

On the Limits of Limits

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ABSTRACT

This discussion paper outlines the connection between the perceived urgency of environmental and resource challenges that humanity is facing during the 21st century and the individual researcher's response within the emerging Computing within Limits community. What is the relationship between our beliefs as individuals and as researchers and the specific issues we chose to study? Furthermore, is there a relationship between skills and topics we happen to be expert in and the subsequent future scenarios we plan for and deem to be more likely to happen?

Author Keywords

Climate change, Limits, Sustainability, Collapse Informatics, Survivalism

ACM Classification Keywords

K.4 [Computers and Society]

INTRODUCTION

This discussion paper ponders the question of the limits of "Computing within Limits". The paper does not go into any significant depth discussing the "computing" part, but rather expresses thoughts about the limits of the endeavour "Computing within Limits" itself. How far do our imagination stretch and what are the limits at play when we frame "Computing within Limits"?

Abstracts submitted to Limits are expected to differ from mainstream computing research. Mainstream computing research typically assumes futures that are little else but extrapolations from the recent past, and where the direction ever and always can be summarized by terms such as "more", "better" and "faster". Such business-as-usual futures will most importantly assume continued economic growth on the aggregate global level and mainstream research in computing is thus conducted against a backdrop of a continued extrapolation of many 20th century trends, e.g. more advanced and complex generations of digital hardware and software, increased resources for research and development, increased availability and use of energy and natural resources, increased urbanism, continued demographic growth, increased global food production etc.

Climate change is perceived to be an increasingly worrying possibility but, judged by the lack of concerted action, at

the same time a problem with little relevance for us here and now. It apparently represents something that can be "fixed" *if* and *when* it becomes a problem that has real-world consequences, or alternatively, as something that *can't* be fixed and therefore futile to act upon. Limitations in the availability of resources and energy (e.g. peak oil) are perceived either as non-existent or as challenges that are no match for human problem-solving ingenuity and (perhaps accelerating) technological developments [24]. Warnings by researchers from the 1950s and onwards [19, 10, 2, 28] are perceived as attention-seeking neo-Malthusian luddites – no better than the boy who cried wolf and who was proved wrong time and time again.

Computing within Limits instead takes climate and resource limits seriously in its curiosity for, and concern about "ecological, material, energetic, and/or societal limits on computing". Our starting points thus differ from the mainstream assumptions above in more or less radical ways, but, how do we actually construe "Computing within Limits" and what are the limits of our own assumptions?

Since the "we" I refer to here is under construction, it might be the case that I misconstrue others' positions. Still, I work on the assumption that submitted texts will represent a nascent corpus of thought on "Computing within Limits" that will be in line with previous writings in the area such as [32, 33, 34, 42].

ON THE SOCIETAL EFFECTS OF CLIMATE CHANGE

With the exception of a small fringe of loud protesters with deep pockets¹, it is now commonly accepted that humanity is facing monumental, possibly civilisation-breaking challenges during the 21st century. These challenges are most often framed in terms of rampant GHG/CO₂ emissions and the subsequent climate change effects of living on a warmer planet with more unstable weather patterns [15, 26, 27, 30]. Due to the contested nature and the upsetting implications of such findings, the discourse around climate change [18] and its possible effects are almost exclusively grounded in verifiable (albeit contested) results from the natural sciences.

Hard facts about climate change to a large extent "belongs" to climate scientists and related disciplines. Insights from

¹ That unfortunately has a strong grip on (especially US) right-wing populist political thought.

the social sciences are generally lacking or omitted, e.g. what will the effects of climate change be on human societies? What do we know about how people as individuals, groups or societies react when under pressure [38]? Instead of projecting the effects of climate change onto future (affluent, Western) societies, we might instead ask what the effects of climate change and of altered ecological conditions are *already today* on poor, non-Western societies, or what the effects of changing weather patterns or altered ecological conditions have been on human societies throughout history [39, 8].

While we could and *should* ask such questions more often, the answers might not be especially encouraging (or forthcoming for that matter). In German social psychologist Harald Welzer's book "*Climate wars: Why people will be killed in the 21st century*" [45] there are not just one but two final chapters. Both chapters are called "What Can and Cannot Be Done" (parts 1 and 2). The first chapter "*examines the possibilities for cultural change that might permit an escape from the deadly logic of unstoppable growth and limitless consumption*". The author then goes on to recommend optimists to stop reading the book after that first final chapter as the second final chapter describes the author's own and much bleaker "*view of how things will shape up in the wake of climate change*". It should be noted that Welzer in general has a bleak (or balanced?) view of humanity after having studied and written a number of books (not translated into English) about the effects that living in Nazi Germany had on ordinary Germans. To the best of my knowledge, the message of these books is in line with Daniel Goldhagen's more well-known book "*Hitler's Willing Executioners: Ordinary Germans and the Holocaust*" [12]. The current rise of populist, xenophobic European right-wing political parties as well as rising anti-semitism and islamophobia in many European countries is furthermore in line with Welzer's arguments about the human response to increased competition for resources:

"Since climate effects strike hardest at societies least able to cope with them, migratory flows will dramatically increase in the course of the twenty-first century [...] As climate effects become more extensive and visible, and as hunger, migration and violence grow in intensity, the pressure to find solutions will be more acute and the space for reflection will be narrower. The likelihood of irrational and counter-productive strategies will become greater, especially in relation to the problems of violence exacerbated by climate change. All the historical evidence makes it highly probable that 'superfluous' people who seem to threaten those already enjoying relative prosperity and security will lose their lives in increasingly large numbers, whether from lack of food and clean water, from frontier wars, or from civil wars and interstate conflicts resulting from changed environmental conditions. This is not a normative statement; it simply corresponds to what has been learned from solutions to perceived problems in the twentieth century." [45, p.180-181].

Closer to home, William Davidow and Michael Malone ponder "What happens to society when robots replace workers?" in Harvard Business Review [7]. They describe a scenario where "*we will soon be looking at hordes of citizens of zero economic value*". Only 10 years from now, in 2025, there "*may be as many as 40 million citizens of no economic value in the U.S alone*". As per Welzer's words (above), how will formerly-affluent societies under stress (for example through shrinking tax bases) treat those "hordes of citizens" that do not "have any economic value" (to say nothing of illegal immigrants knocking on the door)? While Davidow and Malone assume continued economic growth and rapid technological developments, their line of reasoning is as intriguing as it is frightening when they describe the impacts of such developments.

Discussing issues that forces us to directly confront questions of power, as well as our own and others' values go far beyond the agenda of research in computing as it is usually perceived - but perhaps it shouldn't [5, 22, 41]? The time to build ecological, social and economic resilience and to thwart such bleak futures is *now*, in the abundant present. A stated goal of the nascent Limits community is to "impact society through the design and development of computing systems in the abundant present for use in a future of limits and/or scarcity".

ON RESOURCE DEPLETION AS AN ABHORRENT IDEA

Climate change is often described as the overarching challenge facing humanity in the 21st century. A less-discussed threat is that of resource depletion [4, 16, 21], including peak oil [1, 13]. Greer suggests a number of reasons for this state of affairs. The discourse of climate change upholds the idea of human supremacy, agency and control - "we could decrease CO2 emissions if we really wanted to" or "it's our own fault if all hell breaks loose". Peak oil instead constitutes the result of non-negotiable geological limitations that render humans powerless in the face of an "uncooperative" planet not forthcoming in providing us with more of what we as a species crave (resources, energy). The same is true also for other limited resources such as food, water, coal, minerals etc.

It is possible to cling to hopes about human ingenuity and the success of large-scale engineering projects (carbon capture and storage, fusion power, massive scaling-up of renewable energy sources, geoengineering etc.) for much longer than it is possible to deny a reality of decreasing rates of return of limited resources. Rubin [36] writes that despite vast US coal reserves and despite increased production of coal in terms of volume and weight, US coal production actually peaked more than 15 years ago, in 1998, in terms of the amount of energy produced. "*America's production of high-grade anthracite has been steadily declining for more than sixty years. Annual production is now less than a quarter of its 1950 level. Production of the next-highest grade of coal, bituminous,*

peaked in 1990 and has since been declining as well" [36, p.110].

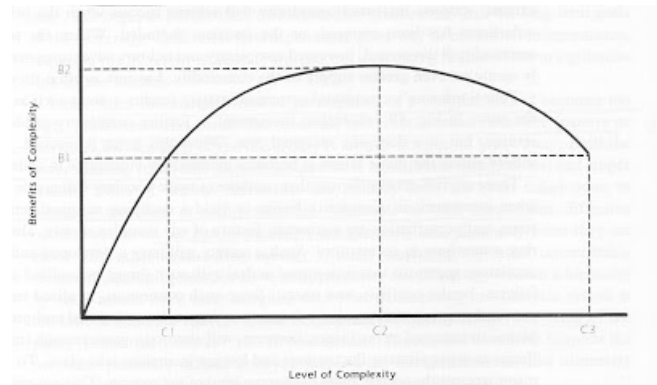
It has even been suggested [13] that the idea of a climate deluge catastrophe to many people is preferable compared to admitting that some of the most important factors for upholding current levels of affluence and technological developments lie outside of human control, and, that the very finiteness of our planet sets hard non-negotiable limits on human activities [6, 28, 43]. The idea that humans are *not* the masters of the universe and that we are not even the masters of our own destiny on this planet is abhorrent – not the least to deviously clever and immensely rich entrepreneurs who have created something (e.g. wealth) out of nothing (e.g. ephemeral ideas or "free" natural resources).

Both climate change and resource depletion represent defining challenges of the 21st century and there is a clear connection between them since the burning of fossil fuels (oil, coal and gas) is the primary driver behind climate change. I will however in this paper work on the assumption that we will have to wrestle with the consequences of resource depletion *before* the full effects of climate change will make themselves known - at least to affluent, Western societies. This is partly a pragmatic choice as the effects of climate change seem to be more obscure and unpredictable while the effects of resource depletion are more in line with how previous civilisations have caught up with and succumbed to various limits.

ON COLLAPSE

The idea of civilisations "collapsing" is intriguing [8, 39]. All ancient civilisations (Sumer, Babylonia) collapsed, as did the Roman and Mayan civilisations "more recently". Archaeologist Joseph Tainter [39] suggests that civilizational collapses are drawn-out affairs that unfold over the course of centuries. Most people would assume that the term collapse refers to sudden changes for the worse, but to an archeologist like Tainter, collapse instead refers to a step-wise process that can easily span several generations or centuries. Tainter's notion of collapse is thus a political process that makes itself known as "*a rapid, significant loss of an established level of sociopolitical complexity*" - where "rapid" means that it takes "*no more than a few decades*". Sociopolitical complexity manifests itself through (for example) increased social differentiation, increased specialization of individuals, groups and territories, increased trading and redistribution of resources, increased regulation and centralized control, increased flow of information between individuals and groups as well as artistic and literary achievements and larger territories integrated within a single political unit. This is also a good description of the world we live in today. To Tainter, societies are problem-solving entities [40]. The payback of solving initial problems is large, but societies over time experience decreasing and later negative returns of increasing complexity. While new problem continue to be

handled (solved), the structural costs of additional layers of sociopolitical complexity stay in place "forever" rather than for a limited amount of time and will continue to incur maintenance costs without adding much utility. These developments are summarized in this picture:



**Figure 1. Decreasing returns of increasing complexity.
From Tainter (1988, p.119).**

The collapse of an empire can take many decades or even centuries - with temporary reversals that can last for a few decades or a lifetime, but, the general direction over time is towards decreased sociopolitical complexity. Despite directing his gaze backwards in time, Tainter also glances towards the future and asks whether modern societies too are vulnerable to collapse. Based on Tainter's ideas, it would seem likely that a possible future collapse of *our* civilisation would be a drawn-out process that would unfold slowly and unevenly in time and space. Others however suggest that our networked interdependent modern globalised civilisation is more akin to a house of card that could collapse catastrophically should some critical tipping point(s) be passed [17, 31].

Are our current social, political and economic arrangements for the most part stable, prone to inertia and to a decades- or centuries long process of sociopolitical decomplexification or are they volatile and prone to a sudden collapse in a world of limits? While we can't know for sure, some people already today bet on particular futures and shape their lives in accordance to their respective beliefs. I will describe three different stances below and I will later connect these perspectives to Computing with Limits.

THREE RESPONSES TO COLLAPSE

Below I outline three different stances that differ in terms of time frames, perceived urgency of challenges and preferred scale of solutions.

Political change (long time horizon)

For a person who believes that we are facing large challenges, but, who crucially also believes that we will have enough time to counteract negative effects as and when they appear, it makes sense to engage at a political

level. That engagement could be at the level of national politics, for example by joining the Green Party, or even on a supra-national level, by joining a NGO that tries to pressure governments to get together and adopt forceful measures at the annual United Nations Climate Change Conferences (e.g. 2009 in Copenhagen or at the upcoming 2015 conference in Paris). A person who chooses to act on this level must by necessity think that change will happen only slowly, over the course of decades and that we consequently have plenty of time at our disposal to change the direction of current developments. Yet another path for such a person could be to become involved in activism on the national level or join a governmental (environmental) agency, e.g. The Energy Agency or The Environmental Protection Agency to help shaping policy making (or joining a think tank or a research institute etc.).

The Green Party is one of eight political parties that are represented in the Swedish parliament. It was formed in 1981 and managed to win seats in the parliament in 1988. It has however had a continuous representation in the Swedish parliament since 1994. The Green Party currently has 25 of 349 seats in the parliament and is since September 2014 for the first time ever part of a governing coalition. It thus took approximately a decade for the party to find its way to the parliament and more than 30 years for it to formally be in a position of power (rather than being part of the opposition). It is harder to say what practical impact the Green Party has had on national politics though. Voting for a political party that urges us to rethink fundamental assumptions by preaching moderation, limitations, and the building of social resilience (preparing for "bad times" for industrial-, information- and welfare society) is difficult to fathom for most voters even (or especially) should those bad times arrive. It is for example hard to convince ordinary citizens (motorists) that we need to curb driving through (yet) higher taxes on gasoline. It is possible to argue that the closer the Green Party has gotten to real political power, the more it has had to dilute its political convictions and package its political positions as "realistic" - at the expense of original more utopian "green" political ideals [9].

The other two most recently formed political parties to win seats in Swedish parliament, the Christian Democrats and the Sweden Democrats, won seats 27 and 22 years after they were formed. Changing society through national politics is a course that is open only for people with abundant patience.

Communal change (medium time horizon)

A person who believes that the challenges we face are larger and closer in time will not find it particularly fruitful to act on a national political level. If she believes there are challenges that will become critical within, say, the next decade or two, it will – during her own lifetime – become necessary to adopt more radical and profound responses than those currently being pursued or discussed politically. These responses will challenge our ingrained conceptions

of economic growth, of rising living standards and of technological development and turn many of them upside down. The time to adopt changes will not be at some nebulous point in the future, but rather *now*. The place to do so will be at some level "below" national politics. Perhaps at a municipal level, at the level of a transition town (e.g. in a small town or in a city neighborhood) or in an ecovillage.

The level of action proposed here is together with others, but at a local level that could make progress visible in a time frame measured in years rather than in decades. Appropriate goals at this level could be to make oneself (and a community) as independent and self-sufficient as possible in terms of water, food and energy, to get to know one's neighbors and to develop practical skills that would be useful to your neighbors in a collapse scenario. Your task would further be to convince or coax your neighbors into believing that it's sensible (or fun, or pleasant) to grow food together, to decrease your use of energy, to reduce your ecological footprint and to act in ways that benefit the local community [37, 11]. The best way to prepare for a disruptive future would be to live your life right now as if that future was already here. Another path for a person who feels the need to hurry but who believes it is still possible to "work within the system" could be to start or to join a company that does pro-social work that has the potential to scale up and to "change the world", e.g. working with wind energy, electric cars, permaculture, social innovations etc.

Individual change (short time horizon)

The third and last stance assumes you can't change the world nor other people. What remains is instead to change yourself and your immediate surroundings. At this end of the spectrum we will also find survivalists and preppers - people who can't be bothered or who feel despair at the thought of trying to change society. It will for them feel more fruitful to spend time and energy preparing themselves and their immediate family for the threat of an (always imminent) societal collapse. Much of their preparations are eminently sensible from a personal resilience perspective and there are significant overlaps between what a survivalist does and what the Swedish Civil Contingencies Agency ("FEMA") recommend every Swede to do so as to be prepared for an accident or an emergency (a storm, flood, power outage or the like).

A survivalist however goes further and strives to prepare physically and mentally not only for occasional emergencies, but also for a more thorough societal collapse. The imagined collapse is triggered at short notice and can be more or less prolonged. A logical end point becomes to prepare for what survivalists call The End of the World As We Know It (TEOTWAWKI). Besides reviving the kinds of practical knowledge that was oftentimes widespread only a few generations ago, survivalists can prepare for TEOTWAWKI by learning to live in a tent and cook food with an alcohol stove, learning to handle weapons and to hunt as well as by learning what foods you can store for

years. This knowledge can go hand in hand with building up (personal) stores of food that could last for years.

A survivalist should always have a prepackaged “bug out bag” (BOB) containing the essentials in case you quickly need to head out to your remote BOL (“bug-out location”) when life in the city becomes unsustainable. It might be that the present-day popular cultural fascination with zombies [20, 25, 44] is a way to handle the anxiety and the cognitive dissonance of a) believing that a catastrophe could be near while at the same time b) not doing anything in particular to prepare for it.

It has to be pointed out that much of the practical advice outlined above (learn some of your grandparents’ skills and crafts, work on personal change) will also fit the “communal change” stance outlined further above. The difference here is primarily in the emphasis of self vs. group and on “every man for himself” vs. “community” and “society”. Rob Hopkins, founder of the Transition Town Movement, has formulated ideas about “The Great Reskilling”² – of acquiring new skills that oftentimes are the old skills of past generations.

ON THE PERCEIVED URGENCY OF CHALLENGES AND APPROPRIATE RESPONSES

All three stances outlined above can make sense - depending on your viewpoint in regards to the threats and the challenges our societies are facing and the time frames over which these challenges will present themselves to us. It comes as no surprise that some authors and activists who believe that collapse will be sudden and catastrophic have chosen to live on a boat [31] or write books (manuals) for how to fortify and defend your “homestead” [35], that others who see collapse as perhaps imminent but still gradual have instead chosen to move to small towns or farms [3, 14, 23], while others again try to change society by writing articles and books [16, 30]. It is also quite possible that many people do not practice what they preach - or perhaps that is true for most of us?

One of the few academic books about survivalists, Richard G. Mitchell Jr’s [29] “*Dancing at armageddon: Survivalism and chaos in modern times*” makes several interesting observations in this regard. US Sociology professor Mitchell schmoozed with survivalists for several years and observes that there are many different kinds of survivalists who foresee (and prepare for) many different varieties of sudden societal collapse. Some of the more “popular” threats (based on a survey) were monetary or economic collapse, social collapse, political collapse, civil unrest or the rise of an authoritarian state. Based on individual beliefs of possible or probable threats, different survivalists will make widely different choices about what to plan for, what

to prioritize and what to rehearse for. What is of interest to this paper is the connection between a) imagining specific futures and b) implications for what needs to be done in the present.

“Suspecting what might happen later suggests what might be considered now: invest in precious metals, cultivate organic gardens, establish the aryan nation. Construct fallout shelters, fortify retreats, stockpile food and camping supplies, amass munitions and armaments. Try to organize mail and phone networks. Dream of forming communes, militia training programs, or revolutionary cells. Develop strategies to protect against future predators, against radiation-crazed bomb victim, rapacious government agencies, the have-nots of the post-apocalypse” (p.12).

I personally consider most of these plans outlandish, but Mitchell’s point is that all survivalist scenarios are based on “middle ground” scenarios; urgently compelling but manageable in scope [29, p.14] and serious enough to cause an immediate societal collapse of some sort but *not* serious enough to render the survivalist’s preparations meaningless. In contrast to the lack of control, the powerlessness and the alienation that many people can feel in modern society - and perhaps especially those occupying low-paying precarious thankless jobs - survivalism offers these individual the chance to prepare for a future where that individual’s particular resources and skills will become Important (with a capital “I”). Some survivalists might prepare by finding a well-paying job and by putting money away to pay cash for a house with solar panels in the countryside. Others might count on the value of their agricultural, craft, medical or herbal skills. Others will stockpile weapons and dry food in the cellar, while others again hone their skills at repairing and trading things. What all of Mitchell’s survivalists had in common was that they work hard to develop and align their current skill sets with the particular future they believe is the most likely to occur. This can happen in more than one way; they might choose to elevate a particular future that can be optimally aligned with their current resources and skill sets rather than the other way around. Mitchell also observes that few survivalists made any preparations for nuclear war since whatever preparations they can make will most assuredly be insufficient in comparison to the challenges faced in the aftermath of a nuclear war.

IMPLICATIONS TO COMPUTING WITHIN LIMITS

I here propose that what is true for Mitchell’s survivalists might also be true for the emerging Computing within Limits community. We as individuals (and perhaps at some later point as a community) will also tend to think about and prepare personally for the particular collapse scenarios we deem to be most likely. And just as there might be a certain element of wish-fulfillment in survivalists’ preparations, are we not also susceptible to the temptation of aligning our work and of choosing “likely” futures in relation to scenarios where our own past work and our own

² For example see <http://www.resilience.org/stories/2010-01-18/great-reskilling>

professional knowledge would become optimally useful? In thinking about Computing within Limits, we would do well to think about and discuss a variety of collapse scenarios and unconditionally ask ourselves what kinds of computing would make sense in those scenarios.

I suggest that individuals in the Computing within Limits community will tend to be drawn in two different directions at the same time. As researchers, teachers and computer professionals, we are invested in technologies whose existence can most readily be justified in a world of (at least some) abundance. Just as survivalists prefer not to think about nuclear war, we prefer not to think about the survivalists' short-time-horizon more immediate collapse scenario. As researchers, we are trained to think about our work in terms of cycles spanning multiple years. Accepting a new ph.d. student is a commitment on the scale of half a decade and it can easily take half a decade to plan and carry out a major research project. A rejected application can delay such a project by one or several additional years (no matter how important and urgent the research itself is). We are currently planning a new master's level specialisation at KTH, "Sustainable Information Society". The initial planning started two years in advance and it will take another two years for the first students to graduate from the specialisation, i.e. again a time span close to half a decade. Inertia is high inside academia and current structures work *against* being in a hurry to change the world.

These slow, cumbersome processes best fit a long time horizon, i.e. the "political change" stance above, but in our non-professional personal lives, we might simultaneously be drawn to explore more immediate responses. For a person with survivalist inclinations, it hardly makes sense to think about post-collapse *computing* since both access to resources and the utility of computing would be questionable in such a scenario. I therefore believe there is a basic mismatch between survivalist ("individual change") scenarios and Computing within Limits.

That leaves us to discuss the connection between Computing within Limits and the other two stances outlined above. What are we as a community aiming at? For reasons of space, I will leave these questions open for discussions at The First International Workshop on Computing within Limits (UC Irvine, June 2015) and end this discussion paper with a few questions that can be discussed at the workshop.

- How do different variations of political and communal change match with specific Computing within Limits projects or possible Computing within Limits research agendas? What are we aiming for?
- What kinds of Computing within Limits-related research is possible to conduct within the current (slow) structures for formulating projects, applying for funds, planning and teaching undergraduate and graduate courses etc.?

- Is it possible to imagine or suggest alternative forms of organising and conducting Computing within Limits-related research outside of current academic structures, e.g. what kinds of structures would be optimally conducive to the kinds of research we believe is necessary?
- In understanding the role of Computing within Limits in future resource-limited societies, what research could and should be conducted already today? What can be learned from countries such as Greece where youth unemployment is extremely high (+50%) and substantial parts of the previously-affluent middle class struggle to maintain lifestyles they consider dignified in terms of material wealth – including access to digital technologies?
- What can be learned from movements and concepts such as "appropriate technologies", "frugal innovation", "minimal computing" and "convivial technologies" that could be useful for defining suitable research projects for Computing within Limits?

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