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LANDSCAPE AND THE SUSTAINABLE DEVELOPMENT OXYMORON
FINAL ESSAY

"THE INTERSECTION OF GLOBAL AND LOCAL SUSTAINABLE URBAN TRANSITIONS"

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The intersection of global and local sustainable urban transitions

1 Introduction

This essay attempts to illustrate the need for better communication between technological innovators, planners, and local communities in the context of sustainable development. It also discusses the necessity of a centralized body concerned with the governance of sustainable transitions. Finally it proposes a possible next step toward a global sustainable transitions. To do this, the essay is divided into three main parts: developing a picture of dependencies of global systems; establishing a context by discussing what the concept of sustainability means in practice (and what it perhaps *should* mean); and, discussing how cultural values impact global and local sustainable transitions. Finally, it concludes by discussing the potential of digital technologies to increase communication between different spacial and temporal transition zones. Most of the discussions here are in the context of urban transitions, and it is also briefly argued why this is the most relevant scale to focus on.

To begin, perhaps the only way to get a grasp of what this is about, is with a few words in the realm of ontology. We exist, to the best of our knowledge, at this particular time in this particular place in the universe. Is it enough to just exist? What does it even mean to exist in the first place? If looking at a single state of a single unit of matter, there is nothing much interesting to talk about in existance: there is an infinate array of uni-dimensional states — something is there, or it is not. However, considering rather the *systems* that are composed of units of ordered matter, then the variance in time and space becomes more interesting and meaningful, and so do the interactions between these systems.

So here we are, human systems composed of subsystems of organs and cells and colonies of microorganisms; existing ourselves as subsystems of our societies, countries, and planet. *As a human*, is it enough to just exist? Maybe not, according to Maslow's theory of human motivation, which presumes that once basic physiological human needs are met, then 'higher' order needs emerge and thereafter become primary motivating factors for the organism, and so on [13]. Perhaps this is the essence of what we have come to know as DEVELOPMENT, defined by Galan in [5], generally, as a change in a system, and more specifically, as "an event constituting a new stage in a changing situation". As motivations evolve while human needs become fulfilled by the current human practices, a need for *new* human practices emerges, and the current become outdated. It is highly likely that, you, as a reader, are constantly developing yourself in such a cumulative way: when you have figured out how to fulfill a need for something, you would move on to figure out how to fulfill a new need. When these new practices to fulfill new needs are defined by an organized collective group of humans, *this is the development that this paper discusses*. In other words, DEVELOPMENT is how society defines its interactions with the future.

Then, to develop, as it has been defined above, one must have an understanding of which systems should undergo change to fulfill the next societal need; to develop *responsibly*, one should further obtain an understanding of how those systems interact with super- sub- and sibling systems, as to not inflict unwanted changes in non-target systems.

2 The interplay between global systems

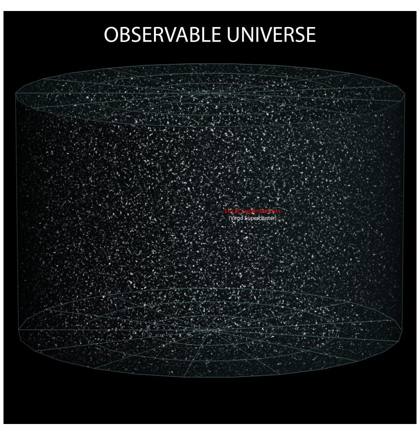

Figure 1: The observable universe. The red label indicates the Virgo Supercluster of galaxies in which ours exists. Image credit: Andrew Z. Colvin CC BY-SA 3.0.

The universe is a big place (figure 1). At this point it might be apparent that *all* systems can have sub-systems and super-systems, and it would take an infinite amount of resources to examine the interactions between an infinite amount of systems. Therefore, this paper draws some limits, shown visually in figure 2: in the spacial scale, systems considered are the earth, societies in

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it (all biological life, not only human), and individuals in them; and in temporal scale, the lifetime of the largest system, i.e. the planet. While extraterrestrial existance might be relevant to the human, it is not discussed in this paper.

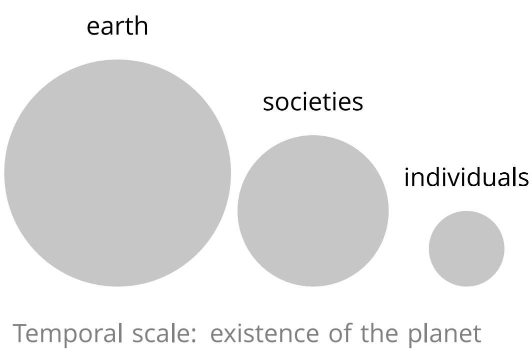

Figure 2: The scope of systems considered in sustainable development in this paper.

The aim of this section is to create context for the discussion of what sustainable development means by examining the different, interconnected global systems that can have a significant impact on biological life on earth and human society as a subgroup of that.

Rees (2003) discusses the concept of systemic hierarchy, where entropy in complex systems is balanced between system hierarchies (see Kay and Regier, 2001, cited in [17]). The idea is that sub-systems import energy (negative entropy (Schrödinger, 1945, cited in [17])) from host systems and export entropy, therefore maintaining their entropy level and therefore their complexity. For such a relationship to hold, the sub-system cannot ask for more energy or excrete more waste than can be handled by its host system, otherwise the entropy (disorder) of the total system increases [17]. The sub-super-system relationship is simplified in figure 3.

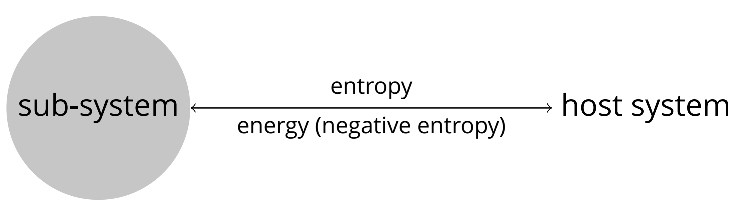

Figure 3: The entropy exchange between a host and its sub-system, based on the concept of system hierarchy discussed by Rees (2003) and others [17]. Energy is an input to the sub-system on the left and entropy is an output of it.

M'Closkey and VanDerSys discuss how the use of systems thinking in landscape architecture relates to discovering and describing the world through a lens of patters; where things and relationships are the WHAT of the world, and the patterns describe the HOW [14]. Similarly, in machine learning, a *model* is a pattern extrapolated from data (the what), which carries as much information about the how as possible. So, to apply this generally, there must be some underlying patterns that can be used to explain interactions in the universe. Rather than looking at every possible variable in interactions between, it can be much more efficient to look for patterns.

Already having established the scope of which systems to consider, are there some general patterns that can be extrapolated from those systems? Firstly, resource use is examined. Each level of system hierarchy shown in figure 2 provides some resources to its sub-system and takes some resources from its host system — and perhaps (most likely), the relationship is not uni-directional nor uni-dimensional as simplified in the figure. The main resources from each system are generalized in figure 4 below. The planet provides geochemical resources to ecosystems and societies, which in turn provide some resources (such as food) to individuals, who use them to maintain health, that allows the individual to pursue its intrinsic motivations, as discussed in the introduction. This figure includes one more system, the economy, drawn in a darker color to highlight that it has some special characteristics to consider.

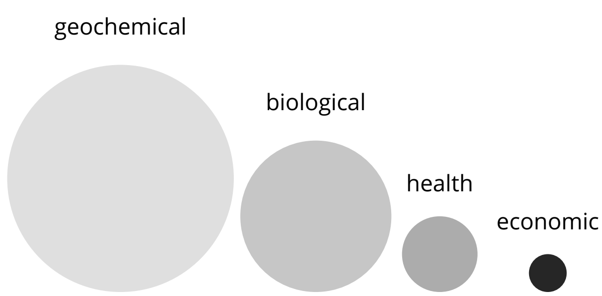

Figure 4: System resources, inspired by Maslow's hierarchy of needs (1943) [13] and Lovelock's discussion of the geochemical processes of Earth that sustain life (1982) [11].

The economy is essentially a communication tool for humans to exchange value, and it has become highly integrated in human society today. Interestingly, modern private enterprises have recognised humans as resources (blatantly apparent from the existence of the field *Human Resources*) to perpetuate more economic growth. So perhaps its fitting to draw the figure in such a way that the economy is the lowest in the hierarchy. This also means that the economy is on top the the system "food-chain", so to speak, where all the other systems are subjected to its resource use. (Note that, despite the fact that these figures suffer from being drawn in two-dimensional space, in reality, interactions do not suffer from this dimensional constraint. Moreover, humans are also agents of the economy, who thereby interact with and extract resources from other host systems.) This relationship between the economy and its highest host system (Earth) is depicted in figure 5 below, considering the entropy balance mentioned earlier, where resources are energy inputs and wastes are entropy outputs.

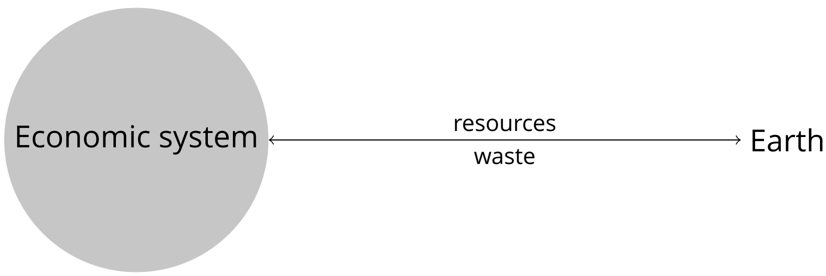

Figure 5: The economy is a subsystem of Earth that may not have a stable entropy balance in its interactions with Earth's geochemical processes and other important terrestrial subsystems.

The interesting thing about the economy is that it exists only to make more economic value; in other words, its main goal is to perpetuate itself. The same could be said about life: the information transcribed in DNA and expressed in the corresponding molecular processes exist only to optimize the amount of life for the available resources [5]. However, the economy does not necessarily care about life. Different life forms may care about the economy in defferent ways, but perhaps we humans should pay more attention to the fact the the economy does not inherently care about us nor any other inhabitants of the planet. In fact, one might even venture to say that we are competing *with* it rather than within it for stable resources.

The current economic paradigm is one of mass consumption [1, 17] and expansionism, where technology is seen as a major solution to provide for human needs, discussed in [17]. However, this very paradigm poises the current economic system to consume its host (Rees (1999), cited in [17]), because it does not necessarily have a mechanism to receive negative feedback from the terrestrial systems it is coupled with, i.e. when the energy-entropy balance shifts. The economy will continue to consume what is available until it is not available or not valuable to it agents. In other words, the the economy operates on a binary state of resource availability, but how does it take into account the quality of those resources it consumes? Furthermore, the economy does not suffer when resources are low like life does; on the contrary, it prospers, as the laws of supply and demand drive prices up.

For example, what happens when the supply of fresh water becomes depleted somewhere? Water is arguably *the* most critical resource utilized by life. Life in that place will suffer and some of it will adapt, or perhaps migrate, as it was designed to do, though this process may take generations. In the short term, on the other hand, the relative supply:demand ratio for water will drive the price up, making it a lucrative business opportunity and a luxury. This will push natural selection into the constraint of economic worth rather than physiological robustness. Is that something we want? A further question is, upon resource depletion, which path will the system favour: 1) using a technological solution to extract the most out of the available global water resources; or 2) using a solution (technological or otherwise) to find the root cause of the local water depletion and remedy it? The second solution may (or may not) be more difficult and economically inefficient, while the first option follows the expansionist paradigm of resource exploitation. One problem could be that the economic system, left to itself, cannot see past short term gains and losses very well without human oversight (authoritarian regimes?). How will the economy of the future account for long term gains such as the health and stability of an ecosystem? Is it possible to include a robust value linkage to, for example ecosystem health, in the current system, and, if not, is it possible to transition into a new system?

Humans developed as individuals and societies and the economy developed along with us. If the economy is decadent, what is the future of development then?

3 Sustainability as a concept

If the current pattern of resource use does not support the host system we exist in, then there must be other patterns that can better do the job. In the grand complexity of the universe, there cannot be only one uncontested pattern. To inspire thought of new patterns, a few words about optimization is systems.

If a dynamic system was to operate at maximum capacity, it might have highly efficient output for a short time, but this would not be sustained, as it would not have any resources left for maintaining itself. On the other end of the spectrum, if a system was to operate in such a way that it constantly maintained the integrity of all its operating parts, that way would be to not to use them at all. So between these two extremes or zero and maximum, there must be an amount of work that the systems can do which optimizes its output against its lifespan, depicted by the circle in the figure 6 below.

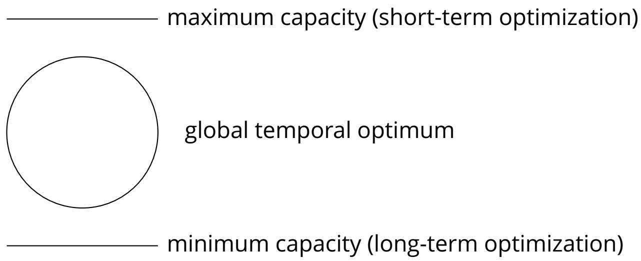

Figure 6: The optimization between maximum capacity (no maintenance) and minimum capacity (no work) of a system. The circle represents the operational zone where the theoretical temporal optimum between short and long term optimization of work may lie.

A practical example of this would be a human working 24 hours a day. The body would quickly start to shut down without sleep. But what 16 hours a day? The organism would last much longer, but how long would their psychological state last? Is 8 hours of work a day optimal? Does this amount of work optimize productivity, joy, health, something else, or some combination of things in a human life? Try to experiment or at least have a thought experiment. What would you want to optimize? The point that this example tries to illustrate is that the optimization of living systems is again not so straight forward as the 2D depiction of lines and a circle in figure 6, and values have to be carefully considered and weighted. Nevertheless, there *is* an optimum of resources a system can use to achieve some goal, be that longevity or something else. The question of what to optimize is up the the designer and the user.

So how does this relate to the concept of sustainability; and furthermore, what *is* sustainability? Perhape it is that optimum of global and local resources that we use in the development of ourselves and our societies, waiting to be defined in a new way. If resource use is currently optimized for economic growth, perhaps SUSTAINABILITY is the future development - a *new* optimization. If not, perhaps it should be. But what would it optimize?

The definitions of the English word sustainability and its translations are often linked to human activity such that an environment offering the possibility of a healthy life to future generations is maintained, for example in [10]. The famous Brundtland Commission's report on the global environment and development (1987) defines *sustainable development* as "...development that meets the needs of the present without compromising the ability of future generations to meet their own needs", cited in [16]. According to these definitions, sustainable development points to resource use that does not cause complete resource depletion in the future. But is it enough to optimize the amount resources available in the future, which then might be used in the same way as today anyway?

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As pointed out by Galan and Hakala, respectively, the laws of thermodynamics insist that time is linear, effects are irreversible, and everything ultimately tends to disorder [5], and [(therefore)] the Earth has finite resources [6]. However, while this may be emprically true at the macroscale of the universe, it is not so simple when it comes to resource use on Earth, as there are many interconnected feedback loops which convert subsytem outputs into inputs and so on. Take the example of a forest. While a forest may have a beginning and an end (as various pressures may push the stable state of the [local ecological] system towards instability [5] to either create or destroy the forest), *between* its beginning and end are many cycles of isolated natural feedback loops that perpetuate the forest. Isolated means that there are no external nutrient inputs into the forest ecosystem once it is established. The forest biome becomes a stand-alone habitat that supports many flora and fauna in many cycles of growth and decay.

The idea that a habitat can perpetuate itself is what we humans might hope from our global habitat, planet Earth. This is how the concept of sustainability is thought of in this paper: that Earth can sustain the life forms that currently inhabit it throughout its natural cycle of existence. Of course, when analysing the homeostasis of our global ecosystem, we should accept that external influences cannot be controlled, for example, possible asteroid collisions, the inexorable increase of solar luminosity [11], or the eventual heat death of the universe. What can be controlled by us, however, are the *internal* influences on the state of the system (figure 7), and this is what the practise of SUSTAINABLE DEVELOPMENT should aim to do. This means that, firstly, the internal workings of the planetary system and sub-systems should be understood, and, secondly, there must be a consensus on the desired states of those systems (the delta what), as well as *what to optimize* to get there (the how).

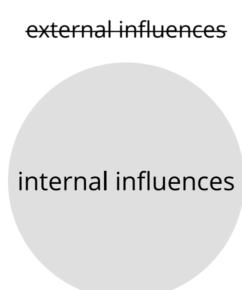

Figure 7: What can be controlled by humans, are the *internal* influences on the state of the planetary system, and this is what we should aim to do with sustainable development.

Up until this point, it has been established that humans naturally strive toward new motivations (development), and that the economy is a parasitic subsystem of Earth (created by that development) that threatens not only future

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resources reserves but also system stability. According to popular definitions of sustainable development, this needs to change. However, it still might not be so clear exaclty how sustainable development might look in practice, especially since the definitions considered thus far do not include how the pattern of resource use might change in the future. The rest of this section discusses some of the variation in discourses on contemporary sustainable development, and the next section discusses how local cultural and geographical difference could influence the implementation of sustainable development.

During the course in which this essay was written, two significant (and new to the author) terms came up: *oxymoron* and *dialectic*. These terms have an important role in the synthesis of the concept sustainable development. The term *sustainable development* was popularised in political discourse and daily life with the publication of the Brundtland Commission's report in 1987 [16]. It was identified as an oxymoron [5, 16], because it implies a system to be in equilibrium (sustainable) at the same time as continuously growing (development) [5], while the host system (Earth) has finite resources [6]. The significance of the second word, dialectic, comes from the fact that a dialectic approach needs to happen more often moving forward: the discourses on sustaible development have diverged in the last few decades [8], and this divergence of meaning can instigate conflicts of interest in the practical applications of an already controversial field.

Weak and strong sustainability are identified by Biely, Maes and Passel (2018) [1] as two main interpretations of the topic, and they also propose that strong sustainability is the only *true* form of sustainability (also see Ekins et al. 2003, cited in [1]). Weak sustainability proposes that technological innovations can replace natural capital [5]; Daly and Cobb, 1989, and Solow 1974, cited in [8]. This is proposed as an oxymoron in [1], due to the fact that it claims "sustainability" by decoupling resources from productive outputs through technology; doing so in a state of tunnel vision, where (negative) effects of the technology on other resources are not a part of the economic equation. Furthermore, Biely, Maes and Passel identify that the current economic situation is based on decoupling inputs from outputs (for example the decoupling of land with amount of produce, which caused environmental problems identified famously by Carson in 1962). This decoupling is precisely the problem [1], as it also decouples the entropy balance discussed in the previous section. Therefore, technology is not a *replacement* for natural resources [1, 17], and sustainable development must not merely preserve resources for future use, but it also must *question* and strive to *redefine the pattern* of current and future resource use. That being said, technology may be a great tool in such an endeavour, IF used wisely (see Marie et al. 2018: [12] and Harari 2018: [7]).

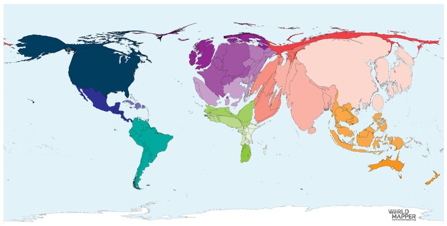
So what is the next step in resetting resource use patterns and defining a development path for a sustainable future on Earth?

4 The impact of cultural values on local and global sustainable transitions

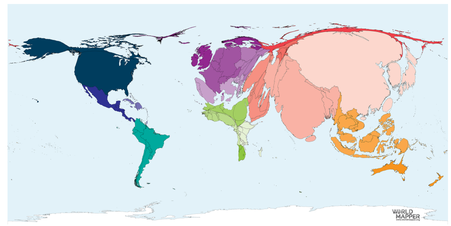
One thing that is clear is that sustainability is a global issue, and therefore it needs organized global oversight to look at the big picture [7], the biggest host system, the planet. Nonetheless, changes are not executed in a centralized discussion panel in a boardroom: they are executed in cities and communities and peoples back yards. Earth is a varied place in geography and culture, and different places have different needs. The aim of this section is to illustrate some differences between places to and address the dichotomy between local and global governance. **In short: the real sustainability project needs both.**

The following figures 8 (a-f) tell stories about the world in terms of population, economic development, and happiness. According to these images, some countries are experiencing high population growth and relatively low economic growth (notably African countries), while some are experiencing high economic growth and almost no population growth (notably China). Furthermore some countries have higher "happiness" scores than others (as calculated by Jeffrey, Wheatley, Abdallah, 2016; see image). In the images (a-e), the size of the country on the map is proportional to its relative share of the statistic in question. The last picture (f; taken from an interactive visualization in `gapminder.org`) shows photographs families around the world by income measured in dollars.

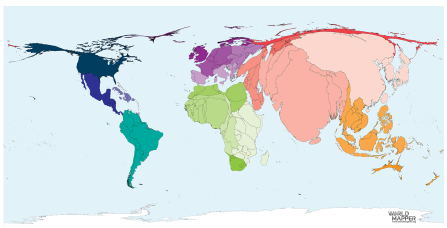
How might sustainability look to all these different groups of people? Some areas might be experiencing the depletion of local fresh water resiviors, while others might be enjoying a booming economy. It was earlier mentioned in this paper that optimization comes down to choosing values. Only the people who inhabit a particular place can choose what is best for themselves and their local systems, just as we, collectively must choose what is best for us and our global system. These two scales must live symbiotically supporting one another, and for that reason there needs to be a balance of local and global governance just like a balance of entropy between hierarchical systems. One way ot achieve this might be by enforcing the collective capacity of self-determination in the sustainable development regimen. This freedom, defined by Murphy in [15] is realized by a community who has the ability to determine their own governance, within or without another political structure. Why this is important is because there is no one right answer to sustainable development that can apply everywhere. What there must be, however, is a set of agreed upon principles that can drive collective sustainable development on a global scale. If a community were to exercise its freedom of self-determination to be anti-sustainability oriented, then all that we can do is remember that no single entity or ideal can change this world, it is a thing that must be done together. In fact, by acknowledging the self-governing ability of communities, the exercise of this freedom may cause more communication and inclusion than before between historically disjunctive groups. Perhaps this collective capacity is not meant for



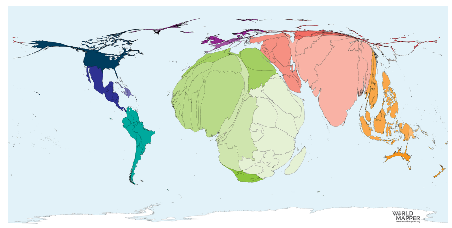
(a) GDP by country in 2018.



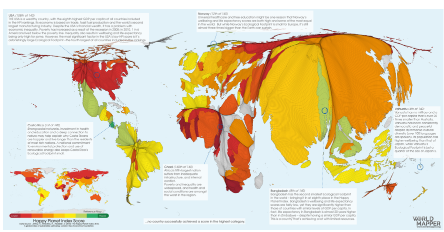
(b) GDP increase by country 2017-2018.



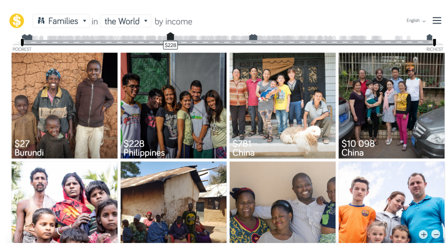
(c) Population by country 2018.



(d) Projected population 2015-2050.



(e) Happiness and population by country 2016.



(f) Families around the world by income.

Figure 8: Stories of development, population and happiness around the world told by 5 maps and some photographs. Country areas on the maps are proportional to the corresponding statistic of that map. Image sources: (a)-(e): `Worldmapper.org`, CC BY-NC-SA 4.0; (f): `Gapminder.org`

segregation, rather for the harmonization of differences, which the exact thing that must be achieved simultaneously by both local and global sustainable development.

As mentioned in the beginning of this paper, the city scale may be a critical unit in which to focus the execution of sustainable transitions: it is minimal in terms of governance, it is maximal in terms of population and in terms of its influence on ecology and economy, and it is culturally and geologically invariant enough to achieve generally agreed-upon decisions. Several people have said that cities are the key to dealing with climate change (Rowe, 2017, cited in [3]; [18, 19]), and cities might also be the key nexus for other areas of sustainable transitions as well.

5 (Digital) technological potential in sustainable development

Technology is a crucial part of the constant interaction of forces that shape our society [9], and it definitely has a role to play in the future of development; but if it is not to replace natural capital, as in the paradigm of weak sustainability, then what is it? Harari (2018) warns of the potential dangers of irresponsibly using the advanced technologies that are continuously being created and improved [7]. So the question then becomes, what should we use technology for? Perhaps for improving access to health care through biotechnology advancements, or for improving the understanding of natural systems through machine learning, or perhaps even for disrupting the current economic practices through innovative blockchain ledgers, such as `regen.network` [2, 4].

One of the problems with sustainable development policy is that it needs to cover a transition term that far outlasts the term of any single political establishment (personal communication, Lähteenoja, 2019), and possibly outlasts even generations. So there are two communication gaps that have been identified so far, the spacial gap between global and local institutions, as well as the temporal gap between present and future individuals and groups who will implement these transitions. Connecting people accross space and time is something that modern digital technologies have been able to excel in, and if there is some critical role that technology can play in a strong sustainability transition, it is firstly and foremost this one.

References

[1] Biely, K., Maes, D., and Passel, S. V. The idea of weak sustainability is illegitimate . *Environment, Development and Sustainability 20* (2018), 223–232.

[2] Booman, G., Craelius, A., Deriemaeker, B., Landua, G., Szal, W., and Weinberg, B. Regen Network Whitepaper, 2018.

[3] Candy, S. Assessing Sustainable Development of Urban Systems . Aalto University, 2019.

[4] Craelius, A. Regen network system architecture, 2018.

[5] Galan, J. Ontological approaches to the Sustainable Development . Aalto University, 2019.

[6] HAKALA, K. MAR-E1006 – Landscape architecture and research LEARNING DIARY Session 1: Start of a journey . Aalto University, 2019.

[7] HARARI, Y. N. *21 lessons from the 21st century* . Vintage, 2018.

[8] HOPWOOD, B., MELLOR, M., AND BRIEN, G. O. Sustainable Development : Mapping Different Approaches . *Sustainable Development 13* (2005), 38–52.

[9] JALAS, M. How to support alternative futures . Aalto University, 2019.

[10] LAYES, J. The role of Big Data in accelerating SDG Action . https://youtu.be/mxq1lShNUpw, 2017. Responsible Business Forum on Sustainable Development, Singapore.

[11] LOVELOCK, J. E., AND WHITFIELD, M. Life span of the biosphere . *Nature 296* (1982), 561–563.

[12] MARIE, N., RAYMOND, C. M., RUTT, R. L., STAHL, A., PLIENINGER, T., SANDBERG, M., BEERY, T. H., AND JÖNSSON, K. I. Landscape and Urban Planning ' Rage against the machine ' ? The opportunities and risks concerning the automation of urban green infrastructure . *Landscape and Urban Planning 180*, August (2018), 85–92.

[13] MASLOW, A. H. A Theory of Human Motivation . *Psychological Review 50* (1943), 370–396.

[14] M'CLOSKEY, K., AND VANDERSYS, K. *Dynamic patterns : visualizing landscapes in a digital age* . Routledge, 2017.

[15] MURPHY, M. Self-determination as a Collective Capability : The Case of Indigenous Peoples Self-determination as a Collective Capability : The Case of Indigenous Peoples . *Journal of Human Development and Capabilities 15*, 4 (2016), 320–334.

[16] REDCLIFT, M. Sustainable Development (1987–2005): An Oxymoron Comes of Age . *Sustainable Development 13*, July (2005), 212–227.

[17] REES, W. E. Economic Development and Environmental Protection : An Ecological Economics Perspective . *Environmental Monitoring and Assessment*, 86 (2003), 29–45.

[18] SHARMA, G. Schneider Electric CEO says war against climate change will be won or lost in cities. , 2017. Interview.

[19] SULIMAN, A. Climate battle will be won or lost in cities, says U.N. climate chief. , 2018. Interview.