

Marloes de Valk

Ville-Matias Heikkilä

Permacomputing

Shintaro Miyazaki: So how would you describe or define permacomputing?

Marloes de Valk: The term was coined and described first by Ville-Matias in 2020 on his website¹ and has since started circulating, being connected to diverse practices. Currently it is collaboratively developed on the permacomputing wiki.² I'm very interested in how the term's meaning will develop now that people are adopting it. The term resonates with a lot of people, it captures something that is very much wished for, a counternarrative to the rapid "upgrade-or-die" cycle promoted by the tech industry. It is also somewhat paradoxical, linking an environmentally lightweight practice such as permaculture with one that is as resource-intensive as computing, which doesn't only weigh heavy on the planet due to energy consumption, but also through unethical and damaging practices in several parts of the supply chain, from mining to manufacturing. Most energy is used during the production and spectacularly wasteful end-of-life phase. This is unequally affecting the Global South. The term permacomputing hints at wanting to do better without being naive about this paradox.

Ville-Matias Heikkilä: Permacomputing asks the question whether we can rethink computing in the same way as permaculture rethinks agriculture. Is there even place for high technology (such as computing) in a world where human civilizations contribute to the well-being of the biosphere rather than destroy it? Permacomputing wants to imagine such a place and take steps towards it. It is therefore both utopian and practical. From today's viewpoint it can indeed also feel paradoxical, because current mainstream computing is pretty much the type of technology that epitomizes industrial wastefulness and many other things that have gone wrong in society and technology.

"Perma" refers to permanence. A technology that depends on a wasteful use of finite resources can hardly be permanent. This is why a radical reduction of that wastefulness is a major concern to us: maximize the hardware lifespans, minimize the energy use. And this is not just about a set of technical problems to be fixed - the attitudes also need a radical turn. Small is beautiful, understandability is beautiful, "virtual" is not immaterial, online time should be used wisely, not everything needs to be constantly available, doing things with less is

not "returning to the past." For a more thorough explanation of the ideas, see my web articles on the topic (the 2020 original and the 2021 update).³

As for now, permacomputing is more like a set of interrelated ideas and practices than a coherent system of thought. Different people have different views on it. Also, many people have independently come up with similar ideas, so there's a lot of overlap between permacomputing and concepts such as "salvage computing," "frugal computing," and "degrowth computing." Much of what comes out of the annual Computing within Limits workshops also has a lot of overlap with permacomputing. I think we should regard all these ideas as different aspects of the same thing, rather than as separate movements whose borders need to be unambiguously defined.

Marloes de Valk: Connecting these diverse yet overlapping practices is very important because they are often not visible to a general audience, sometimes not even to each other. The idea that there are no alternatives to mainstream tech platforms needs to be challenged, the greenwashing on their sustainability pages needs to be exposed. There is a wealth of practices in existence, historical and current, that approach computing as needing limits, including permacomputing, and making the different interlinked ideas visible, showing the relations between them, and creates a strong counternarrative to the one of green capitalism,⁴ which is shaping public discourse on how to best deal with the climate crisis, yet doesn't challenge the "business as usual" of free market capitalism that caused the crisis in the first place. The different terms and related practices that counter this are not competing for recognition as "the" best solution, they are strengthening each other. My hope is that communities working on developing, repairing, and maintaining their own computing infrastructure will benefit from each other's experiences, while always applying ideas and technologies in a situated way, adapting them to meet their local and specific needs.

Shintaro Miyazaki: How is permacomputing different from let's say supercomputing or feminist computing?

Marloes de Valk: Ville-Matias worded this nicely, in the aforementioned essay: "The existence of computers in a human civilization can be justified by their ability to augment the potential"⁵ for humans to have a strengthening effect on the ecosystem. Supercomputing can be essential to accomplish this, for instance when calculating climate models, yet this is only one application of supercomputing. I consider it a technology, not a philosophy. It can be used for climate research but also for something destructive such as oil and gas exploration. It was used to model the spread of the coronavirus, to forecast extreme weather, and to simulate nuclear tests. One of the main goals of

permacomputing is to use as little artificial energy as possible, in that respect supercomputing should be used extremely sparingly because it consumes massive amounts of energy; both in the form of electricity and as embodied energy in the hardware.

Ville-Matias Heikkilä: I don't think supercomputing is a specific technology but a design philosophy that aims at maximizing computer performance at any cost. There are some scientific problems where results actually improve the more you scale the model (weather forecasting for example), but supercomputing has also been a major guiding principle of mainstream computing for decades (e.g., the holy grail of photorealism in consumer computer graphics), and people even find it difficult to think outside the "more is better" box. Permacomputing is all about a wise use of resources. Huge computing tasks (especially ones that help heal the biosphere etc.) are something a society can use some of its surplus energy for, but our main focus is in "less is more" and the minimization of the use of artificial energy. Being happy with the abundance we already have instead of regarding it as scarcity that needs to be overcome with premature obsolescence.

One can say that the difference between permacomputing and "mainstream computing" is "by definition" the same as the difference between permaculture and industrial agriculture. In industrial agriculture, you pour more and more artificial energy and resources on the land in order to maximize the production in a simple-minded, straightforward, and "scalable" way, while in permaculture you co-operate with the land in inventive and thoughtful ways that get you a fair yield with minimal use of artificial energy. The idea of supercomputing crystallizes quite well the mindset that permacomputing is offering an alternative to.

Marloes de Valk: There are many overlaps between what I understand to be feminist computing (there is not one single definition or practice exemplifying it, but many) and permacomputing.

Ville-Matias Heikkilä: It seems to me that movements such as feminist computing often have their main focus on social justice issues around the technology, while permacomputing is mainly focused on the why's and how's of the technology itself. In the 19th century, some activists raised issues about the exploitation that took place in factories, while some others entirely questioned the maximalist production model that factories represented. Both were right and equally important.

Marloes de Valk: I think that is the strength of an intersectional feminist perspective on technology, a view in which technology is never disconnected from social reality, lived and embodied experience. Exploitation and a maximalist production model are inseparable, you cannot maximalize without exploiting people and planet. The differences

between permacomputing and feminist computing are perhaps not as interesting as thinking about how these terms intersect.

For instance the refusal to apologize for not always being available as worded in the Feminist Server Manifesto (FSM)⁶ is not only related to the labor needed to secure maximum uptime, it is also leading to a rethinking of availability in terms of ecological impact. To accomplish 5 nines uptime, a 99.999% availability of servers, the infrastructure needs to expand enormously; for every extra nine a massive amount of artificial energy is required in the shape of hardware (representing embodied energy and resource use), electricity, and fossil fuels. Datacenters burn through millions of liters of diesel every year just to test their emergency generators for example.

Another interesting overlap is the Feminist Server Manifesto's statement to "not strive for seamlessness. Talk of transparency too often signals that something is being made invisible." In permacomputing and permaculture alike, observation is important. You captured this well when writing about how current consumer-oriented computing systems go to great lengths to hide the inner workings of a system, alienating people from their devices. You suggest computer systems could make their inner workings as observable as possible. There is another aspect of observation that deserves attention. People are very much craving stories on how we can approach computing differently and are eager to learn what can be done concretely and practically. The hard part, it seems, is understanding that in terms of sustainability, most of it comes down to not doing, not buying, not adding, yet the initial response is often an impulse purchase of a solar panel and a Raspberry Pi... In certain cases a valid investment, but not always, and careful observation of a problem might lead to different conclusions and solutions. This made me think of a section in a book on permaculture that explained how the first year with a new piece of land you do nothing but observing. Only after having seen the land and all its inhabitants in the process of all seasons can you know what could be done with minimal waste of energy for all species involved, human and non-human.

Ville-Matias Heikkilä: I might also include situatedness. It is mentioned in the FSM as the first bullet point and is also highly relevant to permacomputing. Computers and technology in general should integrate to their surroundings both physically and culturally, adapting to the changing energy conditions and to the needs of the local people. It is important to decentralize and localize.

Systems like WWW that encourage excessive centralization have led us to a kind of world where being able to access a distant centralized server 99.999% of the time is something to strive for and where the owner of a huge server can enforce a "one size fits all" model to all of its users

regardless of their cultures and local needs. And this centralized, “one size fits all” mentality also makes it difficult for people to envision alternative computing cultures, and the lack of this kind of imagination makes it easier for corporations to impose draconian limitations on how people can use technology. Having a more situated, decentralized, and diverse computer culture would help a lot of things.

I would also like to mention the importance of historical situatedness. When permacomputing is envisioning computing several decades or centuries into the future, it is important to know where we came from. The mainstream history of computing is often a “winners’ history” told from a Moore’s law point of view: ever-more powerful hardware “generations” making their predecessors obsolete. We therefore desperately need more varied and alternative approaches to the history of computing in order to better situate ourselves in it. Local histories are particularly important. In a lot of Europe, for example, local computing cultures were “colonized” and even “deprecated” in the 1990s by a “Silicon Valley” culture that emphasized constant growth and obsolescence. This event is sometimes called Siliconization. If we only know about the “siliconized” idea of computing, it is very difficult to envision non-siliconized futures. I’m personally a part of the demoscene, a computer art subculture that has managed to keep many “pre-siliconization” ideals and practices: strict technological constraints can amplify creativity, small is beautiful, no platform is obsolete. Had there not been this kind of “alternative world” to contrast mainstream computing against, coming up with the idea of permacomputing might have taken much longer.

Shintaro Miyazaki: Where do you situate “countering” in permacomputing? How would you situate permacomputing within countering and how would you imagine its role?

Marloes de Valk: Countering within permacomputing is found in providing a counternarrative to the idea of eternal growth and its counterpart overproduction, through a “less is more” approach, exemplified by working with (e-)waste as a resource, emphasizing repair and maintenance rather than production of new devices, planned longevity rather than planned obsolescence. Permacomputing also counters the idea that computers “dematerialize” and lessen resource use, and does so through resource-sensitivity: adapting energy use to energy availability and using energy thoughtfully. Permacomputing counters tech corporations’ claims to universality through a decentralized and local approach. Decentralization is of course not by definition more sustainable, as exemplified by cryptocurrencies and blockchain technology. In the context of permacomputing, decentralization refers to autonomously-administered servers and services, for and by communities. This is also not by definition more sustainable, but at least gives communities the power to make choices about their tools

that allow for less energy-hungry practices, such as offline first, adaptability to intermittent connectivity, and running software that uses as little energy as possible and is tailored to local needs.⁷

Ville-Matias Heikkilä: Back in around 2008, I named my blog “Countercomplex.” The main idea in that decision was that I wanted to counter the kind of complexity that was prominent in the computing world by embracing the smallest, the bit-level minimalism. On the other hand, the countercomplex plane is a mathematical term for a plane that is just as complex as the ordinary complex plane but in an alternative way, so I could also use it as a metaphor for how complexity and diversity may emerge from very small seeds. The Bytebeat phenomenon, or how very short formulas of largely bitwise operations may yield surprisingly-complex structured music, was a kind of prime example of this type of “countercomplexity.” If even very short one-liner programs can yield something like this, we have possibly only scratched the surface of what even very small computers can do. This is also where I envision the potential of “growth” in permacomputing: explore the unexplored spaces of the devices we already have instead of getting stuck with the ideas that their designers had. Computing is a huge ocean of possibilities, even within strict limits, and that’s why we should counter the misguided idea that new things only become possible by “technological progress” that is synonymous with increased complexity.

Shintaro Miyazaki: Please suggest further counter-Ns, N-computing(s), or N-futuring(s). Or other scholars/artists to have a conversation with.

Ville-Matias Heikkilä: Computing within Limits in general is full of interesting ideas we have found relevant to permacomputing and many other ecological alternative-computing concepts, so the people involved with it would be my first suggestion.

Marloes de Valk: I agree, the workshop takes a more radical and transdisciplinary approach than other conferences and workshops on sustainability and ICT. It brings together a growing group of scholars dedicated to promoting the design of computing contributing to a transition to a future in which the well-being of humans and other species is the primary objective.⁸ The workshop’s publications contain a wealth of interesting terms and related design principles.⁹ The term Computing within Limits brings together three principles, according to a 2018 paper by Nardi et al.: it questions growth and aims instead for a steady-state economy, it considers models of scarcity in order to promote resilience in a diversity of current and future contexts, and lastly it aims at reducing energy and material consumption while avoiding the Jevons paradox or rebound effect, in which gains in efficiency often result in lower costs, a subsequent growing demand,

and increased resource consumption. The workshop's focus and the interpretation of its title have shifted a little over the years, starting with an emphasis on designing in the abundant present for the use in a future of limits, to designing for the present with an awareness of current real-world limits.

I'd like to suggest one more N-computing: Trans*feminist computing (Cell for Digital Discomfort) because even though it speaks of practices related to servers instead of computing in general, it offers pluriform and non-cis imaginations with its careful and collective expansion of the feminisms of the Feminist Server Manifesto as an "ambiguous ongoing wishlist for techno-ecologies in the making; an ongoing set of spells for a different tech for this world, for different tech for different worlds."¹⁰

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- 1 Ville-Matias Heikkilä, "Permacomputing," *Viznut*, 24 June 2020, available at <http://viznut.fi/texts-en/permacomputing.html>.
 - 2 Permacomputing wiki, 2022, available at <https://permacomputing.net>.
 - 3 Ville-Matias Heikkilä, "Permacomputing update 2021," *Viznut*, 27 August 2021, available at http://viznut.fi/texts-en/permacomputing_update_2021.html.
 - 4 Marloes de Valk, "A pluriverse of local worlds: A review of Computing within Limits related terminology and practices," *Computing within Limits*, 14 June 2021, available at <https://limits.pubpub.org/pub/jkrofglk/>.
 - 5 Ville-Matias Heikkilä, "Permacomputing," *Viznut*, 24 June 2020, available at <http://viznut.fi/texts-en/permacomputing.html>.
 - 6 "A Feminist Server Manifesto 0.01," *Are You Being Served?* 2014, available at https://areyoubeingserved.constantvzw.org/Summit_afterlife.xhtml.
 - 7 Decentralization is described in more detail on the permacomputing wiki: <https://permacomputing.net/decentralization/>.
 - 8 Bonnie Nardi, Bill Tomlinson, Donald J. Patterson, Jay Chen, Daniel Pargman, Barath Raghavan, and Birgit Penzenstadler, "Computing within Limits," *Communications of the ACM*, vol. 61, no 10. 86–93, available at <https://doi.org/10.1145/3183582>.
 - 9 See "Computing within Limits," available at <https://computingwithinlimits.org>.
 - 10 "Trans*feminist servers," pamphlet circulated at *Art Meets Radical Openness: DEBUG*, Linz, Austria, 15–18 June 2022.

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