The textile as proto-digital:

her processes and inscription into computerlogic and coding

Bachelorarbeit zur Erlangung des akademischen Grades *BEd* gemäß Curriculum

in den Unterrichtsfächern *Kunst und kommunikative Praxis* und *Design,*

materielle Kultur und experimentelle Praxis.

eingereicht an der *Universität für angewandte Kunst Wien*

Am *Institut für Kunstwissenschaften, Kunstpädagogik und Kunstvermittlung*

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Wien am 3.2.2026

Abstract

This paper examines early computation as being built upon textile roots. The reframing of the textile is set in parallel to another erasure from early computing history – the woman. Textile branded as female-connotated work came with the pretence of devaluation. Therefore, to look at the downplayed position of women in early computation can be set in parallel to the removed inscription of textiles from digital logic and processing.

The jacquard loom as one of the only textile positions acknowledged in the history of computation is examined for its processes, with them mostly predating jacquard himself. The assumption of a patriarchal and colonial positioning of the jacquard loom in front of culture-historical processes is described through fields referencing themselves and building up closed information loops, severing connections that don't fit the worldview it perpetuates. Binary information, Parallel processing, punch cards, all basics for building up computational logic are found in the textile sector before, not invented out of nothing by the singular genius of one European man.

These origins, historizations, selections, and partial retellings are interwoven into a post-speculative take on the history of computation, emerging out of textile work and female habitus.

Abstract – german

Diese Arbeit untersucht die frühe Geschichte der Informatik als etwas das auf textilen Grundlagen basiert. Die Entfernung des Textils steht parallel zu einer weiteren Auslöschung aus dieser Historie – nämlich die der Frau. Textilien, die als weiblich konnotiert galten, sind ebenfalls abgewertet worden. Daher kann die Betrachtung der heruntergespielten Position der Frau in der frühen Informatik parallel zur entfernten Einschreibung von Textilien in die digitale Logik und Verarbeitung gesetzt werden.

Der Jacquard-Webstuhl als eine der Wenigen, in der Geschichte der Informatik anerkannten Positionen des Textilbereichs, wird hinsichtlich seiner Prozesse untersucht, die größtenteils älter sind als Jacquard selbst. Die Annahme einer patriarchalen und kolonialen Positionierung des Jacquard-Webstuhls, der sich vor kulturhistorische Prozesse als Verdeckung dieser setzt, wird durch Felder beschrieben, die sich auf sich selbst beziehen und geschlossene Informationskreisläufe aufbauen. Diese Verselbst-ständigungen unterbrechen Verbindungen, die nicht zu dem Weltbild passen, das sie aufrechterhalten und verstärken wollen. Binäre Informationen, parallele Verarbeitung, Lochkarten – alle Grundlagen für den Aufbau einer Computerlogik finden sich bereits davor im Textilbereich und wurden nicht aus dem Nichts von einem einzelnen europäischen männlichen Genie erfunden.

Diese Ursprünge, Historisierungen, Selektionen und partielle Nacherzählungen sind zu einer post-spekulativen Sichtweise auf die Geschichte der Informatik verwoben, die sich aus Textilarbeit und einem weiblichen Habitus heraus bildet.

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Introduction

Textile and digital culture are intertwined and cut. Textile logic formed the foundation on which programming was built, the punch cards of the Jacquard loom with its binary logic of *hole* or *no hole*, setting the standard for the adapted, digital language of *zeroes* or *ones* – but building on this does not mean that the digital is acknowledged as a deviation of the textile, nor the women being acknowledged as participants in the creation of early computing.

Through repeated breaks in history, practices that originated in these women-led areas were taken over by male chauvinism, which appropriated previously devalued processes, repackaging them into a patriarchal system. When looking at the definitions of textile and digital, there is the similarity of a process-oriented way of thinking rather than a produced thing. This dematerialised state is more annotated to the current understanding of the digital – an immaterial amalgamation of processes happening in a black-box.

The gendered attributions of both fields, textile and digital, are examined through their performed separation, mainly through patriarchy, capitalism and archaeology. Collected historical anecdotes, writings, and alternative readings are presented next to the problematization of how a particular historization can shift and distort views. The genealogy of the digital emerging through textile is presented along their performed separation through gendered connotations. The ripple effects of this performative split are then examined through contemporary tendencies and views on computational thinking, feminist theory offering a reposition of the textile and a visibility of the women who advanced computation through it.

Keywords

Digital culture – Textile culture – Data – history of technology – punch cards

Disclaimers

Disclaimer 1 – unfit for APA Standards I include the full names of the Authors, including their first name. Representation is key, and still the bias towards imagining the lone while male genius when reading only a last name is something I also can't rid myself off, therefore actively working against it by naming female* authors in full.

Disclaimer 2 – I use em-dashes and didn't use ChatGPT which seems to have a monopoly on the "–" in writing.

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Revisiting history – Introduction & starting point

The etymological closeness of *history* and *story* is not coincidental. History thought of as an amalgamation of stories tends to set one person in a central view – the storyteller. The question of who gets to tell, what is told and what is heard are questions of power and selection, more than documentation.

Ursula Le Guin proposes the spear as an embodiment of how history is thought of in a eurocentric way. Not only through the selection procedure of what is recorded in a story and what is discarded, but also in a linear logic going from A to B (Le Guin, 1986 p. 169). The timeline as a way to order these stories instils a neutrality and objectivity into them that rises above subjectivity – *While history dealt in stories, chronology dealt in facts* (Rosenberg & Grafton, 1966, p. 10).

She opens an alternative start for human technical knowledge in how she proclaims the bag to be the forthcoming of other deemed *first technologies utilized by ~~mankind~~ humankind*, like weapons. While the hunters are materialized on the wall of cave paintings and go forth as the visible tellings from that time, meat, as she frames it was not a necessity. 15-hour workweeks were enough to gather enough subsistent leaves to keep oneself alive. This excess of time is speculated to have people start wandering off – go hunt for materials, not primarily for necessity, but for the story. The powerfulness of the hero in *his* story was what overshadowed the peaceful gathering that was recontextualised as something that was serving him. This history was coined through the shape of aggression […] *that of the arm or spear, starting here and going straight there and THOK! hitting its mark (which drops dead)* [...] (Le Guin, 1986, p. 169). With this linear approach and tendency to highlighting, the rule Le Guin proposes gives the foreword for a history that is coined by linearity, the male hero, on a pedestal instead of inside a bag, in which he would look miserable instead of almighty (ibid. p.166-170). […] *the story isn't any good if he isn't in it* (ibid. p. 169).

History could be thought of as stories being written with a bias, set in a linear logic to instil absolute truth – new and alternative readings try to breach that. *The past has to be continually re-narrated, and the political point of reactionary narratives is to suppress the potentials which still await, ready to be re-awakened, in older moments* (Fisher, n.D.). A new look always constitutes possible new readings, developing the new out of old. The bag is the first proclaimed moment of erasure of the textile in human history.

Building up on that idea, it is examined how textiles were re-connotated[1] numerous times, most notably the invisibility of the textile as a predecessor to the digital. While the early computer technology of the punch card is copied from a jacquard loom, this connection is documented and written about. What this paper aims to do, is not to only look at the material intersections but look at the gendered views and connotations of either field and the immaterial parallels. The logic, the way of thinking in a textilistic[2] way is also to be brought forward as the central birth point of the digital – connecting it to current projects and new keywords like computational thinking.

Textile culture as a starting point

Textile culture has emerged well before the oldest found textile object is dated to. The earliest intact garment is older than 5000 years, from the Archaeologist Sir William Matthew Flinders Petrie's private collection (Barber, 1994, p. 288-289). The oldest found fibres are dated around 8000 BC (Borella, Ibáñeza, Bar-Yosef, 2020, p. 1). The problem with textiles is that decades of erosion and elements can grind them into nothing, and for a long time, up until the changes that came with Petries approach to archaeology, even if found they weren't preserved at all. The tiny pieces of cloths that emerged from

[1] Reconnotation as a neologism. Reconnotation describes connotations being changed not through a somewhat evolutionary logic of layering info's over each other, but a rebranding. Deleting before present tendencies and replacing them with new ones, these even being possible to be the complete inversion of the original meaning.
[2] Also a neologism.

excavation sites at the time were often thrown away, not being thought of having any worth at all (Barber, 1994, p. 287).

While the earliest cave paintings in the Lascaux cave have been preserved well, and early ceramic shards and vessels have stayed intact, given the circumstances there is the assumption that textiles predate these but simply aren't found due to complete disintegration to the point of their unrecognizability.

The carrier bag theory by Ursula Le Guin is an approach to reconstitute the textile in a lineage where it wasn't formerly thought of. It is the earliest instance in the intertwinement of a preferential for certain attributes that get historized, or can even be historized from the current state of archaeology. It also opens a way to think of history through the lens of survivorship bias when it comes to putting forward theories of how life was, from a time in which there are no material deliverances that document these times in a decipherable way for researchers today.

Gehrlach, in a somewhat cynical way, shows how it might even be impossible to make assumptions about ancestral living by going back amounts that are starting to feel incomprehensible. Under the headline *Carrying systems around 200,000 BC*[3] he makes a case for unsure assumptions and conclusions regarding the survivorship bias of the few artifacts that were found in comparison to the thousands that were lost to natural effects like temperature, wind but also other lifeforms (Gehrlach, 2020, p. 20).

Another hurdle on the way to a historization of the textile was the incorrect assigning of *loom weight*s as decorative *beads*. What Elizabeth Wayland Barber described was the insufficient examination from archaeologists that brought false conclusions. So while the textile thing itself wasn't found or discarded, the *"beads"* were discarded in high quantities, thought of as something that holds no valuable insights or information – they fell on-par with the non-existent fabrics in their non-historization. Barber also talks about Avigail Sheffer who, when confronted with these alleged weights

[3] Translated from german: *Tragesysteme um 200 000 v. Chr.* (Gehrlach, 2020, p. 20)

didn't dare to specify and confirm their use until she started weaving with recreations of them herself. This *expanded archaeology*, going away from only an outsiders-perspective, working with the tools and therefore sharpening their definition was what confirmed their state, usage and importance once she realised how fabrics could be woven that way through her own experience (Barber, 1994, p. 287-294)

Also, the perceived worth of textiles was a reason for tendencies where the historization and analysis was seen as worthless, in comparison to sculptures, jewellery and other artifacts. *Textile crafts, which are often associated with the non-political context of the home, are not only perceived as feminine but also as non-ideological, non-intellectual and therefore trivial* (Kurbak, 2018, p. 14).

Textile thinking and immateriality

The definition of textile is not fixed and a closed-off definition – especially in the academic context. Through anecdotal occurrences over the last 5 years of studying in the department *TEX: Textile – Free, applied and experimental artistic design*[4] the unset boundaries and the first departures of materiality-based definitions are meant to be outlined.

I always saw it as flexible – textile, hard – technical. The problem was always joining something soft to something hard, but this flexible = textile made sense to me. – anonymised

Tufting is collage. It's just glueing. Textile processes are working in their material selves, so if you weave it, or knot it or bind it. The glueing is external to textiles. – anonymised

I am not working with all textiles. I work with string, so rather than areas of material I have something that is very small in two dimensions but almost endless in the third. It's a completely different type of logic. – anonymised

[4] Translated from german: *Textil - Freie, angewandte und experimentelle künstlerische Gestaltung*

One key difference in how the two departments which make up the overarching study program *DEX – design, material culture and experimental practice*[5] are constituted is the separation of different materials like wood, metal and plastic in *DAE – design, architecture and environment for art education*[6] while the aforementioned *TEX* has its lecturers more varied across processes from stitching, knitting or sewing rather than materials. The approaches, going from design to art, are the things that differ between the courses, but technically you could knit in every one of them, although with very different outcomes and contexts.

This observation is just meant to frame the question on how close the textile in its definition needs to be bound to a materialistic counterpart, not coming from literature but also in the habitus of a current textile study program.

Lars Hallnäs talks about the textile-thinking paradox. First, he defines a circular logic in which every well-established area is producing their own individual way of thinking. Exactly this then gets used to further develop the area, therefore inscribing itself again in the loop. There is a reoccurring logic that gets established to the point it can even free itself of its material boundaries. While that part is still present in the raw material, the process of formation opens a paradox that Hallnäs describes the following way: *It is as if material disappears and there is only form left and at the same time, as if it is only a matter of material construction with no form* (Hallnäs, 2018, p. 19). The question if *textile* is a *thing* is approached through a few different viewpoints (ibid.).

Most notable is the definition where the process and the result are differentiated. Textiles are defined as Material, not things, but going on from that standpoint, the time gets a position of defining what textile is. Rather than the finished object or in this case the finished thing, it is primarily focused on the process. *It is a building material, not a built thing; […]it is building, not built* (ibid. p. 20). So while textile

[5] Translated from german: DEX – Design, materielle Kultur und experimentelle Praxis
[6] Translated from german: DAE – Design, Architektur und Environment für Kunstpädagogik

things do exist, it makes no sense of removing the textile from already built objects, but the *textile*, singled out and isolated is focused on the time of production, defined through its process (ibid. p. 19-21).

This dematerialised definition of textile lends itself to be thought more of a process-based amalgamation than a material handcraft. Building up on this, one can put the textile in a better comparison to fields such as running code or process-based techniques like computational thinking.

Computational thinking describes this possibility to abstract, organize and select information in manageable sizes when it comes to tackling a problem that is too big for a person to just think through all at once. Borrowing from the logic of computer science in how it cuts up, manages and combines tasks for machines, it uses this logic and transfers it into a way of thinking. Although it might seem like a way to make humans think like computers, there is a clear distinction that talks about how computational thinking is more than that. It is a way how humans, not computers, think, but borrowing from the vocabulary of computer science to make certain techniques more consciously and intentionally accessible (Wing, 2006, p. 33-35).

One important distinction is that computational thinking is also not equated with programming – *Conceptualizing, not programming* (ibid. p. 35). It is therefore not an alternative for learning how to code, nor should computational thinking be set into the boundaries of computer science alone. Wing addresses a broad range of academic fields, proposing to integrate it into the respective practices, but also suggests it to tackle everyday problems and structures with new tactics (ibid. p. 33-35).

> *Ubiquitous computing is to today as computational thinking is to tomorrow. Ubiquitous computing was yesterday's dream that became today's reality; computational thinking is tomorrow's reality* (ibid. p. 33)

The parallels of definition and their intersections given the knowledge transfer from textile to programming, further their intertwining also in immaterial contexts**.**

The textile as pre-knowledge to computation is not only present today through code learning strategies, but it was also essential for the establishment of the field in a public which was not familiar with it. The accessibility of textile workers tools informed the women workers positive outlook, but also helped build pedagogical tools like the knitting computer (McKinney, 2022, p. 151).

It was the belief of women who, through the similar logic of the digital and textile understood these digital systems and the potentials of them. Their habitus became the front of a campaign where these machines were branded *as comfortable as a quilt made by Grandma* (ibid.). The belief of women was important in two ways: first the transferable knowledge was essential in the production and further developments within the realm of computation. Secondly the usage of textile tools for communicating an ease of use and reliability through connotations of the textile, was important to educate a broad mass which could have formed scepsis instead of trust. The knitting needle computer was a mostly pedagogical tool showing a rudimentary indexing unit through punch cards with slits and holes along the top – by threading a knitting needle through one particular point up to 200 cards could be sorted along that value due to all the relevant cards letting the needle pass through the slit, and all the outliers being picked up through the hole. The knitting needle was not only used for its fitting form, but also as a familiar tool the people who viewed textiles as something comfortable, reliable and harmless. Also important is the distinction that the knitting needle was not meant to show the computers roots in textile-based logic, but to rebrand the closeness as a marketing strategy for ease of use, harmlessness and safety. The parallels between the textile and the digital were not seen as predecessor-indicators, but as a field with similar levels of “comfortableness” (ibid. p. 150-151).

This evolved from perception and mediation to the production realm – women from textile production were also employed to construct semiconductors. This also instilled the connotation of reliability into this *core rope memories*, by referencing a handicraft that is “tried and true” thousands of years old (ibid. p. 150).

Hallnäs points to what the textile is when it is examined as a *thing*: *What we see is not a thing, but something waiting to be a thing, building a thing, localizing form, and defining itself. It is something that travels constantly in between local form and global material* (Hallnäs, 2018, p. 21). This coincides with Wings approach to computational thinking as an idea, not an artefact (Wing, 2006, p. 34). Mckinney rounds off the immaterial connection points through showing how they were not erased but re-connotated, not as an origin, but a public relations strategy using its similarities to produce belief and trust in digital systems (Mckinney, 2022, p. 161).

Hallnäs approach to specialised fields producing a circular logic, building up through self-referencing to the point of dematerialisation can be used to construct an argument in which the digital feeds itself from the textile, but cut off references and connections to fill them in with self-referentiality (Hallnäs, 2018, p. 19).

Texts about textiles – What do we need to de-code?

There are two problems that arise when it comes to examining the history of textiles and women through text alone. Firstly, the lack of historical texts, secondly, that they rarely discussed the points that feminist scholars were interested in. The texts were not written to depict what people at the time already know in their lived *now,* in a way that could be deciphered decades later and get an insight of how things were organised (Barber, 1994, p. 287).

The extraction of feminist history through approaches of classical archaeology are therefore impeded. The field of *herstory* is something that is trying to work around these barriers. *Emphasizing the role of women or told from a women's point of view* (oed.com, n.D.) is an approach to make these gaps visible and fill them through new focal points.

The problem already verbalised in Elizabeth Wayland Barber's headline for the 12th chapter: *Finding the invisible* (Barber, 1994, p. 286) shows that historicising these fields through discovered objects and

text alone is not possible. Hypotheses are one way to try telling alternative readings, but *a hypothesis, after all is no better than the evidence that supports it, and hypotheses without evidence are mere wishful thinking* (ibid.). The current definition of scientific archaeology comes from the culture of patriarchal capitalism – Searching for historization outside of these well-established processes poses the danger of losing scientific measures and therefore credibility.

One approach Barber proposes is not through written text as a documentation practice, but through linguistics. Finding a root of an older language for one technology but a newer one for another can give approximations on when said technology was firstly implemented. As textile things often refer to the processes which were used to construct them, an etymological closeness to names of practices can reveal further construction methods or the combination of more than one (ibid. p. 290-292). This approach is unlikely to produce new information by itself – more it is meant as one strand to underpin a hypothesis that originated from visual observations. *In this vision, textile art is not merely a historical reference but a fertile ground for future experimentation* (Giglione, 2025).

Textile, Text and the digital – encoding bits, into words, into tapestries

The etymological closeness of textile and text is not by accident. Both coming from the Latin *texere*, which means to weave, language itself can be presented not only by the information is shows but by structure, logic and combinations – much like code. While not directly named as a parallel by Barber herself, the way she proposes a look of sensibility through linguistical science on the structure on words, to not read their expressed information but the origins and logic inscribed in their split-up syllables, brings inherent parallels of coding to the surface (Barber, 1994, p. 290-291). The reading of code, etymological analysis of words and the process of weaving textiles can be compared by their varying scales of factors, added together to perform an action that results in a *thing* – be it a program, a sentence or a tapestry.

Lev Malovic's definition of language as *conventions, recurring patterns* and *key forms* broadened the scope to make Geoffrey Batchen use it as his basis for an analysis of new media (Batchen, 2020, p. 27). *The digital, by contrast, is code, inherently alien to human perception. It is, at base, a linguistic model* (Bishop, 2012. p. 441). Using Malovic's definition we can overlap the textile and the digital, for both of them share the same parallels when compared with text. Batchen even describes watching analogue pictures of lace as something we now are familiar with through its parallels to pixelated screens (Batchen, 2020, p. 31).

The intertwinements of textiles and the digital can be examined in both directions: by the combining of parts to form something bigger, or the taking apart of bigger structures down to the small key components.

> *A skilled knitter can look at a complex pattern and break it into repeatable sections. Similarly, in coding, we look for repeating structures to identify opportunities for optimisation or reusable components* (Walker, 2025).

Code Academy, an online educational platform for teaching amateurs how to code also compares textile knowledge with pre-knowledge of coding. One stich is equal to one bit, textile knowledge is transferable into the digital (McKinney, 2022, p. 150-151): *yarncrafting pattern designers (coders) know what it means to code, use an API, design, test, debug, and maintain source code - even if they don't realize it yet* (ibid. p. 151-152).

Another instance of textile techniques being directly translated to computation are core rope memories, most notably used in the Apollo 11 Mission to firstly send humans to the moon in 1969. Margeret Hamilton is credited with coining the definition of software-engineering (Cotton, 2024, p. 15). She was tasked with the production of the software for the Apollo Guidance Computer (AGC), being used in the communication between the pod that went to the surface of the moon and the aerial unit that stayed in the moons orbit. Although it was a male-dominated field, Hamilton repeatedly

proved her position of excellence when it came to the production of reliable code to be integrated in computers (Ceruzzi, 2016).

The code for the AGC was not just loaded into a circuit board but was physically woven into it. Via core rope memory, copper wires were woven through magnetic rings. 1s were stored by looping the wire through one magnet, 0s by bypassing the core. 192 of these wires had to be woven into place by two people passing a needle back and forth. This work required special textile knowledge and material sensibility – therefore women were hired from the local textile plant, that had excellent prerequisite knowledge of sewing (Shirriff, 2019). This also gave Hamiton her nickname “rope mother”. Her code had to be robust, and void of errors as once woven into place, adaptation was harder than starting anew (Ceruzzi, 2016).

Looming Punch Cards onlooking a new data-driven society

The punch card originating in female-connotated textile production being used for early computing is a factor that would automatically make the digital female-connotated as well in theory. In practice this wasn’t the case though, even though women were indispensable also for the building and working on early computers. These breaks of presence, visibility and gendered aspects inside this sector with their underlying structures are examined in the chapter after this one in *The computer – a woman who computes*.

Foregoing there is a brief reconstruction on how material textile technology laid the cornerstone for digital and computational technology – mainly focused on the punch card, and the changes in societal and bureaucratic structures it brought with it.

The punch card in weaving

The jacquard loom was invented in 1804 by Frenchman Joseph Marie Jacquard. While he didn't reinvent the loom itself, he added the punch card reading and interpreting system, which chose one of two fixed positions for every single strand of thread that was running through the loom for every single instance of weaving. The cards were fed, read and switched to the next one fully automatically (Lin & Witkowski, 2025, p. 3).

The punch card is pivotal in the construction of an early computational organization. Originating from this exact type of loom it changed how information can be stored and deciphered, in this case the revolutionary mode of operation was also that the punch cards did not have to be read by a human but were made to directly interact with the machine.

The introduction of the jacquard loom was seen by textile-workers critically, as an attack on their necessity and livelihood through the transfer of agency of reading and interpreting from the human to the machine (Plant, 1997, p. 15).

The reading apparatus is comprised of spring-loaded metal pins that get pushed into the punch cards. *Figure 1* shows that if the punch cards have a hole, the pins go through unobstructed, if there is no hole the pins get pressed. Every non-hole pushes the pin which offsets a hook. This in turn makes a carrier system miss it when it picks up all the hooks on which the warp-threads are located. Every engaged hook gets picked up, making the thread go up with it, making the shuttle pass under it. Every disengaged hook stays down, making the thread stay at the same place with the shuttle passing over it. This binary decoding of the punch cards resulting in an up or down position of the weft is the mechanic behind the jacquard weaving loom.

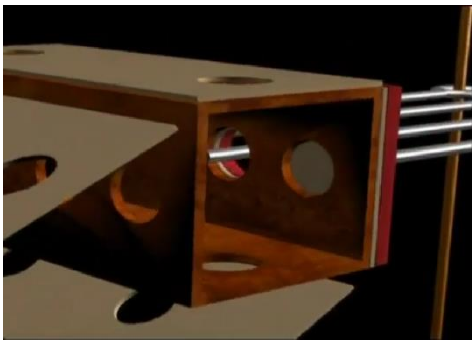

Figure 1: Jacquard loom: holes being "read" by pins

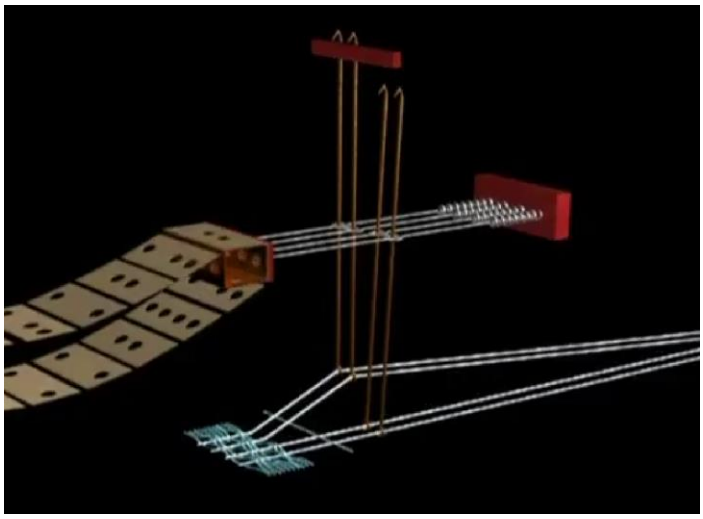

Figure 2: Jacquard loom: threads being shifted up

Figure 2 shows the jacquard loom in the moment the shuttle passed, the light blue thread is under the first two threads of the warp but over the third and forth. The punch card is *hole – hole – no hole – no hole* for the third and forth hooks were pushed back and the red carrier mechanism only took the first two hooks up with it.

The reading of the holes as well as the carrier system picking up the engaged hooks are both parallel systems set in series.

The punch card in early calculation machines

Ada Lovelace, (further introduced in the latter chapters) the earliest computer programmer, in her examination and usage of the Jacquard loom as a piece to reuse in the Analytical engine, often drew parallels between weaving and computation. Only the punch cards gave such reliability, such certainty in combination to mass, speed and storage capacity that she described them in the formation of a machine as *the executive right-hand of abstract algebra* (Plant, 1997, p. 23).

Although the punch cards from the jacquard loom were the inspiration for early computing, the way the holes are read is vastly different, first because of the speed but also because the computers didn't need to facilitate movement like the loom, but calculation. It is closer to an interpretation of information rather than a mechanical process. Another big change of possibilities is the introduction of electricity into the system, with the loom being only a completely mechanical machine, card readers later were electromechanical objects.

One possibility to get the data from punch cards was an array of phototransistors sensors that were interpreting the holes as well as monitoring the card movement. The cards were running through the sensors on the one, and light on the other side, so when the sensors all got obstructed at once the machine registered the start of a card. After that the singular holes were registered by having light shine on the sensor, therefore transmitting a hole in a certain position (Documentation incorporated, 1972, p. 11).

In an introductory film dated around the late 1960s another way was shown through the use of rollers (A) that were under constant electricity pushed the punch cards (C) along a track. If the rollers made contact with a brush (B) through the hole the electricity would be forwarded and therefore registered (Moreland Latchford, n.D.).

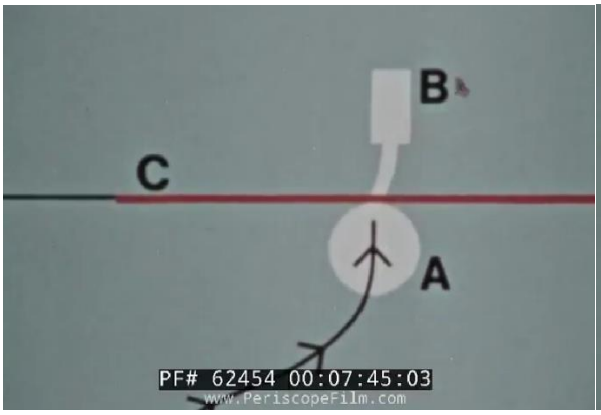

Figure 3: No hole in the punchcard – no energy flow

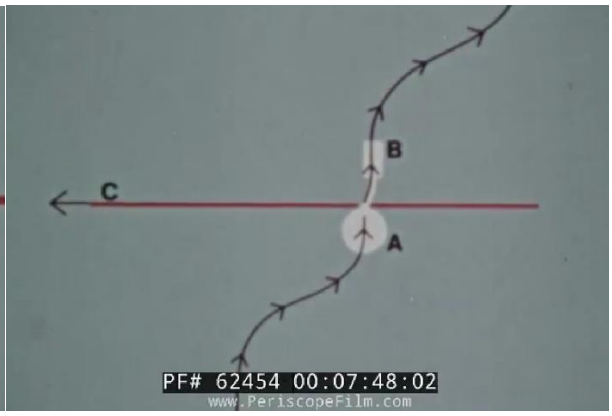

Figure 4: Hole in the punchcard – energy flow

The first drafts of indexing machines were directly based on looms, not only taking the punch card as an element but also the construction method into account. This resulted in a machine where paper slips represented the horizontal weft, and strings pulling these cards through as the vertical warp (McKinney, 2022, p. 150).

The punch card has a position of utmost importance. It is at the center of the calculating machines. It is the controlling element of all their actions and tasks. They facilitate adding, writing, sorting devices, punching devices, form guides, comparison devices, and much more (AWV, 1956, p. 15).

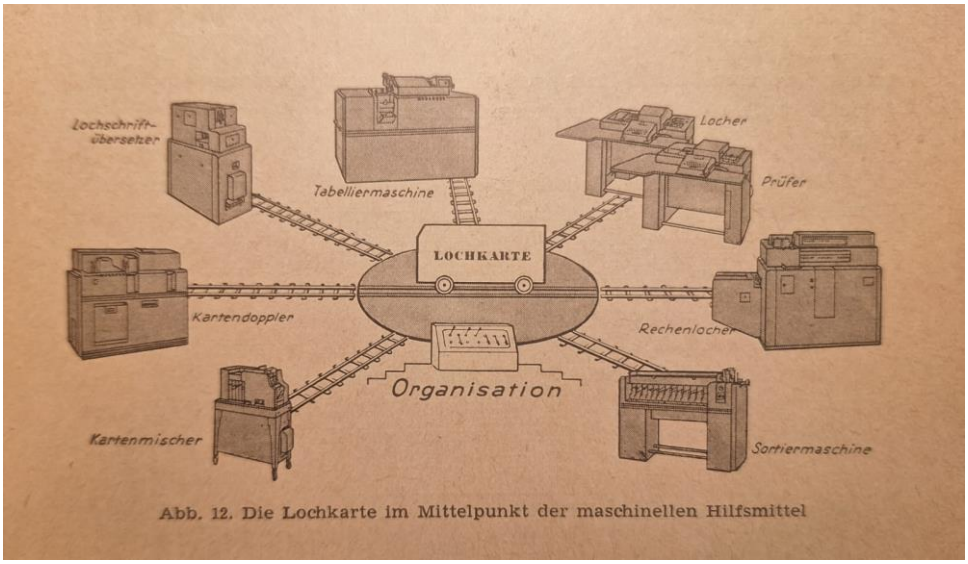

Figure 5: Diagram showing punch card in the center of an array of Machines

The importance cannot be understated for the industry as through the last 100 years (in this cited case from 1850 to 1950) while documenting a 40% increase in accounting power regarding workers, they amassed a productivity rise of 1400%, which is a 35-fold increase of the productivity of a single person (ibid. p. 14).

What is also worth noting is the conscious but not elaborated connection to textile processes. The *handbook of punch card organisation*[7] by *the committee for economic administration, Frankfurt at*

[7] Translated from german: *Handbuch der Lochkartenorganisation*

Main[8] does not include a chapter about intertwinement or building up on textile processes, but the cover art does. It shows two punch cards, sewn together with a red thread and a needle with the subtitle *The red thread through punch card practice*[9] (ibid. front cover).

Figure 6: Cover of handbook of punch card organisation, depicting red thread and a needle stitching together two punch cards

Lars Heide negates punch cards having agency instilled. His conclusion is that punch cards did not change society through themselves, but they facilitated a structure that made certain changes and tendencies viable. They enabled the possible considerations authorities created when they started to think within this logic (Campbell, 2010, p. 146). The position of the punch card therefore is one that can be well described with Melvin Kranzbergs first and forth law of technology:

[8] Translated from german: *Ausschuß für wirtschaftliche Verwaltung, Frankfurt am Main*
[9] Translated from german: *Der rote Faden durch die Lochkartenpraxis*

1) Technology is neither good nor bad; nor is it neutral.

4) Although technology might be a prime element in many public issues, nontechnical factors take precedence in technology-policy decisions (Kranzberg, 1986).

The punch cards could combine information down to a singular point. The reduction of a variable interpretation, different words meaning similar things, was circumvented by a radical reduction of data to *a hole* or *no hole* – similar to a one and zero later. The vast compression of data and the structure of a physical hole also made it possible for machines to read it.

Walter Porstmann frames it through the comparison of many letters and thousands of words that are used to communicate daily, all reduced to a singular 3mm hole, in an array of many possible holes. Every point can have an imposed meaning, and variations are catered for through the expansion of the papers surface, not an expansion of variations of letters to form text again. This *turning thoughts inside out*[10], as he said is what was needed from everyone at the time (Messner, 2011). A way of thinking that holds strong parallels to computational thinking in its reduction of information to smaller units that are easier manageable and interchangeable as smaller information-packages.

This mode of translating information made it clear that punch cards were not merely a copy of the information in another form, they became the main medium for information, also shaping how things were ordered, structured and thought of. To put the change of scale into perspective: Americas Social security system processed 500.000 cards per day, overlooking 26 million citizens after its first usage in the 1890 census where for the first time every record got their own punch card (Driscoll, 2012, p. 8-10). The census in 1890 was estimated to not be finished with counting until the next one was already due 10 years later. Punch cards, in their first broad usage across the whole country were used to have tabulating machines automatically count people in a household and their employment status, along

[10] Translated from german: *Gedankenumstülpung*

with various other information to gauge the nations human resources (Computer History Museum, n.D.). The need for a new way to address scale, informed the new logic when thinking about scale.

The computer – a woman who computes

And when computer was a term applied to flesh and blood workers, the bodies which composed them were female. Hardware, software, wetware – […] women have been the simulators, assemblers and programmers of the digital machines (Plant, 1997, p. 37).

To rectify the shunned position of women in early computation is an undertaking that lots of recent scholars have undertaken. From Sadie Plants highly influential cyperfeminist work zeroes + ones, to more recent approaches by Cait McKinney, Michelle Cotton or Mar Hicks, only to name a few. The approaches range from putting women at the forefront in a retelling of the last century of computation, to short chapter-based writings on the intertwinements of women with computation and textile.

The position this paper wants to further investigate is not only the insufficient historization of textile culture through its gendered connotation but also parallels to the erasure and non-historization of women in early computing, something that only also only possible to be retraced due to the shorter time distance. The connection points of textile and digital culture through their material conditions – via punch cards – and immaterial conditions – via process orientation – are highlighted as well. From this multiplicity of points, the re-connotation of the digital as a male-dominated sphere is examined, closely followed by its various ripple effects.

Ada Lovelace – weaving a computer

While the furthering parts will focus on women representing a class, rather than singularised people, the position of Ada Lovelace is one that is singular due to its absolute uniqueness.

Augusta Ada King-Noel, Countess of Lovelace, later known as Ada Lovelace is deemed the worlds first computer programmer – acting in a time where the computer, as it is known today didn't even exist. Her extensive knowledge of weaving positioned her with an unique approach to computation, laying groundwork to her work in close collaboration with Charles Babbage who today is also called the *father of the computer*. While they both worked on the *Difference* and *Analytical Engine*, it was Ada who frequently brought parallels from weaving into the shared algebraic practice – and it was only her who believed in the surpassing of the machine into mere endless potential, going further than just calculations, which was at the heart of Babbage's practice and outlook.

Her notes for an article on the Analytical engine, which were three times as long as the original text, included *Note G*. The first published computer program, used to calculate the Bernoulli numbers, laying groundwork for all modern computing (Lin & Witowski, 2025, p. 1).

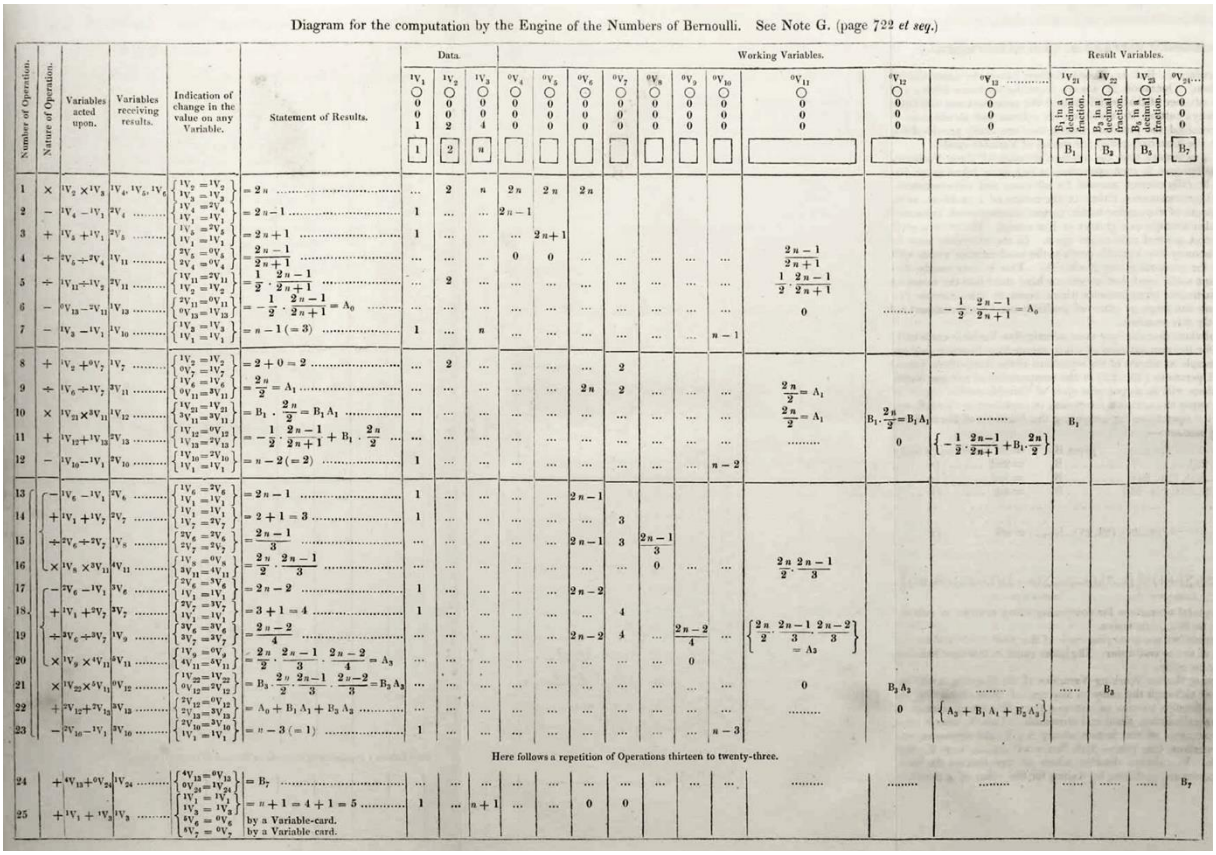

Figure 7: Ada Lovelace's Note G: a diagram for the computation of Bernoulli numbers.

Lovelace doesn't single out the punch cards when they were transferred from the jacquard loom to the difference and analytical engine. She recognises the logic of weaving as the key element that informed the punch cards constitution. Taking these over brings the inherent logic of textiles with it into computing. *We may say most aptly, that the Analytical Engine weaves algebraical patterns just as the Jacquard-loom weaves flowers and leaves* (Lovelace, 1843, p. 23).

A gendered split

From around 1450 to 1650 there is a shift from feudalism to newly set up ways to manage and construct power. While there is no moment in time that is seen as the start of capitalism, cornerstones of its logic and the position of people are defined in that period. Much of what constituted the

patriarchal divide is defined through the male workers body and the female body reproducing this workforce. To facilitate this the power of women was removed through the witch hunts (Federici, 2004, p. 62-64).

Privatisation increased food production but not allowed for better food supply of the workers than before – merely export was fed through the overachieving of the bare necessity. The removal of commons, after reframing it as primitive communism, was detrimental for women. Communal cohesion was essential for women at that time as they already before had less social power and were more dependant on them for subsistence, sociality and autonomy. The loss of this, equated a loss of agency for most women in Europe.

The weaving of complex designs demands far more than one pair of hands, and textiles production tends to be communal, sociable work […] (Plant, 2007, p. 37). The devaluing of the position of the textile cannot only be attributed through social connotations but also the resilience women gained from the communal work, that needed to be broken by the patriarchy. Under the guise of witch hunts these formations of women became the target since the system needed singled out women, performing devalued invisible work. [...] *nocturnal work, women's work, which has to be performed far from the light of the sun and almost in secret* (ibid. p. 75).

After the *loss of the village* not even nomadic life was an alternative because of safety reasons, but also because pregnancies made travel unviable. The monetary domination in the end made it almost impossible as the spiral of devalued reproductive work bound them to the home even more for the impeded possibility to be independent from one's husband. What peaked in the 19th century therefore was the full-time housewife as the new position that defined women's societal and economic position in relation to men. Also, as a disadvantage to men, their wage was not only used to control women but also getting further devalued through the negative view of household work – labour value in total was getting diminished (Federici, 2004, p. 71-75).

This loss of communal practice is also visible in the reframing of modern computer industry in the 1950s and 60s in Britain. The hiring methods more often included the focus on mathematical competence and independence rather than qualities of collaboration. The new standards preferred more male-connotated tendencies rather than female, also employing more men. This was also the time when people working in this field firstly got connotated as socially incompetent, neurotic and awkward – a stark contrast to the communal practice of female cleric work that predated it (Frauchiger, 2022). These connotations overlap with the stereotype of the nerd from today.

Early computing history

To give a broad overview of key inventions and changes in the computing industry, a rudimentary timeline is constructed along many main key researchers, also highlighting how many women laid groundwork for the systems.

1613 The *computer* is firstly named as a person doing mathematical equations (Cotton, 2024, p. 8).

1623 The calculating clock by Wilhelm Schickard was the earliest mechanical calculator, being able to add and subtract six-digit numbers through gears that were turning 1/10 for ever one before them (Freiberger & Swaine, 2016).

1832 A section of Charles Babbage's Difference Engine was built as a proof of concept. 2000 parts, a seventh of the whole machine was used for demonstration using the principle of finite differences (Science Museum London, n.D.).

1843 *Note G*, an algorithm calculating Bernoulli numbers is written for the analytical engine by Ada Augusta, Countess of Lovelace. The form in which she writes it makes her the first programmer (Lovelace, 1843, p. 52-55).

In *Note A* Lovelace highlights the potential of computers not only tabulating formulas, but general-purpose computing, therefore including music, poetry or images (Ibid. p. 18).

1931 Kurt Gödel presents the first programming language, based on numbers (Cotton, 2024, p. 8).

1936 Alan Turing describes a rather rudimentary calculation machine, named *Turing-machine* (Ibid.).

1944 Dr. Grace Hopper writes the first handbook for automatic sequence-controlled calculations (Ibid. p. 10).

1946 Frances Bilas, Frances Elizabeth Holberton, Betty Jean Bartik, Ruth Lichterman, Kathleen McNulty and Marlyn Wescoff known as the ENIAC Six, produced the first digital all-round computer – the ENIAC (Electronic Numerical Integrator and Computer) (Ibid.).

1951 Betty Holberton produces the soft-merge generator, the first instance where a computer is used to create another computer program (Ibid. p. 11).

1952 Grace Hopper and her team construct the first *compiler* – a program that translates content from one programming language to another (Ibid.).

1959 The 1401 computer by IBM gets presented – mid 60s almost half the world's computers are comprised of this unit (Ibid. p. 12).

1960 COBOL (Common Business-Oriented Language) was released off the Basis of Dr. Grace Hoppers FLOW-MATIC programming language to run across windows, Linux, Unix, etc. It is still used in 40% of online banking systems and 95% of ATM transactions (China & Goodwin, n.D.).

1965 Margaret Hamilton coins the term *software-engineering*, while working on the code for the Apollo-11 mission at MIT that will make humankind set foot on the moon in 1969 (Cotton, 2024, p. 15).

1669 The moon landing succeeds, using Margaret Hamiltons code on the apollo guidance computers (AGC). The code is stored in handwoven *core rope memory*, made by women hired from a textile factory (Shirriff, 2019).

1970 The first software-patent IBM gives out is to Janice Lourie for her program on designing textiles on the computer (Ibid. p. 19).

1977 The first PC (personal computer), the apple II gets released (Ibid. p. 24).

1981 IBM reveals the IBM PC, their first micro-computer (Ibid. p. 25).

1983 The *Time Magazine* just for 1983 changes their format p*erson of the year* to *machine of the year*, crowning the computer with the subtitle: *The Computer Moves In* (Time Magazine, 1983).

1984 The Macintosh computer gets released, setting a new visual benchmark for technology (Cotton, 2024, p. 26).

The WISE-campaign (Women into Science and Engineering) gets enacted in Britain (Ibid.).

1985 Sophie Wilson works on the *ARM-processor* – it getting used into 95% of all smartphones up until 2012 (Ibid. p. 29).

A Cyborg Manifesto by Donna Haraway gets published, laying groundwork for further feminist theory intertwined with computation (Ibid.).

1987 *Systers*, an international mailing list for women working in the field of informatics is established by Anita Borg (Ibid.).

1989 Tim Berners-Lee, a British scientist at CERN, invents the *world-wide-web*, firstly constructed to facilitate automated sharing of information between scientists, universities and institutes in a proposal called: *Information Management* (CERN, n.D.).

1990 The first website goes online on the *world-wide-web* (Ibid.).

1991 The term cyberfeminism gets coined through a new manifesto spread in print and online by VSN Matrix, an artist collective consisting of four women (Cotton, 2024, p. 30).

1993 The source code to the *world-wide-web* was released for free by CERN (CERN, n.D.).

2002 The difference engine no. 2 by Babbage, designed in 1932 was finally constructed in full and is displayed in the science museum in London. It's displayed alongside a section of his analytical engine aswell (Science Museum London, n.D.).

Re-connotation of computer work from female to male – and Britains loss of pioneering computation

Feminist media history ascribes the textile a big part for its impact on the women's role in computing. Only through the accessibility of textile worker's tool and their similar tendencies in usage, there was a broad amateur belief of a future where machines can be used to compute information. The similar way of thinking through textiles and the digital was essential for women to pursue that kind of work, that they believed themselves of being capable of doing this work, in a society in which their position is always framed as inferior (McKinney, 2022, p. 151).

Mar Hicks, in her Book *Programmed Inequality* examines the break between female and male-connotated work on computation, looking at sociopolitical changes that informed views and tendencies throughout the early computation age. Clerical work was consciously framed as female to make way for a workforce that is comprised of women, due to the lack of workers regarding the wartime and radical expansion of bureaucratic structures. This redefining opened a position for young, unmarried, childless women to close the gap, but it was never understood as a position to stay and climb up the career ladder. Repeatable, deemed mindless work, that they could do for a few years – before they get tired of it, marry and get kids (Hicks, 2017, p. 8).

> *They disciplined workers in accordance with certain gendered and classed labor ideals predicated on the heteronormative concept of a male breadwinner wage and unpaid domestic work for women within the nuclear family* (ibid. p. 25).

The reorganisation of work by gender was a key element not only for the structure of work done by the people, but also the material structure of bureaus that were adapted to also have segregation of their female and male employees. This sometimes went as far as not letting women leave the premises of the bureau during lunch break, as not to make the male colleagues interact with them in potentially sexual ways. Male clerics, after these reframing measures multiplied by seven, female on the other handy by 83, then making up 20% of the clerical workforce in total (ibid. p. 8).

At that time tools were seen as extensions of man but the information sensibility around punch cards mostly developed in women clerics. Through the different framing of the jobs and the area of interaction, the development can be traced along a gendered split. Information sensibilities defined how *people understand, manage, and make data actionable using specific techniques and devices* (McKinney, 2022, p. 146). These sensibilities are only produced in practice and shape the interaction between workers and the available technology. They are also a key part in recognising technologies that are just appearing on the horizon (ibid.).

Introduced *machine grades* formed the computational labour that women into a dead-end, even though their work changed from operating on electromechanical to later on electric computers – the work was always seen as repetitive and conditioned. As Britain grew their computer system the gendered work fields got exported along with the machines. Women's work being mispresented as easy, mindless and repetitive was even a selling point, arguing for a simple usability of the machines (Hicks, 2007, p. 13).

Women's gendered capital of information sensibility towards punch cards was, what let them breach into the masculine-connotated field of engineering, conceptual art and tool culture later. Their tacit skills were amassed and flexible enough to be transferred to other fields, while expanding their current

ones. Textile crafting got a male notion, through tinkering and coding, which was the start of bridging towards engineering (McKinney, 2022, p. 151-155).

In 1964 it was clear that a further expansion for the managing of key state operations would need more positions in these now female-connotated fields. These would be deemed managerial positions, expanded in responsibility and importance. Deemed unfit for women to possess such positions, instead of allowing the already trained-in expert women in these positions they tried employing men who turned these positions down. The connotations were too strong, which resulted is a labour-shortage and slowing down of the buildup of a computational Britain. After the failed attempt to just insert men there was an initiative to re-connotate these fields making them more interesting for young career-driven men (Hicks, 2017, p. 14-15).

This gendered labor shift was not a side effect of computerization but a core goal of the project to computerize the state – and ultimately the nation (ibid. p. 15) but of course not by women, only men.

Punchcards and (Big) Datafication through textile inscriptions

Weaving was important for computation in a manifold way. On one hand the punch cards, directly marked by Charles Babbage in his notebook while working on the analytical engine, the first proto-computer – June 30th 1836 – *Suggested Jacard's* [sic!] *loom as a substitute for the drums* (Harlizius-Klück, 2017, p. 181). This is representative of the material logic that got inscribed, with the immaterial best described by Heinz Zemanek. The immaterial component of the weaving loom, the logic that got transferred, was the advancement from serial to parallel processing. He argues that this multi-point processing is not only inscribed into the jacquard loom, but in weaving itself. It is not one thread after the other that is set higher or lower, there is a series of interactions where at one singular point a predetermined amount gets lifted all at once. The Bröselmaschine[11] is a machine predating jacquards

[11] It is a german neologism, but a proper noun. Direcly translated to english it would be the *crumb-machine*.

loom being dated between 1680 to 1690. It also uses a binary logic where rows of pegs, instead of holes determine the up or down-position of threads (Zemanek, 1976, p. 16).

Figure 8: Bröselmaschine from 1740, in the weaving museum Haslach, upper austria.

Ellen Harlizius-Klück argues against the jacquard loom being the innovative immaterial moment for computation but argues for an ingrained binary logic in textiles that got picked up on by Charles Babbage and Ada Lovelace in their first proper encounter with it – which was the jacquard loom (Harlizus-Klück, 2017, p. 181-184).

This argues for a broader inscription of textile into the digital rather than the proliferation of a singular person – namely Joseph Marie Jacquard. His position was only cemented by cultural presence, though it needs not to be completely diminished since his version of the proto-binary directly influenced the punch cards for computing, and the paper as a stackable material opened the field for computation beyond before-thought limitations.

Tendencies of large-scale standardisation also come forth in the sizing of the punch cards. For the US census the size of a ten-dollar-bill was used for the cards. This choice allowed the use of existing infrastructure to sort, organize and store the individual – but also grouped – cards. Scaling and

standardisation go hand in hand and become a necessity when starting to deal with large numbers, in the aforementioned case 60 million (Computer History Museum, n.D.).

Big Data is watching you – Fear and anxiety

Big Data is the new logic of amassed information that can compute new patterns beyond the intentions of what is initially recorded. Grid research and interdependency analysis are only a few of the possible patterns that can be used to sift through the data mining of the internet, telephone networks and other digital spheres and generate new findings (Wirtschaftslexion Gabler, 2021).

The amount of data, unthinkable in scale for a human being, comes with the connotation of a neutral objective sight, a view that surpasses the one by a singular subjective person. This moment was undermined when occupy wallstreet supporters were failing to see their #occupywallstreet as a trending topic on twitter. Companies aren't obligated to share their source code or their algorithm that compiles and builds personalised feeds. While Twitter never proclaimed to be without bias, there was a neutrality that prefaced the being let down in *occupy's* case. This alleged censorship exposed not only twitters opaque bias, but also the user's blind faith in a neutrality of something that was beyond their understanding (Driscoll, 2012, p. 3-4).

The dehumanizing power of the bureaucracy (ibid. p. 10) struck people instilling parallels to the nazis use of computation for mass scale human eradication, to the concern that were voiced against opaque systems. The instilled belief in neutrality got overwritten by the fear of a bias that was outside of human surveillance (ibid. p. 10-11).

This feeling of being seen through, is something one cannot deflect with the intent of "having nothing to hide". A felt transparency of the self through machinic observation and computational conclusions is the modern condition, set in comparison to an a-perspective panopticon (Han, 2013, p. 74).

In a society based on trust, there is no insistent demand for transparency (ibid. p. 79).

[His] *utopia of the transparent society is based on the removal of boundaries in surveillance* (ibid. p. 77).

The split of programming and using – inter*facing away from the masses*

In the early time of computation, Rushkoff dates it around 1970, there was no difference between the action of *using* a computer or *programming* one. A computer was understood as a blank canvas on which you had to write your own software for it to function. The clean interfaces and finished, closed off programs of today are a stark contrast in regard to that time. Although then, it did require a certain amount of pre-existing knowledge, once that was acquired and the barrier of entry was overcome the machine was the adaptable part, and the technicians wants and needs could be realised. Under the guise of user friendliness, interfaces got put up in between the code and the people using them. This turned the usage of computers from an educative learning experience from and about the computer simultaneously to an intuitive working but only with already fully built and restricted programmes (Rushkoff, 2010, p. 133-134).

In the American school system today mostly interfaces and programs are taught, rather than programming. The role of the technician is turned into the user, and with it the machine becomes the constant factor while the humans operating it need to start taking in compromises and software limitations, therefore also being hopeless in moments of program failures. In China for comparison, the education involves coding and computer languages rather than finished interfaces and closed off software which is set to have them surpass in computational potential in the foreseeable future (ibid. p. 129-130).

The accumulation of opacity ends in the black box – a way to describe a system which eludes human perception and logic. It demands higher transparency from people about their wants and needs but keeps the process of how it comes to resolutions secret. The only way to interact with it is to be dominated and have faith in it (Ajunwa, 2020, p. 1-2). An increasing dependency on them makes people accept their proposed neutrality – all while the ability to construct them by themselves is decreased (Rushkoff, 2010, p. 140-141).

> *Programming is the sweet spot, the high leverage point in a digital society. If we don't learn to program, we risk being programmed ourselves* (ibid. p. 133).

The power is being split by three groups – the programmers – the ones paying them – and the program itself (ibid. p. 128). If you are not in one of these, you are the one getting and being programmed.

Conclusion – Ripple effects today

The genealogy of the digital is deeply rooted in the textile. Along the performative separation of the textile from computation, the overlap is apparent in a multitude of forms, ranging from processes, to punch cards, to woven computer parts, to education in which the textile is used as a middleman between amateurs and coding. *And when computer was a term applied to flesh and blood* [female] *workers*, (Plant, 1997, p. 37) the same separation happened, just to people instead of a field. Setting these parallel histories in relation reveals the intertwinings that were held back in every instance, for they threatened a patriarchal society of male domination and connotation.

But history, although biased against it, shows how textiles have an inseparable connection to the digital through a manifold of material and immaterial parallels (Barber, 1994, p. 286). That's why the look at women in computation as an expansion to textiles in computation, is mutually reinforcing either fields position in the latter. Hallnäs definition of circular fields and immaterial definitions show the process orientation of the sector which can be set in direct comparison to computation and code (Hallnäs, 2018, p. 19). Zemanek describes the parallel processing of binary states through the loom as the birthplace of the digital – just in combination with the punch cards the jacquard loom takes the position for both material and immaterial bases, which he deems only partially true (Zemanek, 1976, p. 16). Harlizius-Klück seconds that opinion, negating the jacquard loom as the birthplace of the binary (Harlizus-Klück, 2017, p. 184).

Lovelace expands computational potential through analogies of weaving, imagining woven symbols synthetising more than just numbers, resulting in music, poetry and images from computers (Lovelace, 1843, p. 23). Predictions that only recently gained broad integration now, imagined 200 years ago. This shows how information sensibilities building up on textile knowledge made the new technologies in the realm of the digital even just imaginable. The punch card in its radical binary information compression setting new possibilities for computation, directly informing early computers through groundwork and basic structures derived from textiles (McKinney, 2022, p. 146; 150).

Hallnäs describes the circular building up on references, inside of a field (Hallnäs, 2018, p. 19). This shows how the jacquard loom follows the logic of a eurocentric colonising position, overshadowing centuries-old binary textile logic and representing a singular european man instead. Therefore a broader look regarding material and nonmaterial intertwining's apart from singularised positions is needed to properly historize the field and bring old connection into a contemporary definition of either fields – the textile and the digital.

Outlook – education

There is a transition happening in the Austrian education system with the joining of the school subjects *technical work*[12] and *textile work*[13] under the collective *technic and design*[14] (RIS, 2023, p. 2). Also, the introduction of the new subject *digital basic education*[15] which is not to be set in comparison to classic IT education for it involves reflections of the digital through humanitarian and liberal art lenses (RIS, 2022, p. 3).

With the subjects *technical* and *textile work* being introduced in 1986 (RIS, 1987, p. 203), their titles were untouched until 2023, only one year after digital basic education firstly got introduced in 2022. The change coming at the same time, after it being the same for almost 40 years can be interpreted as a general change of approaching textile and digital education, potentially opening new connecting points between them.

[12] Translated from german: Technisches Werken
[13] Translated from german: Textiles Werken
[14] Translated from german: Technik und Design
[15] Translated from german: Digitale Grundbildung

Outlook – post-gender feminized network culture

There is a movement of reclaiming sections of the internet with parts that got lost on the way to the current state. Interfaces being brought up in-between the users and the code add a layer of computational surveillance and loss of understanding (Rushkoff, 2010, p. 134). Marta Ceccarelli proposes a two-layered system, the Clearnet with all its surveillance, and the dark forest. *This layer is for forgiving relationships, close connections and community building where pseudonymous sincere interactions can occur without fear of unmasking* (Ceccarelli, 2025, p. 40). These privately hosted rooms and newsletters behind passwords and paywalls, are the new creative hub for cultural production and sincere communication (Ibid. p. 39-41). The reappearance of community after the loss Silvia Federici described finds itself in a multimedial setting, reminiscent of old textile communal gatherings.

> *The weaving of complex designs demands far more than one pair of hands, and textiles production tends to be communal, sociable work allowing plenty of occasion for gossip and chat. Weaving was already multimedia: singing, chanting, telling stories, dancing, and playing games as they work, spinsters, weavers, and needleworkers were literally networkers as well* (Plant, 2007, p.37).

The *girl online* is a framework to understand the current webs interaction with its users. It is an avatar that regardless of gender fits everyone (Walsh, 2022 p. 17). When online, your ~~inter~~face gets absorbed and turned into computable data. It is not showing you as a person, but rather actions that are graded for the algorithm to react to (Publig, 2025). The position of the girl as constituted by a reaction to other's desires is set in parallel to online presence. The girl can even be seen as an inhumane position, CNC-machines or NPCs without real agency (Quicho, 2023). [The girl] *is the default condition of vulnerability that touches us all—creatures caught in a web of total exposure, vying for both privacy and visibility* (Ibid.).

This performative view on presence on the internet as a gendered subordinated serving action can be put in parallel to Judith Butlers view on *doing gender*. She describes women as a historical idea rather than a material fact, putting lived experiences that are constituted by the surroundings first (Butler, 1988, p. 521-522). The woman, or in the case of the internet the girl, is *embodying certain cultural and historical possibilities* (Ibid. p. 521).

Outlook now

Regarding the textile and the digital and their feminist history – severed connection are starting to get bound together again in a varying array of archaeological reframing or the possibility through adapted education systems. All these will guide us through the speculative post-gender era of ubiquitous computation.

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Figure 1: Victoria and Albert Museum (2016) *How was it Made? Jacquard weaving*. Youtube: 2:12

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Figure 2: Victoria and Albert Museum (2016) *How was it Made? Jacquard weaving*. Youtube: 2:43

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Figure 3: Periscope Film LLC (late 60s) *PUNCHED CARD DATA PROCESSING INTRODUCTION IBM 029 COMPUTER 62454.* Youtube: 7:45

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