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A feminist server stack: co-designing feminist web servers to reimagine Internet futures

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ABSTRACT

In this article, we reimagine the Internet as a feminist cosmos called a Feminist Server Stack. By scrutinising how webserver infrastructure is normalised based on imperial conventions and distorted knowledge systems, we suggest alternatives. This embrace of 'post-patriarchal futures' (Bardzel 2019, 20) offers counter perspectives on how we may holistically embody the Internet as a situated ecology. When experiencing the Internet materiality, it leads us to imagine beyond the known and possible. We focus on enchanting affirmations and tacit hands-on computational methods from the frontiers of feminist digital literacy and server communities. These acts make visible the seams and fissures of concealed undercurrents and schemata of infrastructures. The findings reveal utterly different relationships between webserver providers and clients. Drawing from extensive fieldwork and observational analysis, we show how the choreography of happenings is seeding the ground for participatively co-designing the transfiguration of planetary computing into one that is scalable, visceral, and restorative. We welcome these nascent pathways to guide us to an enigmatic realm upon which theories of co-design could dance in communion with a realm that is *to-come*.

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1. Internet infrastructure co-designed as a feminist cosmos

The proliferation of Internet engagement whilst living with COVID has brought to the fore an over-reliance on a variety of techno-cultural imbroglios that compels many of us to renew questions of how pervasive infrastructures can be reimagined. Even the readers of this very text have most likely accessed this from a digital library database, transmitted from a disc drive in a server stack via an unspecified location to the device where you are. As you stare at the screen, it is highly likely that your view time in each proprietary software application is measured and scrutinised if you do not use encryption. Corporations like Google, Amazon, and Facebook have sequestered monopolistic supremacy by capturing and manipulating data on individuals. This form of mass espionage surveillance results in an ever-growing accumulation of power and control (van Dijck 2013).

You may not be aware that it is possible to occupy this space differently. Three decades on since Tim Berners-Lee, one of the main architects of the World Wide Web, proposed an imaginary of the Internet as a tool for common good (Drescher 2017),

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these techno-capitalist-dominions have set default standards that relentlessly dominate, define and control how Internet users connect and thus influence social imaginaries of what the Internet is and what was or could be.

Over the last decade, just as the concentration of network-connected devices and applications increases, so does the volume and complexity of network activity and hardware consumption. Topologies of planetary-scale computation and its megastructures are referred to by Information Technology (IT) professionals as a *Technology Stack*. In the field of software studies, there are calls by philosophers of technology to redesign and reorganise 'the total apparatus of the built interior into which we are already thrown together' (Bratton 2015, 182). These appeals call for urgency when primary decision makers gain more power and penetration, producing patriarchal normative futures for countless living and more-than-human beings (Perez 2019).

Designers are undoubtedly implicated in the tension of the traditional desire to design flat and smooth systems with multifarious capabilities (Lewis et al. 2018). Designing technologies under the mantra of convenience and user-friendliness has limited choices and control to allow the very users to access the inner workings of the devices they have an intimate relationship with. Storni (2014) playfully uses the word 'de-*sign*', as an act of removing signs, marks and traces of work in order to shape the user as 'a (passive) spectator of the designer's magic tricks'. This can re-affirm designer authorship to keep users outside of interstices of technologies, even how they understand themselves as 'users'. While we comprehend the various intimacies of living with computational ubiquity – predominately manifesting on screens where personal thoughts and domestic lives are exposed publicly via mobile phones, this tacit familiarity doesn't often extend to the cables and infrastructures that such displays and devises rely upon.

For most lay-users of digital technology, we may not stop to think how much is deliberately concealed. Opaque devices such as routers are perceived to be mundane and therefore typically concealed in households and workplaces. Locations and management of remote computer server stacks and data centres are clustered in defensive environments, sealed off in refrigerated chambers, often founded on infrastructural conduits consigned during colonialist expansion (Neilson 2018). The prescriptive and top-down approaches of Internet Service Providers (ISPs) have been accepted into the social fabric of everyday life as givens.

The ontological omnipresence of a *Technology Stack* requires a reimagining of what alternatives and transformations of Internet futures could be, aligned with scholarship of feminist Human Computer Interaction (HCI) (Bardzell 2019), techno-science and philosophy (Grosz 2001, 2011, 2017), and materialist informatics (Marks 2020). This reimagining is a server infrastructure called a *Feminist Server Stack*, which is a critical, speculative design based upon existing womxn[1] led technical collectives that physically bend the wires and agonistically type the Command Lines that act underneath the skin of an Operating System. In opening up the seams and scars of technology (Galloway 2007; Storni 2014), we show how such communities are 'infrastructuring' (Karasti 2014; Star and Ruhleder 1996) and realising continuous co-creation (Bannon and Ehn 2013) to reclaim agency, knowledge, and power through a visceral relationship with the Internet. We expand feminist co-design by attending to the bodies and materials as the site where the ethical, political, and intersectional agonism manifests. Invoking Derrida's depiction of a 'democracy to come' which embraces a 'promise-*and thus the memory of that which*

carries the future, the to-come, here and now (2005, 85–6)'. A *Feminist Server Stack* is thus a proposition and provocation that draws on womxn's counter cultures that hover in-between the often-opposed genres of dystopia, utopia, fiction, and speculation (Dunne and Raby 2013) to imagine 'Stacks-to-come' (Bratton 2015, 298).

Reorienting our enquiry towards the more ambivalent realms of feminist, webserver peer production enables us to move away from the targeted and plagued approaches of supremacy's persistent customs. Neither does our paper conform to the dominant norms demanded for methodologies or pragmatic solutions to be applied to technological 'problems'. Rather, our agenda is to advance mature dialogues on expansive, feminist co-design that considers the ethics of agonistic pluralism (Björgvinsson, Ehn, and Hillgren 2012; Mouffe 2009 that attends to 'remaindered' experiences left out of the yoke of current regimes of control (DiSalvo 2015; Honig 1993). In other words, attending to excluded bodies and neglected materials, such as the minerals mined from unceded lands that make up the alloys and copper wiring, is a way to sensitise care about plural worlds, because we are 'always-participating-with-many' in structuring futures and imaginaries (Akama, Light, and Kamihira 2020).

We begin by tracing some of the genealogies of existing womxn led technical collectives and feminist server communities to highlight the politics behind why and how they were built and named. Thelead author, Nancy, is involved in the feminist grass roots movement as a member of the GCA Academy (GCA). She also administers a feminist server, where access to private mailing lists has been informed and permission vetted (see Mauro-Flude 2015; GCA 2001; SysterServer.net 2005). The sections that follow draw from these sources to show how agonism is manifested by an autonomously determined community. Our examples demonstrate how feminist web server communities can contribute to the restoration of diverse spaces of sociability and sisterhood. The focus we give to bodies and materials and how they assemble through agonism is embedded in palpable practices around technologies that are arcane, reimagining the systems in which these technological artefacts are living within (Bell). The mere touch of a simulated keyboard is enough to summon vast networks of global information. Attending to the politics of feminist co-design can guide us towards a more situated and holistic awareness of the material substrates in the network topologies procured in such acts. In doing so, we can understand just how visceral the Internet is, and of what has to be done, so it can be ethically and pluralistically codesigned otherwise.

2. Feminist server genealogy and the politics of ISPs

Typically, feminist web server collectives consist of womxn who have a personal interest in migrating to less commercialised, measured, and observed platforms. These are communities of designers, artists, critical theorists, feminist economists, nurses, blockchain researchers, software developers, and commons-oriented researchers. Conceived from within grassroots activist movements, feminist server subcultures provide resources, tools, and support to womxn to learn to use alternatives to proprietary software and build and maintain their own computer networks for further development within broader communities and possibly become (their own) Internet Service Provider (ISP) web server administrator. Most engagements in feminist server groups are constructed upon vetted participation, in which each member is collectively encouraged to

contribute, according to her skills and wills, sharing the password, writing documentation, coordinating meetings, submitting programme modifications, translations, and spreading the word.

The earliest known feminist web server collective is SysterServer.net launched on International Womxn's Day 8 March 2005 as an initiative of the Gender Changer Academy (2000–current). The SysterServer.net (2005–current) offers services to 'feminist, queer and antipatriarchal groups and collectives'. It provides an autonomous repository of resources and digital literacy support to womxn where it was, and still is, partially seeded from the Open Source and Free Software movements, which incorporate principles of freedom in sharing information and source code for others to modify and extend to better suit idiosyncratic predilections (Mauro-Flude 2008).

The first webserver of SysterServer.net was lovingly named *Jean*. The front end of the web server hosted a.html website featuring a womxn touching and assembling the hardware, exploring its inner parts (Figure 1). The act of renaming the hardware webservers as *Adele and Jean* is contrary to heavily prescribed trajectories and metaphors in IT language such as 'Master and Slave', which was typical when referring to computational hardware drives. Totalitarian terms like 'slave', inherited from engineering's violent expropriations of sexist, racist, and classist stance, have been recently banned in the coding community (Cimpanu 2020). Important developments like these are not merely to politically correct computer jargon but have been enacted upon the very source code of the Linux Operating System (OS) by Linus Torvalds, the creator of the Linux kernel in 1991. Torvalds responded to a 'pull request' on GitHub (a worldwide repository for open-source software) that requested a review, and so modified and committed to forthcoming documentation for the new version of Linux 5.8 OS to scrub out colonialist oppression being perpetuated in computational culture.[2] This is one of the many instances we highlight, to attend to the persuasive power of metaphors and languages (Lakoff 2004), as well as materials and bodies, that then scripts the socio-political life of humans.

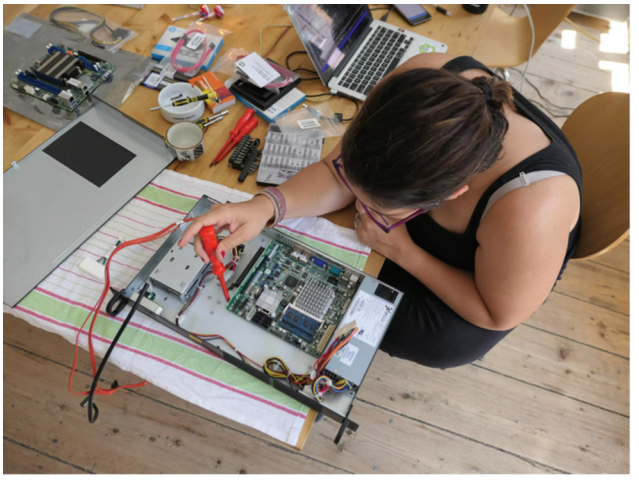

Figure 1. Adele being assembled, the feminist webserver in a server stack rack in the home of one of the founders of SysterServer.net, a collective who is also understanding the inner parts of the mechanism. Image: Author.

The value of a womxn's only space is a contested site of rich, agonistic debate, as we shall hear. There are multiple asymmetries, beyond just gender, where womxn who customarily have few coding experiences, are less familiar with its operation, and need introduction. The following examples reveal how such communities have created their own protocols and give agency to material devices as ways to nurture the development of small-scale networks of webservers as techno-social spaces. The reimagining here, commences in a 'post-patriarchal future' (Bardzell 2019, 20). This is less about defining a mythologised opportunity for all, but rather commits to pluralities of participation and situates labour in the mundane present to explore multiple possible futures-in-process (McKenna 2001), in vestiges (Bratton 2015) and in enigmatic, emergent, and contingent ways.These are necessary strategies because commercial models of the ISPs are becoming exceedingly complex or intimidating, arguably relying on unsuspecting users and assumptions oftheir rudimentary digital literacies. Authoritarian policies and organisations in many computer cultures perpetuate implied norms, rules, and protocols that can be an obstacle for people from very different upbringings. Advising us to shed these cultural and social markers of belonging and exclusion, Bell (, np) remarks how we 'need to . . . bring as many diverse and divergent kinds of people along on the journey and look holistically and critically at the many propositions that computing in particular – and advanced technologies in general – present'. Such efforts will be politically significant and have vast material consequences.What we examine has resonance with existing discourses in feminist co-design where practices of co-operation, governance, provision of shared resources are undertaken through 'commoning the networks' (Mauro-Flude 2015, np) that 'emphasises the active nature of the commons and the commoner that are taking part in the creation and maintaining of local and global commons (Marttila, Botero, and Saad-Sulonen 2014, 11). Infrastructuring material intimacy with the Internet will also be evident in the practices we share, as womxn navigate alternative, aesthetic ways of participating and generating understandings of complex configuration of socio-technical worlds. These practices challenge the official modes of consumption, knowledge production, and dissemination, especially within opaque infrastructures sanctioned by state and commercial interests. We underpin the discussion with materialist feminist theories of situated, relational, and dynamic positionalities (Grosz 2011, 2017) and the ethics and politics of participation that explores how womxen come together to co-design the invisible, mediating structures around them. In doing so, we complicate the function of peer production to investigate how unusual and eccentric approaches to co-designed spaces navigate, evade, and often eclipse existing protocols, laws, and regulations of the current techno capitalist hegemony.

3. Shared agreements, rough consensus, and running code

Shared agreements are co-created within feminist server communities. Networks of feminist web servers are not possible without an autonomously maintained ISP, which bequeaths agency to its community of users for its galvanisation. The following email demonstrates how engaging in autonomous and self-organised communities exists, with no clear determination of responsibility, control, or headquarters beyond the feminist server member herself, including improvising ways to vet new community members:

> Subscription to the mail list is currently open upon moderated approval. Only members can view the list of members and the archives . . . From now on, we suggest a system of recommendations enabling a new subscriber to register in the mailing list if two other people already in the list back up their nomination. What do you think?'[3]

Another agonistic example can be witnessed in seeing decisions on how much to pay, what to pay for, and how resources are used to maintain, are shared and continuously improvised. The following email is a request for solidarity funding for financial upkeep from the collective with no spreadsheets but a simple bond of trust and as candid '*I just made it up*' declaration:

> . . . the solidarity funding round for 2020. In the past I always did a bid for 120 euro, a price I simply made up. If you all think we should pay more or less let me know . . . There are 41 people subscribed (although I see one person twice:)). I would love to hear some more voices.[4]

The implementation of technical utilities and the related costs involved are conferred, administered, and maintained experientially with peers. In this way, feminist web servers are built, installed, co-designed, maintained, and autonomously determined by an intimate community of 'prosumers' which bestows agency to the hands-on procedures beyond a typical consumer of off-the-shelf computational equipment. They support each other by sharing passwords, writing documentation, translating information into different languages, and submitting software versioning modifications to repositories such as GitHub, a code library with a transnational user base and a highly valued space for technologists who are devoted to iterative code dissemination.[5]

These pragmatic supports are more significant when contrasted against traditional IT server system administration culture. Conventional replies to a technical question will often be given as a short and sharp 'RTFM' (Read The F****** Manual).[6] The repeated use of this acronym has ossified a confronting practice and 'makes you feel, as if you were at the very beginning of your nerdy career' (GCA 2005). Those who are not familiar with the practices of computer culture are often vexed in ISP spaces: 'Making people expect "RTFM" as . . . advice is proven to be an effective means to keep people out' (GCA 2001). Not being formally trained in computer science or engineering, womxn can often be observed to muster up the courage to participate in touching keyboards, asking questions and knowledge sharing. Aimless acts of lurking, marvelling, discovering, hanging out in the environment of the chatroom, hack lab, mail list experientially reading/hearing the lingo, witnessing people in action are all important. These formative acts and approaches in womxn centred engagement with technology seed the ground towards understanding the role it may play in their lives. Posing technical questions and sharing information about technical knowledge is context sensitive. In the atmosphere of a feminist server environment, be it implicitly in a chatroom or an email, negotiating codes of conduct are based on trust to empower the participants through creating spaces of inclusion and confidence. In some cases, a code of conduct can be a collaborative document with a list of principles for participants to modify, alter, or add other opinions and idiosyncratic articulations to what is there.[7]

4. From autocracy towards circular profusion

Feminist web server collectives have many aspirations. A shared hope is that the server is collectively administered as a communal procedure in peer-to-peer networks as a continual process. This prospect is enacted by participants who scale up and down their administrative access, befitting the verisimilitude of necessity

Yet the community is contingent on the status of the server as an intermediary agent, which now and then, has its own inexplicable demands, packages that need to be upgraded or stitched in short periods of time, which is not always straightforward. If an individual believes a particular new application could enhance the webserver, then the individual drives the installation and communications about it to the community. This acts to break the boundaries between administrators and clients and provide a continual documentation of the community:

> Hi. A photo of the server output. The issue was being caused by a filesystem not unmounting properly. It was not possible to log in to find the service that was trying to unmount so went for a hard reboot. That went smoothly and I can log into the machine again.[8] (see Figure 2)

As we see above, a feminist server approach differs in know-how and ability to use privilege and act on-the-fly to repair the server. In traditional ISP norms, users world never be given the password to execute commands as a #sudo because there are clear distinctions between the server manager and the user as client. #sudo is a command (meaning 'super user do') that temporarily elevates a user's privilege to allow completion of super-sensitive server administration tasks on the *nix OS.[9] In this way, #sudo allows an endorsed user to execute a high-level command in the webserver, according to specifications of the system administrators who are authenticated to do so. If a user/client is not listed with permissions of a 'sudoers' and tries to run a command using #sudo, it is considered an attempt to breach system security. An alert is sent to the administrator authorities of the server with a record log of location and timestamp and as a provision the user is locked from the system, until the situation is clarified.

Rather than seeking to attain equality within the existing ISP procedures, the participants of a feminist run server aim to provide an autonomous space for experimentation with Internet protocols. As Swierstra (2015) highlights when it comes to assessing the 'soft impacts' of emerging technologies through stories, these impacts can be made 'present for anticipatory reflection'. These bearings are based on possibilities, which tend to be formidably vast, so the imaginary needs to occur neither entirely in fantasy nor in concrete reality, but in between, where both other 'realms' can germinate, and come into existence.

To sustain the feminist web server, collective and personal communication primarily occurs via open source encrypted chat room software and community discussion email lists. The womxn who show up for the computer server system maintenance correspond about it. The following is an email report on 'sudo update' that elucidates both the trepidation and tangible action, which ensured the stability of the OS on the web server. At another moment when things had inexorably gone awry, the servers nearly failed, and an emergency maintenance email followed soon after it was reported:

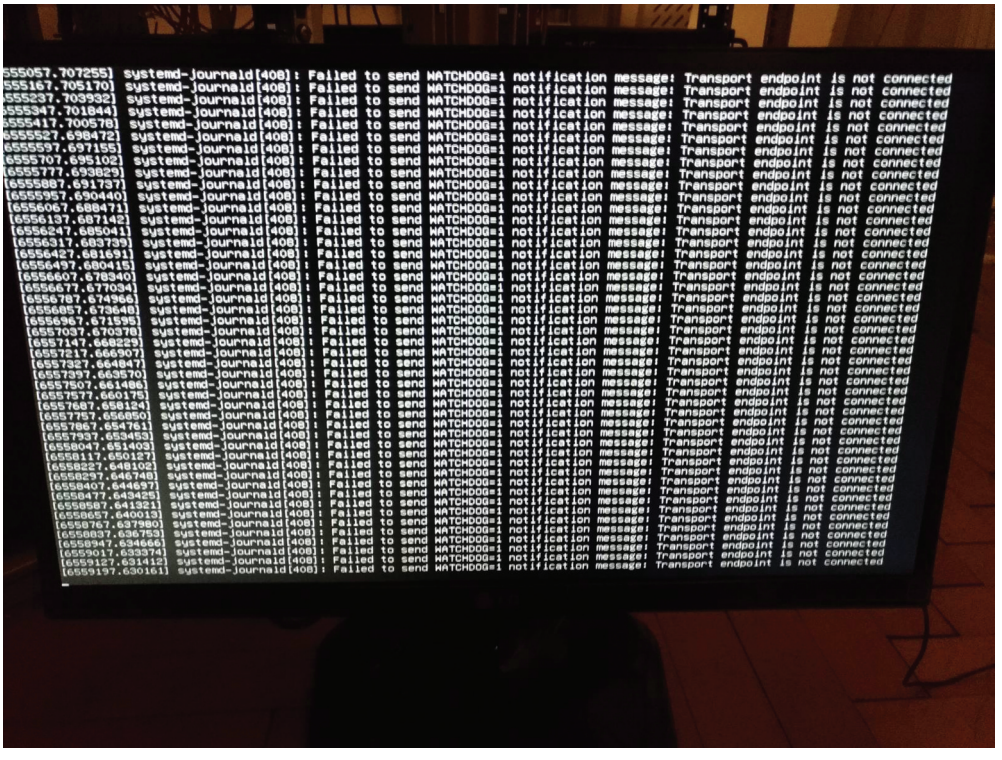

Figure 2. A photo of server 'Adelle' output during 'downtime', a period when it is unavailable, shared by a SysterServer.net community member. Image: Author.

> Last night I updated #sudo on both servers. Sorry for not consulting with the group first, but it was serious and I was online and well, you know. Thanks [name redacted] for pointing it out … [10]

We can read above how a participant pointed out that the update was executed without consulting the group. It is notable that this did not cause major concerns for the collective. These illustrate constant underlying tensions and negotiationin co-designing participation in feminist web server communities.

Resisting limiting visions, finding the most fertile directions with a motley crew of allies is crucial for a *Feminist Server Stack-to-come*. These alternatives are not driven by consensus, rather they are agonistic spaces (Mouffe 2009) to practice 'outside' a space that was formerly established by the dominant other. The value of a womxn's only space and their bodies as a contested site of agnostic debate is not new. Silvia Federici states 'there is nothing automatic about capitalist development, it is still written in "letters of blood and fire"' (cited in Elliott and Franklin 2018, 172).

In their advent, feminist-led Internet digital literacy and webserver events were frequently depreciated as futile and pointless. One example is how Weiden (2005) from Debian Women claimed:

> . . . The problem is when these groups don't have a clear target, in the end they turn in Barbie worlds that don't exist in reality. Instead of integrating the women into the community, they serve as ghettos, re-creating existing groups in the community with the only objective *being more friendly* for women . . .

This is a persuasive hand grenade, but the activating pin is missing. It is for these reasons that we must consider very carefully the boundaries of what constitutes occupying spaces 'as a womxn' to avoid further insularity or mirror the patriarchal world (Lorde 2018). Arguably, 'clear targets' referred to above speaks to the activism, politics, and labour in gendered ways that underlie many feminist waves, rather than measurables like Key Performance Indicators (KPIs) that stifle agonism. Grosz (2001, 25–26) remarks that 'we need quite different terms by which to understand space and spatiality, if we are to be able to more successfully rethink the relations between women and space'.

Taking the lead from Barzdell's (2018, 20) analysis into feminist utopias of participation allows us to keep 'a consistent focus on bodies . . . makes it more difficult to talk ourselves out of noticing the violence we are doing'. In other words, reimagining alternative Internet futures like a *Feminist Server Stack-to-come* can be ambiguous and incomplete, thus being substantiated in bodies and materials can keep plural agonisms real and alive. This also means touching, breaking open, and altering things, as we shall hear next.

5. A new millennium *Vvitch* bag: Internet materiality and holistic computing

Art, design, and technology have evolved through mutual exchange. Working inherently with materiality in the process of making meaning, a more intimate and subtle process develops. It comes as no surprise, then, that when feminism, art, and webserver technologies meet, a plethora of imaginaries emerge. In 2000, Gender Changer Academy (GCA) took their name and inspiration from a computer element (see Figure 3) stating a Gender Changer is

> an adapter that changes the "sex" of a port. Ports with pins are said to be male, ports with holes are said to be female. In the situation where two pieces of hardware both have the same port, an adapter saves the day and makes a connection possible. We are reclaiming the term to mean a person interested in the gendered aspects of technology . . . Technically speaking a genderchanger is a small device that changes the "sex" of computer cables. To us a genderchanger is someone who wants to change the idea that computers are for men only . . . figures out how her computer works, and she is not afraid of taking it apart. She can also change any card, plugin and unplug any devices without too much hassle. She is the witch and a knitter of modern times. She is a secretary with a ballpoint of steel. She is also kind to penguins, and she lets her cat sit on the monitor. (GCA 2001)

Defined by its dearth of pins, the GCA namesake seen in Figure 3 when worn may activate a discussion and further the awareness about the significant lack of womxn led computer culture. It is acknowledged that generally people know very little about what is under the hood of computational equipment. Here, we allude to issues around the technological power relations of commodity electronics most understood by the maker culture adage that states 'if you can't open you don't own it'. A hands-on practice of maintenance supports critical discussion about obsolescence and the use of second-hand parts where reasonable.

Figure 3. Here we see a female gender changer (two sides with pin holes – female) talisman gifted to the graduate of the GCA. This socket typically connects to a male gender changer (two sides with pins – male). Image: Author.

> Hardware is a mystery, a barrier . . . playing is a way to get to know how stuff works . . . being able to interact with it gives one a sense of control and independence. Secretaries of today should have a toolkit to be able to Do It Themselves, a millennium witch bag. (GCA 2003, 4)

There are multiple reasons why womxn customarily have few coding experiences, are less familiar with server operation, and require some kind of computational initiation. Thus, to graduate from the GCA, womxn would need to complete 'Computer Hardware 4 Girls' workshop. The first instructions are to 'break open a floppy disk' (this part was introduced as many womxn were petrified of breaking the computer during GCA's early workshops). Following this step is 'hardware basics' such as: how to operate tools like demagnetising screw drivers, 'for demolition and reconstruction'. Disassembling and assembling computational hardware, participants were encouraged to 'crash', excarnate, and unravel computer towers, name all the parts, and to 'put it all back together again. Preferably with an improved installation' (Gender Changers Academy 2003, 3). The graduate of the GCA hardware workshop would both receive a Gender Changer Accountment (Figure 3) and the *Computer Hardware 4 Girls Reader* (Gender Changers Academy 2003). This handout included chapters that detailed components inside and outside the computer, as well as health and environmental issues.

Touching the materiality of electronics can be a portal to play directly and repetitively with more-than-human entities such as network interception, intersections, and tangential assemblages, with distant and local actants. Exposing technology's inner working is to expand the 'machine' to 'describe interrelationships encompassing devices, bodies,

agents, forces and networks' (Critical Engineering Working Group 2011). To engage in a tactile manner with the physical properties of the hardware is a direct contact with the minerals that transmit currents and signals. We will expand on this intimacy and material importance in the next section.

6. Post patriarchal stacks-to-come

Scholars of materialist informatics interrogate the ecological consequences of technologies of extraction (Marks 2020). These armatures guzzle data, energy, time, and minerals through server stacks in data centres, currents, and fibres that connect to and from end-user devices suchas mobile phones, Internet routers, and ethernet hubs (Jussi 2016). This implicit critique of the IT ISP industry effectuates an assortment of perspectives, including a critical examination of designers' responsibilities to engage in a philosophy of technologies as robustly political and materialist.

To swell the readers' imagination of what a *Feminist Server Stack-to-come* is, and what the Internet could become, its reimagination invites us to roll-up our sleeves and engage with the materiality of the infrastructures underneath the skins of ISPs. The lines of texts in the examples earlier are the languages of how womxn communicate with the computer and with one another. There is care, passion, and labour in this activity, instead of being distant and consuming. Moving closer to the materiality allows us to activate an embodied consciousness to feel the heat of the processor, hear the speed and power of the disc drive whirling, and see what files are taking up the space. One can pinpoint the glitches. It allows the body to tacitly sense the server and the network and contemplate how the system 'talks back' (Schön 1983, 348).

To think viscerally, kinetically and materially is to evoke and sense beyond the fingers that type the Command Lines of the Operating System and feel the 'sixty different minerals' (Jussi 2016, 24) that make up the computer chips which have been extracted from distant lands. Attending to the touch of the metal allows us to connect with the properties of these elements that make the hard, smooth, shiny surfaces, to be both mesmerised by its talisman-like qualities and be troubled by the ethics of participating in extractive violence, and all the while, *the cat sits in front of the monitor*. This disrupts normative exchanges with hardware and engage corporeally through (and with) the aether for the emergence of multiple becomings (Grosz 2017, 2011, 2001). This can mean building tacit, intuitive networks of solidarity with minerals, lifeforms, humans, and non-humans alike.

In the wake of the fourth industrial automation (Chen et al. 2018), sixth species mass-extinction (Ceballos and Dirzo 2017) and the ongoing global pandemic, the explorations we report also aim to foster awareness of the ecological implications of commercial ISPs and the burden of the infrastructures' intra-connectedness. There is a carbon footprint when we command an Internet search, along with the energy to power our computers and phones. Radical experiments with capricious client–server relations can enable a critical reimagining of the material bonds between human and non-human agents when designing computational artefacts.

As 'The Stack becomes our dakhma' (Bratton 2015, 354) a *Feminist Server Stack-to-come* is an invitation to participate in self-healing mesh-works to profoundly amend the relationships we have lost with the rudiments and mechanisms that run the Internet. This can be restorative and holistic. It enables us to ruminate on alternative circular forms of

economy and decentralised modes of exchange, to learn, not only about the reach of infrastructures but also the provenance of the elements which they are composed. To reimagine Internet infrastructuring as a bio-geo-political dance means to pursue a continuous modification in the ethics of exchange as vividly open-ended, plural, and agonistic 'in dialogue with our non-human kin … across differences in material, vibrancy, and genealogy' (Lewis et al. 2018, np) while committing to shared processes, which are always ongoing, despite complex and hard to imagine social and political possibilities (Agid 2016).

7. Conclusion: Internet futures

While a *Feminist Server Stack-to-come* is a nascent and partially speculative proposition, the feminist web servers being explored and prototyped today, represent emerging practices that enables its members to assess possible future bearings, experiment with systemic change to co-design altered relationships to the Internet. These communities also recognise dominant and inherited strategies and support each other to shed them. Attending to their practices have importance for feminist co-design, as it allows us, as a community of designer-researchers, to appreciate what languages are used, learn how decisions are made by whom, and what outcomes they enable that constitute agonistic infrastructuring. This, in turn, allows us to be inspired in ways to subvert, queer, question and speculate as ways to reimagine futures. To remain critically active in participating is to keep open the widest range of possibilities in a techno-deterministic landscape where we urgently need to see norms shift (Light 2011). When we commit to the politics of feminist co-design, this also means we commit to continuous modification in the ethics of exchange as vividly open-ended – negotiating values is not unlike learning a dance where sensorial tendrils tune in and tacitly feel out knowledge through opening new channels of experience.

In the face of extractive legacies, the attention we give to bodies, materials, and agonism is important to bring us closer to work with ecological problems in the absence of deep structural change. This means we must continue to attend to the labour of making, concern ourselves with conditions, resources, and access for the workers, and further extend attentiveness to lands where resources are mined, where energies are generated, how ecologies are rehabilitated, how products are recycled, and what the embodied effects and physical inscription of constant computer work are having all intra-related non-beings. To have a material stance is to become an experiential agent of participation as a start.

One way we could begin to know these impacts is to feel these haptic tensions in our bodies by touching, sharing, and crashing the visceral materiality of systems. This means to be tacitly attuned to the most fertile directions in which to proceed rather than just pointing at ossified obstacles. Sensing the convoluted gap between production and consumption that feeds into concealed machine labour is still a challenge to come to terms with. Addressing it will exceed the bounds of this paper; however, we hope that we have highlighted the capacity that feminist codesign with other peripheral agents can contribute to compelling innovations and nuanced understandings, through mediating, interpreting, and questioning infrastructures as a place where interstitial knowledge may flourish *while carrying the new millennium Vvitch bag*.

Notes

1. 'Womxn' is a variation on the traditional spelling of the words woman and women, intended as shift away from the connotation of woman, meaning 'of man'. By participating in the spelling of 'womxn' feminists acknowledge the diverse identities of women that are not defined in relation to men (Oxfam 2015-6).
2. The majority of webservers, cloud infrastructures, supercomputers, and smartphones in the world have Linux-based systems. Evidence of pull request and ongoing commentary in the computer developer community of just how far this extends, see the Linux GitHub repository. Accessed from https://git.kernel.org/pub/scm/linux/kernel/git/torvalds/linux.git/commit | https://github.com/puppylinux-woof-CE/woof-CE/issues/1880
3. systerserver.net Adminsysters mail list – email 02.02.2019, 12:22.
4. systerserver.net Adminsysters mail list – email 29.10.2019, 01:53.
5. Two examples among many of these is https://github.com/melaniehoff/Peer-to-Peer-Folder-Poetry or https://github.com/hackersanddesigners/momentary-zine
6. RTFM, Accessed from http://en.wikipedia.org/wiki/RTFM
7. Examples http://vvvvvvvvvvvv.net/share/p/Code-of-Conduct | https://pad.constantvzw.org/p/feministserver
8. systerserver.net Adminsysters mail list – email 28.01.2020, 07:30. Thursday, 1 July 2021 at 00:04
9. *nix refers to Unix-like OS. Unix seeded the ground for Linux, a kernel wrapped in one of the many distributions (Debian, Gentoo, and so on), *nix OS enables communication with the computer via the Command Line. For instance, a *nix derivative is found in the Terminal application hidden in the utilities folder on Mac OSX (hence the X) based on a *nix OS, Open BSD. These are alternative user paradigms to Microsoft Windows and how users typically instruct Mac OSX to perform commands, through pointing and clicking the Graphical User Interface with a mouse. They often come readily installed on computers when purchased or assigned in many working scenarios. For further elaboration, see Mauro-Flude (2008).
10. systerserver.net Adminsysters mail list – email 28.01.2020, 07:30.

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