circularity and decoupling, which reframe them in a way that makes sense of the EU's ecological ambition.

For now, I want to stress how inadequate the current EU CE policy is. According to the

new action plan and the European Green Deal, the CE should play a central role in the transformational towards sustainability, which by the EU's own admission is a moonshot. It is supposed to be backbone of the industry, the heart of the economy, which supports and powers this transition. Indeed, it is defined as the regenerative growth model that is required by this very transition. So, we could think of the CE as the engine which powers this moonshot. However, if it mainly consists of dusting up previous CE policy and making minor revisions to it, this is not an appropriate response to such new problems. Not because these problems are overly ambitious, the ecological and climate crisis are real, and the EU must react to it. Not because they are not hard problems, they certainly are. But because the EU does not acknowledge them as hard, unstructured problems and is looking for easy solutions instead of making the hard but necessary choices. As it stands, with inadequate approaches like circularity and delusional ends such as decoupling, the CE is in no position to power a moonshot but is moonstruck. But given that we are dealing with an unstructured problem, we should not only question if the CE can get as there, but also whether the metaphorical moon is the right goal for its efforts.

Chapter 3: Letting Nature Close the Loop? Circularity as Biomimicry, not Recycling

We knew how to build rockets, and we knew where the moon was. We don't know all the answer where we are going"
Saul Griffith, American Engineer and Entrepreneur, 2021

The answers to our questions are everywhere; we just need to change the lens with which we see the world.
Janine Benyus, *Innovation Inspired by Nature*, 1997

1. Introduction: Opening the Loop – What is Circularity?

My analysis of the current European Union (EU) circular economy (CE) policy in the previous chapter has shown that circularity is a key concept for the 2020 action plan. The EU frames circularity as an independent and inherently sustainable approach. However, the dominant interpretation in EU policy of circularity as closing material loops makes this framing implausible. Material loops boil down to a description of the CE rather than being an independent concept. Worse, this description can neither capture the 2020 CE, which is defined in terms of regeneration and restoration, nor is closing loops sustainable: at best it would increase the eco-efficiency of pollution. Framed in terms of recycling, as closing material loops, we cannot make sense of circularity as an approach towards the EU's ecological goals.

Therefore, I will reframe the concept of circularity in this chapter. I offer an alternative interpretation which is more conducive to the CE's sustainability and defend it against philosophical objections. Consistent with the methodology outlined in the first chapter, I will take an approach that is both interpretive and normative. My interpretation of circularity has to make sense as something it *could* mean for the CE in the EU. On the other hand, it must also contribute to the CE, and expand on it to improve its sustainability, if only conceptually. Hence, it is also what circularity *should* be mean, if we take the ambition of sustainability seriously. Connecting policy to philosophy, I argue in this chapter that circularity could and should be understood as a strong from of biomimicry.

In the following section, I will show that relevant versions of the CE appeal to the circularity of nature and can therefore be understood to employ a biomimetic approach of imitating nature. This leads to the core philosophical problem of this chapter, which is whether biomimicry is a good approach towards sustainability. Philosophers have argued that there are weak conceptions of biomimicry, which take nature as an inspiration but can make no claim to ecological sustainability, and strong versions, which could but face serious issues, such as committing the naturalistic fallacy and problematic understandings of nature. In the third section, I will argue that these problems can be overcome and defend a strong version of

biomimicry that would constitute a suitable concept of circularity, based on an understanding of nature provided by ecology. The approach of the CE should therefore be understood as ecomimetic circularity. In the fourth section, I will derive three values from ecological principles on which this approach would be based and discuss their implication for policy: holism, relationality, and limitedness.

2. Circularity as Biomimicry

In this section, I will offer a new interpretation of circularity beyond material loops such as recycling. For this interpretation to be convincing, it cannot be an act of outright invention. As Lakoff (2010, 72) argues, "new language must make sense in terms of the existing system of frames". In order for my reframing to work, I will have to draw on intellectual sources that connect to the existing system of frames. However, I also need to expand the scope, given that I have scrutinized what it means in EU policy context exhaustively in the last chapter. Hence, my reframing will be a two step-process: first, I will motivate the Ellen MacArthur Foundation (EMF) as viable source of meaning for the CE in the EU and argue that its vision of circularity is a biomimetic one. Then, I will secondly connect this understanding of circularity to the literature on biomimicry: the science writer Janine Benyus who coined the term, the academic field of industrial ecology, and recent philosophical engagements with it. This will not only underpin the concept theoretically, but also outline the core problem: uncontroversial, weak, versions of biomimicry are not necessarily sustainable, whereas stronger sustainable ones are philosophically contentious.

2.1 Reframing Circularity: From Recycling to Regeneration

A plausible place to look for additional, but also connected sources of meaning is the EMF. This foundation, named after the Ellen MacArthur, the circumnavigator turned lobbyist, is internationally the most influential think-tank related to the CE (Hobson 2021, 162–64). The EMF has also specifically impacted the development of EU CE policy: "The concept of circular economy gained prominence in Europe in 2013 with the first report of the Ellen MacArthur Foundation" (Kovacic, Strand, and Völker 2019, 31). This influence has only increased over the years. The 2015 CE action plan directly refers to this report as its first and main source of justification (COM 2015, 2). The definition of the CE in the most recent action plan as a "regenerative growth model that gives back to the planet more than it takes"(COM 2020, 2), is

almost identical to EMF definition of the CE as "an industrial system that is restorative or regenerative by intention and design" (EMF 2012, 7). Therefore, I take the EMF to be sufficiently connected to the EU's systems of meaning for the CE to make a reframing based on its resource plausible.

The definition which the EU adopts also shows how the EMF is helpful to reframe circularity. As argued in the previous chapter, it is part of the reason why the idea of material loops is implausible: if the economy should give back to the planet, then the loop may not be closed but must remain open for the restoration to work. Moreover, the definition also uses the curious biological language of regeneration. To see what that means it is helpful to look at the iconic butterfly diagram which depicts the EMF's regenerative and restorative system (see Figure 2.1 below). This diagram shows a lot of loops, such as recycling, remanufacturing, reusing and so one. Analyses usually point out that this conceptualization of the CE distinguishes "between technical and biological cycles" (Kanda, Geissdoerfer, and Hjelm 2021, 1814; Bocken *et al*. 2017, 1), however I argue they fail to conceptualize the relation between these two cycles: What is special about this diagram is not that these economic process on the right run circular, nor that they are integrated with the environment on the top or bottom, but that they mirror ecology on the left: recycling should be circular in the same sense that biosphere regeneration is circular. The EMF acknowledges this quite explicitly: the technical cycle of the economy is supposed to be modelled after the "living world" because "it works" (EMF 2011). In this way, the CE can claim to be "regenerative and restorative by intention and design" (EMF 2013, 7): Circularity is not any loop, but one that interfaces with and is modelled after nature, so that is restores it and regenerates like it.[23]

To understand what this means, it is helpful to look at an example of the CE, presented by EMF: the mushroom-plastic *MycoComposite* developed by the company Ecovative Design It is an organic and hence biodegradable packaging product made from mushroom roots, which can be used as an alternative to plastic and is supposed to tackle pollution in the oceans. Clearly the biodegradability of the mushroom creates a loop, but if we look more closely, it is a specific kind of loop. As the EMF (n.d.) recounts "[t]he founders of Ecovative Design were inspired by the way mushrooms growing on wood chips bonded them together". The inspiration for this

[23] While EMF is maybe the most representative here, this idea is by no means limited to it. The Dutch counterpart Metabolic bears the organic approach already in its name and proposes in its seven pillar approach that "in a circular economy, all materials should be used in such a way that they can be cycled indefinitely, just as they theoretically can in nature" (Metabolic 2017). This proposal also embraces a circular approach inspired by nature explicitly as it suggests that "cities can learn from human bodies" (Metabolic 2018b). This example will be discussed in more detail in the next chapter.

loop comes from nature. This point is made even more explicit in the EMF's (n.d.) explanation why this is an example of the CE: "[i]n a circular economy, products can be designed to break down naturally after use *as they would in the natural world*" (my emphasis). So, the specific loop here is not materially closed, but counts on transformation such as breaking down and composting, which is desirable because it corresponds to nature.

Figure 3.1: The Butterfly Diagram

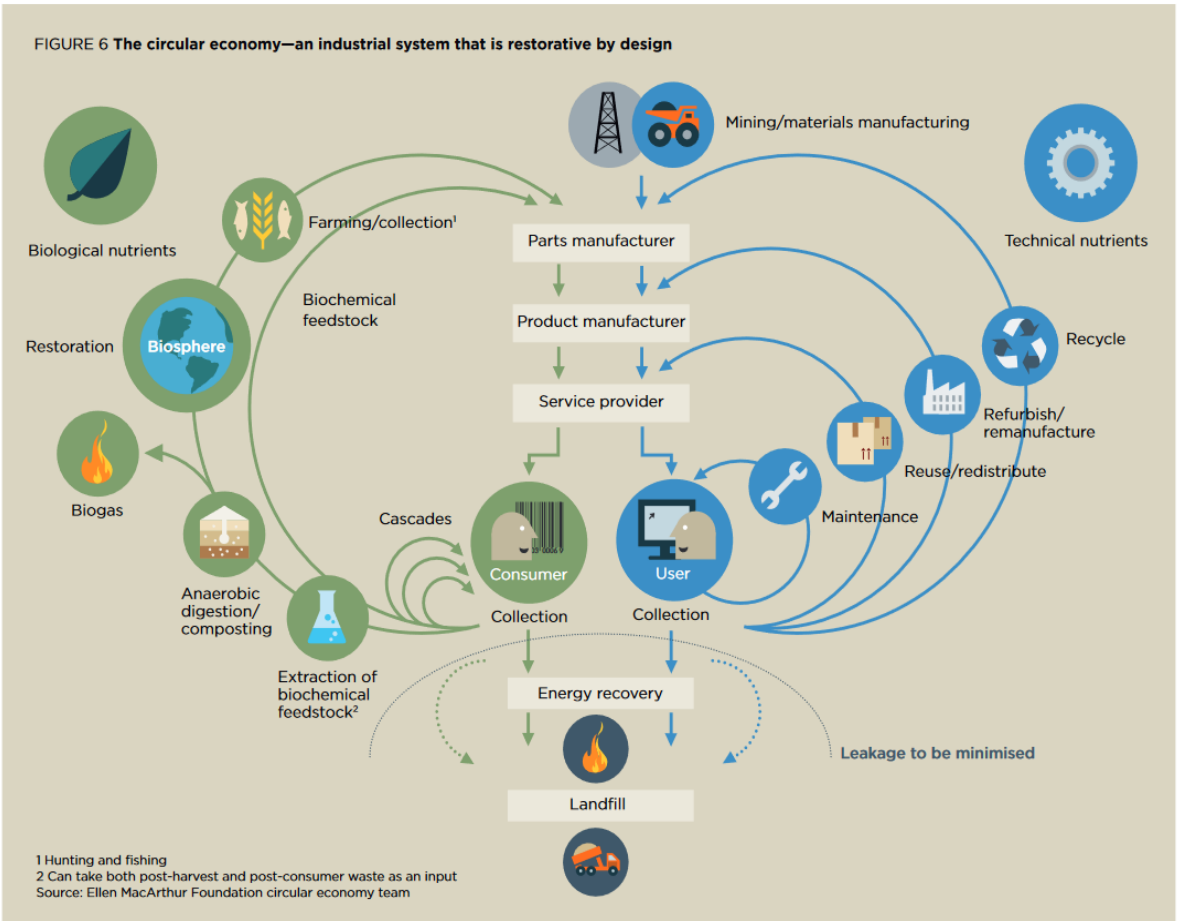

Figure 3.1 adopted from the EMF (2012, 24) depicts a regenerative and restorative system. The economic or industrial loops on the right are modelled after biological loops on the left.

For these reasons, circularity can be understood as imitating nature, a biomimetic approach. There is no need to argue that we must understand it in these terms. Since I am concerned with reframing the concept for the purpose of the EU policy, as a first step, it is sufficient to establish that it is a plausible interpretation for a relevant conception of the CE: biomimicry explains the frequent appeals to nature in the context of the CE, such as the EMF butterfly diagram and by *MycoComposite*. However, as I argue in Appendix 2, appeals to nature are not rhetoric quirks, but fundamentally embedded in the intellectual roots of the CE. Biomimicry has also the right conceptual scope for an approach: Opposed to closing material

loops, it explains how and why the CE can be sustainable – by taking inspiration from nature and modelling our systems after it. Of course, this explanation can be contested, and I need to argue that we should understand circularity as biomimicry. In the next section, I will investigate biomimicry from a more philosophical perspective to see what would make this interpretation normatively convincing.

2.2 The Sustainability of Biomimicry: Weak and Strong

Biomimicry has enjoyed considerable popularity for a while (see Appendix 2), but biomimetic approaches are controversial. The first and maybe foremost point of contention is how to understand them. So, before getting into the argument about sustainability I will need to flesh out biomimicry more. The most extensive work on Biomimicry up to date is still Janine Benyus‘ (1997) book *Biomimicry*, which articulates this concept in the modern sense for the first time.[24] She defines biomimicry after the Greek bios (life) and mimesis (imitation), as the "conscious emulation of life's genius. Innovation inspired by nature" (Benyus 1997, 2). Imitating or emulating nature (which she equates with life) has three different functions according to her: nature can serve as model and source for inspiration, as a measure or standards for rightness, and as a mentor from which we learn. However, besides mentioning these three functions in the epigraph to the book, she does not discuss them in a more systemic fashion.

Which is the right version of understanding biomimetic circularity? In the discourse around the CE there are a wide range of appeals to nature (see Appendix 2): There are biological analogies, metaphors and similes, businesses inspired by the planet, industry designed on biological lines, and economies modelled after nature. While differing drastically in many aspects, these are all expressive of a certain biomimetic notion, a soft view on the relation between nature and human systems: there might be some similarities between them, but they remain distinct. *MycoComposite* could be understood to fall into this category, too. Its approach takes inspiration from and is modelled after the natural world, so that products break down *as* they would there. This rhetoric device, the simile, appears to conceive nature as a model which makes the value of imitating nature mainly inspirational or creative.

The critical discussion in the field of industrial ecology is helpful to expose why the utility of such biomimicry is limited. As discuss in more detail in Appendix 2, this field is organized around such inspirational, rhetoric understanding of biomimicry, such as biological

[24] Even though Dicks (2017, 259–60) argues that Benyus implicitly adopted much of Wes Jackson's prior work of agroecology and its conceptual roots reach into ancient Greek philosophy, in particular Aristotle's work.

analogies or metaphors (Den Hond 2000, 61; Ehrenfeld 2004, 826). It is rhetoric, because some desirable characteristics of biological and ecological systems are transferred onto human systems, such as industry or the economy. Consider the proposal that industrial wastes should be cycled "in a way analogous to the cycling of nutrients by various organisms in an ecological food web" (Frosch and Gallopoulos 1989, 272). Here, the idea is not that employees of one company literally eat the waste of another's employees, but rather that one company uses the waste of another company as a resource. This proposal must partially be metaphorical because there are important differences between industry and the food web – e.g. many industrial materials are not organic, l*et al*one edible. Because of these dissimilarities, critics have noted that it is unclear whether such analogy is desirable. After all, what works in nature does not have work in industry, if they are distinct (Boons and Baas 1997, 80). Worse, it has been argued that such metaphor only has creative or inspirational value, but does not constitute a proper strategy as such (O'Rourke, Connelly, and Koshland 1996; Ehrenfeld 2004; Johansson 2002). This corresponds to Benyus' notion of nature as a model, which is not a reliable method or approach. If circularity constitutes such notion of biomimicry, then its value as a sustainable approach would be doubtful: It provides new ideas but grants little justificatory force for why these are sustainable. [25]

There are other ways of understanding biomimicry, however. Interpreting Benyus, the environmental philosopher Henry Dicks (2016; 2017; 2019) has argued that besides the metaphoric or poetic aspects, biomimicry can also be a form of ethics where nature serves not as a model but as a measure. According to him, this constitutes a broader environmental ethics, where nature is the source rather than the object (Dicks 2017b): in what he calls the narrow view, environmental ethics is concerned with the ethical obligation humans have towards nature, e.g. protecting the wilderness, whereas in this new biomimetic ethics, ethical principles for human systems are also derived from nature.[26] He concludes such principles

[25] Sometimes this metaphor has been defended because of its epistemic merits. In particular, Isenmann (2002; 2003) has made the argument that nature can serve as a model from which we learn and Dicks (2016, 239) argues that nature can function as a mentor. What these have in common is that studying ecological system and biological functions provides insights into what works well or at last has worked for a long time, like what sort of materials can be cycled or how systems adapt to changes. The metaphor has not only inspirational value but can serve as heuristic device that leads to the discovery of working principles. However, Isenmann (2002, 150; 2008) himself emphasizes, this falls short of a consistent approach because the heuristic device itself provides no reason what or even when we can take nature as model and when not: it needs additional inferences. Therefore, even taking its epistemic values into account, biomimicry as metaphor is insufficient as an approach to achieve sustainability.

[26] Dicks maintains that this broader view is a new perspective in the field of environmental ethics, which according to him was mainly concerned with a debate between anthropocentrism and non-anthropocentrism (Dicks 2017b, 268–69). However, this is not entirely correct, even in the narrow field of Wester environmental philosophy. For

> have great practical relevance to the development of agro-ecology, the circular economy, the transition to renewables, the bio-based economy and other technological, economics, and social changes" (Dicks 2017b, 273).

They are practically relevant because we can understand *MycoComposite*, also according to this notion of biomimicry. Instead of a simile, '*as it would* in the natural world' could mean to take the natural world as a measure. Nature as a measure serves as reliable source for principles that leads to ecological sustainability. A biomimetic ethics thus provides exactly the kind of theoretical foundation that would grant plausibility to the approach of circularity.

Unfortunately, biomimetic ethics are philosophically highly controversial. The discipline of philosophy has since modern times displayed a strong aversion against the idea of deriving ethics from nature (see Daston 2014).[27] Therefore, it is unsurprising that biomimetics has also come under significant criticism. Philosophers of technology Vincent Blok and Bart Gremmen (2016, 205-6) have outlined a central dilemma for any biomimetic ecological sustainability strategy: there is weak biomimicry which is philosophically uncontroversial but provides no foundation for ecological sustainability – these correspond to the metaphoric or poetic versions discussed above, where nature only serves as a model (see Table 2.1 below). In contrast, a strong view, such as the biomimetic ethics from nature championed by Dicks, provides a foundation for ecological sustainability. Yet, it faces two severe philosophical challenges as Blok and Gremmen (2016) assert, because 1) deriving ethics from nature commits a fallacy and 2) it relies on a problematic view on nature as perfect and distinct from humans.[28] In short, what is needed is a strong version of biomimicry, however according to Blok and Gremmen this version is philosophically untenable.

instance Callicott (1986) has already drawn implication for human ethics from ecology, for instance that a moral psychology of egoism is unwarranted. While this may not be a biomimetic ethics, it is clearly a broader environmental ethics, where nature or ecology serves as a source for ethics.

[27] At least most of Western philosophy, which is highly anthropocentric. There are exceptions, especially in ecocentric environmental philosophy mentioned in the previous note.

[28] They also outline two other problems that are specific to biomimetic technology: namely that it is unclear what the role of technology would be, since either nature is perfect in which case there is no need for technology or it is imperfect in which it unclear why technology should imitate nature (Blok and Gremmen 2016, 213). Analogously, the same dilemma applies to mimesis: it could be taken to mean copying nature, but biomimicry seldomly provides a carbon copy and rather results in the adaption of some natural aspects into technology. Else, this adaptive process could be embraced, but this would result in a change of nature and thereby make it less perfect. I will not engage with these two problems because I take them to derive from the demand that nature must be perfect and distinct from human on the strong view of biomimicry. If this demand is unwarranted as I will argue, then these problems dissolve, too. I will thus forego the metaphysical intricacies regarding the ontological difference between nature and technology because these are only tangentially relevant for my argument.

Table 3.1: Types of Biomimicry

Type of Biomimicry (Blok and Gremmen 2016)	**Nature as** (Benyus 1997)	**Philosophical Qualities** (Dicks 2016)	**Discipline**	**Problems** (Blok and Gremmen 2016)
Weak	A model	Poetic	Industrial Ecology (Ehrenfeld 2004)	only metaphoric, inspirational value
Strong	A measure	Ethical	Circular Economy (Dicks 2017)	Naturalistic fallacy & Perfection of nature

Table 3.1 compares conceptions of biomimicry by various authors, aligning them into two general kinds:[29] *a weak form predominant in industrial ecology, that takes nature as model which has philosophically uncontroversial poetic qualities, but as metaphor constitutes no approach, as well as a strong conception based on nature as an ethical measure which would be needed for the CE, but faces the problems of committing the naturalistic fallacy and falsely relying on a perfect conception of nature*

If they are right, the CE is in serious trouble. Not only are there no practical strategies that could achieve its ambition of sustainability, but the sustainability of circularity is questionable on conceptual grounds. There is no reason to assume that its approach seems in principle able to do what it promises, namely contribute to ecological sustainability. This even before additional difficulties such as operationalizing and scaling it up complicate it further. But while I agree with Blok and Gremmen that the weak version does not do the job for circularity, I do not accept their pessimistic conclusion because, as I will argue in the remainder of this chapter, these two problems can be overcome. There is a philosophically defensible version of a strong biomimetic ethics according to which we should understand circularity.

3. A Philosophical Defense of Strong Biomimicry Against…

In this section, I respond to both philosophical challenges to biomimicry that Blok and Gremmen presented. A central issue will be how to define nature. I will offer a specific ecological understanding of nature in the second part of this section, but for analytical clarity I keep these issues distinct and first refer to nature *simpliciter*. On another note, I am

[29] It would be possible to add another row in the middle, that might take nature as mentor (or perhaps model in a stricter scientific sense) and has an epistemic orientation (see fn. 25 above). I think this would fall in between the weak, industrial ecology, and strong CE version of biomimicry, which as I will later suggest might be better conceived of as spectrum. For reasons of simplicity, I have excluded it here, because it either is strong enough and faces the same philosophical problems or remains on the weak side and does not constitute an approach.

transitioning here from the hermeneutic angle of my approach to the more normative one. I do not claim that the versions I defend is the one most or even some CE proponents or practitioners adhere to, especially in the EU. Rather I argue that it is a possible way to understand circularity which we should adopt if we want this approach to be ecologically sustainable. In the last section, I will provide an initial discussion of how this view of biomimicry could make sense for the CE and what it implies for EU policy.

3.1 …the Naturalistic Fallacy…

Blok and Gremmen (2016, 214) posit that strong biomimicry commits the naturalistic fallacy. The naturalistic fallacy dates back to philosopher G.E. Moore (1903) and consist according to Blok and Gremmen (2016, 214) "in arguing that something is good because it is natural". Any strong version of biomimicry that takes nature as a measure, and thus ethical criteria of the good, appears to commit this fallacy. The issue is that the naturalistic fallacy has nothing to do with nature nor is it fallacy in the technical sense. As historian of philosophy Lorraine Daston (2014, 580-581) elucidates, it stems from Moore's ethical intuitionism, for whom natural meant "any more fundamental category (e.g. pleasure of social harmony)" and the fallacy arises if the good is falsely associated with such categories, instead of being intuitively clear. From this follow two things: one, it seems to be an odd kind of fallacy that does not result in logical invalid arguments, but rather in not conforming to "Moore's beliefs about the nature of goodness" as environmental philosopher Baird Callicott (2017, 167) aptly put it. And two, even if we should grant that this was a problem, it would not constitute a special challenge for strong biomimicry but for most ethical theories. For instance, utilitarianism would commit the naturalistic fallacy by equating pleasure with the good. So it is hard to see why Blok and Gremmen (2016, 215) think, "the risk of the committing the naturalistic fallacy is therefore a formidable problem for the strong conception of biomimicry". Because the naturalistic fallacy is concerned with the nature of the good (not the good of the natural), it is a challenge for any non-intuitionist ethic.

Another take on the naturalistic fallacy which could pose a challenge for biomimetic ethics is Hume's is / ought problem.[30] Blok and Gremmen (2016, 214) argue that "[the naturalistic fallacy] is more general than Hume's is/ought fallacy of stating a conclusion

[30] These two problems together with the fact/ value distinction are often equated with one another, even though they differ significantly both in the their theoretical foundation as well as in the logical implications (Daston 2014, 580). All they have in common is a "bifurcationist ontology of ethical judgement" – the idea that normative judgements about value or what ought to be, are different from non-normative judgements about what factually is (Daston 2014, 581).

containing the copula *ought* derived from premises all connected by the copula *is*". Since they take the naturalistic fallacy to be more general than Hume's problem, they focus on the former rather than the latter. In contrast, I agree with Callicott (2017, 167) who thinks that the is / ought poses the more general and greater problem. After all, Hume's problem applies to any ethical argument so that no empirical premise about what is can imply a normative conclusion. Surely, this is more general than the naturalistic fallacy, even understood correctly as referring to fundamental categories. More importantly, in contrast to Moore's personal view on ethics, it constitutes a logical fallacy – a *non-sequitur* – which must be taken seriously. Since Strong biomimicry takes nature as a measure, it will have to rely on some empirical premises about what is the case in nature but based on these then draw normative conclusion what ought be done. It seems to bite directly into Hume's is / ought problem.

Can a strong version of biomimicry overcome this ethical problem? First it should be noted, due to its generality the is / ought distinction poses a metaethical problem that will affect most ethical theories. When utilitarianism claims that we ought to minimize pain and maximize pleasure, they have to assume that humans in fact feel pleasure and pain or when Kantianism mandates that we ought not treat humans as means, it must presuppose that humans are ends in themselves.[31] But as Callicott (2017, 163-64) laments, this general metaethical problem is often specifically wielded against environmental ethics (to which biomimetic ethics belongs, as discussed above). Maybe this is because of its proneness to start with facts about what is in nature and then move on to what should be done regarding to this:[32] for instance when founding father of the field Aldo Leopold describes as the basic concepts of ecology that "the land is a community" and then moves one to the ethical prescription that "the land is to be loved and respected" (as cited in Callicott 2017, 163), he crosses from what is to what ought to be.

[31] In such anthropogenic ethics, this is commonly accepted. For instance, in a recent article about the ethics of representation and action in virtual reality, the philosopher of technology Philip Brey (2017, 9) provides a Kantian arguments about real wrongs towards virtual characters: "As Kant put it, '[...] he who is cruel to animals becomes hard also in his dealing with me' and 'Tender feelings towards dumb animals develop humane feelings towards mankind.' Certainly, if disrespectful treatment of animals causes disrespectful treatment of human beings, then disrespectful treatment of virtual characters, which may be even more similar to such treatment of real humans, will have the same consequence. *It should also be clear, however, that this argument is in need of sound empirical support*" (my emphasis). Brey acknowledges the crucial relation between the Kantian ought, and the empirical is about human psychology, and points out that this is an issue for the soundness of the argument, but not for its validity. An argument would be needed why non-anthropogenic ethics should be treated differently.

[32] See previous notes. This might be an explanation for why this problem is more often applied to environmental ethics than to other kinds but no justification. Even though it may be easier to notice this issue when we move from facts to values than when we start with the values and ground them facts later (or even leave these implicit), the order of the premise should not matter because they can be rearranged at will in logical argument: see Callicott (2017, n. 22) an example.

However, this argument can be validly reconstructed by granting additional middle premises as Callicott (2017) demonstrates:[33]

(1) The biological sciences, including ecology, have now discovered that the natural environment is a biotic community or society to which we belong.
(2) We all generally have a positive attitude toward the community or society to which we belong and share a common interest in it.
(3) We should act in a way that is in accordance with our interests.
Therefore,
(4) we ought to respect (preserve the integrity, stability and beauty of) this biotic community.

Stated as such, this argument allows for the transition from is to ought through the bridging premises 2 and 3. Strictly speaking, this circumvents Hume's is / ought problem rather than solving it, because the third premises contains an *ought* so that the argument does not entirely consist of *is* statements, but I don't see any relevant reason why we may not state this premise.[34] The substantial or major premises are still 1 and 2, which provides the necessary values for the argument to get off the ground even though they are is-statements. These premises can be contested on empirical grounds which would undermine the soundness but not the validity of the argument – see Callicott (2017, 170) for examples. It thus seems that environmental ethics in general can weather the is / ought problem.[35]

For strong biomimicry or biomimetic ethics things look even brighter. Because nature is seen as the source of ethics which provides a measure that serves the human objective of achieving sustainability, it leads to less controversial claims. Even a strong view on biomimicry does not necessarily call anthropocentrism into question; we can desire to be ecologically sustainable for our own purposes. Again, this premise has already been granted from the outset – the question at hand is whether the biomimetic circularity of the CE provides a good approach to do this. Critics, such as Blok and Gremmen (2016), whose article is subtitled, "Biomimicry

[33] For reason of intelligibility and brevity, I have conjoined three iterations of this argument given by Callicott (2017), see p. 170, 172, and 173 respectively, which resulted in adding an additional premise (3). This addition has made the argument also valid in a strict logical sense. In contrast, Callicott was more careful to preserve the nuances of Hume's views on causality, morality, and theory of action. A strictly valid argument would not be entirely Humean for whom morality is not a matter of reason, but of sentiment (Callicott 2017, 167, 169, 172). These nuances are valuable in the thorough discussion of Hume's is / ought discussion undertaken by Callicott, but would bring me too far of track here. If this logical gap between is / ought cannot or should not be entirely closed, this would result in much more general skepticism, which affects all ethics alike – the third premise after all is the only one not unique to environmental philosophy.
[34] See previous note.
[35] Indeed, Callicott can be taken to argue that it is *better* suited than many other ethics to do so, Much of his argument consist in providing an link between Hume's ethics to environmental ethics, via a Darwinian account of evolution (Callicott 2017, 165-166,167-168,170-172) . Because it embraces biological sciences which provides the evolutionary background the necessary support for the value-laden is-statement, rather than merely asserting them from the armchair such as in the Kantian argument in footnote 31.

as a New Way of Thinking and Acting Ecologically" should accept this too, because it would thus seem that they address the very same question. Yet, when discussing the ethics of biomimicry, they shift gear and ask, "to what extent nature … can be claimed to be ethically good at all" (Blok and Gremmen 2016, 215). Somehow along the way, the goal was changed from whether a strong view of biomimicry can serve a specific ethical purpose (being ecologically sustainable) to whether all of nature is good. Surely, some people may adhere to such naïve totalizing conception of biomimicry, but this is not the version that is defended here. As discussed in the previous section, Dicks (2017) has made clear that biomimetic ethics is a specific kind of environmental ethics, so a sub-branch rather than a conclusive ethical system. The claim of biomimetic ethics is quite weak: it is not that *all* natural principles are ethical nor that *only* natural principles should be ethical, but *also some* natural principles are ethical –the ones conducive to ecological sustainability.

Stated as such, biomimetic ethics passes quite uncontroversially through the is / ought problem. Consider the following argument:

(1) Nature functions according to principles which are ecologically sustainable
(2) We ought to be ecologically sustainable
Therefore,
(3) we ought to adopt natural principles.

We have accepted the second premise, because the shared goal of biomimicry specifically and the CE in general is to be ecologically sustainable. Therefore, we do not need motivating premises about the value of community and the human proneness to act according to our values or interest, which might have been controversial in Callicott's argument because they bridged the is to ought (or rather because they called anthropocentrism into question). We also do not need a more general and thus stronger first premise, that all of nature is good for everything, but can rely on the relatively specific and weak goal of being ecologically sustainable. If insisting on a binary view between strong and weak biomimicry (where either nature provides some moral guidance or none at all), this argument implies that a strong view is true.[36] Biomimetic ethics can thus overcome the 'naturalistic' 'fallacy' or better the is / ought problem.

Does this mean that the ethical concerns regarding strong biomimicry are completely dispelled and the approach of the CE philosophically viable? Not quite. Blok and Gremmen (2016) provide two other arguments against biomimetic ethics, besides the charge of

[36] This might suggest that it may be wiser to think of biomimicry as a spectrum, with degrees of strength. Then we could reject the strongest possible form of biomimicry, according to which all nature and only nature is good, without being forced to accept the weakest possible form, in which nature is no ethical value and *vice versa*– there might be plenty room in between these two extremes, as this argument indicates.

committing the naturalistic fallacy. Firstly, they question the ecological sustainability of nature.[37] According to them, nature has also produced "enormous amounts of waste", after all many of its evolutionary designs have literally gone the way of the dodo (Blok and Gremmen 2016, 214). This can be said to target the first premise of the argument, because it questions whether nature is sustainable. Secondly, they call the naturalness of biomimetic ethics into question. Since we posited the second premise about ecological sustainability, the normativity has not been derived from "but imposed on nature. This lead to the paradox that biomimetic ethics is itself not ecological or natural" (Blok and Gremmen 2016, 215). Both of these concerns do not undermine the validity of the argument, but rather its soundness and while they appear to be ethical objections, they are really concerned with nature. The former implies that nature is not perfectly sustainable and the latter posits that human intervention undermines naturalness. These objections are thus derivative of Blok and Gremmen's (2016, 216) second problem for the strong biomimicry, which according to them "presupposes perfection of nature". Yet, if nature does not have to be perfect, as I will argue in the next section, then these two other ethical objections fail, too.

3.2 …and the Perfection of Nature

The second major objection Blok and Gremmen level against biomimetic ethics is its naïve view on nature: "according to the strong concept of biomimicry, the production of nature is already perfect and should be reproduced" (Blok and Gremmen 2016, 211). The idea that nature is perfect is naïve or problematic for two reasons. One, it is vulnerable to counterexamples since there is no shortage of natural examples which we take to be less than perfectly sustainable. In the previous sub-section, I have already discussed the issue of evolutionary waste that Blok and Gremmen use, but we could add that organic dinosaurs remains and air are surely natural in some sense, yet their combination – burning fossil fuels – is highly unsustainable. Two, if nature is perfect, this leaves little room for human agency, besides simply reproducing it. But since the CE would be the work of humans, this is problematic because it is unclear in how far an economy can reproduce nature one to one. It also poses a challenge for biomimetic ethics if not all of its principles (such as the goal of ecological sustainability) are derived from nature, which was briefly discussed in the previous

[37] They also question the goodness of nature more generally, since "it can be argued that ethics is contrary to the natural processes of the struggle for existence" (Blok and Gremmen 2016, 215). But for once, this assumes a rather simplistic view on evolution as competition only, rather than cooperation, too (Tsing 2015), and again this appears to have moved the goalpost towards a totalizing biomimetic ethics as discussed above.

section, too. Given these problems, it would be untenable to claim that nature has to be perfect – entirely good and entirely distinct from humans. However, I argue in this section that a biomimetic approach strong enough to contribute to the CE's ecological sustainability does not have to say either.

Before embarking on this venture, we should get straight what is meant by nature, because much hinges on the vagueness of this term. As historian of philosophy Daston (2014, 582) colorfully illustrates

> like all truly interesting words, "nature" is a mille-feuille of meanings. It can refer to everything in the universe (sometimes including and sometimes excluding human beings), to what is inborn rather than cultivated, to the wild rather than the civilized, to raw materials as opposed to refined products, to the spontaneous as opposed to the sophisticated, to what is native rather than foreign, to the material world without divinity, to a fruitful goddess, and to a great deal else, depending on epoch and context. Ancient meanings still resonate in modern European vernaculars

Blok and Gremmen's (2016, 206) diagnose that nature in biomimicry corresponds to the ancient Aristotelian meaning of nature as *physis*: "phusis [*sic*] is natural production or self-making (*auto-poesis*)". But not everything that self-produces can be said to be sustainable. In summer, algae in lake reproduce, which makes such lakes eutrophic and undermines their sustainability. If natural is what self-produces, we are bound to encounter the problem regarding its perfection. Yet, *auto-poesis* is often interpreted to be something larger still, the view that "nature qua physis is Being itself" (Dicks 2016, 226). Clearly, many things that *are* even in a fundamental ontological sense of the word, are not ecologically sustainable. *Physis* also leads to the assumption that humans have to be separate from nature, because it denotes the natural self-production opposed to the human and thus unnatural form of production, *techné* (Blok and Gremmen 2016, 206).[38] With nature as *physis*, the problems regarding the perfection of nature are unavoidable.

But does biomimicry have to rely on this view of nature? Indubitably, Blok and Gremmen (2016, 205-206) are right that many accounts of biomimicry have (unconsciously) relied on Aristotelian view of nature as *physis*, because this ancient meaning still resonates in Western modernity as Daston (2014, 582) reminds us. In his article "the philosophy of biomimicry", Dicks (2016) has even explicitly endorsed *physis* as the appropriate interpretation

[38] As Blok and Gremmen point out, things are more complicated still. Even though *physis* and *techne*, nature and humans, appears to be diametrically opposed, they are also both grounded in *poesis* which leads a conundrum that nature has to be distinct from humans and technology, while also being understood in a technical sense. These nuances must not concern us here, since I will argue later in the case of ecology that such dual relationship of distinct but related can be sustained. The issue at hand is the divide, not the connection.

of nature for biomimetic ethics. He argues, this view captures biomimicry better than other views on nature: the laws of physics are too abstract to provide the right biomimetic principles, because the "complete destruction of life on earth is no less compatible with the universal laws of physics than is constructive participation in its continued existence" (Dicks 2016, 230). Likewise, nature as the living or organic, which might be suggested by the *bios* of biomimicry and which Benyus originally takes as a definition, would preclude inspiration from ecological and physical phenomena that are not alive in the biological sense (Dicks 2016, 230–31). Maybe the technological image of nature as *physis* is the most accurate interpretation of what thinkers of biomimicry would say. Maybe this view is superior to a physical or even biological one. But it does not follow that biomimicry must adhere to this interpretation of nature or that it is the best one.

I submit, a better way of understanding nature for biomimetic circularity stems from ecology. Ecology is a science that studies how living and non-living beings interact in their environment (Ghazoul 2020, 1). Clearly, this is a broad perspective, which constitutes one of the reasons which make it attractive: it satisfies Dicks worry and includes both living and non-living beings. To conduct investigation on such broad perspective, ecologists often use a systems perspective: Nature in ecology is thus best understood in terms of ecological systems.[39] This raises the question, why such ecological understanding of nature should be the right kind to imitate. Ecological systems fulfill crucial functions for survival on the planet: they "yield a flow of essential services that sustain and fulfill human life" (Brauman and Daily 2009, 26; Salomon 2009). However, they are not only important for the present sustenance of life, but "persist over long period" (Pickett and Ostfeld 1995, 273). This features of ecological systems, "that they are the basic unit for sustaining life over the long term, which provides one of the main reasons for studying them" (Fath 2009, 8). If ecological systems function as the basic unit for sustaining life, we can attempt to emulate the principles according to which they function in order to increase our ecological sustainability.[40] Nature as conceived of by ecology in terms

[39] Systems in ecology can refer to "individuals, populations, communities, landscapes, and ecosystems" (Pickett and Ostfeld 1995, 262). All of these constitute individual fields, located at very varying levels of analysis, which have substantial differences (Jorgensen 2009; Fath 2009), but following the ecologists Pickett and Ostfeld's lead I will forego these nuanced intricacies and all-encompassingly refer to "ecological systems" as the object of enquiry for ecology

[40] Note that I am changing the language here from functioning to principles. What should be imitated is not so much the function itself but the reason why they function sustainably, the underlying principles, which sets strong ecomimicry apart from weak approaches. Principles are also closer in kind to values than functions. I will elaborate on both points the next section.

of ecological systems is thus conducive to a biomimetic approach. Formally, the final argument might be expressed as such:

(1) Ecological system function according to principles that are ecologically sustainable
(2) We ought to be ecologically sustainable
Therefore,
(3) we ought to imitate the principles of ecosystems.

An ecological understanding of nature thus fits with the arguments for biomimetic – or rather ecomimetic – ethics, because it imitates ecology rather than biology, *bios, physis* or physics.

An ecological understanding of nature also fares much better in regard to the problems of perfection than nature as *physis*. Because it is narrower in scope and as a natural science informed by empirical evidence, it is much less vulnerable to counter-examples that call its perfection into question. Of course, according to the best scientific understanding of ecosystems, we know that these are not perfect and can be dis- and corrupted (Pickett and Ostfeld 1995, 273–74). Nonetheless, if anything can tell us what is ecologically sustainable, the science of ecology appears to be the best possible answer we have. If ecology does not perfectly tell us what is ecologically sustainable, it is the closest to the ideal we can get.

Ecology is also much better equipped to deal with the second problem of perfection. The idea that humans should be separate from nature is controversial because biomimicry relies on interfacing both, since nature must be transformed into human solutions through biomimetic technology. Likewise, the moral imperative to be ecologically sustainable, the normative ought inherent in the second premise of the argument of a biomimetic ethics is not derived from ecology *per se*. It refers by the 'we' to humans, which leads to the apparent "paradox that biomimetic ethics is itself not ecological or natural" (Blok and Gremmen 2016, 215). However, this worry disappears on the current best understanding of ecology. As the renowned ecologists Steward Pickett and Richard Ostfeld (1995, 265–67) argue, as a rule, humans are integral members of ecosystems and should not be exempted from ecology. Humans are also non-privileged members of these eco-systems, and remain subordinate to ecology as a whole (Callicott 2017, 170).[41] Therefore, the ethical goal of humans to be ecologically sustainable

[41] Of course, this is view is contestable as Callicott (2017, 170) caveats himself: "theologians, for example, might deny [that mankind is a non-privileged member of the organic continuum]". For a more contemporary relevant objection, Anna Peterson (2004) argues that strong social constructivists might maintain that there is no outside culture, and that any view of nature is ultimately imposed by humans. But these privilege human activities in problematic ways. Despite their own critical impetus, they fail to deconstruct the notion of the social or of culture and take them for granted in a totalizing manner, from which there is no escape. Such extreme metaphysical relativism is logically possible, but not very attractive. Most people would agree that there is something out there that ecology studies apart from human discourses and practices.

comes neither from the outside of ecology, nor is it imposed on it. Strong ecomimicry derives ethical principles for ecological sustainability from the inside of ecology; by including humans in ecology, it remains natural or ecological.[42]

I have argued that biomimetic ethics can overcome the two major problems posed by Blok and Gremmen. As established in the previous sub-section, if we understand the goal of this ethics to specifically contribute to ecological sustainability, rather than all of ethics, it passes the is/ought problem.[43] Moreover, like I argued in this sub-section, on an ecological understanding of nature, rather than *physis*, the problem of perfection also disappears: a strong view on ecomimicry does not have to say that all of nature is good, only that ecological principles conduce to ecological sustainability. It also does not have to assume that humans are distinct from nature and can play no part in it, because they are part of ecological system. Such view of biomimetics is strong enough to preserve the ethical force of taking nature – or rather ecology – as a measure, without being philosophically untenable. As such, the underlying approach of the CE would go beyond metaphoric or poetic qualities and is able to contribute to ecological sustainability. So we should understand circularity as strong ecomimicry, but what does this precisely entail, especially for the CE in the EU?

[42] A flipside of the objection discussed in the previous footnote is that if humans are part of ecology, all human ethics could be said to be biomimetic. However, as environmental philosopher Peterson (1999) argues in general about nature, and Pickett and Ostfeld (1995) about ecology specifically, we can acknowledge that humans are part of either, without conflating both.

[43] Another objection against ethical appeals to nature is that they lead to problematic positions. Usual examples of such positions are Social Darwinism, race realism, or gender essentialism, all of which justify the subjugation and oppression of some group of people by their natural inferiority. The idea behind this objection is not so much that all ethical appeals to nature are necessary bad in themselves, but that they open the argumentative door for others that are. Feminist philosopher and ethicist, Louise Antony (2000, 13-14) can be partially understood to give such argument in the case of sexism "herein lies the sad moral of tale: there is no way of understanding 'natures' that will disarm the pernicious appeals without simultaneously invalidating the liberatory ones." While the ethical scope of ecomimetic circularity is limited, it is not immune to such moral risks: ecology has been pervaded by Neo-Malthusian eco-fascism and even parts of the CE intellectual origins can be traced to such population thinking for instance by Paul Ehrlich and Garrett Hardin, and posit their own fortress version of the CE (Calisto Friant, Vermeulen, and Salomone 2020, 12). This is a less principled but not a less important objection. It does not undermine the possibility of a morally unproblematic strong ecomimicry, but it gives reasons to remain wary of its concrete formulations. Some of the precise principles I will discuss in the next section will hopefully ease these worries in general and I will in the next chapter return to the specific issue of Neo-Malthusianism.

4. Ecomimetic Circularity: Principles and Values for the CE

In this last section, I discuss some ecological principles to explore what these imply for the CE. Ecomimetic circularity is form of ecomimetic ethics that imitates principles of ecological systems. This approach is powerful because it takes a path between two problematic extremes: it avoids baseless philosophical speculation about nature, since it relies on a scientific conception of ecology. Yet, it still remains a strong form ecomimicry that can serve as reliable approach towards sustainability. This middle path also leads to a problematic tension. On the one hand, it must be based on ecology as science. On the other hand, however, it needs to consist of values and not merely functionings, which means that it cannot be based on empirical observation alone. In this section, I will try to achieve this difficult, yet desirable middle-ground with two complimentary strategies: first, I will rely on broad and abstract conceptualization of ecology, which I take from Picket and Ostfeld's portrayal of the current paradigm in ecology and its principles. Second, I will then interpret these principles as values based on philosophical discussions of ecology and point out their practical implications for the CE.

In their article, "The Shifting Paradigm in Ecology", Picket and Ostfeld (1995) delineate the new belief system in the science of ecology. A paradigm according to them is "the most general view point a science takes of the world" and they outline the new one, by contrasting "how it has changed over the last few decades" (Pickett and Ostfeld 1995, 261). The classical paradigm, connotated by the metaphor "the balance of nature", has rightfully been replaced by a new paradigm which they describe as the "flux of nature" (Pickett and Ostfeld 1995, 261). Under the old paradigm, ecosystems were considered as closed and self-regulating. they were thought to have a stable equilibrium point and a fixed succession, and disturbances were exceptional and excluded humans (Pickett and Ostfeld 1995, 263–65).

In contrast, the new paradigm views ecosystems as always changing in a nonlinear way, open for and dependent on outside influence, and considers disturbances and human activity as an essential part of them. With the discussion of the shifting paradigm, Picket and Ostfeld provide a useful general overview about ecological principles, from which I will derive ecomimetic values for the CE (see Table 3.2 below). Their argument has the right conceptual scope for my purpose. It is both linked to the science of ecology, yet broad and abstract enough in its dealing with paradigmatic principles to serve as a base for ecomimetic ethics. There are roughly three major areas of changes in the principles from the classical to the new paradigm, each relating to one ecomimetic value, holism, relationality, and limitedness, which I will discuss in turn.

Table 3.2: Ecological Principles and Ecomimetic Values

'Balance of Nature' Principles	**'Flux of Nature' Principles**	**Ecomimetic Value**	**Implications: the CE**
Stable Equilibrium	Constant change	Holism (Callicott 1986)	May not exclusively focus on products
Fixed Succession	Non-linear, complex		
Closed	Open	Relationality (Callicott 1986)	Must take external consequences into account
Self-regulating	Dependent on externalities		
Disturbances are exceptional	Disturbances are normal	Limitedness (Pickett and Ostfeld 1995; Dicks 2016)	Cannot grow infinitely
Humans excluded	Human included		

Table 3.2 compares the principles in ecology according to the classical and the new paradigm. It also juxtaposes these properties to ecomimetic values, discussed by environmental philosophers, and relates them to their implications for the CE.

4.1 Holism

Maybe the most important and obvious difference between the classical and the new paradigm in ecology is the matter of change. As the metaphor of balance implies, the classical paradigm was consider to be static, tending towards a stable equilibrium point (Pickett and Ostfeld 1995, 264). Moreover, change, for instance in the successions of population, was thought to happen in deterministic and linear ways. In contrast, the new paradigm is conceptualized as being in flux, which expresses "variation, fluidity, and change in natural systems" (Pickett and Ostfeld 1995, 266). But not only is the new paradigm more dynamic, also the kind of change differs: e.g. "successions are rarely deterministic" (Pickett and Ostfeld 1995, 267). It does not follow a linear order, but have complex dynamics and are better understood by network and chaos perspectives (Pickett and Ostfeld 1995, 269).

From the properties of non-linear change, it is possible to derive the value of holism. Holism is one of the "metaphysical implication of ecology" which the environmental philosopher Callicott (1986) argued for. According to him,

> the concept of nature emergent from new ecology and from new physics, is holistic … Contrary to the object ontology of classical physics and biology in which it was possible to conceive of an entity in isolation from its milieu-hanging alone in the void or catalogued in a specimen museum – the conception of one thing in the New Physics and New Ecology necessarily involves the conception of others and so on, until the entire system is, in principle, implicated.

Holism derives from the connectedness of ecology, which rejects an ontology of individual objects. As a value holism requires a focus beyond individual entities and suggests instead that a systemic, holistic perspective is needed to understand nature as ecology. Callicott's argument

can be tied to the new paradigm in ecology: The flux of nature means that ecological systems change constantly through the complex, non-linear interactions. Therefore, individual changes cannot be isolated and affect the whole system. Holism can thus be based on ecological principles.[44]

The value of holism has clear implications for the CE, which should adopt a system perspective and not effect changes through parts in isolation. Pickett and Ostfeld (1995, 269) already spell this implication out in relation to ecosystem management, which they criticize as having "been limited by its focus on individual components". But this holds also for the CE, as the example of *MycoComposite* shows. The mushroom-based replacement for plastic is supposed to reduce ocean pollution. Surely this will have some benefits, but it will be hard to tell what effects precisely replacing "8 million tons of plastic that enter our oceans every year" with mushroom compost will have (EMF n.d.). It seems unlikely that such large intervention via one component would be conducive to overall ecological sustainability. In the natural world this amount of mushroom plastic would almost certainly not reach the oceans. This by no mean only concerns the EMF as my analysis of the EU's CE strategy has shown, the 2020 policy plan increasingly only focuses on products in isolation and neglects a more systemic perspective. Such development is runs counter the ecomimetic value of holism and should be reversed.

4.2 Relationality

A second shift in ecology concerns relations between systems. Under the classical paradigm ecological systems were considered both as closed and self-regulating. Closed means that "important structures and interactions occur within the boundaries set for studying them" (Pickett and Ostfeld 1995, 262). From this assumption also follows that these systems are self-regulating: "If they are indeed self-contained, then they must be internally regulated if they are to persist" (Pickett and Ostfeld 1995, 262). The new paradigm differs on both points. According to it, "ecological system are never closed, but rather experience inputs such as light, water, nutrients, pollution, migrating genotypes, and migrating species" (Pickett and Ostfeld 1995, 267). Indeed, they depend on this input, and are therefore not seen as self-regulating, but rather

[44] Warren and Cheney (1993) have criticized that Callicott's holism is based on a metaphysical notion of ecology, because it runs counter hierarchical theory in ecosystem ecology, which states that the relations between organism is hierarchically ordered and cannot be reduced to a systemic perspective. This suggest that the holism might not go as deep as Callicott suggests, who draws an explicit connection to Deep Ecology. Whether or not they are right and a line between science and metaphysics can be drawn with certainty it seems that the point I am making is compatible with ecosystem ecology: the encyclopedia of ecosystem ecology states one of their central properties, "Ecosystems are whole system and studies of ecosystem dynamics require holistic views" (Jorgensen 2009, 3).

constituted by their environment.

The second paradigm shift can be captured by the value of relationality, which was also proposed by Callicott (1986). According to him, the metaphysical implications of ecology, also concern our moral psychology:

> Since individual organisms, from an ecological point of view, are less discrete objects than modes of a continuous, albeit differentiated whole, the distinction between self and other is blurred (Callicott 1986, 313).

He argues, we should move from our atomistic worldview of separate individuals to a "relational" view of the self, where everything is connected (Callicott 1986, 316). Whether or not we subscribe to this moral psychology, a milder version appears to be suggested by the second paradigm shift from closed to open, and self-regulating to dependent. This can be seen as complementary to the first shift, which concerned the internal connection. The second shift conceptualizes the relation between ecological systems. The holistic ontology, according to which ecological system are whole systems, is complemented by a relational one. As a value this implies that we should not only takes intra-connectedness seriously, but also the interconnectedness.

Relationality also has relevant implications for CE policy. It implies that the CE may not be seen as a geographically closed system, but must takes its relations, in particular ethical relations, beyond into account. A relevant case is here the matter of illegal waste-shipments, which the 2020 action plan addresses and intends to prevent. Relationality grants support to these efforts of achieving global justice and encourages to pursue them further. According to this value, the CE in the EU must take responsibility for its relation and embrace that it will remain dependent on outside influences such as resources or migration.[45] A strong ecomimetic approach is thus incompatible with externalizing negative consequences, such as waste, or geographic isolation, because any system is in relation with other systems.

4.3 Limitedness

A last important area of the paradigm shift concerns the causes and limits of change. The classical paradigm emphasized stability and thus focused on "pristine and apparently 'natural' systems", which were thought of as undisturbed or as recovering from disturbances (Pickett and Ostfeld 1995, 263). In line with this principle, Pickett and Ostfeld (1995, 263) argue:

[45] This provides some ease for the ethical worries of eco-fascism which were discussed in fn. 43 above. It seems that our current best understanding as ecosystems as open and the ecomimetic value of relationality, are opposed to racist migration and population control. This point will be elaborated in the next chapter.

> [h]umans were often purposely left out of ecology, because they introduced multiple states to systems, acted as disturbance agents, transported materials and organisms beyond their usual distributions, acted as external regulators of ecological systems, and prevented orderly deterministic successions

As this quote indicates, the role of humans is thus a major overarching point of difference between the paradigms. Not only does the new reject stable, closed, self-regulating, ecological system, characterized by linear change, it also explicitly includes humans who undermine this old world view because "[l]andscapes that have not experienced important human influences have been the exception for hundreds if not thousands of years" (Pickett and Ostfeld 1995, 267). Consequentially, the naturalness of ecological systems does not result from being pristine or undisturbed; rather human caused changes are a crucial part of ecology according to the new paradigm.

This difference between the paradigms relates to the ecomimetic value of limitedness, albeit in a roundabout way. For this point, Pickett and Ostfeld do considerable part of the intellectual work that leads to a value themselves. They caveat, in contrast to the balance of nature which appeared to emphasize stable natural limits that are not to be disturbed, the flux of nature might lead to a problematic, yet false conclusion:

> The metaphor and the underlying ecological paradigm may suggest to the thoughtless or the greedy that since flux is a fundamental part of the natural world, any human-caused flux is justifiable. Such an inference is wrong because the flux in the natural world has severe limits (Pickett and Ostfeld 1995, 273).

There are functional, historical, and evolutionary limits to "anthropogenic disturbances" (Pickett and Ostfeld 1995, 274): "[p]roblematic human changes are those that are beyond the limits of physiology to tolerate, history to be prepared for, or evolution to react to". So roughly, while changes (even disturbing and anthropogenic ones) are part of ecology, not any change can be condoned on ecological grounds. The new paradigm still emphasizes limits.

Limitedness as a value was defended by the environmental philosopher Dicks (2016) in the context of biomimicry. He argues, taking nature as measure "prescribes tried and tested standards which limit what we may and may not do" (Dicks 2016, 236). But he goes further than natural limits, and argues that nature is also limiting (Dicks 2016, 236):

> natural beings not only possess various limits without or beyond which they cannot exist but also—at least in some cases—they possess the capacity of self-regulation such that the transgression of these limits may be avoided

While this quote illustrates how limitedness can serve as a measure or value, it is not grounded in ecology.[46] Even though the interjection restricts this to some cases, compared to Pickett and Ostfeld, Dicks overemphasizes the self-limiting capacities of natural systems. To make limitedness an ecomimetic value requires synthesis. Ecological systems have limits and are to a degree self-regulating but taking humans into the equation means that these limits can be disturbed and the capacity for regulation upset. Ecological limitedness thus means that human have to limit themselves, because they are part of ecology.

Limitedness has far-reaching consequences for EU CE policy. As I demonstrated in section 2 of the first chapter, economic growth is a core ambition of the action plans (even though ecological concerns have become more important in its recent iteration). Moreover, as my discussion the fourth section shows, the goal is infinite economic growth, because growth should be decoupled from its negative impacts. However, infinite growth is at odds with the value of limitedness. As Pickett and Ostfeld (1995, 266) put it, "[n]o component of a natural ecological system, at whatever level of organization, grows without limits". An ecomimetic approach to circularity must limit economic growth. Clearly, this implication has major consequences, as it upsets a core ambition of the CE policy. I will relegate a further discussion, of limits to the next chapter.

This section provides an idea of what an ecomimetic circularity would be and mean for the CE. It is not intended to be comprehensive or exhaustive. Nevertheless, this shows that it is possible to have a strong form of ecomimicry, which on the one hand takes scientific ecological properties as a measure and on the other hand derives principle of values from it. This fulfills both conditions outlined at the start of this section. Moreover, these principles have concrete implications for the CE and can guide it in practice. Ecomimetic circularity thus constitutes a concrete approach towards sustainability.

5. Conclusion: Closing the Loop on Ecomimetic Circularity

In this chapter I have presented and defended an alternative interpretation of circularity. Following the analysis of circularity as framed in terms of closing material loops as well as its problems, in the previous chapter, my interpretation is supposed to reframe this concept. We *could* understand circularity as a biomimetic approach, because it explains the biological rhetoric and practice in relevant CE institutions such as the EMF. Furthermore, we *should*

[46] Dicks (2016, 228), as discussed above in section 3.2, relies on an understanding of nature as *physis.*

understand it in this way, because it is a suitable approach for the EU's ambition of ecological sustainability. I argued that ecomimetic circularity, conceived of a strong form of biomimicry which imitates ecological principles, overcomes the philosophical challenges of committing the naturalistic fallacy and falsely presupposing nature to be perfect. I have interpreted these principles as values, such as holism, relationality, and limitedness. They are grounded in scientific ecology, but at the same time have normative and guiding content. They thus tell us that and how the CE can be sustainable.

Putting this chapter into context, reframing circularity as ecomimicry has made my criticism of the EU's CE policy in the previous chapter more constructive. It takes the effort of building a frame of circularity seriously, and in Hoppe' terms, makes sense of it, by providing an understanding more appropriate for the ecological ambitions than recycling. In rethinking the CE as an unstructured problem, I analyzed and clarified ecomimetic circularity as a means on which it could and should rely. This also constitutes an important first step in my effort to develop a philosophy of the circular economy in the EU. But since circularity was framed as independent from the CE itself, the next step is to see how this approach can be scaled up to a more systemic level, which I will in the next chapter. This chapter can be understood to focus on the circular part, whereas next focuses on the economy. This will involve grappling with the ecomimetic value of limitedness as well as the CE's goal of achieving unlimited economic growth by decoupling it from ecological pollution.

Chapter 4: The Ecomimetic Economy: Recoupling with Ecological Limits

In the spaceman economy,
throughput is by no means a desideratum, and …
to be regarded as something to be minimized
rather than maximized.
The essential measure of success of the economy
is not production and consumption
Kenneth Boulding, *The Economics of the Coming Space-Ship Earth*,1966

The spaceship metaphor can be dangerous
when used by misguided idealists
to justify suicidal policies for sharing our resources
through uncontrolled immigration and foreign aid
Garret Hardin, *Lifeboat Ethics*, 1974

1. Introduction: Decouple or Limit Growth?

There are two loose threads still to tie up within my philosophy of the CE in the EU: Reframing the delusional goal of decoupling that I discussed in chapter two and scaling up the CE's ecomimetic approach to the level of the economy that I explored in the third chapter. Both of these implicate questions about economic growth, which will be a central theme of this chapter. A strong ecomimetic approach must be based on ecological values or principles and cannot ignore the limitedness of ecology, which I presented in the previous chapter (see point 4.3). If the economy should mimic ecology, then it cannot grow infinitely and must stay in the appropriate limits. This seems like a major liability of such approach, and I will in this chapter also discuss the political problems it entails. However, it is not unique to ecomimicry, but rather an independent problem of any economy that aims to be sustainable.

Consider the following argument. If the carrying capacity and available resources of the planet are limited, and if economic growth cannot be decoupled from the biophysical processes that pollute the planet and depletes its resource,[47] then the economy cannot grow forever. The first conditional should be beyond question. There is no shortage of evidence that points to the dangerously dwindling pool of resources, and the extreme excess of pollutants such as CO^2 (Masson-Delmotte *et al*. 2018). But, in particular, proponents of the CE must accept it, since the whole point of implementing it is to tackle the problems of over-consumption as well as the climate and ecological crisis. As discussed under point 2.1 in the second chapter, this is the motivation or justification for the EU's 2020 CE action plan. Yet,

[47] As in the epigraph to this chapter, ecological economists like Boulding (1966, 8) often refer to economic growth which is coupled to biophysical processes as 'throughput'. See Costanza *et al*. (1997, 7–8) for a discussion. I am not adopting this term because it is distracting from my notion of recoupling too much here.

the plan goes on to claim that the CE can achieve decoupling and thus denies the second conditional. I have already argued that this ambition is delusional, the CE cannot decouple economic growth from pollution and depletion absolutely at any relevant scale (see 4.2 in chapter two). The upshot of this argument is twofold. One, regardless of the approach, the CE cannot grow indefinitely and two, decoupling must be rethought.

I will begin this chapter by offering an alternative interpretation of decoupling. Similar to circularity, I will reframe this concept and argue that we can and should understand the CE to achieve *recoupling*. I will flesh recoupling out and argue the right way of understanding the CE is to base economy on ecology, which scales the ecomimetic approach to the level of the economy. However, this understanding is philosophically contentious, for metaphysical and ethical reasons: Ecology and economy are seen to be ontological heterogenous" (Veraart and Blok 2021). Imposing natural boundaries on the economy can also lead to ecofascist Malthusian lifeboat or population thinking (C. Thomas and Gosink 2021).[48] In the third and fourth section, I will present these criticisms of recoupling and outline an ecomimetic economy that is ontologically plausible and ethically defensible. This philosophical defense not only clears out fundamental problems, but also sets the stage for a complete view of my philosophy of the CE. I propose the CE in the EU should be an ecomimetic economy that is recoupled with ecological limits. Still implementing an ecomimetic economy, especially one that does not pursue economic growth will be politically difficult. So, in the fifth and last section, I will relate the philosophical argument to the CE in the EU and argue that there is a potential policy path for an ecomimetic economy beyond growth.

2. Recoupling and the Ecomimetic Economy

Given that the CE cannot achieve absolute decoupling, this concept needs to be rethought. In this section, I will reframe decoupling analogously to circularity in the previous chapter. My task this time is both easier and harder. It is harder because economic growth is a core goal of the CE and there is no way of reframing decoupling that will make this plausible. Hence, the reframing will have to run contrary to a core ambition of the policy plan. On the other hand, there are more substantial visions beyond absolute decoupling already in the policy plan that

[48] The kind of argument against economic growth I have just presented is often described as Malthusian (Ashworth 2008, 259; Rostow 1973, 549; B. Thomas 1985). The moral problem arise from the focus on overpopulation apparently implied from this argument because, "only misguided idealist" can advocate ecological boundaries and no population control (Hardin 1974). My argument below will provide some guidance for idealists.

can serve as a basis for this reframing. My reframing will work in three steps. I will in the first subsection expand on these existing concepts and argue that we should understand decoupling in the restorative sense, albeit an extended or modified one: recoupling the economy and ecology. In the second subsection, I will provide a practical example of recoupling and discuss how it relates to the ecomimicry. Lastly, I will derive a theoretical underpinning for this concept from ecological economics, which allows to understand recoupling as basing economy on ecology.

2.1 Reframing Decoupling: Free-coupling and Restorative Decoupling

When I analyzed decoupling in the EU CE action plan under section 4.1 of the second chapter, I argued that it contains two versions that go beyond absolute decoupling. Absolute decoupling is a decrease of pollution while the economy grows, halting and not merely weaking the correlation between both. However, in the 2020 CE action plan, the EU intends to decouple "economic growth from resource use and its impacts" (COM 2020, 19), so not only focusing on the negative impact of resource use such as pollution, but resource use *per se*. As I pointed out, this comes close to the Cornucopian vision that "the world can, in effect, g*et al*ong without natural resources" (Solow 1974, 11). I called this free-coupling, because it envisions an economy that is detached from the natural world. This version constitutes an even less plausible goal than absolute decoupling.[49] It also envisions the relation between economy and nature in a way that is unfitting for the CE. As I argued in the previous chapter, the CE can and should be understood to employ a strong ecomimetic approach, which takes ecology as measure: it infaces with and is modelled after the natural world, rather than being detached from it. Therefore, free-coupling is the wrong way to capture the relation of economy and nature, in the context of the CE.

This point becomes even clearer when we consider the second conceptual addition to decoupling. The CE is supposed to create a "regenerative growth model that gives back to the planet more than it takes" (COM 2020, 2). Contrary to absolute decoupling, the CE should not only take less, but give back and restore. Based on this reversal (instead of halting or severing) of the link between economy or its growth and ecology or it is pollution, I called this restorative

[49] Not even the staunchest advocate of green growth believe that we could g*et al*ong without any resources at all but argue that we can transition to more sustainable ones For instance, the recent notorious *Ecomodernist Manifesto* speaks of substituting resources and using them more efficiently. It does not attempt to get rid of nature and but seeks to preserve as much as possible (Asafu-Adjaye *et al*. 2015, sec. 3): "Decoupling raises the possibility that societies might achieve peak human impact without intruding much further on relatively untouched areas. Nature unused is nature spared". So while its proponents believe in absolute decoupling, not even them come close to such Cornucopian view.

decoupling. This version thus envisions a very different relation between the economy and nature understood as the planetary ecological system: rather than detaching them, it emphasizes their mutual dependence. Restorative decoupling thus does more justice to the interface between economy and ecology inherent to the CE. The biological language of regeneration also hints at the ecomimetic approach of imitating nature.

Is restorative decoupling thus suited for the CE? No, because as such it remains an addition to decoupling. Since restorative decoupling is not only supposed to takes less but give back, while growing the economy, it is still vulnerable to the criticism of absolute decoupling discussed in the first chapter and, if anything, makes this goal even more implausible. What is needed is not a conceptual addition to decoupling but a shift in perspective, a reframing. To become a plausible goal, restorative decoupling must give up the ambition of economic growth. Consider that there are two ways of giving back more than one takes. One is giving back a lot. The other is taking less. As argued in point 4.2 of chapter two, the first path is blocked – the CE cannot even pollute less than it currently takes, so it certainly cannot restore or give back more than that. But it could grow less and thus take less. This would mark a significant shift in perspective away from decoupling. It does not try to decrease or severe the link between economic growth and environmental harms, but rather explicitly acknowledges and embraces this link. To signal such reframing, I will call this *re-coupling*.

Recoupling makes sense in the semantic context of CE, as required by Lakoff (2010, 72) and explained in the previous chapter. It is morphologically consistent with the language of loops expressed by the prefix re- (cycling, using, generation). Recoupling also fits into the ecomimetic frame of circularity outlined in the previous chapter. Imitating ecosystem functions and principles as an approach to the economy in order to become ecologically sustainable is a form of recoupling. The reframing of recoupling also resolves the tension between ecomimetic principles of limitedness and the EU's ambition of economic growth: economic growth takes places within ecological limits.

One might object that such reframing is at odds with the growth strategy of the CE in EU. This is obviously true. However, recoupling is not necessarily at odds with the ambition of creating a "regenerative *growth model*" (COM 2020, 2 my emphasis). A model is mainly descriptive; the prescriptive content derives from the additional goals. To give an analogy, modelling the spread of coronavirus does not require spreading the virus more. If the goal is to save lives, then the spread should stay within the capacities of the health-systems. Likewise, since the goal of the CE growth-model is to be regenerative and regeneration is limited, at least in biology or ecology, limiting growth is not only compatible with the CE but required on this

very model. Clearly, this would still constitute an astronomic shift in economic policy, and I will return to the political project of relinquishing economic growth towards at the end of this chapter. But as an initial motivation for this reframing, I want to point out that we already have a growth-model, so for the CE the emphasis should be on becoming regenerative.

For these reasons, I propose that decoupling in the context of the CE should be reframed as recoupling. Recoupling avoids positing delusional goals for the EU CE policy and constitutes a suitable relation between economy and ecology for the CE. It also eliminates the conflict between economic growth and the ecological value of limitedness. Still what recoupling is and how it relates to ecomimicry on the level of an economy remains rather abstract. Next, I will outline a practical case of recoupling and discuss how it relates to the ecomimetic approach I have outlined in the foregone chapter.

2.2 Metabolic: A Practical Example of Recoupling

In this subsection, I will clarify what I mean with recoupling, by providing an example as well as discussing its conceptual relation to ecomimicry. To be clear from the outset, there is no recoupled or ecomimetic economy, on a relevant scale. A large part of the contribution I am making in this thesis, is proposing such conceptual innovation for the CE in the EU, which hopefully will change the economy practically. Nonetheless, on a more local level, the Dutch CE company Metabolic provides a starting point to illustrate what I have in mind. As the name indicates, this company looks "at cities through a 'Metabolic' lens that brings into focus a new framework through which to model urban flows: urban metabolism" (Metabolic 2018b).[50] Based on this metabolic framework, it conducts consultancy work for urban actors, such as municipalities, companies, and NGOs, and advises them how they improve their energy and material flows and implement CE principles.

For instance, Metabolic (2018a) has mapped the metabolism of the *DGTL* (see Figure 4.1 below), a world-renowned electronic music festival in Amsterdam, to enhance its sustainability. This was done by identifying leverage points in the metabolism, such as the smelting of aluminum tent which is CO^2 intensive (Metabolic 2018a, 8). But the metabolism not only highlights critical areas, where negative impact can be reduced, it also enables to make positive contributions to sustainability. By separating urine from feces, the festival "produced

[50] Urban metabolism is a rich concept which has been studied by various scholarly fields, such as ecological economics, urban ecology, political ecology and Marxists studies. Since my focus is here on a practical example, I cannot discuss this academic context here, but see Appendix 3C for an initial discussion and Brote, Allen, and Rapoport (2012) for an interdisciplinary overview.

enough struvite to grow 157,000 branches of mint" – plants which absorb CO^2 (Metabolic 2018a, 5). Rather than attempting to severe the link between economic activity and ecological impact, it embraces this relation and attempts to create "positive influence not only on the local environment, but also to avoid embodied impacts in the form of CO^2 emissions, land and water use" (Metabolic 2018a, 2). Of course, the positive impact should not be overstated, Metabolic (2018a, 8) itself concludes that the *DGTL* is far from fully circular or sustainable. It serves as a limited protype of recoupling, rather than full-fletched example.

Figure 4.1 The Metabolism of the *DGTL*

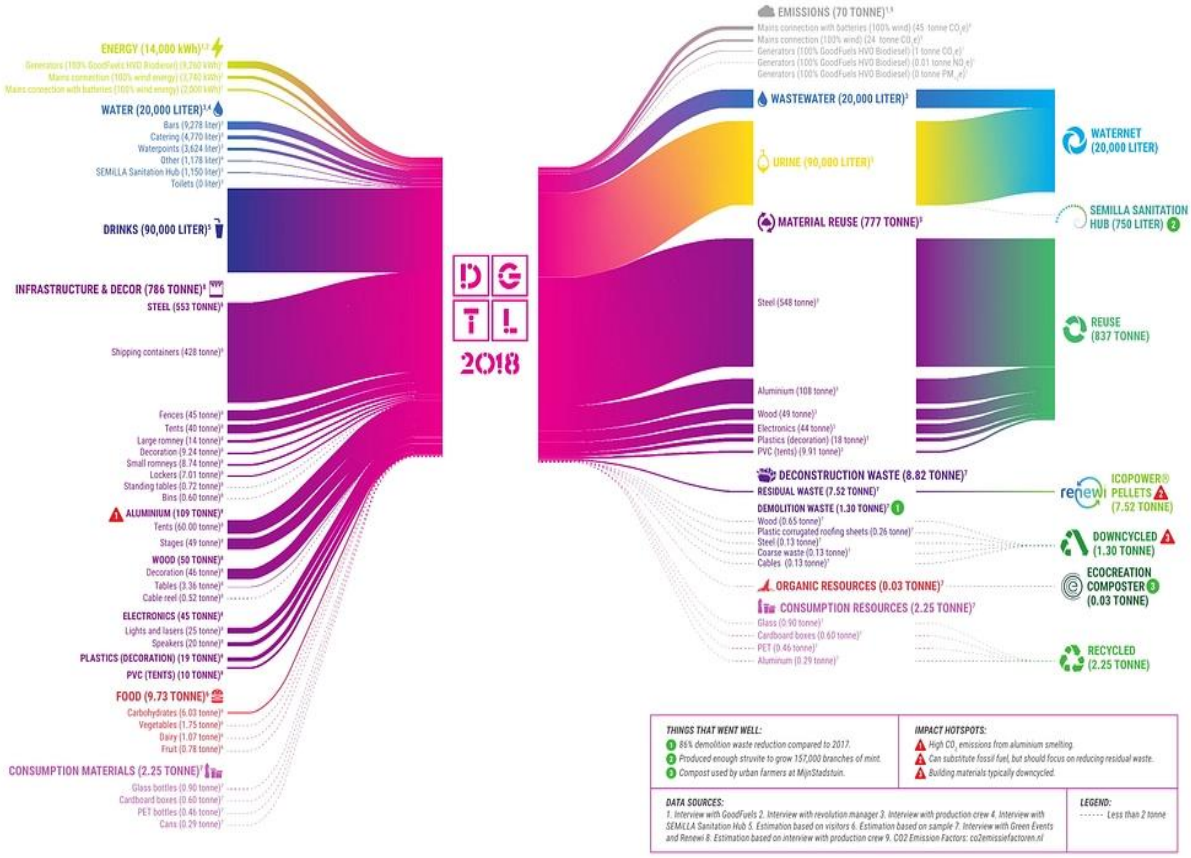

Figure 4.1, adopted from Metabolic (2018a, 4), depicts the material and energy in and out flows of the DGTL*, highlighting three positive achievements and the three high impact areas.*

But if recoupling results from studying and improving the flow of material and energy, is it not based on the recycling approach to circularity, which I previously rejected in favor for an ecomimetic one? No, for three reasons. First, as Figure 4.1 shows, this approach is not under

the illusion that materials and especially energy can stay in a closed loop contra the laws of thermodynamics. Second, the concept of metabolism is explicitly based on the assumption that "cities can learn from human bodies" and considers this "[m]ore than a metaphor" (Metabolic 2018b); it can thus be considered a strong biomimetic approach. Lastly, Metabolic (n.d.) takes a "systemic approach to sustainability": an urban metabolism is characterized by internal (the impacts aluminum smelting after its usages), and external systemic considerations (how urine from the festival can be used elsewhere positively). Indeed, it is considered as a form of "urban ecology" (Metabolic 2018b). So it seems that the specific approach employed could be interpreted to be ecomimetic, in my sense.[51]

Recoupling avoids the delusional goal of decoupling and resolves the conflict with the ecomimetic value of limitedness. But what is the relation between recoupling and ecomimicry? Here I have argued that the CE should aim for recoupling that is embracing the link between economy and ecology rather than severing it. In the previous chapter, I have defined circularity as the strong ecomimetic approach of taking ecological values as a measure. Scaling this approach up, means basing economy on ecology, which can be seen as a way to achieve recoupling. On the level of the economy, the distinction between means and ends comes apart:[52] a recoupled or ecomimetic economy is based on ecology; *vice versa* recoupling or ecomimicry can be seen as the goal or process of doing so by basing the economy on ecology. This is what the CE should aim for here. The example of the festival shows that recoupling has been pursued on smaller scale through an ecomimetic approach. Of course, *DGTL* was highly confined (Analogously to decoupling (see Table 2.2) we could describe this as sectorial, geographical, and temporally limited recoupling.) Whether recoupling can work on the level of the economy is a very different question, which I will address in the next section conceptually, by outlining a theoretical foundation for basing the economy on ecology.

2.3 Theorizing Recoupling: Basing Economy on Ecology

Providing a theoretical foundation for (re)coupling or basing economy on ecology requires some explanatory work. Even though economy and ecology share the same semantic root of the ancient Greek *Oikos* (house) (Veraart and Blok 2021, 177), they have with the

[51] I am not arguing that is has to. While the internal consideration corresponds to the value of holism and the external ones to relationality, there might be differences. While Metabolic (2018b) states that the ecological limits are important and "urban areas need to go on a diet", it is more equivocal regarding economic growth than me and stops short of recommending that economies have to stop growing.

[52] Unsurprisingly, since we are dealing with the CE from perspective on an unstructured problem, as argued in the chapter 2, section 2.3, where distinction between means and ends may not be tenable at all.

specialization of these disciplines in the 19th century separated and usually been considered apart from each other (Costanza *et al*. 1997, 46–48). Hence, there are few modern theoretical frameworks which encompass economic and ecological dimensions. An exception to this is the scholarly field of ecological economics which sought to reintegrate these perspectives (Costanza *et al*. 1997, 48–50). The eminent ecological economist Robert Constanza (2019, 258) defines it as a "transdisciplinary effort to bridge natural and social sciences broadly, and especially ecology and economics", aiming "to develop a deeper scientific understanding of the complex linkages between humans and the rest of nature". Ecological economics thus constitutes an intellectual approach to connecting economy and ecology, from which a theoretical underpinning of recoupling can be extrapolated. However, this extrapolation requires some additional precision because ecological economics is far from a unified field (see Appendix 3A for a discussion). Therefore, I will specifically draw upon Social Ecological Economics, a conceptual framework or paradigm which Clive Spash's (2011; 2012; 2013b; 2020) has developed over a series of articles.

Social Ecological Economics has foundational metaphysical, epistemic, methodological, and ideological assumption (see Table 4.1 below). It presupposes ontologically that "biophysical and social realities are distinct but are interconnected" (Spash 2012, 45), in a hierarchical sense where social system are subordinate to the biophysical ones, (Spash 2020, 2; 2012, 43). This ontological position is accompanied by an epistemological "critical realism" which provides a "course between the postmodern temptation to be nihilistic, while avoiding the modernist temptation to claim a single optimal answer or truth" (Spash 2012, 43). It accepts that there is a world independent of human construction and that knowledge of it is possible, but not absolutely because it is constantly subject to criticism and revision (Spash 2012, 45; 2020, n. 2). Such ontology and epistemology translate into methodological and ideological position for Social Ecological Economics. For instance, it adopts a strong view of transdisciplinarity, according to which the economy should be open to "learning from ecology and biological sciences" (Spash 2011, 356; 2012, 45). Since there is a world independent from humans, and human system depend on this, we can and should learn from it.[53] According to Spash (2011, 358), this also requires moving past economic growth as the ultimate goal, because "ecology challenges orthodox economics by contributing ... alternative requirements…such as sustainability and resilience".

[53] Learning is also a cautious epistemic mode, consistent with the critical side of realism.

These foundational assumptions have relevant implications for recoupling. The ontology grants plausibility to notion of *re*coupling economy and ecology, because they are assumed to be inherently connected: it is making an existing relation explicit. Moreover, since the relation is hierarchical, the relation is best understood as basing the subordinate economy on ecology. I will later return to epistemological implications for the recoupled CE in more detail, but broadly speaking this position allows to accept the interconnection of social and natural system without conflating both. The methodology of learning from ecology, can be seen as enabling an ecomimetic approach, such as what cities can learn from the human body, or the economy from ecology about sustainable principles. Likewise consistent with recoupling economy and ecology, Social Ecological Economics requires moving beyond the ideology of growth and instead pursues also ecological values. Social Ecological Economics provides consistent theoretical underpinning for recoupling and the ecomimetic economy.

Table 4.1: The Philosophical Foundation from Social Ecological Economics for the CE

Philosophical Category	Social Ecological Economics	Implication for CE
Ontology	Hierarchical connection between biophysical and social realities	Economy can be based on economy…
Epistemology	Critical Realism	…without conflating both...
Methodology	Strong transdisciplinarity, Learning from ecology	… so that ecomimicry can work
Ideology	Pluralistic, Heterodox	…and economic growth is not required

Table 4.1 list a some of Social Ecological Economics' new foundation as formulated by Spash (2012, 45) *as well as their implications for recoupling the CE*

This concludes my reframing of decoupling as recoupling. While basing the economy on ecology seems like a radical idea, it has been partially practiced by Metabolic. Moreover, it can be theoretically founded in Social Ecological Economics, according to which economy and ecology have a shared ontology and that learning from ecology is methodologically a valid approach (see Appendix 3C for how Urban Metabolism and Social Ecological Economics relate). By no means does this absolve all conflicts around recoupling. But this practical example and theoretical foundation grant initial plausibility, which turns recoupling from a speculative concept into a defensible position: In my response to the metaphysical (section 3) and ethical (section 4) objections, I will use the example as evidence and draw on the above listed foundational (ontological, epistemological, methodological, and ideological) assumptions for my argument.

3. A Metaphysical Defense of Recoupling: Economies and Ecologies?

In this section I will defend the recoupled CE as an ecomimetic economy against metaphysical objections. In particular, I respond to a direct argument against basing economy on ecology by Veraart and Blok, which they present in their recent paper, *Towards a Philosophy of the Biobased Economy: A Levinassian Perspective on the Relations Between Economic and Ecological Systems*.[54] As this title indicates, they formulate their criticism mainly in terms of the Bio-Based Economy (BBE), which constitutes an EU economic policy in itself (Veraart and Blok 2021, 172–73; Vivien *et al.* 2019, see Appendix 3B). However, because they take the "underlying aim of both BBE and CE as connecting economy to ecology: that is, basing an economy on the biosphere" (Veraart and Blok 2021, 174), they refer to "all types of bioeconomy (including CE[…])" under the bio-based-economy (Veraart and Blok 2021, 176).[55] So even though their argument is directed the BBE, it is also relevant for the CE, in particular an ecomimetic or recoupled one. My philosophical defense not only responds to this relevant challenge, but further clarifies what I mean (and do not mean) by basing economy on ecology, in line with the Hoppe's argumentative style.

I will first reconstruct their argument as stating that economy and ecology are ontologically heterogeneous, metaphysical apples and oranges so to speak. Then, I will go on to criticize this argument as internally inconsistent in its treatment of ecology and nature. Drawing on the foundational assumptions from Social Ecological Economics, I argue that recoupling economy to ecology is compatible with a more fundamental ontological heterogeneity of nature.

[54] Zwier *et al.* (2015) present another direct ontological argument with ethical implication against basing economy on ecology, which they direct at the EU bioeconomy (but also take to include circularity). Based on a Bataillean framework, they argue that the bioeconomy falsely universalizes a restricted economy of scarcity and forgets its ground in the general economy where energy is abundant. This metaphysical mistake would ultimately lead to catastrophe and undermine humanity's ethical character. Unfortunately, I do not have the space to engage with their rich thinking here, but I believe a response similar to the one I am presenting would also work: clarifying the vague notion of nature through ecology and adopting a more nuanced perspective on economy-ecology relations as provided by Social Ecological Economics.

[55] This is thus one of the examples of overly abstract philosophical engagements with policy that I mentioned in the introduction: aggregating CE and BBE by their underlying aim, makes for a powerful argument, yet for poor policy analysis, because both constitute nuanced own strategies, with an elaborate context and intricate relations. This is one of the reasons I opted to turn philosophy to policy: Even though I adopted part of my thesis title from this paper, the omission was almost as inspiring. In line with the policy turn, I will further down discuss how CE and BBE policy (should) relate in the EU.

3.1 The Levinassian Argument: Ontological Heterogeneity

Veraart and Blok's argument is that the economy cannot be based on ecology as these two realms are metaphysically not clearly relatable. They argue that the "relation between economy and ecology is heterogenous, ambiguous and contradictory" (Veraart and Blok 2021, 188). Therefore, they conclude "[a]ggregating the two – that is, basing an economy upon the biosphere – will pose a major challenge" (Veraart and Blok 2021, 188).[56] However, the challenge cuts deeper than that the relation between economy and ecology is merely in for clarification: economy and ecology or biosphere are "ontological heterogeneous" and thus "neither clearly distinct nor clearly similar" (Veraart and Blok 2021, 176). Therefore, the laws and principles of domains cannot simply by applied to the other, which creates an ontological problem for basing economy on ecology.

As evident from their subtitle, Veraart and Blok develop this argument through a Levinassian perspective. On the one hand, Levinas considers economy and nature as joined in the nourishing *Oikos* (Veraart and Blok 2021, 180), but on the other hand posits "a strict (ontological) heterogeneity of and /or separation between man [*sic*] and nature" (Veraart and Blok 2021, 187). This is due to Levinas phenomenological view on nature as *Il y a* (there is), the fundamental condition of being that constitutes a radical other for and remains inaccessible to humans. Because of this inaccessibility, there is an "epistemological ceiling" to our knowledge of nature (Veraart and Blok 2021, 185). This ceiling limits the sphere of human influence on nature and reserves part of it (*Il y a*) beyond human control. Levinas' thus provides a paradoxical double perspective on the bioeconomy (see Figure 4.2 below): from a human perspective, it is always already implied by the intrinsic link of economy and ecology in the *Oikos*; at the same time its full realization remains impossible as nature is not fully under human control. Both sides of this perspectives present an ontological problem for basing economy on ecology, to which I will respond one by one in the next subsection.

[56] The careful reader might have noticed that there is subtle but significant conceptual shift in what basing economy on ecology means, from connecting to aggregating. This will be a main point of leverage for my argument further down.

Figure 4.2: Levinassian Philosophy of a Bio-based Economy

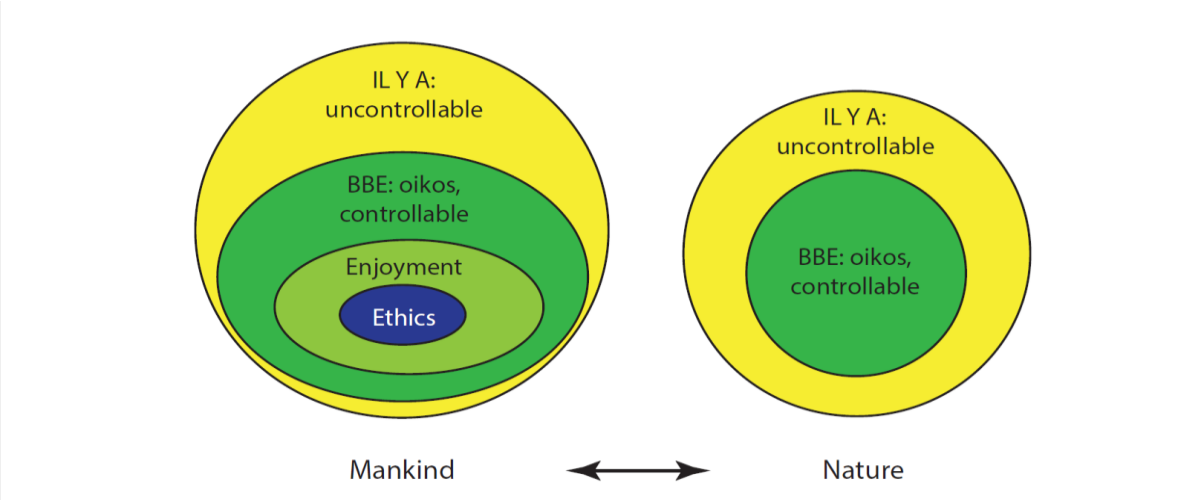

Figure 4.2, adopted from Veraart and Blok (2021, 187) depicts their Levinassian philosophy of the Bio-Based Economy. From the perspective of humankind, a bio-based economy is required by the Oikos, *which sustains humans (enjoyment), and their society (ethics). However, from the perspective of nature, it is always limited by the more fundamental* Il y a.

3.2 My Response: Hierarchical Ontologies

First, basing economy on ecology is problematic from the human perspective of the *Oikos* where both are intrinsically connected. As Veraart and Blok (2021, 176) point out, "an economy, too, is subjugated to natural boundaries" and "economic processes – such as networks of trade, communication, house-holding, and even management structure – can also be encountered in natural systems". They argue "the biosphere and the economic sphere are neither clearly distinct not clearly similar" (Veraart and Blok 2021, 176). So if economic and ecology are intrinsically linked as the *Oikos*, how is it possible to base one on the other? Here, it is necessary to supplement the *Oikos* with a more nuanced perspective of Social Ecological Economics. As stated above, this paradigm centrally posits that, "biophysical and social realities are distinct but … connected" (Spash 2012, 45). The version of recoupling economy and ecology I defend assumes that it is possible to differentiate between economy and ecology, but also that both intersect. Once this assumption is granted, then it serves as the right kind of ontological basis for recoupling: if both were incommensurable, then it would be hard to see how one could be based on the other. Likewise, if they were identical, there would be no point in basing on one the other. So the question is, which ontological assumption is more plausible.

Veraart and Blok's assumption is based on the observation that economic processes are subject to biophysical realities Social Ecological Economics of course shares this part of the assumption, but interjects that being subject to, does neither mean being identical nor being

based on: Many models of the current economic systems do not acknowledge that they are subject to biophysical processes. To illustrate this with the example from Metabolic, according to Veraart and Blok's assumption, we would not be able to differentiate between *DGTL* and other festivals, because all are subject to biophysical processes and have a metabolism. There will be urine and feces at every festival, but how we understand it and what we do with varies widely. On the assumption of Social Ecological Economics, however, we can acknowledge that the metabolism of *DGTL* was special because it explicitly embraced the relation to biophysical or ecological processes. I take the assumption of being distinct but interconnected to be more plausible or at least more useful than neither distinct nor similar, because it allows to make such distinction. Hence, it is possible to overcome this first part of the ontological argument.[57]

This raises the second ontological problem from the Levinassian perspective: the fundamental otherness of *Il y a,* which creates an epistemic ceiling and sphere beyond human control. I do not want to wager in on the metaphysical debate about what nature ultimate is. It might very well be that Levinas, Veraart, and Blok are right about the phenomenological dimension which eludes humans. But this is beside the point. Recoupling the economy does not claim to encompass all of nature, but to base economy on ecology. This neither says that ecology equals nature, nor that economy and ecology are to become one.

Social Ecological Economics only presupposes an ontological realism about the interconnection of biophysical (ecological) and social (economic) systems. As a paradigm located at the intersection of social and natural sciences, it does not make any further reaching metaphysical claims. So, it is simply agnostic towards the question whether there is something like an *Il y a.* If there is, the economic base in ecology is best seen as subclass of nature: as even evident from Veraart and Blok's own graphic conceptualization, the BBE or in my case the CE belongs to the middle-sphere of *Oikos,* within nature (see Figure 4.2 above). They explicitly oppose a combination of these because the two models "belong to non-equivalent descriptive domains": the butterfly diagram assumes that "there exist a common system of control based on the shared identify of the two metabolic systems", which "fully ignores the heterogeneity of and discrepancies between humanity and nature" (Veraart and Blok 2021,

[57] They argue moreover "even if the two spheres were clearly distinct, economies cannot just blindly mirror ecological principles" for ethical reasons (Veraart and Blok 2021, 176). This part of their argument references the articles about biomimetic ethics by Blok and Gremmen (2016, 207) , to which I responded already in section 3.1 of chapter 2. To reiterate, the claim is not to mirror blindly nor to be completely ethical; the point of strong ecomimicry would be to base the economy intentionally on ecological principles for the purpose of sustainability. This must be supplemented by further concerns, such as social justice, in order to be ethical.

186). However, this argument just moved the goal post, by subtly switching from ecology (the common system) to nature (which is ontological heterogenous). It is a clearly defined aspect of nature – ecology – which provides the basis for a common system and leaves room for fundamental otherness.

But beyond such metaphysical compatibility, Social Ecological Economics has similar epistemic and ethical implications to the Levinassian framework. As outlined above, it is epistemically based on a "critical realist" position, according to which "we can never demonstrate that we have discovered the truth "(Spash 2012, 43) and therefore "scientific knowledge is always subject to strong uncertainty" (Spash 2012, 45). This can be seen as an epistemic ceiling in itself. So basing economy on ecology, according to Social Ecological Economics, does not have to claim to have all encompassing knowledge about nature. It only has to say that we know some sustainable ecological principles. This would be possible on all, but the lowest epistemic ceilings.

The second implication concerns the relation between economy and ecology. One of the central worries Veraart and Blok (2021, 177) have about the BBE is that it will result in asymmetric relation, where "economic demands determine the manner in which the biosphere should receive assistance". The heterogeneity of nature serves as barrier which places nature beyond human control and thus prevents economic domination. Again, this implication is shared by Social Ecological Economics: While it posits the ontological connection of biophysical and social realities, it does so in an hierarchical sense, "with the economy emergent from and embedded in social relations, while social and economic systems are also subject to biophysical structures and their law like conditions" (Spash 2020, 2; 2012, 43). As understood by Social Ecological Economics, basing the economy on ecology, does not open the door for economic domination, since social systems are embedded in and depend on ecological ones.

Here, it is worth pointing out another move of the goalpost by Veraart and Blok regarding the meaning of basing on. At the start of the article they define it (and the aim of both the BBE and CE), "as connecting economy to ecology" (Veraart and Blok 2021, 174). However, they conclude at the end that "[a]ggregating the two – that is, basing an economy upon the biosphere – will pose a major challenge" (Veraart and Blok 2021, 188). Over the course of their argument, the meaning of basing economy on ecology has shifted from connecting to aggregating them. Aggregating does indeed appear to be a problematic definition, both ontologically (as there are differences between economy and ecology), but also ethically (as it would allow economy to dominate ecology). However, Social Ecological Economics is directly opposed to aggregation because it conceives of economy as subordinate

to ecology. According to this framework, we could and should stick with the initial meaning of basing economy on ecology, that is connecting both. This hierarchical order, economy subordinate to ecology, and ecology only as part of nature dispels the ontological argument from the second side of Levinas framework.

This concludes my ontological defense of the ecomimetic economy, which recouples economy with ecology by basing former on the latter. Drawing on the theoretical foundation in Social Ecological Economics, I have argued that economy and ecology are sufficiently alike (but not identical) to allow for such connection. Moreover, based on ecology, the economy neither dominates nature, since ecology leaves room for a larger metaphysical view of nature beyond human control and knowledge, nor ecology, as the economy is ontologically subordinate to it. According to the assumptions of Social Ecological Economics, economic laws may not apply to ecology, but ecological laws certainly do apply to the economy. My defense also positively characterizes what this recoupling must mean ontologically: first and foremost basing economy on ecology is basing economy *in* ecology. This implies ecological limits to the economy and raises ethical objections, which I will address in the next section.

4. The Ethical Defense of Ecological Limits: Too Much or too Many?

There are quite a few ethical objections which could be levelled against ecological limits to the economy. These objections roughly fall into three categories: one, limits might be seen as intrinsically problematic and going in one way or another against human nature; two, limits could be criticized as directly leading to problematic politics, such as ecofascism; and three, limits may have undesirable side-effects, such as requiring giving up economic growth. I will here focus on the second kind because this objection is both the most pertinent and serious for my case. It is pertinent, because placing ecological limits on the economy appears to imply giving up control about a human domain so that humans could come to be dominated by nature (or rather as we are going to see other humans acting on behalf of nature). Ironically, giving up control could turn into an excuse for authoritarian politics that enforce these limits in an unjust fashion. I will argue in this section, the discourse around ecological limits is replete with such authoritarian and discriminatory politics, evident from its focus on overpopulation. The charge is also serious for obvious reasons: ecofascism would be on (hopefully) all accounts a terrible outcome, but especially for a philosophy of the CE in the EU it would be devastating, given Europe's track-record with fascism.

So before worrying about going against human nature or having undesirable side-effects, I want to ascertain that ecological limits do not open the door for such population politics. Moreover, there have been excellent philosophical discussions of the anthropological worry about limits,[58] and I will turn to (some) indirect consequences and economic growth in the next section. Since this is a very vague moral objection – fortunately, ecofascism is more of a looming threat than political reality yet (Malm 2021) – I will begin by reconstructing and motivating this problem: the danger of ecofascism stems from Malthusian population thinking which is deeply entrenched at the mainstream intersection of economics and ecology. Then, I will respond that it is based on flawed logic as well as a misunderstanding of both ecology and limits: I argue for self-imposed limits derived from the science of ecology which do not necessarily lead a problematic focus on population, which also positively characterizes what I mean by ecological limits.

4.1 Ecofascism and Malthusian Population Thinking

One of most common manifestation of this ethical objection against ecological limits is that it leads to Malthusian population thinking. Such thinking, named after the 18th century British economist Thomas Malthus, reasons that if there are material limits to the planet, then it cannot sustain infinitely many people. Malthusian thinking is morally problematic because it conceives of ecological problems mainly in terms of overpopulation, which the human geographer Cassidy Thomas has criticized as "eco-fascist" (Dyett and Thomas 2019; C. Thomas and Gosink 2021).[59] Following the scholar of fascist ideology Stanley, he defines ecofascism by employing (false) "us /them" dichotomies, where 'them' is (falsely) rendered "a dangerous actor" and 'us' acquires a (false) "sense of victimhood" (C. Thomas and Gosink 2021, 42): seeing demographics as the main ecological problem, makes overpopulation a threat which serves as justification for the few to neglect their moral duties or grants them the right

[58] As the ontological argument by Zwier *et al.* (2015, 371) (see fn. 54 above) highlights, limits could relegate to humans to loop workers who are only concerned with restricting themselves which undermines "the ethical character of humanity". However, the kinds of transgression, they recommend, "art", "contemplation" "ethics of passivity" (Zwier *et al.* 2015, 369) are compatible with the limits I advocate. Ecological limits themselves might not necessarily lead to such ethics, but they also do not undermine it either. While this objection might be more cogent than the Malthusian, which I address, its consequences are both less severe and less at odds with my proposal. For a discussion of how to interpret limits in line with an ethical account of anthropology see Kallis (2018; 2019) or Pellizoni (2021) and of how this might relate to a Bataillean perspective Romano (2019).

[59] It has also been criticized as social Darwinist, racist, patriarchal and colonial. However, ecofascism can be seen as the both the most serious as well as overarching concern because fascism incorporates discriminatory disdain for various demographics. It is not my intention to neglect the nuances of these other critiques, but for reasons of simplicity I will focus my reconstruction of already complicated argument on ecofascism. Dyett and Thomas' (2019) article provides an excellent overview of these concerns.

to control the many. The criticism against ecofascist Malthusian population thinking expresses two main ethical objections: it is an immoral excuse and justifies unethical population control. This population control can be either actively authoritarian, in form of mandatory birth control or immigration restriction, or passive, consisting in refraining to assist those in need and letting nature run its course.[60]

Malthusian reasoning is both widely adopted in ecology especially in relation to economics, but also logically flawed as well empirically unsound: ecological limits by themselves do not imply a limit of the population, nor are ecological problems mainly stemming from overpopulation.[61] The invalidity and unsoundness of Malthusian arguments makes it difficult to respond to them. This is why the criticism of ecological limits usually takes the form of slippery slope arguments: it is hard to say what precisely is wrong about ecological limits, except that they lead to population thinking, and it is hard to say what is wrong about populating thinking except that it opens the door to morally questionable forms of assigning blame and imposing unethical population control. Still given that ecofascism is deeply enough entrenched in ecology it is worthwhile to take this charge very seriously.

To get a sense of what Malthusian population thinking is and how it relates to both eco-fascism and mainstream environmentalism it is helpful to look at Garret Hardin's (1974) "Lifeboat Ethics". The well-known ecologist urges to see the environment as a lifeboat, which sustains human but has limits that can be overloaded. Based on these ecological limits, he argues that rich nations should prevent immigration, especially from poor countries, to keep themselves in their lifeboat afloat. Further, he urges to resist humanitarian impulses and let people in said poor countries, such as India, starve and thus limit population the "crude way" (Hardin 1974, 4). Besides its outright selfishness, this 'ethics' reveals clear eco-fascist tendencies: it constructs a us / them category, the rich people in the life-boat versus the poor people outside and renders former as victims threatened by the latter. It also justifies authoritarian responses, such limiting immigration, and is at best a case for neglecting moral

[60] The inclusion of passive authoritarianism obviously blurs the boundaries between these problems. This might open up some deep moral questions about the difference between doing and allowing, however such blurring is actually leads to an accurate depiction of the messy moral problem. Fascist usually are not successful because of the cogent ideologies, see next footnote.

[61] For instance, carbon emissions are much more correlated to affluence than population size (Chancel and Piketty 2015): it were the richest countries that have emitted much more than the most populous ones. Indeed, the "people in the EU consume more than whole of Asia put together", despite constituting only a fraction of their population (Salleh 2010, 206). This goes to show that Malthus argument is unsound, however since I engage with it philosophically, my response will focus on its logic rather than empirical implications. I demonstrate below how this argument is invalid, or at least incomplete and relies on a second hidden premise.

duties (not let people starve), and at worst for outright eugenics.[62]

Unfortunately, Hardin's lifeboat ethics is not an outlier nor thing of the past. The debate at the intersection of ecology and economics in general and around ecological limits and overpopulation specifically has been historically subject to Malthusian thinking in a way that still resonates in this discourse. Hardin's lifeboat ethics belongs to argument between the Neo-Malthusians and Cornucopians, which I already briefly mentioned in the context of decoupling, in chapter two: The pessimistic Neo-Malthusians such as Hardin and Ehrlich stressed that because of ecological limits population growth must be stopped, whereas the optimistic Cornucopians (such as Solow and Simon) replied that by decoupling economic growth from its impact on ecology, human population can keep growing indefinitely (Jackson 1995; Næss and Høyer 2009). Between these two extreme camps, the mainstream economic position takes a more moderately optimistic position, which states as long as the economy grows, population growth can be sustained (Jackson 1995, 9). So those who oppose economic growth and decoupling have traditionally adopted a critical stance towards population growth, which places my argument against decoupling in bad company.

This holds up until today: the ecological economist Herman Daly, who promotes a steady-state economy, has argued that steadiness not only concerns economic, but also population growth (2016), and explicitly invokes Hardin's lifeboat ethics to opposes mass-migration (2015). Recently, the environmental scientist Haydn Washington has argued for the need of "ecological ethics in new ecological economics" as well as ethics beyond economic growth (Washington and Maloney 2020, 1; Washington 2021). According to Washington and Maloney (2020, 6):

> if EE [ecological economics] were to foreground ecological limits, plus ecological ethics and ecojustice, it would have to consider the key drivers of *un*sustainability. Environmental science has long referred to the entity Impact = Population x Affluence x Technology [IPAT] (Ehrlich *et al*. 1977), which foregrounds overpopulation and overconsumption as drivers of unsustainability. However, several supposedly EE models not only do not foreground population, they completely ignore it.

[62] See Naess (2004) for details analysis and critique of the lifeboat ethics. He argues that it is best understood as social-Darwinism. Hardin himself insists that he is not chauvinist or racist, but his focus on India tells otherwise. Ecologist like Hardin or Ehrlich pretend to discuss the matter of overpopulation in an objective scientific, however somehow white people are never the problem even though the Dutch Randstadt region has the same population density as New Delhi. Ehrlich (1968) confesses at the beginning of his book *The Population Bomb* "I have understood the population explosion intellectually for a long time. I came to understand it emotionally one stinking hot night in Delhi a few years ago". It is not a stretch to see such emotional insights as resulting from racism.

They argue, to be ethical and take limits seriously, ecological economics must focus on population. This argument is in particular relevant to my case because both the CE as well as Social Ecological Economics are among the EE models which ignore population (Washington and Maloney 2020, 3).[63] It seems, the ecomimetic CE with its underpinning by Social Ecological Economics positing ecological limits to economic growth checks all the boxes of Malthusian population thinking and runs the risk of justifying ecofascism. However, I will shortly respond that the kind of ecological limits I envision do not require to focus on overpopulation in morally problematic way.

To make this point, I need to dig deeper into the intellectual roots of Malthusian argument. As indicated by the label (Neo-)Malthusians, the worry about overpopulation based on ecological limits goes back to the economist Malthus' (1798) *Essay on the Principle of Population*. In this essay, he argued that "the power of population is indefinitely greater than the power in the earth to produce subsistence for man [*sic*]" (Malthus 1798, 13). Reproduction rates are exponential, whereas food production increases only linearly. Put simply, the human desire for sex which increases the population outstrips the availability of food that sustains this population. As a response to this principle, Malthus (1798, 34–38) was also the first to suggest cutting welfare, in order not to unnaturally inflate the reproduction of the poor to the point where their exponential increase would overburden and crash the sustaining productive system. Rather he advocates, the natural resource limits of the earth, what he calls "positive checks", should keep human population in the rights size (Malthus 1798, chap. V). This reasoning is based on the idea that human "preventive checks" do not work, because humans cannot control their desires themselves (Malthus 1798, 70). This prefigured Hardin's crude-way of population control. Note two things from this discussion: One, Malthus argument has thus a very specific kind of natural limits in mind, and two, his argument needs a further second premise about unlimited desires. My response in the following section, draws on both points.

4.2 My response: Ecological Self-Limitation

The hidden second premise is why we need not accept the unethical consequences of Malthusian arguments. The political ecologist Giorgos Kallis (2019, 29, 34–41) observes, "Malthus … did not discover resource limits. He invented the unlimited – and not to be limited

[63] How important this focus should be is evident from their critique of Social Ecological Economics. As they note Spash (2012, 45) in his foundation of Social Ecological Economics does state that "restrictions are necessary on population growth and the scale of human activity". Yet, according to Washington and Maloney (2020, 4) this goes not far enough as it does not prioritize or foreground the issue of population.

– subjects of modern economics". On this point the Malthusian, Cornucopian, and mainstream economists agree (to varying degrees). They may have diverging views on ecological limits, but all adopt a form of the unlimited desire, for instance in the homo economics model of humans as utility *maximizers*. Crucially, they must say this on the Malthusian argument because it is not only the sheer number of humans which overwhelms these limits, but also what these people do. For Malthus, this was to reproduce without limits and for modern proponents it is to consume. Washington and Maloney and make their case with the help of the IPAT equation, which models human impact as a function of population, affluence, and technology. So, if the impact exceeds limits, this concerns not only the amount of people but also how much these people have or consume. If they focus on population, they must assume that humans cannot limit their desire to consume.

In contrast to the mainstream, Social Ecological Economics rejects this second premise. It posits that individuals make fallible choices based on conflicting values under uncertain circumstances (Spash and Dobernig 2017, 8–9). Moreover, in growth-oriented market economies consumers are manipulated, e.g. through advertisement, to desire and buy more (Fellner and Spash 2015, 405–6). So according to Social Ecological Economics, consumption is not expressive of an intrinsic limitless desire and a good life beyond hedonism without always needing more is possible (Spash 2012, 43). On this view, humans are able to limit themselves and we are not forced to focus on population. Ecological limits allow thus consider other factors such as affluence and do not necessarily function as an excuse to neglect moral duties. The response to limits can be that some humans have too much, not that there are too many.

Self-limitation points to a second fundamental difference between these Malthusian limits and the ecological limits I defend. For Malthus, the limits were absolute and imposed by nature – they are positive checks. He argued for cutting welfare and letting nature run its course to reduce population the crude way. In contrast, the ecological limits I have in mind are not out there in nature, but self-imposed. This might seem puzzling at first, because I argued boundaries arise from basing economy in ecology. However, this misunderstands the notion of ecology I derive these limits from. Consistent with the critical realist epistemic foundation of Social Ecological Economics, I have outlined a scientific notion of ecology. According to this view, ecology is a human activity and ecologically discovered limits are human limits. (They remain nonetheless ecological, as humans are part of ecology on such scientific view.) To return to the example of *DGTL* to illustrate the general principles on a micro-level, there are thresholds to how much excrements any ecosystem can absorb and remain accessible to

humans. However, the recoupling does not consist in waiting for that to happen, but to acknowledge and prevent it. In this way, the space not only remains accessible but a viable place for future festivals. Such preventive limits discovered, decided upon, and enforced by humans is what I have in mind.[64] This is in line with the assumption of Social Ecological Economics that any social system is always already subject to the biophysical reality. If limits were out there, we would not need to do anything and leave the work to nature. But explicitly recoupling, basing an economy on ecology, is a self-limiting activity: ecological limits on the economy are imposed by humans on themselves.[65] This self-imposition thus prevents the moral problems of justifying authoritarian solutions that stem from letting nature do the work. .

Self-imposed ecological limits are ethically defensible. Contrary to Malthusian thinking, I assume along with Social Ecological Economics that it is possible for humans to limit themselves. Overpopulation is thus not an excuse to neglect other moral duties, such as assistance or reducing one's affluence and consumption. Moreover, imposing limits on oneself avoids the need for authoritarian approaches, both in the active sense of imposing restriction such as birth or immigration control, or in the passive sense of letting nature run its course. To be clear, in case of the CE in the EU the limits should be imposed by Europeans on Europeans. Of course, this still gives rises to questions of social justice related to participation and distribution. Yet, these go beyond the scope of ecomimicry (even in the strong sense) and this thesis which mainly investigates the ecological sustainability of the CE.[66] Hopefully this discussion will ease ethical worries about ecological limits. However, since these limits do not logically imply the moral problems of ecofascism, on the downside, the philosophical defense cannot refute them or rather such refutation is pointless: Ecofascism remains a political possibility, precisely because it is does not rest on a rational reasoning, but selfish and bigoted sentiments. In the final section of this chapter, I turn towards such more political approach and discuss the implication for policy and political feasibility of this philosophy of the CE in the EU.

[64] Of course, this micro example cannot be fully scaled to the level of the economy, but it illustrates the general principle. Limits might be adjustable through some tweaks such as separating urine and feces, but there will be no unlimited festival and it might be good decision to limit festival to a short period so that there can be festival again next year. It also captures the distinction between need and wants. Humans will need to use a bathroom, but they do not need to do all in one spot for the purpose of entertainment.

[65] Washington and Maloney might criticize such view of limits as anthropocentric, but as I have argued in chapter 2, 3.1 a strong ecomimetic approach is compatible with both moral anthropocentrism and ecocentrism. Humans can desire to limit themselves for their own sake or the sake of others. This is about agency, not moral standing.

[66] Nonetheless, it is worth pointing out that Washington and Maloney in their pursuit of ecological ethics would be wise to consider other ecomimetic values besides limitedness, such as holism and relationality, which I take to be at odds with the selfish focus on one's lifeboat and restrictive immigration policy. Their ecological ethics themselves appears to be rather limited or mono-dimensional.

5. Towards a Philosophy of the CE in the EU

After philosophizing about the CE, I will in this final section return to it as a policy in the EU. 'Towards' this philosophy has a double sense. It highlights the incompleteness of my philosophy; I do not claim to have finished rethinking the CE, there are many other considerations such as the just mentioned distributive or participatory issues. In accord with Briggle's policy turn, it also expresses the pragmatic aspirations of this philosophy: I am looking for a way in which this philosophy can be relevant for policy. Therefore, I will in this section explore the implications of this philosophy for EU policy, but before, I will summarize the philosophy of the CE that I have argued for over course of the last two chapters.

The CE should be based on a strong ecomimetic approach to circularity in order to be sustainable. This means taking ecological principles and values as a measure for technical and economics processes, which include holism, relationality, and limitedness. Because of limitedness, the economy cannot growth indefinitely and the CE should not (in vain) attempt to decouple economic growth from environmental pollution but rather recouple economy with ecology. Recoupling means making the connection between social and ecological system explicit and results in an ecomimetic economy that is based on ecology. While this might appear metaphysically problematic, it is plausible when these realms are understood as ontologically distinct but interconnected in a hierarchical sense: the economy is located within ecology (which in turn is part of a wide conception of nature, whatever nature is). The ensuing ecological limits can be ethically justified, as an act of self-limitation: with the ecomimetic CE Europeans intentionally (and in negotiations with other ethics) base the economy on ecology to limit themselves in line with their (incomplete and fallible knowledge of) ecology.

Can this philosophy of the CE as an ecomimetic economy that pursues recoupling be turned into policy in the EU? I argue yes. There are two considerations for such implementation, which I will pursue in the next two subsections: one, is there a policy pathway for an ecomimetic economy and two, can this policy be based on limits rather than pursue economic growth? This argument is supposed to be explorative rather than exhaustive. I discuss pathways through which my philosophy could be relevant for policy. Moreover, I interpret this could, the political feasibility, generously, as something that might happen (but is not necessarily likely to) – I make no claim about the *realpolitik* in Brussels, only that a trade-off between economic growth and ecomimicry could be politically justified.

5.1 The Bio-Circular Economy as a Pathway for Ecomimetic Policy

In this subsection, I will present a way in which the philosophical notion of ecomimicry could figure in policy. For this purpose, I will draw upon the work of ecological economist and EU policy scholar Mario Giampietro (2019) who offers a relevant practical way of conceptualizing the relation between the CE and ecology: the circular bioeconomy. According to him, the bioeconomy (another EU economy policy to be explained shortly) provides the approach for the CE:

> Circular economy is the "what"–the result to be achieved (the desirable outcome capable of decoupling the use of resources from natural resources), whereas bioeconomy is the "how" (what type of biophysical processes should be enhanced to achieve the expected result) (Giampietro 2019, 144).

However, he criticizes, this approach in the EU is misconstrued because the CE should still lead to decoupling, which the bioeconomy can and should not achieve. In principle, this is the same argument for recoupling I am making framed directly in terms of a policy strategy. However, it needs further clarification, because it introduces the intermediary of the bioeconomy, which is an intricate policy concept in itself. Moreover, while Giampietro's argument is original and perceptive, it needs some modification as he does not distinguish between its descriptive and normative content. I address these points here in turn but elaborate on them in Appendix 3B and 3C, where I also discuss the relation between my conceptual framework in Social Ecological Economics, the bioeconomy, and urban metabolism.

In the context of the EU, the bioeconomy is another economic policy pursuing sustainability that has been introduced in 2012 and was recently updated in 2018 (COM 2012; 2018a). Not only does it share a similar timeline as well as goal with the CE, but both strategies are explicitly interconnected (see Figure 2.1): The CE action plan aims at "supporting the sustainable and circular bio-based sector through the implementation of the Bioeconomy Action Plan" (COM 2020, 6), whereas the "bioeconomy needs to have sustainability and circularity at its heart" (COM 2018a, 1). Indeed, this connection is so strong, that the bioeconomy policy document just combines them, simply referring to the "circular bioeconomy" (COM 2018a, 6,7,9,11). The bioeconomy itself is defined as covering

> all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and

> industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services (COM 2018a, 1).

There are several noteworthy points about this definition: the bioeconomy interlinks ecosystem with economic and industrial systems. Moreover, it does so by including not only system functions but also their principles. So it seems as if the bioeconomy pursues precisely the ecomimetic recoupling that I have argued, the CE should be based on, and that this approach cannot only be supported in theory but realized in policy practice.

Still, this conclusion does not hold up as the outcome of a descriptive analysis like in Giampietro suggests. Even though I agree with him that the bioeconomy *should be* the approach (the how) for the CE, in EU policy the opposite *is* the case. The bioeconomy is subsumed under the CE. Both documents, the CE action plan and the bioeconomy strategy, clearly state that the bioeconomy only applies to the bio-based sectors, whereas the CE has no restrictions (COM 2018a, 1; 2020, 6). As quoted above, it is the bioeconomy which should have circularity at its heart to be sustainable (COM 2018a, 6),[67] and not the other way around. This is also evident from the combination in the circular bioeconomy, where circular is predicated on the bioeconomy. The CE is the overarching strategy and provides the guiding approach. If Giampietro's analysis was correct, then the expression bio-circular economy would be more accurate. So rather than a descriptive analysis, we need to understand this as a normative argument for such reversal

With such reversal, the bio-circular economy can be seen as putting recoupling and ecomimicry into practice. Currently, the bioeconomy is conceptualized as subclass of the CE, a circular bioeconomy: it is "the renewable segment of the circular economy" (COM 2018a, 3). But if the CE is to be regenerative and restorative, one might argue that all its segments should become renewable. The relation between these policy initiatives could and should be reversed from a circular bioeconomy into a bio-circular economy, which comes very close to my philosophy of an ecomimetic economy. Of course, to be a strong form of ecomimicry, this would most likely still involve significant changes that go beyond current EU bioeconomy policy (see Appendix 3B). Still it is already concerned with "functions *and principles*" of biological systems (COM 2018, 2, my emphasis). This focus beyond functions on principles indicates at least seeds of an ecomimetic ethics. Moreover, the 2012 bioeconomy was explicitly a strategy for "sustainable growth" (COM 2012, 2), whereas the 2018 plan does not refer to growth anymore and lists "understanding ecological boundaries" as one of its three areas for

[67] Not ecomimetic circularity as I have reframed it, but the vague undefined kind endemic to the policy documents.

actions (COM 2018a, 10–11). There are some reasons to be optimistic for economic policy beyond growth and within ecological limits. Still, bioeconomy's relation to growth is ambivalent (see Appendix 3B) and since its pursuit is deeply entrenched in EU economics, growth needs further discussion.

5.2 The Crisis of Growth in EU Economic Policy

In my view, the main gatekeeper against such change is the question of economic growth:[68] It is a clear goal of the policy but also what makes it impossible for the CE to be sustainable. Unlimited growth is incompatible with an ecomimetic, recoupled economy and dictates the implausible ambition of decoupling. So the question is, if the EU could give up on economic growth for the CE. I think yes, based on a historical argument, which shows that growth was not always the goal of economies and suggests that it could change again.

The economic historian Matthias Schmelzer (2015) has argued that economic growth is a relative recent phenomenon. To start with, economies have only grown after the advent of fossil fuels and the ensuing industrial revolution since around 1800 (Schmelzer 2015, 263; Mitchell 2011, 13). The political pursuit of economic growth dates back more recently still. First, in the 1930s, following the great depression and the New Deal, 'the economy' was designated as the object of study of and by Keynesian economics (Schmelzer 2015, 265; Mitchell 1998). Then in the 1940s and 1950s, growth became a point of competition between the US capitalist market economy and the Soviet socialist planned economy: the soviet premier Nikita Khrushchev famous stated, "[g]rowth of industrial and agricultural production is the battering ram with which we shall smash the capitalist system" (as cited in Schmelzer 2015, 266). So the political goal of economic growth developed from an ideological struggle. To be sure, there were factual reasons for this as "economic growth has been bound up with the most dramatic rise in living standards for millions of people" (Schmelzer 2015, 263). But it has since then evolved in into what Schmelzer (2015, 264) calls the "growth paradigm", where empirical insights are inextricably linked with economic theories and positive as well as negative ideological beliefs.

[68] Spash (2020, 5–7) would add that mainstream economics is characterized by two paradigms, the growth-paradigm and the "price-making" or market paradigm. According to his view, also market forms of price-making would need to be changed. While the question of price-making is relevant for the CE, which as I have pointed out before has shifted in problematic ways to focusing on products (which endorses the market logic of exchange), the question of economy growth is at least a more direct problem. Since I cannot discuss this second paradigm in detail here, I will focus on the growth-paradigm and relegate the price-making paradigm to the important distributional questions that are left unsolved by my discussion.

What's more, this economic ideology is starting to lose its credibility. Schmelzer (2015, 264) argues, according to the positive side of the paradigm, economic growth was seen as intrinsically good. It had gained so much political traction, because it was considered to benefit all. For instance, it was believed that "growth is a substitute for equality of income" (Schmelzer 2015, 266). The idea being that if there is a bigger cake, then all slices are bigger. However, economic studies now "show that recent growth in rich nations did not alleviate poverty, nor has it been indispensable for human flourishing; rather "other factors, most importantly the degree of equality are much more important" (Schmelzer 2015, 263). Not only do the comparative sizes of the slices matter, but a bigger pie has not even meant that nobody starves. The ideology of growth as serving the "common good" has thus become questionable (Schmelzer 2015, 266).

The same holds on the negative side of the paradigm, which adhered to the ideology of growth as necessary or unavoidable. It was believed that economies just have to grow endlessly, either because of deterministic forces or because they would collapse otherwise (Schmelzer 2015, 268–69). This ideology was contested early through discussion around ecological boundaries, most notably the *Limits to Growth* report, but still remained hegemonic in economics (Schmelzer 2015, 268; 2017). However, recently, the climate crisis has revitalized this discussion around ecological limits. Moreover, the financial crisis showed that economies will not grow indefinitely. Following this, critical voices of unlimited growth have manifest within the mainstream, including renowned economists such as Thomas Piketty, Joseph Stiglitz and Barry Eichengreen (Schmelzer 2015, 269). It thus seems that the growth paradigm in economics is in crisis.

While this might appear disconcerting, the downfall of economic growth provides an opportunity for the CE. The simultaneously failure of the paradigm on the positive and negative side yield a strikingly optimistic picture. Schmelzer (2015, 270) cites a "celebrated statistical survey of welfare over time and between societies" which concludes:

> Just when the human species discovers that the environment cannot absorb further increases in emissions, we also learn that further economic growth in the developed world no longer improves health, happiness or measures of wellbeing. On top of that, we have now seen that there are ways of improving the quality of life in rich countries without further economic growth

The pursuit of economic growth has thus always been ideological and there have been economies that did not grow, as well as economies that did not prioritize growth as the ultimate goal. Given that this ideology appears less and less plausible, the time might be right for a new economic politics, beyond economic growth.

The paradigmatic crisis has implications for the CE. Not only does it appear to open the door for non-growth oriented economic policies in general but, considering the particular influence of the financial and climate crises on the CE, it might be tailored for it. As I argued in the first chapter based on the analysis by Kovacic, Strand, and Völker (2019, chap. 3), the context of financial crisis gave birth to the CE, because it was an economic policy which allowed to pursue growth, but also include environmental concerns. The climate crisis then shifted its ecological ambition to the forefront. The response to the financial crisis can be seen as attempt to save the growth paradigm. However, since both the financial crisis and growth paradigm are losing relevance while the climate crisis is gaining it, we might face a *crisis* in the literal Greek sense of the word: a turning point, where a choice has to be made. That choice should and importantly could favor ecological sustainability over economic growth.

The argument about the ethics of ecological limits shows that this turning point might have a downside. Recall from the first chapter Calisto Friant, Vermeulen, and Salomone's (2020) four different types of CE discourses: Reformist, Technocentric, Transformational, and Fortress (see Figure 2.2). The holistic Reformist type and segmented Technocentric are both optimistic and think that economic growth can be decoupled. While there traces of all in four EU policy, these two optimistic types dominate EU policy, the former in the words and the latter in actions (Calisto Friant, Vermeulen, and Salomone 2021). My argument has denied this optimistic position, but we need to make certain that it leads to the right kind skepticism. The segmented skeptical Fortress CE derives from Hardin's work and thus is explicitly "build on Malthusian theories of over-population and resource scarcity to advocate for strong population control and materials efficiency strategies" (Calisto Friant, Vermeulen, and Salomone 2020, 12). So by moving past economic growth and optimistic narratives of growth, as I argued we should with an ecomimetic economy via the bioeconomy, it is essential for CE policy not to fall into a segmented kind, in particular for the EU.

Calisto Friant, Vermeulen, and Salomone's label "Fortress CE" plays cleverly on "Fortress Europe" , which has come to critically conceptualize the EU's increasingly restrictive and militarized immigration policy (Van Avermaet 2009): pushbacks in the Mediterranean and fences at the easter borders. This resonates with the discussion of ecofascism above. Thomas and Gosink (2021, 44) have warned of such militarization in response to ecological limits, which they call "arming the lifeboat". While moving beyond economic growth, we must maintain a holistic perspective not only in accord with the ecomimetic value of holism, but also to avoid building an economy that sustains only Europeans at the cost of others.

The modified bioeconomy presents a path towards such transformation and an

ecomimetic CE. Given the state of the growth paradigm, this path might even be open. But there is also a wrong turn looming, as the danger of ecofascism is real and relevant for the CE. A full and definitive exploration of this path and its dangers is beyond the remainder of this thesis. Indeed, ensuring that we are taking the right way at this turning point, is a political task that needs to be struggled and not only argued for. For now, I will content myself that we could understand the CE as ecomimetic economy based on ecology, and we should do so, as long as we remain wary of ecofascism. This has brought us another step further towards a philosophy of the CE in EU.

Chapter 5: Grounding the Space-Ship: The Coming Philosophy and Policy of the CE in the EU

We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard,
John F. Kennedy, President of the United States of America, 1962

In the meantime we are wasting our intellectual resources …on low-priority achievements like putting a man on the moon. This is no way to run a space-ship
Kenneth Boulding, at the Committee of Space Science, 1965

That's one small step for man, one giant leap for mankind [sic]
Neil Armstrong, First Man on the Moon, 1969

1. Review: From Recycling to Recoupling

In this thesis, I have taken the first steps towards developing a philosophy of the circular economy (CE) in the European Union (EU): to become more sustainable, it could and should be understood as an ecomimetic economy. According to my argument, as an ecomimetic economy the CE imitates ecological principles rather than closing material loops, like recycling; it pursues recoupling, by acknowledging and embracing the link between economy and ecology rather than attempting to decouple it. My policy-philosophy has allowed to rethink the CE fundamentally while remaining practicable, satisfying the demand for far-reaching *and* rapid change in light of the climate and ecological crisis. I will recap my argument here before reflecting on its wider implications in the next sections.

In the first chapter, I have outlined the problems of unsustainability and pointed out that there is a gap in the research on the CE between policy analytical and philosophical approaches. To approach this middle-ground, I have adapted and synthesized a methodology from Hoppe's (2010) policy philosophy, Briggle's (2016) policy turn for philosophy, and Poole's (2018b; 2018a) philosophical criticism the United Nations (UN) Sustainable Development Goals (SDGs). This approach develops philosophy from policy, by explicating and critiquing the worldviews embodied in the language of documents, and makes philosophy relevant for policy, by formulating policy recommendations. Being both hermeneutic and normative, it consists in arguing what the CE could and should mean in the EU.

I started to apply this approach in chapter two, where I conducted a discourse analysis of CE policy in order to understand how it is conceptualized in the EU. Comparing the EU's 2020 CE action plan to the 2015 one (and analyses thereof), I derived the core problem from policy: while the ecological ambition has increased significantly, this increase is not matched in the proposed actions. This means that as a policy the CE constitutes an unstructuring problem

and needs to be rethought. Not even on a conceptual level does the 2020 action plan come to close to achieving its sustainability goals. It relies on poorly articulated and inappropriate means, such as the recycling circularity, and delusional ends, such as decoupling. Therefore, I have reframed these two concepts in the following chapters through hermeneutic and normative philosophical argumentation.

In the third chapter, my argument has been that we could understand circularity as a strong ecomimetic approach rather than recycling because it speaks to the biological language of restoration and regeneration inherent to the European CE. It has also been that we should understand it in this way because taking ecological principles and values as a measure is conducive to sustainability and philosophically defensible: if the goal of this ethics is limited to sustainability and nature conceived of terms of ecology, it neither commits the naturalistic fallacy nor presupposes a perfection of nature. The implications of this approach for the CE policy are that it must not focus on products in isolation but adopt a holistic systems perspective. Its relationality mandates integrating global concerns, such as illegal waste-shipments, and pursuing the relation of the CE beyond the geographic boundaries of Europe. Lastly, the ecological value of limitedness is at odds with the ambition of economic growth.

For this reason, I have reframed decoupling, in chapter four. I argued that we should not understand the CE to pursue unlimited growth by (in vain) attempting to decouple growth from pollution, but to recouple economy with ecology, which means to embrace this relation by basing economy on ecology. Drawing on a theoretical framework from Social Ecological Economics, I have then defended recoupling against philosophical objections, such as violating the ontological heterogeneity of economy and nature or leading to ecofascist Malthusian population thinking. This characterized the CE as an ecomimetic economy which makes the inherent connection between economy and ecology explicit and places the economy in its ecological context as an act of intentional self-limitation. Finally, I outlined a window in EU policy for such philosophy of the CE via the modified bioeconomy strategy. Since the economic growth paradigm is in crisis and its hegemony waning, this window might be open, but we be careful not to sustain an ecofascist Fortress Europe. In the next, section I will reflect upon the implication of this argument.

2. Reflecting on the CE…

Taking a step back and answering my twofold research question: does the CE in the EU provide an answer to the problems of unsustainability and if not, how could it be conceptually improved? The answer to the first part is a clear no: While the new action plan is much more ambitious in the ecological dimension and acknowledges the urgency and depth of the problems, it undertakes neither the practical nor intellectual works necessary to address ecological problems adequately. However, the CE could be part of the solution. The frequent appeals to nature, the biological language, loops which are modelled after and intersecting with the ecosphere, all this points to another underlying biomimetic approach or worldview inherent to the CE in the EU, which would be much more conducive to its sustainability. This approach can be consistent articulated as a strong form of biomimicry which is based on imitating principles or values from ecology. According to this ecomimetic approach, the CE should not focus on products on isolation and pursue economic growth or attempting to decoupling. It would be based on a holistic systems perspective and seeking to recouple the economy with ecology and its limits. So, the answer to the second part of my research question is, the CE can be improved by reconceptualizing it as an ecomimetic economy.

Such reconceptualized CE can be seen as grounding Boulding's (1966) space-ship earth. It grounds the idea which has been floating out there and 'coming' for over half a century in present policy. Moreover, while the space-ship was considered "thought-provoking" and "a metaphor", it lacked theoretical grounding. For instance, the question how a closed system is supposed to be defined leaves room for speculation (Spash 2013a, i, 6, 19). Strong ecomimicry avoids the predicament of closing loops or systems and provides a consistent articulation beyond metaphoric value. It leads the way towards finding our "place in a cyclical ecological system which is capable of continuous reproduction" (Boulding 1966, 7–8) – by following ecological principles and basing our economy on them. My arguments can be understood as grounding Boulding's spaceship in EU policy and ecomimetic philosophy. In turn, the imagery of the spaceship is helpful to illustrate the implication of this argument, for the future philosophy and policy of the CE in the EU. In the next subsection, I will reflect on the societal and scholarly implications of the CE as an ecomimetic economy through four senses of grounding: earthing, running aground, prohibiting or landing, and basing on. Then, in the second subsection, I will reflect on my approach, and a final sense in which I ground the space-ship by rooting the philosophy in policy, considering strengths, weaknesses, and future directions.

2.1 … as an Ecomimetic Economy…

The most fundamental implication of ecomimicry concerns the relation between human, economic, and natural, ecological, systems. In the EU, these have been considered apart, even within the context of the CE. Closing material loops, for instance through recycling, can be conceived as an economic operation internal to human systems. However, the ecomimetic philosophy of the CE, which I have argued for, requires to think of ecology and economy as coupled. It also challenges the manner in which humans relate to nature. Formerly, as Veraart and Blok (2021, 178) critically pointed out, the CE could be seen as system of control over it. The implicit assumption was that humans would overcome ecological problems through their ingenuity in engineering and innovation. Such perspective is not compatible with my reconceptualization of the CE as an ecomimetic economy. Janine Benyus (1997, 9) conceives of biomimicry as another industrial revolution, a "returning home to earth". Whereas circularity as closing material loops was a mechanistic, engineering interpretation belonging to the industrial revolution, following Benyus, the ecomimetic one offered by me is organic, ecological. Especially in the strong sense, ecomimicry subjects humans and their economy to ecological principles. Rather than overcoming it, we need to learn from and be guided by the ecological system we live in, which presupposes an attitude of humility and not of control. We can understand this implication to be mean is that we should *earth* the space-ship in ecological systems of the planet. Given the techno-optimistic space-exploration rhetoric, this requires rethinking the CE considerably.

This implication of earthing is also relevant for the philosophy of technology. It might require rethinking what technology is and could be seen as a paradigm-shift. Under the paradigm of the empirical turn, technology is often conceptualized in "engineering-oriented" or "society-oriented" terms (Brey 2010, 41), as "artifacts" or 'things' (Verbeek 2005, 3). Usually biomimicry is also considered to be technology (Blok and Gremmen 2016), but does this also include the ecology-oriented, ecomimetic circularity based on principles or values? Blok (2017) and others have argued, yes, but according to them "earthing technology" implies a paradigm shift, a "terrestrial turn", which "theorizes [technology] explicitly in its planetary context and as a planetary phenomenon" (Lemmens, Blok, and Zwier 2017, 123). However, their Anthropocenic notion of earthing technology is more metaphysical and global than the European and science-based ecomimicry I have argued for. My sense of earthing walks a middle ground between the concrete and abstract. It could be seen as closer to Bruno Latour's (2018) notion of "down to earth", which proposes to understand large political, technological

or scientific issues as always related and embodied in a local, concrete context. This initial debate shows that earthing has far-reaching implications for the philosophy of technology. Whether or not it constitutes a paradigm-shift, the notion of earthing technology and the question concerning strong ecomimicry both warrant further research.

Further, the ecomimetic link between ecology and economy concerns sustainability. To delimit this thesis, I have investigated whether the EU's CE can be ecologically sustainable. However, if ecology and economy are linked, an exclusive focus on only the ecological dimension will not suffice. For instance, a recent Oxfam report finds that over half of the carbon in the EU was emitted by the wealthiest 10% of the population and that this is the only demographic whose emissions have increased in the last 30 years (Tim Gore 2020). It appears that economic inequity is ecologically highly unsustainable. On the flipside, in the previous chapter, my argument has run across such intersections between ecological sustainability and socio-economic justice: along with ecological limits to the economy comes the dangers of ecofascism, embodied in Hardin's life-boat or the fortress CE. Given the ecomimetic implication of an organic worldview on which I just reflected, this does not become less important. From the outset, fascists such as Benito Mussolini were clear that "fascism desires the State to be strong and organic" (Mussolini and Gentile 1932, 20). Organic thinking remains one of the easiest ways to recognize modern fascists (ContraPoints 2017a; 2017b). As our thinking and economy become more organic and sustainable, we must remain wary not to undo achievements in justice: We should rather *run* the space-ship *a ground* on the hard rocks of justice than staying "Adrift in a Moral Sea" (Hardin 1974).[69] So while I focused on the ecological dimensions, this thesis is an argument for further research on sustainability from the standpoint of justice, and especially on the link between sustainability and justice.

Ecomimicry also has economic implication and requires an upheaval of our fundamental economic policy. As I have discussed, ecomimicry is at odds with unlimited growth. This should not come as a surprise: an unlimited growth model is unlikely to be regenerative and there is something deeply uncircular about linear or exponential growth itself. If the point of the CE is to change the economy from linear to circular, of course this involves a fundamental reorientation. To expect otherwise, would be wanting to have the cake and eating it, while claiming to go on a diet. Ecomimicry only recommends that this diet should be plant-

[69] If you take issue with the negative or destructive implications of this metaphor, it would have been possible to understand grounding here as 'firming in justice' or 'deflecting the charge'. But I would argue that we should rather have no CE than one that sustains Fortress Europe. In my philosophy of the CE, sustainability will not serve as a justification (however slippery) for fascism.

based if you excuse this metaphor. In practice, this raises further questions, such as when does economic growth need to stop? This requires empirical research but given the current state of ecology and the climate, a plausible answer might be: a while ago. It seems that we have left (or at least are on course for leaving) the safe-operating space for the economy. So maybe we ought to *prohibit* the spaceship from crossing this space or even *land* it, if we have crossed it already. These senses of grounding are supposed to convey that an ecomimetic economy might not only need to stop growing but shrink. It could entail, what has come to be understood as degrowth, an intentional reduction of economic and industrial activity.

This implication opens-up future avenues for joined research on degrowth and the CE. Even though degrowth and CE researcher initially concurred on the need for a sustainable economy (Charonis 2012; Hobson and Lynch 2016), the fields have more recently drifted apart because of a disagreement about economic growth (Valenzuela and Böhm 2017; Hobson 2021; Genovese and Pansera 2021). My argument moves this disagreement out of the way (the CE should not pursue growth): In practical terms, degrowth offers tactics and policies for shrinking the economy in line with ecological sustainability and justice (D'Alisa, Demaria, and Kallis 2014), whereas the CE constitutes an already present policy strategy. On the more theoretical side, the ecomimetic economy is an economic model which also captures human-nature relations, which both remain undertheorized aspects in degrowth (D'Alisa and Kallis 2020; Heikkurinen 2021), while degrowth conceptualizes holistic transformational processes towards a circular society (Calisto Friant, Vermeulen, and Salomone 2020; Romano 2019). Both scholarly fields stand to benefit from my argument.

Besides such academic synergy, ecomimetic and degrowth economies are be implicated in the same wider societal transformation. Recall from Schmelzer's (2015) historical argument in the previous chapter that economies started growing in absolute terms only after the industrial revolution. Moreover, the pursuit of growth became economic ideology with the New Deal and during Cold War under Keynesian economics. As pointed out above, ecomimicry can be seen as another industrial revolution and the CE is certainly embedded in a new European Green Deal. The same societal changes which would lead to an ecomimetic economy could also lead to a new post-growth economic ideology.

These changes might even challenge the concept of the economy. Defined by (Post-)Keynesian economic expertise, 'the economy' is currently understood as the national aggregate of production or consumption (measured by the GDP) (Schmelzer 2015, 264–65; Mitchell 1998; 2005). As I have argued, an ecomimetic economy introduces a new ecological expertise to our understanding of 'the economy'. Consistent with its underpinning in Social

Ecological Economics, it *bases* the spaceship in a different scientific framework than conventional economics. This new expertise might transform our conception of 'the economy'. Indicators for such tectonic conceptual shifts are that the CE is not mainly driven by economists but sustainability professionals (Andersen 2007; Henry *et al*. 2021). Moreover, most circular activity does not happen at the national level (Ghisellini, Cialani, and Ulgiati 2016; Kirchherr *et al*. 2018): As my analysis and examples show, it is predominantly supra-national institutions, such as the European Commission, or local companies and municipalities, like Ecovative and Metabolic, which seek to establish circularity. It could be that these overarching frameworks und local frontrunners will eventually converge on the national level, when economists become interested (or fade into oblivion if they do not). Still, for now it seems that we must either consider 'the economy' in less national and economic terms, or circularity less in terms of 'an economy', but possibly both. This is little more than an initial observation; the way in which circularity or ecomimicry might affect our understanding of what an economy is, warrants much more discussion. But where the CE happens also relates to the fifth and final sense of grounding.

2.2 … and a Philosophy in the EU

My approach was to *root* the philosophy of the CE (or the space-ship if you will) in EU policy and grow it from there. To bridge these disciplines, I developed a philosophy of the CE as an ecomimetic economy from and for EU policy. As the just discussed implications show, this is policy philosophy as Hoppe would argue. It raises and responds to deep questions about values or worldviews inherent in the policy and constitutes a mega-strategy: an organic framework beyond control and economic growth. Such philosophy can also be operationalized on a tactical level and thus remains relevant to policy and stakeholders, required by Briggle's policy turn: for instance, the criticism of product-centric policy is intrinsic to the CE action plan, the relation to the bioeconomy policy concerns its immediate context, and the connection to the Fortress Europe the wider background policy. The philosophy could and should be relevant for the EU and creates room for possible alliances with the degrowth movement. My approach can be considered a success.

But the success of this policy philosophy is limit by being monolithic. The philosophy in the EU was supposed to be compatible with other CE philosophies or policies and I have been successful in maintaining external plurality. My discussion of waste-shipments and the immigration shows, an ecomimetic economy is able to interact with the world outside the EU without imposing this philosophy on it. I limited the philosophical 'we' to Europeans, but what

if we Europeans are not a sufficiently homogenous group? My discussion centered around EU policy, but as a complex supranational institution, the EU must balance various conflicting lower-level interests. While I think ecomimetic circularity can be of value at these levels too, there are open questions: should businesses not aim for economic growth, even when the overarching economic framework does not change? My approach has not paid sufficient attention to internal plurality and how to include diverse lower levels or accommodate conflict, even though much of the CE happens at the scale of companies or municipalities. The philosophy of the CE in the EU should engage lower-levels in the future.

However, upon reflection, there is tension between the philosophy and policy which is not easily resolved by more of the same. While philosophy requires clarity and internal consistency, policy allows for strategic ambiguity and deliberate vagueness. It appears that clarity and consistency are more desirable, but ambiguity or vagueness can be used deliberately and strategically to build support across various levels, which is of vital importance to govern effectively, in democratic multilevel-institutions. This shortcoming is also reflected in the hermeneutic and normative methodological structure of my approach: only because the CE in the EU could and should be understood as an ecomimetic economy by no means implies that it will, especially in light of the internal plurality and potential conflict.

So what is the role of philosophy in regard to governance or policy-making? Hoppe (2010, 190) would argue that there is opposition but no tension: policy philosopher with their argumentative style should keep a distance from politics. They are concerned with puzzling, not powering. Even though unstructured problems require powering-oriented approaches, such as interactive or participatory styles, these are for non-philosophers (Hoppe 2010, 192). The relation between philosophy and politics is complicated, but claiming to have no politics is also political.[70] I am more inclined to agree with Briggle (2022, 204), who argues that philosophy adheres to an extremely liberal "politics of serendipity" where philosophical insights are supposed to have an impact on "real-time, real world issues" by making good arguments and hoping for the best. According to Briggle's view such liberalism is insufficient, and philosophy should not keep a distance from politics.

Indeed, the policy turn proposed by Briggle (2016) is supposed to close this distance

[70] Hannah Arendt (1990, 73) famously stated that "the gulf between philosophy and politics opened historically with the trial and condemnation of Socrates". That separation being one of the reasons why she did not call herself a philosopher. On a personal note, during my studies three separate professors mentioned that philosophy should play no part in politics based on the same two examples, the killing of Socrates being one and Heidegger's Nazism the other. In line with Arendt, I would argue that Heidegger's Nazism is all the more reason to be political. In any case, how to delineate the public sphere is the most fundamental political questions, which cannot be avoided.

by engaging stakeholders. However, at further reflection, the name 'policy-turn' is somewhat misleading, because it is not a turn towards policy. This would again mostly change what philosophers talk about (policy) and only a be a minor addition to whom they talk to (policy-makers). Rather, he wants philosophers to work "in dynamic partnerships with a range of people that might include parents, community groups, elected policy makers, bureaucrats, scientists, engineers, farmers, architects, manufacturers" (Briggle 2016, 172). Policy making is not suitable for such purpose, because it is a highly professionalized and esoteric domain (as I experienced first-hand by tracking through EU documents). Based on this policy philosophy, the stakeholders I could engage with is the European Commission, the EU's upper-most legislative-executive branch. Reflecting on this, I think this exclusive, high-level focus is insufficient. I would argue, what would be a better approach and what Briggle really has in mind is a *polity*-turn, that addresses and engages all of the community, rather than just policy makers.

A further reason to go beyond policy making is being pragmatic which is ironic because policy recommendations are appealing for their pragmatic impact: I wanted to make recommendations for EU policy to improve the sustainability of the CE realistically. Yet, as Spash (2013b, 355) has remarked in regard to such pragmaticism, "civil protest and organised social resistance are the best approaches, to achieving environmental policy change, and just as pragmatic", but of a less (neo-)liberal political ideology. To be relevant and have a pragmatic impact, it is not advisable for philosopher to only puzzle alongside the policy makers. For philosophy to be relevant to the polity, and thus more deeply rooted in the policy, it should also grow from the grassroots and engage with movements there.

From this reflection, I conclude that policy philosophy is a highly valuable enterprise, however in the future I think we should interpret it more broadly. The philosophy of the CE in the EU also needs less liberal, more powering-oriented approaches that do not only work strictly with policy-makers, but also oppose them alongside heterogeneous stakeholders on various levels. In other words, I think it is necessary to take the concerns about the political unwillingness to change back up, which I set aside at the beginning of this thesis. But now I think that philosophical approaches can play a role in this political struggle. This does not so resolve the tension between philosophy and policy than embracing (or, I dare say, recouple) it: As Briggle (2015, 12) argues "once you are advocating for a cause, doubt and questioning, arguably the philosopher's bread and butter, become liabilities…it's a pickle". In face of the ecological and climate crisis, philosophers may not hide in their armchairs, but must bite into the butter-pickle-sandwich.

3. Conclusion

My philosophy of the CE in the EU as an ecomimetic economy can help to achieve its ecological ambitions. But this entails major changes to the CE as it is currently conceptualized in EU policy. Most fundamentally, it constitutes a Copernican turn in of how we relate to nature through the CE: Not as separate from or in control of, but humbly finding our place within it. This could very well lead to the insight that we are taking up too much space. The philosophy of the CE is by no means finished and implementing it in the EU would require astronomic efforts. I have discussed some of these difficulties as well as potential response in the final chapters, both politically and scholarly. This discussion is neither definitive nor does it make the problems disappear, but this should not be reason for discouragement. The self-proclaimed point of this policy is to tackle issues which by the EU's own admission are monumental and generational. So far, the EU has not acknowledged the CE as an unstructured problem and avoided making hard choices. My argument has clarified that this is not possible: either this is a new deal or business as usual, either it changes the fundamental orientation of the economy, or it stays linear. If this is to be Europe's man on the moon moment, as Commissioner von der Leyen claimed, she would be wise to remember Kennedy, Armstrong, and Boulding: We do not shoot for the moon because it is easy. Small steps can go a long way, but we must get our priorities straight this time. Instead of shooting for the moon, we should ground the space-ship and look down to earth. Because the right policies will not come by themselves, philosophers should do more than point in the right direction from a distance and hope for the best

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Appendix 1: Full Comparison of 2015 and 2020 Action Plans

This appendix contains the full analysis of the 2015 and 2020 EU CE action plan's bodies, which I use basis for section 2.2, in Chapter 2. My analysis is oriented around comparing and contrasting their respective table of contents, discussing overlap and changes section by section. Since the 2015 did not include a table of contents, I have recreated one in the style of the 2020 plan for it, highlighting similarities (see Table A1.1 below) and differences (see Table A1.2 below). Moreover, I have also conducted a brief quantitative analysis of actions proposes (see Table A1.3) as well as frequency of economic entities (See Table. A1.4)

When comparing the table of contents (see Table A1.1 below), what strikes me first is how many sections are virtually identical and have only received a slight make-over. For instance, Points 1 and 2 of the 2015 plan, "PRODUCTION" and "CONSUMPTION", are both subsumed in points 2 of the 2020 plan, as "A SUSTAINABLE PRODUCT POLICY FRAMEWORK" framework. The notion of product policy framework might appear promising, however looking at it more closely, I find that little substance has been added to it: It consist of "to make the Ecodesign framework applicable to the broadest range of products and make it deliver on circularity" (COM 2020, 4), however as discuss already in the main body, this idea is almost identically worded in the older plan (COM 2015, 4). Section 2.3, like in 2015 focuses on "industrial symbiosis" (without concretizing it further) and so adds little new to the production process besides considering the possibilities of bio and digital technologies (COM 2020, 6).

Worse, with the move in section 2.2. from consumption to consumer empowerment, the new action plan focuses on a much narrower set of action. The new plan purports to influence consumption through information such as labelling regulation and repairability of products (COM 2020, 5–6), while the old plan also discussed pricing and other economic measures as well as the possibility of a collaboration economy that would facilitate the sharing of production activities (COM 2015, 7).

So, in its first section, the 2020 action plan adds a little more in terms of sustainable product design, remains more or less constant in regard to the production process, and focuses significantly less on consumption. This latter cut is so significant that the sustainable policy framework of the 2020 is 2 pages shorter than section 1 and 2 of the 2015 plan. Instead of offering a more ambitious vision, the new plan might be less comprehensive in terms of production and consumption.

Table A1.1: Comparison of the 2015 and 2020 Action Plans' Table of Contents

CE 2015	CE 2020
Introduction	1. INTRODUCTION
1. PRODUCTION 1.1 Product design 1.2 Production process	2. A SUSTAINABLE PRODUCT POLICY FRAMEWORK 2.1. Designing sustainable products 2.2. Empowering consumers and public buyers 2.3. Circularity in production processes
2. CONSUMPTION	3. KEY PRODUCT VALUE CHAINS 3.1. Electronics and ICT 3.2. Batteries and vehicles 3.3. Packaging 3.4. Plastics 3.5. Textiles 3.6. Construction and buildings 3.7. Food, water and nutrients
3. WASTE MANAGMEENT	4. LESS WASTE, MORE VALUE 4.1. Enhanced waste policy in support of waste prevention and *circularity* 4.2. Enhancing *circularity* in a toxic-free environment 4.3. Creating a well-functioning EU market for secondary raw materials 4.4. Addressing waste exports from the EU
4. FROM WASTE TO RESOURCES	5. MAKING CIRCULARITY WORK FOR PEOPLE, REGIONS AND CITIES
5. PRORITY AREAS 5.1 Plastics 5.2 Food waste 5.3 Critical Raw Materials 5.4 Construction and demolition 5.5. Biomass and bio-based products	6. CROSSCUTTING ACTIONS 6.1. Circularity as a prerequisite for climate neutrality 6.2. Getting the economics right 6.3. Driving the transition through research, innovation and digitalization
6. INNOVATION, INVESTMENT, AND OTHER HORIZONTAL MEASURES	7. LEADING EFFORTS AT GLOBAL LEVEL
7. MONITORING PROGESS TOWARDS A CIRCUALR ECONOMY	8. MONITORING PROGRESS
8. CONCLUSION	9. CONCLUSION

Table A1.1 compares the table of contents from 2015 and 2020 action plan, by color-coding similarities and shows that most sections of the newer plan are adopted from the older one.

Something similar applies to the following sections. While the 2020 plan does not discuss section 3., "WASTE MANAGEMENT," and section 4," FROM WASTE TO RESOURCES", of the 2015 plan next, it incorporates them in its section 4, "LESS WASTE, MORE VALUE". Again, this appears to signal their integration into a unified framework. However, once more, rather than expanding on two sections from the 2015, their combination in the new plan is three pages shorter. This brevity constricts the concreteness of actions. For instance, the older plan includes concrete statistics on recycling: "only around 40% of the waste produced by EU households is recycled ... with rates as high as 80% in some areas, and lower than 5% in others"(COM 2015, 8–9). Based on such data, it proposes to put nuanced

> Waste management [and] waste hierarchy into practice. The waste hierarchy establishes a priority order from prevention, preparation for reuse, recycling and energy recovery through to disposal, such as landfilling (COM 2015, 8)

By contrast, the newer plan merely stipulates the need for "enhanced waste policy", but does not provide an enhanced policy, in its corresponding point 4.1 (COM 2020, 12). Furthermore, it states the ambitious goal of "decoupling of waste generation from economic growth" and acknowledges this "will require considerable effort across the whole value chain and in every home" (COM 2020, 12). However, it does not say where this effort will come from and what it will look like, besides briefly mentioning an "extended producer responsibility scheme" and harmonized "separate waste collection system" COM 2020, 13). It is left unclear how extending producer responsibility and a waste collection system could decouple waste generation from economic growth. The other two subsections, 4.2 and 4.3, of the 2020 plan respectively contain brief updates on actions from the older report, such as a "non-toxic environment" strategy (COM 2015, 12), and facilitating a "secondary raw material" utilization (COM 2015, 11), but offer nothing comprehensively new. .

Only section 4.4. of the 2020 plan provides a truly new and concrete field of action: While the older plan briefly meantions the problem of"illegal transport of waste" (COM 2015, 10), the newer one develops this point and proposes to provide new "EU rules on waste shipment" (COM 2020, 15). This is a laudable addition, not only because it addresses matters of global justice related to the CE, but also because it is the kind of new action I expect in line with the increased ambition. Here the newer plan takes a brief problem from the older plan, sets an ambitious value for it, and delivers a new section that it addresses this matter concretely. However, this positive example is also negatively revealing because I find little else in the 2020 plan that lives up to it, especially related to the environmental ambition. Mostly, it consists of

minor updates or small additions to the old plan. Sometimes the new plan is even smaller scope or adds vague ambitious statements like decoupling.

Most symptomatic, for the comparison of the bodies are the sections 3. “PRIORITY AREAS” or 5. “KEY PRODUCT VALUE CHAINS”. In these sections, I see the most changes from 2015 to 2020 (see Table A1.2 below). But even though the newer plan now speaks of the need for “urgent, comprehensive and coordinated actions” in “response to the climate emergency” (COM 2020, 6), it only expands the scope of the older plan slightly: It revises some areas (from plastics to packaging and from demolition to buildings), and adds few key value chains, such as electronics, ICT, batteries, vehicles, textile. Despite the greater ambition reiterated in this section as an urgent emergency, the newer plan is in continuation with the older. Applying the 2015 plan more broadly does not have potential to fulfill the 2020 ambitions. Moreover there is a shift from the wider focus on “sectors”, where “interaction between the various phases of the cycle are fully taken into account” (COM 2015, 13) to “product value chains” (COM 2020, 6). While value chains address products admittedly in a broad manner, they nonetheless have a smaller conceptual scope than areas or sectors. So the expansion in the 2020 plan in quantitative terms – more products – also contains a qualitative retreat from a more holistic approach. need for “urgent, comprehensive and coordinated actions” in “response to the climate emergency” (COM 2020, 6), it only expands the scope of the older plan slightly.

Towards the end, there is continuation as well as some additions from the older plan to the newer. The 2020 sections 6. “CROSSCUTTING ACTIONS” as well as 8. “MONITORING PROGRESS” are almost identical to the 2015’s point 6., and 7: both envisions horizontal or cross-cutting actions with other strategies, consider sources of investment and financing, and how innovation or research could be beneficial to the CE. These sections are in continuation with the older plan. A small but curious addition to the topic of research in the newer plan is 6.1. “circularity as a prerequisite for climate neutrality” (COM 2020, 16). Under this point, the new plan purports to “analyse how the impact of circularity on climate change mitigation and adaptation can be measured in a systematic way” and “improve modelling tools to capture the benefits of the circular economy on greenhouse gas emission reduction” (COM 2020, 16). This point is revealing, not only because it reiterates the ambitious goal of climate-neutrality, but also because it considers circularity as a prerequisite to achieve this, even though it admits that the impact currently cannot be adequately measured or modelled. In the 2020 plan, the circular economy or circularity is just assumed as necessary for solving the climate crisis and evidence should be collected in a way that makes this assumption plausible.

Table A1.2: Contrast of the Action Plans' Table of Contents 2015 and 2020

CE 2015	CE 2020
Introduction	1. INTRODUCTION
1. PRODUCTION 1.1 Product design 1.2 Production process	2. A SUSTAINABLE PRODUCT POLICY FRAMEWORK 2.1. Designing sustainable products 2.2. Empowering consumers and public buyers 2.3. Circularity in production processes
2. CONSUMPTION	3. KEY PRODUCT VALUE CHAINS 3.1. Electronics and ICT 3.2. Batteries and vehicles 3.3. Packaging 3.4. Plastics 3.5. Textiles 3.6. Construction and buildings 3.7. Food, water and nutrients
3. WASTE MANAGMEENT	4. LESS WASTE, MORE VALUE 4.1. Enhanced waste policy in support of waste prevention and *circularity* 4.2. Enhancing *circularity* in a toxic-free environment 4.3. Creating a well-functioning EU market for secondary raw materials 4.4. Addressing waste exports from the EU
4. FROM WASTE TO RESOURCES	5. MAKING CIRCULARITY WORK FOR PEOPLE, REGIONS AND CITIES
5. PRORITY AREAS 5.1 Plastics 5.2 Food waste 5.3 Critical Raw Materials 5.4 Construction and demolition 5.5. Biomass and bio-based products	6. CROSSCUTTING ACTIONS 6.1. Circularity as a prerequisite for climate neutrality 6.2. Getting the economics right 6.3. Driving the transition through research, innovation and digitalization
6. INNOVATION, INVESTMENT, AND OTHER HORIZONTAL MEASURES	7. LEADING EFFORTS AT GLOBAL LEVEL
7. MONITORING PROGESS TOWARDS A CIRCUALR ECONOMY	8. MONITORING PROGRESS
8. CONCLUSION	9. CONCLUSION

Table A1.2 compares the table of contents from the 2015 and 2020 action plan by highlighting changes, which shows that most addition pertain to expanding in the CE to more areas and adding social concerns, whereas little new substance is added to environmental one.

Section 5 and 7 of the 2020 plan constitute additions to the 2015 plan. In "MAKING CIRCURLARITY WORK FOR PEOPLE, REGIONS, AND CITIES", the newer plan adds to social benefits and "a just transition", through "job creation" and "launching a pact of skills" to its commitments (COM 2020, 15). And in "LEADING EFFORTS AT A GLOBAL LEVEL", it aims to share knowledge and resources in order to create "partnership initiatives" (COM 2020, 18). These actions might be far from perfect, but they at least constitute clear additions to the 2015 plan and a concrete attempt to meet the EU's new social ambition of a just CE, domestically, as well as on a global level. As such they provide a valuable backdrop to evaluate the environmental efforts or rather lack thereof.

The comparison of the 2015 and 2020 plan's bodies yields the clear result that the scope of the actions has not significantly increased. For the most part, the newer plan just continues the trajectory of older plan and only proposes minor revisions to its efforts (see Table A1.1 above). Concrete new additions are mostly limited to matters of social goals (Table A1.2 above), whereas environmental ambitions are restated throughout the body without proposing actions that could achieve these: such as decoupling waste generation from economic growth or achieving climate neutrality through circularity. The 2020 plan offers few actions that go beyond the 2015 in terms of sustainability.

Indeed, in a few places the 2020 plan appears less developed in this matter. Both its section 2 and 3, do not integrate their respective counterparts from 2015, but are shorter and less comprehensive. Their shortness is also not compensated by greater density, as the 2020 plan proposes 19 actions less than the 2015 one but has 5 reviews to the 2015's single one (see Table A1.3 below). Moreover, the review of the 2015 plan was to the bioeconomy, which as considerably reworked to harmonize with the CE (as argued in chapter 4). The new action thus provides both fewer actions in total as well as fewer originally new actions.

Table A1.3: Actions Proposed by EU CE Action Plans

Amount	2015	2020
Total	57	35
Review	1	5

Tables A1.3 comparatively lists the amount of actions proposed by the 2015 and 2020 EU CE action plans. The 2015 not only proposes more actions in total, but also fewer reviews.

Besides this quantitative reduction, there is also qualitative narrowing of scope: the 2020 plan moves the focus away from a more holistic economic perspective to one almost exclusively based on products. Whereas the older plan considered "PRODUCTION", "CONSUMPTION", and "SECTORS", the newer focuses on "PRODUCTS" and their "VALUE CHAINS". Even though the older report is longer, the new report mentions the words product or products considerably more often (see Table A1.4 below) The drawback of this shift of focus is that other aspects are considered less. For instance, the new report meantions the words production, process/es and producer less than the new one. Thereby aspects of production that are not directly linked to products, such as the processes that are needed to make or distribute them or the responsibiltiy of producers are considered less. This becomes even more problematic when the consumption side is taken into account. Even though the 2020 action plan contains the word consumption actually more often than the 2015 one, it serves almost exlusively as a desiderata, not as a proposed measure: The goal is to "keep consumption within planetary boundaries, and therefore strive to reduce its consumption footprint" or that the "consumption of plastics is expected to double in the coming 20 year" is considered as problem, but no action or solution to is proposed (COM 2020, 2; 9).

Table A1.4: Comparison of Economic Entities

Words	**2015**	**2020**
Product/s	79	91
Production	14	8
Process/es	15	9
Producer	8	4
Consumption	9	12
Consumer	12	5
Consuming	3	1

Tables A1.4 compares the frequence of words related to production and consumtion between the two action plan. The 2020 plan meantions the terms product or products much more, but other words much less often than 2015 plan

This approach is exemplified best by the following quote

> The plan presents a set of interrelated initiatives to establish a strong and coherent product policy framework that will make sustainable products, services and business models the norm and *transform consumption patterns so that no waste is produced in the first place* (COM 2020, 2, my emphasis).

Here the action plan states the ambition to change consumption, but immediately shifts the focus back to production. All solutions are products or belong to the production side. In contrast, COM (2015, 7) discusses “innovative forms of consumption” and proposes action which

> support the circular economy in each step of the value chain – from production to consumption, repair and remanufacturing, waste management, and secondary raw materials that are fed back into the economy (COM 2015, 3)

Besides this qualitative different use of consumption, the older plan also uses the word consuming or consumers, which require a shift of perspective to the consumption side of the economy, much more. It talks about how the “choices made by millions of consumers can support or hamper the circular economy” or that a circular economy could imply a “collaborative economy”, where consumers work together (COM 2015, 6–7). The focus on products in the newer action plan leads to neglect of other economic entities and actors.

Appendix 2: The Conceptual Roots of the CE

In this Appendix to Chapter 3, I elaborate on the relation between the CE and biomimicry. I argue that the appeals to nature are not accidental but that a biomimetic approach is rooted at the intellectual core of the CE. A good place to start for such argument is looking at its conceptual origins. While the CE consists of a notable mix of ideas from heterogenous sources,[71] the EMF (2015, 46) recounts its own history of ideas in the influential Growth Within report:

> Major schools of thought related to the circular economy emerged in the 1970s but gained prominence in the 1990s. Examples include the functional service economy (performance economy) of Walter Stahel; the "cradle to cradle"® design philosophy of William McDonough and Michael Braungart; biomimicry as articulated by Janine Benyus; the industrial ecology of Reid Lifset and Thomas Graedel; natural capitalism by Amory and Hunter Lovins and Paul Hawken; and the blue economy systems approach described by Gunter Pauli.

Let's unpack these, one by one, starting with what I consider the outlier. The performance economy promotes dematerialization of the economy by shifting the focus from products being bought to service which can be rented (Stahel 2010). In my view, even though this approach has become a hallmark of the CE, it is not characteristic for circularity. It is more often associated with the sharing economy, which, as sustainability scholars Marvin Henry *et al.* (2021) argue in a comparative literature review, was recently absorbed by the CE. This view is affirmed by Stahel himself who considered the performance economy a third model besides the linear and circular economy (2016, 436). The conceptual difference is that the sharing or performance economy is less concerned with the flows of good and resources, and rather offers a new model of consumption that is based on sharing – most commonly in the form of renting goods as services. This is often referred to as servitization or dematerialization. Of course, this idea could be rendered part of circularity through loops such as reusing, but it is an awkward fit with the rich ideas of sharing and performances. Furthermore, it overly expands the concepts of circularity and dilutes the proper meaning that could serve as an approach for the circular economy which is of interest here. Therefore, I consider the approach of the performance economy (which could be understood as dematerialization) to be related to, yet distinct from circularity (see Figure A2.1 below). However, this point is not decisive. For the present purpose

[71] Since I am interested in the specific purpose of reframing circularity for EU policy, I am focusing on a particular version of the CE that is most relevant for this purpose. As argued above the EMF can be seen as such. See Calisto Friant, Vermeulen, and Salomone (2020) for a complete overview, that does justice to the hetereogenitiy of ideas.

of outlining an alternative frame for circularity, it would also be possible to see it as different approach within circularity.

Figure A2.1: Map of the CE's Conceptual Roots

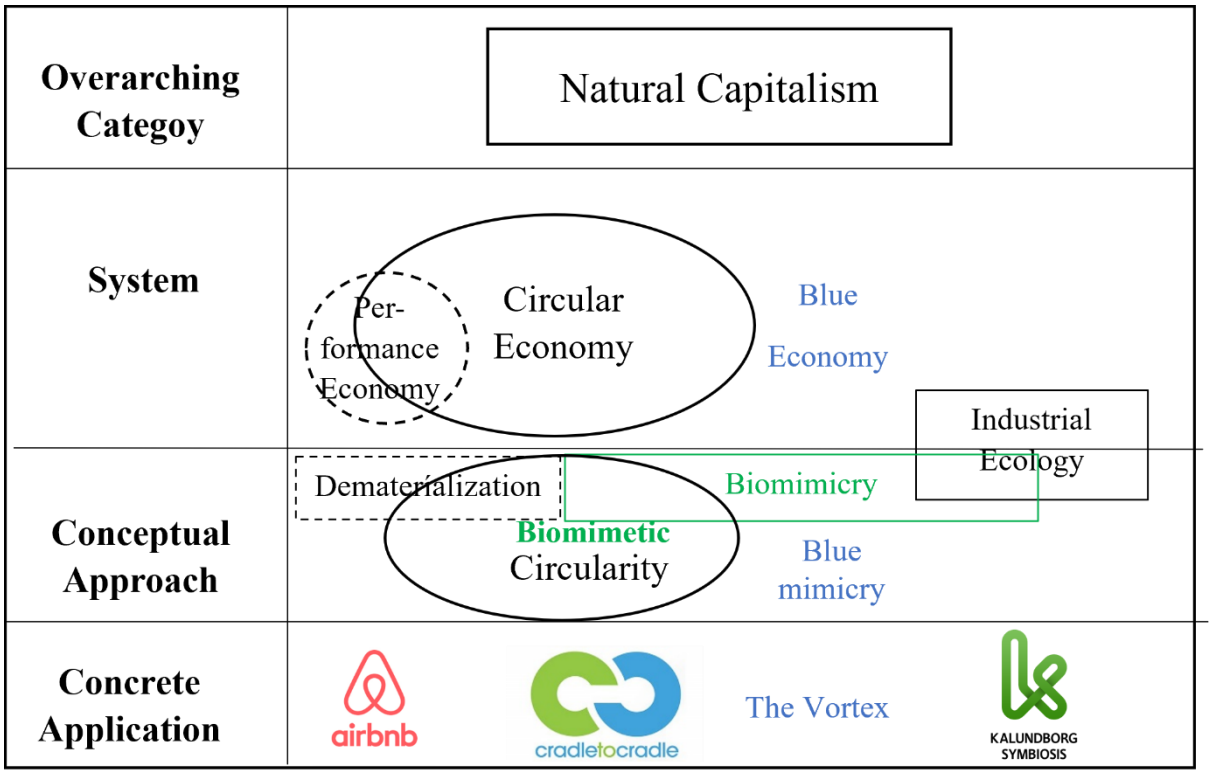

Figure A2.1 maps the conceptual roots of the CE. They are grouped vertically in different: Systems may fall under varying overarching categories and have different conceptual approaches, which can be applied in various way (even though I have provided only one example each). Horizontal distance signifies distance or (partial) overlap. Dotted lines imply the distinction is optional, whereas colors high-lights connections, across boundaries.

In any case, examining the other concepts yields a much more homogenous picture. Pauli (2010, 14) defines the blue economy as a new business model consisting of "100 innovations inspired by nature that can generate 100 million jobs over a decade" and wants to "do more with what the earth already provides". Natural Capitalism is a blueprint for a shift of the economy towards "redesigning industrial system on biological lines" and "investing in natural capital" (Hawken, Lovins, and Lovins 2013, 10–11). Industrial ecology is a field of research that attempts to bridge the apparently disparate realms of industry and ecology (Lifset and Graedel 2002, 3). While there are diverse approaches in this field, Lifset and Graedel

(2002, 3) argue that centrally "industrial ecology looks to non-human 'natural' ecosystems as models for industrial activity", which has come to be understood as the "biological analogy".[72] The core idea of biomimicry is to introduce a new way of thinking that takes inspiration from nature and imitates, "consciously emulating life's genius" (Benyus 1997, 2). A similar idea is at the heart of the McDonough and Braungart's (2002, 90) approach to design because "if humans are truly going to prosper, we will have imitate nature's highly effective cradle-to-cradle systems of nutrient flows". All of these ideas share a common denominator: Whether it is a new business model, an economic transformation, a field of research, a new way of thinking or a design strategy, they seek an ecological transformation by relying on or rather imitating nature.

Biomimicry is a central concept for the CE. It is one of its intellectual origins, but at the same time it pervades most other concepts (see Figure A2.1 above): Biomimicry is an approach that can be applied in various forms. As a specific design strategy that imitates nature's systems of nutrient flows, cradle-to-cradle is a perfect example for such concrete application – it is an instance of biomimetic circularity. This biomimetic approach would obviously undergird the CE. Parallel systems might also have biomimetic approaches. For instance the blue economy proposes innovation, "inspired by the Blue Planet Earth with a blue sky and a blue ocean" (Pauli 2010, 17). This is indicative of biomimicry based on blueness rather than circularity, let's call this bluemimicry, and for example in the business idea of Vortex, a company that developed new water cleaning-technology and was "inspired by the observation that dirty water cleanses itself as a river moves downstream" (Pauli 2010, 17). Both of these in turn can be seen as examples of the Natural Capitalism for which biomimicry is a core strategy (Hawken, Lovins, and Lovins 2013, 12–14) under which we might classify business models that have biomimetic approaches. The field of industrial ecology can be is both a scholarly research program as well as new practically minded intellectual approach to industry. As such it is located in between the system and approach level. These ambiguities notwithstanding, it also employs a biomimetic approach. Its first proponents, Robert Frosch and Nicholas Gallopoulos (1989, 144) argue that "much could be gained if the industrial system were to mimic the best features of the biological analogue".[73] This is approach is applied for

[72] Other industrial ecologists concur that the biological analogy or "the metaphor from biology", popularised by Frosch and Gallopoulos in 1989, [and] is the most important conceptual contribution of industrial ecology" (Den Hond 2000, 61). A later review goes as far to claim that the whole field "springs from what has come to be called 'the biological or ecological metaphor' (Ehrenfeld 2004, 826).

[73] There are also other aspects to industrial ecology, however the biological analogy appears to be the defining feature – see previous footnote. Yet given the debate, the conceptual map leaves open whether biomimicry is the

instance in the Kalundborg industrial symbiosis park. So all in all, biomimicry figures greatly in the CE's intellectual origins provides a clear conceptual approach for it. There might be other (un)related approaches, such as dematerialization, which can be thought of as constituting either a separate conceptual approach for the performance economy (employed by companies such as Airbnb or Uber) or alternatively as a different influence of circularity. I will remain agnostic whether biomimicry is the only approach, but it clearly a central one for the CE., which is sufficient for the argument I am making.

only approach for industrial ecology, of if there might be other ones. In the following section I will explore nuances of biomimetic approach and how analogies and metaphors factor into them.

Appendix 3: Ecological and Bioeconomics

In this Appendix to chapter four, I provide a more elaborate discussion A) on ecological economics from which I derive my conceptual framework (section 2.3.), B) on the bioeconomy as a concept and policy (section 5.1) as well as C) how ecological economics, bioeconomies, and my example from *Metabolic* about Urban Metabolism (section 2.2), relate. This not only adds depth and nuance to my use of these approaches but also shows there these are conceptually compatible.

A) (Social) Ecological Economics

Ecological economics is far from a unified field. In practice, it is characterized by a plurality of approaches and encompasses various views on the relation between human and natural systems. As the scholar of the field Clive Spash (2011) points out in a historical analysis, ecological economics has evolved out of the environmental movement in 1960s. Building on the groundbreaking work by ecologist Howard Odum, who investigated the interrelation of environment, power, and society, as well as by the economist Nicholas Georgescu-Roegen's who studied the economy from the perspective of entropy in the 1970s (Spash 2011, 351; Costanza *et al*. 1997, 56), it developed into scholarly field with an international society (ISEE) and a journal (ecological economics) with mainstream recognition (Spash 2020, 4). However, as Spash (2011; 2012; 2020) argues, in this development, transdisciplinarity has been exercised in a very weak form, or mainly consisted in a multidisciplinary approach. So instead of constituting a unified approach, in ecological economics various perspectives ranging from orthodox mainstream economics to radical heterodox voices coexist.

This coexistence is also characterized by conflict, as these perspectives not only lead to widely diverging but sometimes opposing positions. So ecological economics *per se* cannot serve as a theoretical framework for recoupling and more consistent perspective is needed. Indeed, Spash (2013b, 353) outlines three camps within ecological economics, that have "divided epistemological, methodological, and ideological positions" (see Figure A3.1 below). First, according to him, there is "new resource economics", which sees "ecological economics as nothing more but a sub-field of neoclassical economics", adopting its methodology and theories, so that "market systems are basically only in need of a few …side constraints" (Spash 2013b, 356). This approach thus provides no new theoretical underpinning, besides that nature provides resources for markets. Second, there are new environmental pragmatist, who are "primarily concerned with political impact, regardless of the means" (Spash 2013b, 356). For

such pragmatic reasons, they do not pay attention to epistemology and dismiss theory (Spash 2013b, 355). Finally, social ecological economists, to whom Spash (2013b, 357–58) counts himself, outline a theoretical position explicitly opposed to orthodox economics. They adopt a hierarchical ontology where socio-economic institutions are subordinate to nature and a strong transdisciplinary approach based on a coherent set of methods at the intersection of ecology and economy. Given these conflicting three camps, what kinds of ecological economics serves as theoretical underpinning for recoupling matters and needs to be further specified.

Figure A3.1: Ecological Economics in Three Camps

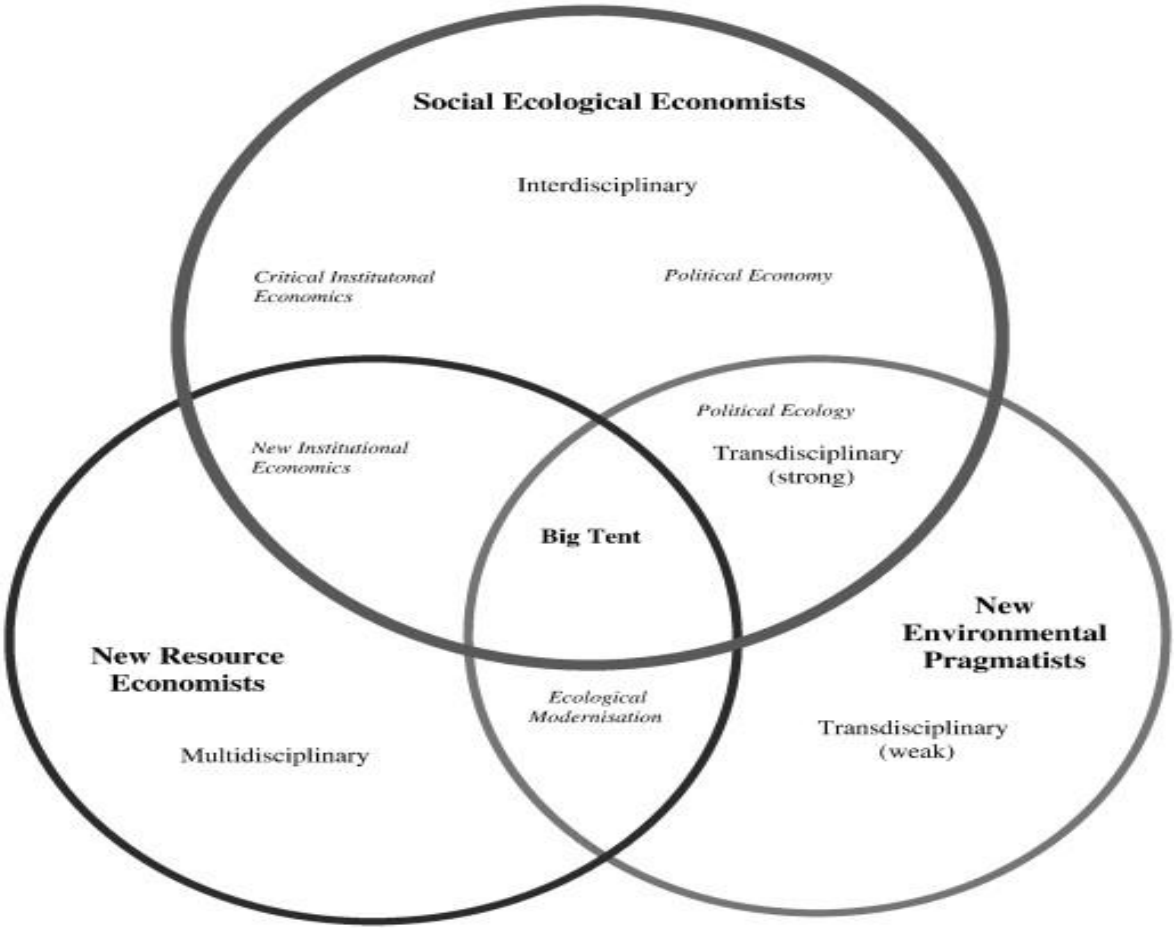

Figure A3.1, from Spash (2013b, 354)*, depicts the diverging camps in ecological economics.*

Spash's classification is not a neutral survey of the field, but part of the wider normative project he pursues over the course of various articles (2011; 2012; Spash and Ryan 2012; Spash 2013b; 2020). Broadly, his argument is that ecological economics should adopt a social ecological economist position. Tellingly, he labels only this camp in terms of ecological economics. According to him there are

> two alternative ways in which economists address environmental issues. First…as special cases of more general theoretical constructs [and s]econd, is the recognition that serious attention to environmental reality leads to the need for a totally new way of thinking (Spash 2011, 343).

New resource economics pursues the former way, which Spash (2013b, 351) describes as shallow, because it avoids more fundamental question arising from economy-ecology relations. In contrast, Social Ecological Economics engages with these "deep" matters and provides such new of thinking (Spash 2013b, 359). The middle path and pragmatist position is problematic because it avoids the question of theory altogether or advocates a pluralist perspective. However, such pluralism does not constitute proper approach and is in practice too easily overtaken by mainstream economics, not least because "orthodox economists [are] also placed in positions of power within society (Spash 2011, 364). Therefore, this second way is the right one for ecological economics, if it seeks to be an independent intellectual system, rather than extension of regular economics to the environment, which Spash (2020, 1) argues, it should, in order to realizes its "revolutionary potential".

As Figure A3.1 indicates, there are also potential overlaps between each camp as well as an encompassing big tent, making for potentially 7 positions. This suggests that ecological economics is best seen as multidimensional spectrum onto which individual scholars fall with varying degrees (See Spash and Ryan (2012) for an empirical investigation). But Spash (2013b, 359) also concludes that the Venn diagram is an oversimplification, as there should be no overlap between New Resource Economists and Social Ecological Economists, because he places the latter firmly in opposition to the former. For reasons of expositional intelligibility, I stick to this simplification. Moreover, I will later return to the potential overlap between these two camps.

B) Bioeconomies

I have argued in section 5.1 of chapter four that Giampietro's argument is ambiguous in regard to whether it is normative or descriptive. However, there is a second ambiguity, both in Giampietro's argument and the bioeconomy itself. His reasoning is based on an analysis by Vivien *et al.* (2019, 190-3), who distinguish between three types of the bioeconomy (see Table A3.1 below): Type I originates within ecological economics and is based on thermodynamic processes and biophysical limits of the planet. It envisions a "coevolution with the biosphere" for the economy" (Vivien *et al.* 2019, 194). Type II in contrast is science based and promises

that these limits can be extended through (bio)technology and innovation, which enable decoupling and economic growth. Type III lastly, also called bio-based economy, focuses on biomass which could serve as a substitute for fossil fuels. In the latter two, nature serves as an inspiration or resource for the economy. The upshot of the analysis is that there was a "semantic and conceptual hijacking" "in support the hypothesis of a perpetual economic green growth" (Vivien *et al*. 2019, 195). Even though the policy discourse adopted the idea of the bioeconomy from ecological economics (type I), it was voided of its original meaning, and now mainly refers to type II and III. So the bioeconomy is a highly ambiguous concept.

Table A3.1: Three Types of Bioeconomy

	Type I bioeconomy	Type II bioeconomy	Type III bioeconomy
Illustrative references	Georgescu-Roegen (1975a,b, 1978)	OECD (2009, 2017a,b,c)	Langeveld et al. (2010) EC (2012, 2018)
Definition	An ecological economy, that is compatible with the biosphere	A science-based economy driven by industrial biotechnology	A biomass-based economy
Nature/economy relations	Struggle against entropy and coevolution with the biosphere. Economic development in line with biological evolution	The cell is a factory Technology has the power to "correct God's mistakes"	Biomass replaces fossil fuels and mining to produce energy and materials
Science, technology and society	Megatrends with "promethean technologies" Pending the advent of Prometheus III, the economics of prudence and sharing	Prospect of a fifth Kondratiev wave based on the rise of biotechnology. The "economy of techno-scientific promises"	Biorefining at the heart of ecological transition (multi-level perspective). The economy of learning
Sustainability	"Strong sustainability" approach and degrowth perspective	Very "weak sustainability" approach	"Weak sustainability" approach
Governance	Democratic deliberation and ecological planning	Commodification of knowledge. Defense of intellectual property rights	Mission-driven policy - backcasting to identify desirable futures for the bioeconomy through product identification and stakeholder coordination
Tensions and paradoxes	Counter-expertise rather than concrete technical solutions Criticism from social groups who remain at the margins of decision-making centers Degrowth is not on the decision makers' agenda	Conflicts and competition in patenting but knowledge accumulation remains problematic How can biotech processes be integrated into complex multi-technological products? How can breakthrough promises be maintained as a one-best-way solution in all areas of application? Social resistance to GMOs	Substitution of products or functions by new products (chemicals and materials) Probably, increased pressure on resources and land

Table A3.1 adopted from Vivien et al. (2019, 194) compares three types of bioeconomy: type I envisions coevolutionary perspective on nature and economy, whereas type II and III seek to harness nature's resources or control it.

This ambiguity seeps into Giampietro's argument because he is not careful enough to distinguish between the three types. His argument could be understood to attempt reversing the hijacking and recommend changing the EU bioeconomy from type II/III to type I but does not do so explicitly. To the contrary, he claims to only focus on "the first of these three interpretations" (Giampietro 2019, 145). Indeed, he outlines "an entropic (thermodynamic)

narrative that reflects on the limits on economic growth imposed by nature" for circular bioeconomy, which would be consistent with type I (Giampietro 2019, 143). Still, he constantly compares this narrative to the bioeconomy in EU policy as a "new economy paradigm based on technological progress" (Giampietro 2019, 143). This second narrative refers to the type II and III bioeconomy, which is not surprising as the policy discourse is dominated by these versions and the concept decoupling only make sense on them. If he only focused on type I, he would not be able to analyze policy and criticize it. So, he is best understood as implicitly arguing that the type I bioeconomy should be the approach for EU CE policy.

This clarifies what I am precisely proposing. Not any but type I bioeconomy should be the policy pathway for my philosophy of the CE. According to Vivien *et al* (2019), the bioeconomy in the EU would need to shift from type II or III, based on engineering, innovation, or type I based on ecology and limits. So this explicates Giampietro's argument but can also be seen as the inverse to the argument by Vivien *et al* (2019). I hijack of the mainstream discourse around the CE through critical or heterodox schools of thought. (Even though according to my initial analysis, I am less skeptical than them of EU bioeconomy policy: the new plan does not mention growth but seeks "understanding ecological boundaries" (COM 2018a, 10)). Conceptually, this hijacking move can be further elucidated by integrating it with the theoretical foundation of recoupling in Social Ecological Economics

C) Bioeconomies, Ecological Economics, Metabolisms

The tree types of bioeconomy can be mapped onto Spash camps in ecological economics (see Figure A4.2 below). Type I bioeconomy corresponds to Social Ecological Economics, as it takes the interrelated, ontological hierarchical structure of economy and ecology seriously and imposes natural limits on growth. Type II bioeconomy falls neatly into the narrative of progress envisioned by ecological modernization (in between new environmental pragmatism and new resource economics), which states that limits can be expanded through science and innovation. The focus on biomass as a resource by type III places it among the new resource economists. Changing the bioeconomy from type II or III to type I, aligns with the theoretical foundation of ecomimicry in Social Ecological Economics.

Since type II is best characterized as belonging to ecological modernization, the other types are also placed at the intersections of the camps. Moreover, locating type III bioeconomy at the intersection of Social Ecological Economics and new resource economics, which Spash

argues should not exist, highlights its conflicted character: as the political ecologist Kallis (Kallis 2019, chaps. 2, 3) has argued, many ecological economist adopt the same assumptions as mainstream economist about unlimited wants. There may thus be a conceptual overlap between these two camps, albeit a contested one. This also fits Vivien *et al.*'s (2019, 191–93, 194–95) analysis, who argue that this version, albeit often subsumed under type II, contains a less weak (I would not call it stronger) version on sustainability. Lastly, while type I could be placed anywhere in the Social Ecological Economics camp, implementing ecomimicry through the bioeconomy must be based on strong transdisciplinarity as well as a degree of pragmatism. Moreover, recoupling to limits far-reaching distributional question. This is why I think it is best captured in the intersection close to political ecology.

Figure A3.2: Three Camps of Ecological Economics and Three Types of Bioeconomy

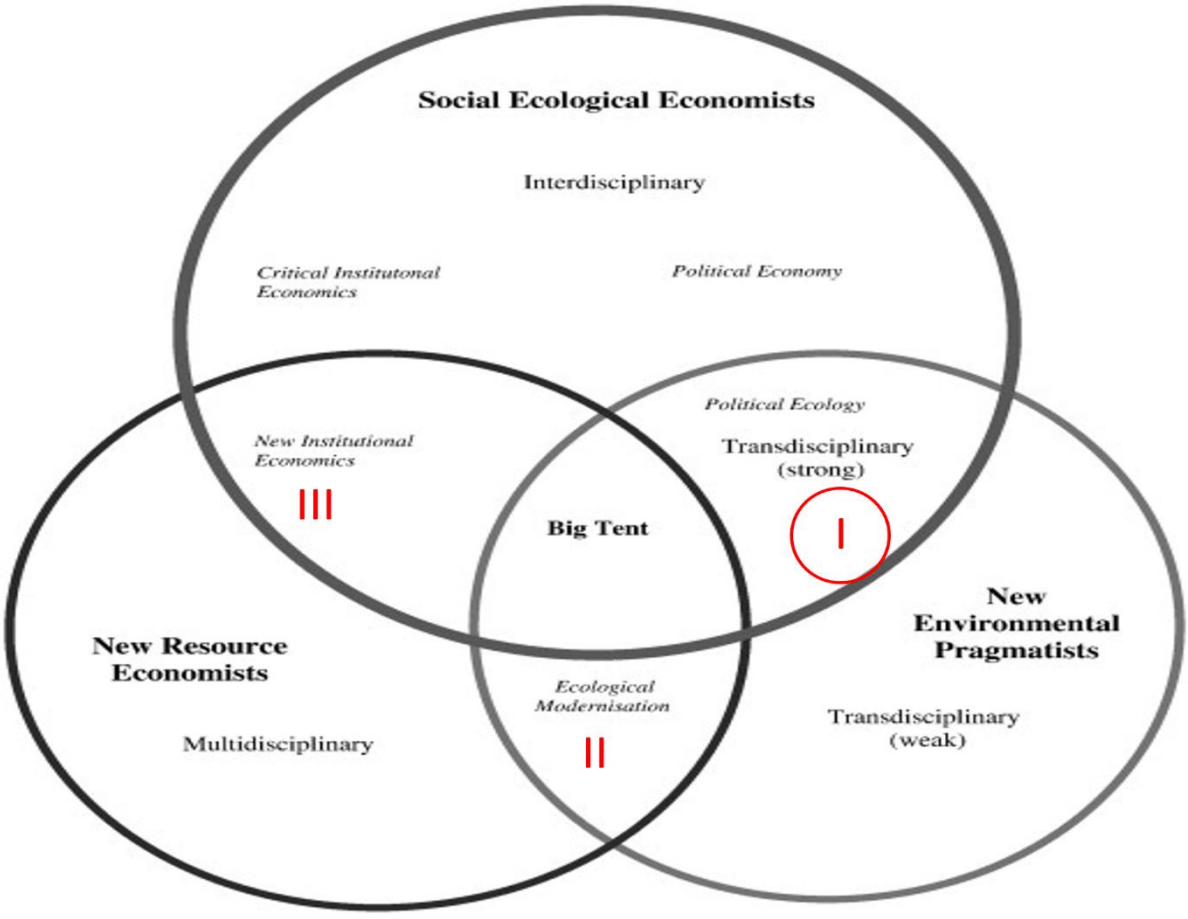

Figure A4.2 provides a conceptual synthesis of the three camps in ecological economics adopted from Spash (2013b, 354) *and three types of bioeconomy. The red circle marks the appropriate type I bioeconomy as an approach to recoupling that can be found(ed) in Social*

Finally, urban metabolism can also be elucidated by integrating it with the bioeconomy and ecological economics. For Giampietro (2019, 144 my emphasis), type I bioeconomy is a "entropic or *metabolic* narrative". Analogously to my example of the *DGTL*'s metabolism he also conceptualizes the economy in terms of in- and out-flows. Likewise, to study the (urban) metabolism primarily consists in taking the "material base of the economy" (in cities) seriously (Broto, Allen, and Rapoport 2012, 855). It not only also has the same intellectual roots in Odum's and Georgescu-Roegen's work, but necessitates the deep questions about the relation of the economy nature, which Spash (2013b) takes to characterize Social Ecological Economics. It also shares the concerns for socio-political matters, because to study the urban metabolism means to acknowledge, the "metabolic rift", the inequity of flows within cities, but also between cities and the "ecological hinterland" (Broto, Allen, and Rapoport 2012, 856, 857). Studying urban metabolisms could be seen as a way of operationalizing type I bioeconomy in cities, which in turn could be captured under the framework of social ecological economics. So, while these concepts are compatible, both the example as we as the overarching framework highlight that the bioeconomy should further integrate socio-political concerns.