**2. Agency, planetary boundaries, and Latour’s dis-hoping for a new accounting model**

Under the lenses of Actor–network theory (ANT) everything in the social and natural worlds exists in ever shifting networks of relationships between different actors (participants). Furthermore, it implies that there are no external social forces beyond what and how the network actors interact at present. Thus, objects, ideas, processes, and any other relevant elements are seen as just as important as humans for creating social situations (Latour, 2005).

Is there any difference between actors and agency? IF so, What is AGENCY here. What are HUMAN, MACHINE and NON HUMAN agents here.

This paper argues that the recursive increases in the speed of agency is what enabled the physical impacts of advanced production systems that characterizes the Anthropocene era (Levy & Egan, 2003). Over previous spans of years and decades, transactions among physical object products have not increased in speed as much as transactions through data transmission and processing. Figure 1 presents the increasing trend of CO2 emissions along with the empowerment in economics of human agency, machine agency, and non-human agency.

**Figure 1.**

Figure 1 shows the increasing speed of agency and its relationship with CO2 emissions, and in consequence with the planetary boundary of climate change. The horizontal axis shows the evolution of time divided in three periods: human agency, machine agency and non-human agency. The first period is where economic activity was performed exclusively by human agency. During this period, a slow increase in CO2 emissions occurred, and therefore anthropologic climate change. Subsequently, the second period shows the increasing of CO2 emissions when machine agency was integrated into economic activity, originating an amplification of human activity. The last period shows the application of non-human agency to the economy. Through the second to third period, CO2 emission increase becomes exponential. Through the periods disclosed in figure 1, there is a recursive increase in the speed of agency together with an increase in the CO2 emissions generated by human economic activity.

Computing economic agendas using symbols enabled an increasing speed of monetary flows, faster than for physical flows (Leblanc 1990 for example). It is easier and faster to move money than heavy objects, and it is easier and faster to move data compared to ‘money’ as money requires additional encoding and decoding processes.

Early financialization, understood here as the process in which money in all its forms becomes more important than the real object supporting these abstractions of value, was limited to the speed and volume of money. These barriers were removed when money became encoded in electrons and photons rather than large masses like coins or paper (Leblanc, 1990). While the edges of an organization’s possible economic growth are financial, it is still constrained by physical limits of planetary boundaries. At issue is that the financial economy, which is expressed in transactions of monetary units, and the ‘physical economy’ measured in transacting movements of mass can be different sizes by orders of magnitude. They maybe be thousands of times different in speed, milliseconds for machines vs. seconds for people (Kirilenko et al., 2017). When financialization allows an increase in the speed of economic transactions, more economic activity per unit of time can be accomplished within the financial system without interacting with slow and massive objects. When faster economic activity causes a corresponding increase in physical activity, then the speed of movement toward physical limits may be increased. It has been a trend over the previous decades that faster economic systems produce CO2 at a higher rate, though this trend may change with energy sources.

When an economy operates at a faster speed, it reaches planetary boundaries more quickly. An economic system operating with physical objects in non-circular economy can reach planetary boundaries faster than a slower economy.

**2.1 Dis-hoping and accounting: individual action as a catalyst toward collective agency and transformation**

This paper adopts Latour’s views on “dis-hoping”. Latour (2017) claimed that we need to came to a solution to climate change through action and not merely “hoping” for an instant solution. In other words, not trusting in hope alone to deal with the problem. In this call, Latour claims that the actions from individuals is an essential part of the solution (REF NEEDED; CHECK). Individuals represent consumers, corporations would not survive if consumers stopped buying its products. Therefore, it is extremely relevant to provide individuals with information systems that allows them to improve their decision making (Rodrigue and Rome, 2021). Individuals usually tend to be more sensitive and reactive to localized experiences and so more exploration of individualized, local information and engagement are needed (Latour, 2017). Furthermore, the agency of individuals is not possible ‘‘without the installation of instruments capable of tracing the loops that make the least of our actions react in response to its causes” (Latour, 2017, p. 252).

[Merche: In this need of tracing loops is where accounting can play a major role. Accounting has been recognised as taking a mediation role in the implementation of sustainable practices (Miller & O’Leary, 2007; Larrinaga et al., 2018) such as in the United Nations Sustainable Development Goals (SDGs) (Bebbington & Larrinaga, 2014; Bebbington & Unerman, 2018) and therefore, there could be a role for accounting in mediating the implementation of sustainable and circular economy practices (Lapsley et al., 2010). In order to advance in the development of circular economy, alternative forms of accounting are needed to transform waste from an item into a source of value. This can be possible by providing measurement systems of the circularity of the economy at different levels such as a national, industry, corporation, etc (Di Maio et al., 2017; KPMG, 2019).]🡪INFORMED CLIENTS!

Accounting could become a catalyst creating informed consumers that make a change through their decision making (Rodrigue and Romi, 2021). In other words, this paper proposes CAM, an individualized system accounting model, that aims to assist individuals in recognizing and assessing the repercussions resulting from their actions, therefore enabling and encouraging individual engagement in climate change and planetary boundaries.

Pressure facing societies from planetary boundaries, particularly climate change, makes the connection between individual action and large scale change apparent and critical, but faced with the scale of the problem, individuals may be overwhelmed. There are not always clear actions and behaviours that can be taken by individuals to alleviate the problem. It is necessary to have a clear model of the problem and potential solutions, in detail, so that people can participate and make decisions which reduce carbon footprints and direct carbon use. This paper proposes the application of neural networks’ technology to develop the CAM.

Carla asks:

**Is there any difference between actors and agency? IF so, What is AGENCY here. What are HUMAN, MACHINE and NON HUMAN agents here.**

( Jesse )

Latour’s actors are in a social network, which is not a compete context, it is only on the human world (so far in history) and the actors are not well defined on a physics basis. Though his program is valid as a model of interaction, it is missing some pieces such as where do actors get their energy from and what is the source of their section making.

Agency is the capacity for self guided action. It does not have to be complex, or human. The origin of the agency is the decision making part, and the section can be as simple as on or off, stop go. For example, a bacteria is self guided, and a computerized oil well, also the movement of a robot is self guided. These are all agents, producing action from decisions. Although the only decision a simple oil well makes is perhaps to remain on or turn off, while the robot may make millions of different decisions each second. The quantity of decisions made is a measure of the agency of an object. We can talk about this quantity as ‘the strength of agency’. A rock makes no decisions and so has no quantity of agency. Other related component is action, and efficacy, action is a measure of the output energy of the decision, efficacy is efficiency of results.

Machines make more decisions now, so stronger agency as well as having stronger action.

Agency had been almost exclusively animal / human / organization in past centuries, but now machines are complex enough to often be strong agents. Such machines can operate in different domains like manufacturing or outer space or on facebook or in a national tax department. Their domains are not strongly limited but because they are not as complex as humans their expertise in action has until recently been limited - until about 5 years ago.

Because of deep learning neural networks, these are machines which can now accomplish many tasks that previously humans could do, like write books, drive cars.

In our paper, the agents that we created are neural networks. They have agency to make decisions about the input they receive. The result in our system is that the network guesses what an object is, and it should guess correctly 99% of the time. Then it guesses how the object was made and how it will decompose. The action that it has can be called its ‘outputs’, the outputs that it makes are to give information to people thereby acting on the thought process of people. So it has social agency, similar to Facebook AI agents which seek to influence behavior of people

“recursive increases in the speed of agency is what enabled the physical impacts of advanced production systems”

My reasoning is that humans by themselves have a fastest speed of action. That speed is slower than machines. Human decision making speed is also slower than computers. A machine controlled my a computer has agency and action potential. This agency and action potential can be much more than that of a person. We can can the nonhuman agency NHA. The actions of NHA in some cases enable the creation of more NHA- more mining allows more robots to be built and more robots mine more metal, for example. The same could be true for larger systems which are not so closely connected.

So agency when successful can be recursive. In fact whatever agency is not recursive dies, so after some generations only the recursive agents remain.

Agents which are successful accumulate more agency as their actions prepare their environment to make their success more likely. Regardless of the classification (NHA or not).

Action occurring in a shorter time period is called faster action. If we require an expression for this or some physics I can provide that.

Let us note section 3.1.3 Method of prediction, the last paragraph of which reads as follows. There are a few edits that I made in this.

The CAM shows the use of a carbon estimator ***& chain*** enabling interaction between human and NHAs. The estimator ***& chain*** allows CAM to benefit from **~~recursive~~** increase of speed and capacity in the computation of data.

I want to change the last sentence because it is not correct -This is not recursive, because the CAM is not making products for the production of CAM components.