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OPINION

Destination Earth: Considerations for a map to sustainable futures

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"Destination Earth" (or in short "DestinE") is a project of the European Commission to develop of a Digital Twin of the Earth: a highly accurate data-driven digital representation that is continuously updated based on real-world data [1]. DestinE will monitor and simulate the Earth system development as well as the impact of human interventions, make implications of environmental change visible and offer scenario-testing and predictions. By offering data-driven scenarios of potential futures, DestinE is envisioned to play a key role in environmental governance. It aims to support a variety of users, including government, industry, and citizens, in environmental decision-making by allowing them to explore different pathways and outcomes of interventions and non-action, and deciding on the best options for the future [1].

As DestinE is expected to help policymakers to navigate changes over time under the influences of diverse conditions, we propose to understand it as a 'map' to the future that offers pathways and directions for reaching sustainability goals. The map analogy captures the role and importance of information in DestinE (showing potential pathways for future changes) as well as its character as an artefact (it is a human-made system with which users interact). The map analogy is useful because it highlights the potential pitfalls of navigating the future based on a Digital Twin and offers an entry point for critical considerations of the use of Digital Twins in environmental governance practices.

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The map is not the territory

While maps are useful tools for navigation, it is important to remember that, to quote the philosopher Korzybski: "[a] map is *not* the territory it represents" (emphasis original) [2]. A map offers a certain perspective on the territory based on its expected use. For example, hiking maps show the territory in a different manner than a map for cars or ships. While all these maps need to be accurate to be useful, they are most useful if they represent the territory in a way that that fits with the users' navigational needs: representing the territory at a particular scale, and including markings and focus points.

The map analogy thereby reveals some crucial points for reflection about the development of a Digital Twin to navigate our planet. DestinE is not the planet, but a representation of Earth that offers particular information. This representation will have a certain degree of abstraction and show a certain perspective on what elements of Earth matter, based on what is considered meaningful for its use. In the case of DestinE, the representation of Earth is produced by a conglomerate of data collection and modelling methods [3]. The data selection is crucial, because data form the fundamental building blocks from which the representation of Earth is constructed [4]. Such selection is commonly shaped by views and assumptions that developers hold about the (future) use of the Digital Twin and about the interests, goals, and

values of the foreseen users, as well as what data is already available and what is technically possible [5]. Because DestinE is expected to inform European environmental governance, the question what is included and excluded in the representations of Earth and how this is communicated to users is crucial for the potential futures to which it can guide us.

DesinE as a map of synthetic futures

DestinE is not just a selected representation of physical Earth in the here and now, but also a representation of its potential future states. To account for this, we suggest to understand DestinE as a map of 'synthetic futures'. We deliberately use the term 'synthetic' because of its double meaning as 'artificial' and as 'combining different elements into a whole'. With synthetic futures we mean digitally produced (hence 'artificial') potential futures of the physical twin that are assembled by combining data input from a myriad of sources with predictive algorithms. As such, 'synthetic futures' reflects at the same time the difference between DestinE and Earth, as well as its added value for governing climate change mitigations. Based on scenarios showing diverse synthetic futures, policies can be made on how to mitigate climate change and intervene in the real world.

The challenge of being guided by scenarios reflecting synthetic futures, is that synthetic futures are artificially created representations. They reflect scientific uncertainties, bias, gaps, or errors anywhere in the Digital Twin development process, whether it be human or machine-made. The synthetic future perspective underlines the precariousness of predictions, and its scientific uncertainty and risk need to be clearly communicated to DestinE users.

From synthetic futures to sustainable futures

The above raises various questions regarding the content of the 'map' offered by DestinE and its use: what information do we need to navigate sustainable futures? Will it be possible to account for all relevant information in DestinE? Are there any blind spots? How should we deal with uncertainty and risks in the offered information? Which users and goals does DestinE serve? And whose sustainable futures does it represent: the Earth's, or merely Europe's?

With DestinE still under development, it is too early to tell. However, the map analogy shows the importance of exploring these dimensions of DestinE. If Earth is truly the destination of the futures offered by Europe's planetary Digital Twin, we need to take these questions into consideration when implementing DestinE in environmental governance processes. We therefore make an appeal to climate scientists, sociologists, ethicists, and political scientists to work together to explore the opportunities and challenges of using planetary Digital Twins in environmental governance.

Author Contributions

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