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THE INDUSTRIAL REVOLUTION AND CALCULATING ENGINES: ANALYTICS OF CAPTIAL AND GENDER DIFFERENCE IN THE WORK OF CHARLES BABBAGE AND ADA LOVELACE
Lecture 3. September 27

CHARLES BABBAGE

You've read some biographical material about Babbage in the Schaffer article. Let me add a few things. And locate his work with respect to issues we talked about last time.

Babbage was a mathematician who first rose to notoriety when he wrote a paper for the Royal Astronomical Society, in London in 1822, arguing that it might be possible to mechanize the calculation of astronomical mathematical tables. *Note the cosmos, the ordered universe, again!* The machine was touted as a device that might mechanize intellectual labor, and he appealed to the British government to fund it.

Babbage's writing was wide ranging; he published on mathematics, machinofacture, economics, and later in his life, theology.

He called this machine the Difference Engine. And you read his account of this *never-built* device in the excerpts. How did you understand this Engine to work?

> "based on the mathematical principle that the successive differences of values of polynomials were ultimately constants, so tables of these values could be computed by addition and subtraction of predetermined constants" (Schaffer 1994: p. 206).

Difference Engine could only do one task, since, in present terms, there was *no difference between hardware & software*; you'd have to build new machine for each problem.

> This was the problem that stalled Pascal in selling his accounting machine (which could only add and subtract, only using French currency divisions).

> In other words, the logic was built into the structure of the machine.

> This brings up history parallel to that of calculating machines – and that is history of AUTOMATA, machines that mimicked the behavior of people, animals, in which the logic of operation is inseparable from the machine itself.

> Babbage was a big fan of these devices (p. 16).

> Some of devices invited philosophers to speculate that humans were automata.

La Mettrie wrote *Man, A Machine*: humans were machines, mind and body both. He argued against Descartes that humans were a compound of the material and immaterial [read selections — including abt gender]

Automata; we can revisit some of this history when we get to cybernetics and Artificial Life.

Back to the problems with Difference Engine — the overlap/identification/confounding of a particular logic system with its material instantiation, was a problem the Analytical Engine was meant to solve; this was to be a general computing device. *How was this to work?*

It would have a "store" and a "mill." (p. 55) (what we think of today as memory and CPU: and, indeed, even in his sketch for a difference engine, Babbage wrote "The mechanical means I employed to make these carriages [the carrying of numbers in calculation] bears some slight analogy to the operation of the faculty of memory" (p. 48).)

The Analytical Engine would be set up to do different tasks using punched cards — similar to those used at the time to set up patterns on factory looms in France. Can someone try to explain this somewhat?

(p. 55) Two sets of cards: operation cards and variable cards.

This allows "a finite machine to make calculations of unlimited extent" "I have converted the infinity of space … into the infinity of time. The means I have employed are in daily use in the art of weaving patterns" (p. 63).

PUNCH CARDS [chads][store and mill are terms from textile industry]

SCHAFFER

Article begins with a simple observation: computer was once used to refer to a type of person, a worker who undertook a portion of calculations done in connection with compiling navigation charts, astronomical tables, and the like. Often these were retired clergy and clerks doing work in their homes and mailing it in to a central place, like London.

In France, many were out-of-work hairdressers. In the early 19th century, young women, prior to marrying would take such work, building up a dowry.

This is less important to Schaffer's article than factory work more generally. It is in showing how work was to be mechanized in Babbage's formulation that Schaffer leads us to understand how definitions of INTELLIGENCE emerged out of a very particular set of social and labor relations in early 19th century London.

What are those relations? Let's locate ourselves in the history in which Babbage sought to build his machine (or have others build it!). *Specifics?*

OK, so Schaffer says he wants to "explore[s] the coproduction of ideologically freighted accounts of intelligence and politically charged systems of machinery. To make machines look intelligent it was necessary that the sources of their power, the

labour force which surrounded and ran them, be rendered invisible" (p. 204). *What does that mean?*

In some ways this is a very Marxist argument about the erasure of labor — Schaffer cites Marx as a contemporary reader of Babbage! — but I think what's interesting here is not only the fact that the labor was rendered invisible, but HOW it was rendered so, and with what effect. <u>HOW?</u>

Schaffer wants to look at the multiple meanings of the word INTELLIGENCE in the time and context in which Babbage wrote. *The hidden history of the word INTELLIGENCE.*

So, what did INTELLIGENCE mean for Babbage? How did the Analytical Engine incorporate INTELLIGENCE? What would he mean by MACHINE INTELLIGENCE?

> <u>knowledge</u> about systems (often visual, panoptic, allowing management)

> <u>surveillance</u> of manufactory practices, allowing the projection of the "intelligence" of the designer onto the workplace and workers, reduced to "machines" and not seen as having craft knowledge or any "intelligence" of their own.

> "The machinery of the factory <u>and the calculating engines</u> embodied the intelligence *of the theory* and abrogated the individual intelligence of the worker" (p. 210). *What does this mean?*

> economic efficiency was "intelligent": "Parcelling the processes of Lagrangian algebra into specific components allowed the increase in speed of the machine, the transformation of infinities of space into manageable durations of time, the most economical recompense to each component in terms of consumed power (if mechanical) or consumed wages (if human)" (p. 209).

> <u>visible</u> from the POV of the overseer (linked with traditions of the display of machines to get public favor and upper-class attention). Needed systematization of tools. Rational management and standardization (required suppression of craft culture). Who owned the labor? the skills? the machines?

"the faculties of <u>memory</u> and <u>foresight</u> with which Babbage sought to endow the Analytical Engine also characterize his self-presentation as the unique author of the machine. They *embodied* his control over the engine while they *disembodied* the skills and camouflaged the work force on which it depended" (p. 214). *What does this mean?*

> **Luddites**: broke looms because they disembodied their craft intelligence and made people machine-like.

> [According to Pellew's *Life of Lord Sidmouth* (1847) III. P. 80, Ned Lud was a person of weak intellect who lived in a Leicestershire village about 1779, and who in a fit of insane rage rushed into a 'stockinger's' house, and destroyed two frames so completely that the saying 'Lud must have been here' came to be used throughout the hosiery districts when a stocking-frame had undergone extraordinary damage. The story lacks confirmation. It appears that in

1811-13 the nickname 'Captain Ludd' or 'King Lud' was
        commonly given to the ringleaders of the Luddites.]

        A member of an organized band of English mechanics and their
        friends, who (1811-16) set themselves to destroy
        manufacturing machinery in the midlands and north of
        England.

Babbage said the machines were "creations of my own <u>mind</u>" (p. 214).

        even though, recall, from Babbage's "Of the Analytical Engine," "I would
        never do anything myself if I could afford to hire another person who could do
        it for me" (p. 52) [though that person would not get intellectual credit!]

        INTELLIGENCE RESIDED IN THE MIND, NOT IN THE BODY
        (I.E., IN CRAFT, PRACTICE, ETC.). IN THE MIND OF INVENTORS, NOT
        CRAFTSPEOPLE. FACTORY WORK COULD SYSTEMATIZE CRAFT.

Babbage on this basis wanted to lay claim to owning the <u>means of production</u>; his
engineer, who owned his own tools, thought that he could therefore make more
calculating engines if they ever went into production. INTELLECTUAL PROPERTY

Babbage wanted standardization (as you saw at the end of his Analytical Engine
chapter). <u>Artisan skill would be transformed into its wage equivalent.</u>

These new "computers" then, would embody particular relationships between people,
specifically relationships by which calculation would be considered the activity of a
unified subject who <u>surveilles</u> the machinery of <u>Mind</u> (remember that Descartes, too,
argued that philosophizing was best accomplished by a singular agent; he asked us
to imagine the perfect STATE. <u>The mind becomes a political formation</u>), and
specifically relationships of class under capitalism.

        As an Italian friend wrote to Babbage: "Your engine seems to give us
        the same control over the executive which we have hitherto only
        possessed over the legislative department" (Babbage, p. 64). All
        political puns intended.

factory guide quote (p. 220): inside the automatic system, people could see those
"admirable adaptations of human skill and intelligence" by which "we are giving to
the present age its peculiar and wonderful characteristic, namely the triumph of
<u>mind over matter</u>." <u>Descartes</u>

        workers and machines; factories as automata (p. 223). fetish of machines

        intelligence: memory and foresight; qualities that would *also* allow capital
        accumulation

The Analytical Engine, which was to have *memory* and *anticipation* built in (which
Schaffer claims were "profound resources for Babbage's metaphysics and political
economy" — how he thought about <u>God</u> as well as <u>running a factory</u>).

Babbage "<u>even claimed that these were the virtues of divinity</u>" (p. 224). *Ninth
Bridgewater Treatise* 1837.

He sought to show that the qualities of memory and foresight, which he attributed BOTH to the factory organizer and to his machines, "these features of machine intelligence were all that was needed to understand and model the rule of God, whether based on the miraculous work of the Supreme Intelligence or on His promise of an afterlife. Foresight could be shown to be responsible for all apparently miraculous and specially providential events in nature" (p. 225).

So, we haven't strayed far from the belief that the logic of calculation mirrors the logic of creation, something <u>Leibniz</u> argued.

<u>We are back in the realm of the theological, but this time with capitalism thrown in!</u>

<u>"The world system was a macroscopic version of a factory, the philosophy of machinery was the true path to faith, and the calculating engines' power of 'volition and thought' revealed to all." (p. 226).</u>

"Babbage [claimed] that the world could be represented as an automatic array only visible from the point of view of its manager" (p. 226).

ADA LOVELACE

Charles Babbage's friend, the Countess Ada Lovelace (Byron's daughter). She translated an important Italian examination of the logic behind Babbage's Analytic Engine, but also added her own notes, many of which went beyond the argument of the original manuscript itself. Lovelace was, until recently, a hidden figure in all of this — even though an early computer language, ADA, was named after her. Had you heard about her?

She has been credited with inventing the idea of the <u>stored program</u>. Funded much of Babbage's later work with family money. She was in ill health for much of her life, and probably died of uterine ulceration, now thought to be uterine cancer.

Babbage had said that the Analytical Engine could eat its own tail (recursive), feed results back in as starting points. She phrased this in terms of cycles of cycles, nested iteration.

What does Lovelace see that Babbage does not?

The distinctions between *operations* and *objects operated upon*.

the objects *may not only be numbers*, but *anything* that may be <u>represented</u> by numbers: "Supposing for instance that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent" (p. 249). And more...

"the Analytical Engine weaves algebraical patterns just as the Jacquard loom weaves flowers and leaves" (p. 252). A GENERAL MACHINE

"The Analytical Engine has no pretensions to *originate* anything. It can do whatever we *know how to order it* to perform. It can follow analysis; but it has no power of *anticipating* any analytical relations or truths" (p. 284). DETERMINIST

This seems to go against Babbage's explicit claims about the engine's anticipation or foresight of relations on page 48 (and that Schaffer writes about [and, to anticipate, *anticipation* will be important for next time, when we look at cybernetics]) — Ada Lovelace denies any agency to the machine. *Garbage in garbage out!* This is the earliest statement of the idea that computers only do what they're programmed to.

PLANT

Ada had a sense of herself as a prophetess. She associated herself with visions. Think how she is described by herself, by those around her. Stereotypically feminine: *Enchantress of numbers*, *Queen of the Engine*, "Babbage's 'fairy lady,'" *hysterically* in love with mathematics.

As a woman in Victorian England, she was understood to have duties to mothering and family that trumped her mathematical vocation. Indeed, her intellectual efforts were seen to compromise her body, and, as Plant mentions, the solution to all sorts of maladies for upper-class women in Victorian England was getting pregnant, which was considered a cure for "hysteria," "wandering womb."

In other words, to the politics of class in Victorian England, we might add *the politics of gender*. Lovelace was fortunate as a member of the upper class to have mathematics tutors and access to the drawing rooms of gentlemen like Babbage, but she was not thereby easily permitted to participate as a full member of the community of scientists.

Film excerpt: *Conceiving Ada*

People around her — and even she herself — accounted for her persistent illness and frailty by suggesting that she was doing "too much Mathematics." This "too much mathematics" even extended to accounting for her addiction to gambling, her having visions, needing to use opium.

How would you compare her circumstance to that of Max in Pi?

The twist is GENDER. Ada's doctors and relatives were voicing a then common objection to women undertaking advanced studies, which saw these as against women's nature.

The question is how the body and the mind become GENDERED and thereby how COMPUTATION and INTELLIGENCE *not only bear the marks of class*, but also GENDER — something we'll explore further when we look at the work of Alan Turing on modeling the mind with a computer.

Connect this, too, to Babbage's location of intelligence in the MIND, not the attentive, crafting BODY. When women are associated with the bodily, on this view, they are not seen as intellectually equal to men.

But anyway, why should we focus on Ada's body in telling these tales? Does Babbage have no body? Why does it not figure into the ways he is remembered? He is famous for delegating work to others — bodies are just *means* to minds, but he is only able to see it this way because of his own comfort; compare Descartes.

And, indeed, look back at Babbage's approving quotation of the 18th century mathematician Joncourt, "Lo! the raptured mathematician!" (p. 42).

Note that gender is a relationship — and that the qualities assigned to women or men can shift over time, across cultures. When Ada was working, women were thought to be too imaginative, too intuitive, too embodied, for mathematics — a vision Ada tried to turn on its head and make into a virtue, even narrating her use of opium as augmenting her mathematical prowess. GENDER IS OFTEN CONCEPTUALIZED THROUGH DIFFERENCES IN THINKING; AND THESE ARE OFTEN RANKED.

A hundred years later, the script would flip, with imagination and eccentricity becoming the hallmark of scientific genius — Einstein, Feynman — and women becoming "too practical" to be pathbreaking scientists.

Recall, from Plant, Freud's theory that women invented weaving as a "natural" extension of their identification of pubic hair as a covering for their shame. So, even if they "invented" weaving, this was not original or creative, but mimetic. This is just one of the more bizarre ways that women's intellectual work has been discounted, by being reduced to the merely bodily, the automatically natural.

A struggle with the body became a kind of struggle with gender — where the body itself became feminine and the mind masculine. COMPARE METTRIE on GENDER.