ZINBUN No. 51 2020

Article

Maikon and Cyber-Capitalism: Some Preliminary Remarks on a History of Computerization in Japan, 1960–1990

Kyōto University, October 2020

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Abstract: This paper presents a preliminary sketching of research in progress, namely how computers were designed in all best interest of serving human social interaction, how they grew out of their imagined functions, becoming the revolutionary tool of cybernetic capitalism. A few years after their introduction in the United States, in early 1980s Japan, microcomputers were developed, produced *en masse*, and sold to their first users. But to archive their use as an extension of the factory, a tool to gain unlimited access to what Marx has called the workers "social disposable time," the computer machine had to be constantly interconnected to the other "limbs" of the factory machine. The creation of the first computer network in Japan, the MARS seat reservation system was based on cybernetics, creating a complex system to automatize Japanese National Railways—a threat that to its trade union was beyond comprehension. Beyond automation, in the 1980s, a student computer club at Kyoto University created PLANET, a network of different home computers (*maikon*) to democratize computer use. Their humanistic approach created a standardized and unified system, creating a machine which operation would revolutionize its economic base.

Keywords: Computer, Capitalism, Cybernetics, Japan, Marx, Japan National Railways, maikon, BASIC

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In late 2019, Kojima Hideo, a veteran of the Japanese gaming industry and one of the most well-known game developers globally, published the computer-game "Death Stranding." Kojima is well known for plots that range from childish to the metaphysical, often with loose ends and confusing story twists. In post-apocalyptic North America of Death Stranding, the player assumes the role of Sam Porter Bridges, a humble parcel carrier, delivering mail and goods through a landscape barren of vegetation, that is plagued by the "time fall," rain that accelerates time and thus destroys all it touches, and by "Beetees," the souls of the dead that roam the world and kill the living. Civilization—or what is left of it—took refuge in underground shelters that are connected to each other—with Sam's help—by the "chiral network." This knowledge-machine-network can reproduce everything inorganic but is unable to create something anew. Creation still needs humans, and humans need social networks. But these social networks are not created through the "chiral network," but through "real" personal interaction by sending gifts or even people in packages that are transported—literarily—on our working-class hero's back.

In a sense, Kojima's "chiral network" can be understood as an artistic representation of the internet, of social media, and knowledge-based industrial production. Like the "chiral network" in the game, it does not create something anew but is relying on its human users to "generate content." On the other hand, computers do serve the first and foremost purpose of human interaction that is to connect humans to each other for different purposes, be it to ensure subsistence, to work together, or just to maintain friendship. But in Death Stranding, the computer-generated relations and creations by computers are hollow and not satisfying to their users. It needs the human hand and mind, "living labor" in Marx' understanding. The intervention of the character of the humble friend (Sam), carrying goods (Porter) to other people and thus connecting them (Bridges) ensures that in Death Stranding those social needs are served. This character of the computer-machine, connecting machine driven production (constant capital) to human labor (variable capital), is, so I argue, the basis for the computerization of capitalism in Japan since the 1960s.

Death Stranding was published in the early days of the Corona-pandemic. Since then, computers have become even more dominant as a tool of knowledge reproduction, not just for recreation in one of its social-network monopolies. Home office, remote work, and telework have become the "new normal" amongst many working people throughout the world. But the Corona-Crisis, as a health crisis but also a global economic depression, just accelerates what has been in the making since several decades, namely the computerized reorganization of labor relations between humans, and between humans and the machine.

In this paper I would like to present a—very preliminary— sketching of research in progress, namely *how computers were designed in all best interest of serving human social interaction, how they grew out of their imagined functions, becoming the revolutionary tool of cybernetic capitalism*. As this is a concept paper it engages in a rather prolonged discussion of the underlying framing by talking about Marx understanding of the machine, as seen mostly in the *Grundrisse* and the *Capital*. After that I would like to connect the first computers and their networks in Japan to their genesis in the Second World War, talk about the advent and importance of cybernetics as theory of computer systems, and show how at the grassroots level, 1980s students at Kyōto University laid the foundation of how computer-terminals would be used after the advent of the internet.

Marx and the computer-machine

In this research, a Marxian understanding of an history of technology will be applied to analyze the Computer-machine and its function in the capitalist mode of production. The reader will ask, why is this necessary? In recent undertakings in understanding the historical, the functional, and the economic-political impact of the computer-machine there have been arguably three tendencies.

The first tendency is the historization of the personal experiences of programmers, engineers, and entrepreneurs. In the Japanese case, like the narrative of "Silicon Valley," these are often expressed as success stories of eyewitnesses writing about their individual participation in events of historical significance. The more academic variation of this narrative is a history of technology and the men inventing it. This approach has been rightfully criticized by what one could call a "citizen history approach" for silencing non-corporate, female, and non-white or non-western agents of history. This second approach argues that the computer has been abused by corporate interests. Shifting the perspective to ordinary citizens being involved in knowledge production like BASIC programming and early networking in the 1960s-1970s, or in the case of the post-Soviet societies of the 1990s, draws a progressive alterative of historical agency and changes the perspective to empowerment of race, class, and gender.[1]

While this paper's approach is very much indebted to research done in the "citizens-history" approach, it is critical of the underlying notion that the appropriation of the computer-machine will lead to liberation and empowerment. In contrast, sticking to Marx' chapter thirteen of the "Capital," it is argued that if the computer is a tool of the capitalist mode of production, it cannot change its fundamental exploitative function. Empowerment can flatten or even overcome the boundaries between class-divisions

[1] Most prominently Joy Lisi Rankin, *A People's History of Computing in the United States* (Cambridge, Massachusetts: Harvard University Press, 2018).

based on race and gender, but in social average empowerment in the capitalist world means to transcend the working class and become a (small-scale) capitalist oneself. The tool of the individual's subjective freedom, the computer-machine, will necessarily turn into a tool of the exploitation of the many.

The third approach is that of Marxist philosophy. This approach is interested in computerization processes in the capitalist mode of production mainly to discuss strategies to overcome capitalism. Most vocal is the autonomist or postoperaist school based on Antonio Negri and Michael Hardt's "Empire" (2000), that employs notions of knowledge labor as the "general intellect," Foucauldian notions of the "biopolitics" of rule, and "virtuality" as place of political action. A more recent attempts are Paul Mason's 2015 "Postcapitalism" or Nick Dyer-Withford's "Cyber-Proletariat." While this paper shares the notion with postoperaist philosophy, that the networked computer-machine ("the network") is the harbinger of a new organizational form of capitalism its approach differs in two significant points: Mason understands capitalism since 1973 up to 2008 as a neoliberalist deterioration of regulated capitalism, artificially kept alive by financial capital, to which the history of computers before the internet is just a "prologue" to the real thing. As this research is history research, it will be argued that it is exactly this "prologue" that shaped human-machine based labor for a new type of capitalism. Second, like in Negri's case, with Mason a multitude of commons-producers undermine capitalism by producing "zero value" goods that cannot be reinjected into capitalist circulation.[2] Instead of focusing on the "digital economy," or information and communication technologies (ICTs), that in 2017 were providing just under three percent of GDP in OECD states[3], this paper follows more closely Dyer-Witheford's understanding of "cybernetic capitalism", that the invention of the "automata (robots, AI)" and the "network" through an "conjunction of automation and globalization" that resulted in a "encompassing of the global population [of proletarians] by networked supply chains and agile production systems, making labor available to capital on a planetary scale, and [...] as a drive towards the development of adept automata and algorithmic software that render such labor redundant."[4] This understanding of the computer-machine as a tool for a planetary entanglement of labor power, and not just a means of "zero-value" knowledge productions is what makes

[2] Paul Mason, *Postcapitalism: A Guide to Our Future* (New York: Farrar, Straus and Giroux, 2015), 175–76.

[3] "ICT Investments in OECD Countries and Partner Economies: Trends, Policies and Evaluation," OECD Digital Economy Papers, April 19, 2019, https://www.oecd-ilibrary.org/science-and-technology/ict-investments-in-oecd-countries-and-partner-economies_bcb82cff-en.

[4] Nick Dyer-Witheford, *Cyber-Proletariat: Global Labour in the Digital Vortex* (London: Pluto Press, 2015), 15.

Dyer-Witheford's research helpful to understand the historical trajectory computerization has taken. Additionally, his concept of a capitalism defined by its organization of production, from Fordism, Taylorism, and Toyotism to cybernetics, avoids the trap of either claiming capitalism to be nearly over ("late capitalism"), having reached its high-water mark ("high capitalism"), or being unchanged since the nineteenth century ("capitalism").

In respect to these three approaches, which all recognize the computer to carry the idea of emancipation (of individual success, emancipatory agency, or by itself generating the means of the system's downfall) this paper sees its task in writing a pragmatic-materialist social history of the computer-machine in Japan, framing it as a tool within Marx' work on the capitalist mode of production. As such, three premises will be established:

1. The computer is a machine tool, a means of labor, of the capitalist production process. This also means that the machine is "capitalist" only in the way it is used socially.
2. As a machine in the capitalist production process, it is "constant capital," i.e. it cannot generate social usable value on its own. Human labor must be injected into machine operations to create value.
3. A computer as part of the computer-machine network, the "automaton," transcends factory space and labor time, reaching into the home (spatial) and the "social disposable time" of the human working it (temporal).

The Machine and capitalism

For Marx, a machine is not defined by the power or underlying technology (her special character as a tool). In principle it did not matter that the first spinning machine of John Wyatt in 1735 was not run by a steam engine, but by a donkey. Writing a history of technology in Marx sense should not be about "invention" but about its social and natural function:

> "Does not the history of the productive organs of man, of organs that are the material basis of all social organization, deserve equal attention? And would not such a history be easier to compile, since […] human history differs from natural history in this, that we have made the former but not the letter? Technology discloses man's mode of dealing with nature, the process of production by which, he sustains his life, and thereby also lays bare the mode of formation of

his social relations, and of the mental conceptions that flow from them."[5]

Marx' organistic notion of the machine, or human technology in general, follows the method of Darwin, and thus argues that the evolution of nature as a process is comparable to the development of technology by human agency. While plants and animals will produce productive organs to multiply themselves, and thus inherit their genetic code to the next generation, human agency would have a different need, that is the formation of social relations. Humanity's need for continuing its natural existence with the help of tools is part of this social process, as are all "mental conceptions," that includes knowledge production through invention of technology and vice versa, which would also serve social needs. One could understand the machine as an "organ" and the factory which assembles all the organs of industrial production under one roof, as the extension of the natural body, only scaled on the whole of society.

Machines had to slowly emancipate themselves from the original organs they were replicating. Marx refers to early models of steam driven locomotives that were still conceptualized around the horse they were supposed to replace.[6] Other forms locomotives were connected to a pre-industrial idea of force transmission, like in watermills, supporting Marx idea of the emancipation of the "corporal form" (*körperform*) of a tool becoming a machine.[7] But when machines emancipated from their corporal or historical forms, their impact on society was huge. Marx goes so far to establish a concept that can be understood as revolutionary agency of the machine, a concept that is strikingly similar to the revolutionary agency of the proletariat:

> "Machine operation rose by itself growing naturally on an inadequate foundation. When it attained a certain degree of development, it had to revolutionize its ready-found basis, that had still been expanding along its old form, and to create a new basis according its own method of production."[8]

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[5] Karl Marx, *Capital. Vol. I*, Karl Marx, Friedrich Engels. Collected Works. Vol 35. (Progress Publishing Group Corporation, 1996), 375.

[6] Marx refers here probably to the "Steam Horse" by Butterely Company in Derbyshire UK, and a follow-up model, operating between 1813 and 1815, that were using "legs" to push forward the carriage on four wheels. This is not entirely correct, as the first commercially used steam locomotive was the 1812 produced "Salamanca", running coal on the Middelton Railway. The train was moved by rack-and-pinion (a cog connected to the pinion on the side of the rails) locomotion.

[7] Karl Marx, *Das Kapital. Kritik der Politischen Ökonomie. Erster Band.* (Berlin (GDR): Dietz Verlag, 1953), 400–401.

[8] Marx, 400. My translation.

Along this argument, it is not surprising that the first modern network in Japan had already a corporal form before it was augmented by computers, namely the railway system of Japan. But it is important to note here, that we will use Marx understanding how machine operation could revolutionize the economic base by growing out of its base. The changes to society, be it in Japan or the rest of the world after the late 1990s through computer terminals (the "Personal Computer," the smartphone), the network (the Internet), and the human-machine interface (software, AI) were indeed revolutionary. The mission of this research is to trace back the revolution to its genesis, to the "steam horses" of computers: the microcomputer (Maikon, Pasokon), the "sneaker networks," Bulletin Bords, and early software. By understanding *what exactly* grew out of its base, we can grasp the meaning of this revolution.

Marx argues, that if the machines were small—and thus not part of factory automation—the "class of workmen" employed on these machines had to be specialized and hard to reproduce.[9] Thus labor relations relied on the organizational model of the manufacture. These changed with the size of the machines that could not any longer been operated by a single person. Now the special skills of the worker faded in their importance in the production process and, in tendency, became just another cog of the automation apparatus. In the case of the computer industry, this might seem to be counter intuitive, as we have the opposite phenomenon—miniaturization. Still, the expansion of the factory floor into the office building and finally the home or public space follows the same logic. Thus, networked, the sum of its miniaturized parts forms the behemoth of the computer-machine, a social factory without spatial or temporal boarders.

According to this, we could make out a development process that will be the guideline for my research: First, the means of labor are in crisis, and thus open a window of opportunity for the development of a completely new technology. As Tessa Morris-Suzuki has already shown, the reasons for automation in the Japan's 1960s were first and foremost a crisis in labor relations, especially in the rising of wages as cheap labor from the countryside had finally settled in the cities.[10]

Like an organ, the computer had to "grow," or change its potential use constantly. In the superstructure, that is in the universities, but also in the free time (=social disposable time), specialists and enthusiast researched, experimented, and played with this newly grown organ, enquiring on its actual social use. Since around 1984, this newly generated knowledge about the potential uses of the machines became seemingly social: Educational and economical efforts were made to distribute the machine and its knowledge. Finally, the home or personal computer, the network and the software became

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9 Marx, *Capital. Vol. I*, 386.

10 Tessa Morris-Suzuki, *Beyond Computopia.* (Abingdon: Routledge, 2011), 50–58.

an "automaton", a machine-complex with slightly different forms and differentiated uses (e.g. PC, while game console and the Japanese word processor served the same function, only on the extreme of the spectrum of games or text) that shared the same technological genealogy and the same applications. The global unification of this automaton in the late 1990s did not change anything about the computer-machine: there is nothing "personal" about the computer. It is an end-terminal of a larger network— a network that connects and unifies, negates differences, and finally interfaces human and machine knowledge insofar, that artificial learning (with the input of huge amounts of human labor) can augment knowledge production and automate material production.

In my paper I will only scratch the surface of these phenomena. Before I do so, I will first try to frame the computer into Marx' understanding of the machine's role in the capitalist mode of production. First as "constant capital," and second in its double character of first liberating human labor from tedious tasks, but then recapturing human labor again. Before I turn towards the historical genesis of computerized production in Japan, I will briefly refer to Marx' concept of "social disposable time," the part of the day when the worker is neither working nor satisfying his basic physical and mental needs. This is important, as the computer-machine as a capitalist tool extracts extra-time of labor during this period of "social disposable time."

The machine as constant capital

Marx is very adamant in his understanding of the machine differing from human labor. At first glance, the machine by its operation adds value to a product. Still, as constant capital it cannot add more value to the product than the value which has been added in the process of the creation of the machine itself. As the machine is producing faster than the human worker, the fact that the product contains less value than a product created by a human worker, this is beneficial as the value of the total sum of the products is higher. Therefore, the "productiveness of a machine is measured by the human labor power it replaces."[11]

Additionally, the machine transfers the value added in its own creation, it acts a lot "like a force of nature" — only with the difference that natural processes add no value and are free.[12] The machine is the middle between human agency (labor) and natural forces, bridging both processes. The computer is different from Marx' machines functioning side by side to human labor, as it creates value though interfacing with its human users, at least when it works as a terminal, that is by adding knowledge to the means of production.

[11] Marx, *Capital. Vol. I*, 394.
[12] Marx, 390–91.

This value-begetting labor is quite expensive and might dwarf the value of the computer-terminal itself.

For example, in the contemporary field of "deep learning," value is added by creating models which are the foundation of machine learning-capable programs. Without a model, the machine-programming (or neural network) is not able to analyze the data provided, thus does not function in inferring to data to make "autonomous" decisions (i.e., "stop car at zebra-crossing"). But to train a machine for a model, and the design and preparation of the dataset can consume a significant portion of time and resources expended in the project, in some cases approaching 80 percent of the total budget of a research and development-project."[13] The resources expended are humans who are experts on the given data and create value by preparing the data-sets for machine learning. Although there are applications for data-analysis that do not involve human agency —e.g. creating data clusters of "consumers"—most machine learning must rely on specialist intervention. For example, a team working on machine learning to enable a small robot to clean up the sewers would need experts on sewage related labor. Only they know which data would correctly reflect on an actual situation for a worker underground.

Accordingly, we can propose that computer-machines must intersect with human labor to create surplus value, which without capitalism does not generate any revenue.

Expanding the factory and value-adding Social Disposable Time

While the computer, if one follows Marx value theory, does not add extra-value to the production process, the computer possesses a character in its relation to human labor that is quite different from the non-digital machine. Expanding the factory in the Marxian sense does not just mean the physical expansion, but also a temporal expansion that aimed at getting as much labor extracted from the working day as possible. Though the evolving forces of production the factory would finally develop into an automaton that is divided into its intellectual and mechanical "organs" and run by a central source of power or energy, as Marx reasoned. With the machine entering the shop floor the relationship between the materials and the means of labor is changed thoroughly, as the ration of "living labor" in the labor process in its tendency is being reduced in favor to the "constant capital" of the machine. Marx was convinced that the means of labor (*arbeitsmittel*) would run through a process he called "metamorphosis," morphing labor into being part of an "automated system of machinery," in which the worker would be an "intellectual link" (*glied*), supervising the machine's "action against raw materials." In this understanding, which is very close to the automation processes in industrial labor in Japan in the

[13] John D Kelleher, *Deep Learning* (Cambridge: MIT Press, 2019), 31–32.

1970s, through the power (*macht*) of the machine the worker becomes the "means of the machine's actions".[14]

Still, Marx is not entirely pessimistic about the effects of machinery on the workers. His understanding of the machine in the 1857-8 *Grundrisse* could be interpreted as an opportunity for the emancipation of humanity from the capitalist mode of production. For example, in the *Grundrisse* Marx argues that the less human labor is needed, the less humans do have control of the process itself. Labor would not be enclosed into the production process, but rather be watching over the industrialized process of changing materials through natural (=scientific) agency (*agentien*), that he had "pushed" between himself and the transformation of an inorganic object of nature he tries to master: "Instead being the main agent, he steps aside next to the production process."[15]

The production process now takes agency, reacting to the problem of its intrinsic tendency that "living labor" or "variable capital" plays a decreasing, but the agency of automation an increasing role. As such the value produced by human labor—the only labor that can add value—is decreasing as well and thus is threatening the accumulation of capital. By this decrease of the quantity of living labor in the production process, the worker is now able to access something Marx names (in English) "social disposable time." This is the time the workers could engage in social activities in their best interest. In the optimistic scenario Marx employs, necessary labor would be aligned along the needs of the workers and such expanding the social disposable time for every person.[16] This, Marx thought, would give worker time to engage politically as proletarian in her or his education and emancipation. But the capitalist mode of production is sneaky, as production is a process of mechanized industrial agency that will try to uphold itself against the "noise" of human agency. Capitalism in tendency expands the production process beyond the spatial and temporal boarders of the factory and finds ways to reroute the attention of the working in such way, that she or he does not use of social time for emancipation, but for extra—unpaid—labor.

Therefore, computerization is not just factory automation. Tessa Morris-Suzuki in 1988 understood the meaning of "information capitalism" along this line, namely that automation would smooth the working process as worker were more efficient and less bound to the factory.[17] But automation does not create more value beside the acceleration of living labor and harnessing the loss of constant capital through accidents and machine

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[14] Karl Marx, *Grundrisse Der Kritik Der Politischen Ökonomie*, Karl Marx, Friedrich Engels. Werke 42 (Berlin (GDR): Dietz Verlag, 1983), 591–93.

[15] Marx, 601.

[16] Marx, 604.

[17] Morris-Suzuki, *Beyond Computopia.*, 74.

failure. Going beyond the factory, computerization led to the expansion or liberation of the factory and the organism of machinery of its spatial and temporal boundaries: into the homes, the schools, the universities, the "social disposable time."[18] By computerization the automaton of the factory became delocalized. The input and control of living labor becomes possible anytime and anywhere, payed, and unpaid labor time (social disposable time) are merging, reintroducing the 12-hour workday. The computer makes this amalgamation process of slicing up labor time more bearable to the individual worker through the gentrification of labor, gamification of labor, and the standardization of labor, while simultaneously re-feeding small slices of living labor back into the production process.

In such way, the computer is a tool serving the expansion of the factory on the scale of human society. This expansion again serves the need to integrate any form of "social disposable time" into the commodity chain, and to negate any physical dislocation, that is the physical absence from the production process by the worker walking out of the factory gate (and into, god forbit, the union office), to incorporate waking hours into working hours or time for consumption.

This paper will now show how the computer as "means of labor" was introduced in Japan, forming the organs of the computer automaton: the computer-terminal, the network, and the human-machine interface. The introduction of the home computer was a commercially very successful experiment to figure out what the individual would do with the computer. In such, programmers and enthusiast created an elite culture, that would be the basis of the construction of the "user." By finding out the potential of the capitalist "agency" of the computer accelerating the process of changing nature through human labor, we will continue to analyze the impact of cybernetic computerization on the people of the Japanese archipelago.

The MARS Network

The first computer network of Japan was installed at Japanese National Railways in 1960. Bearing the name MARS, the ancient Roman god of war—and peace though war—, MARS exemplified the connection between the war time mobilization of Japanese science and technology research, and its application in times of peace in the postwar period. The railway of Japan was a logical application of the first computerized network, as the mesh of rails and communication lines that had been already developed in the first half twentieth century just had to be computerized. Also, as a state-run company with a strongly politicized and thus powerful trade union movement, JNR's administration had stakes in the automation of labor.

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[18] Brought to the "consumer" by the leisure industry in the disguise of "leisure time."

Before the automation by a computer network, the reservation of a seat on an express train was quite labor intensive and involved several employees and a considerable amount of time to complete. National Railways had established a Reservation Management Center (Shiteiseki kanri sentā) at each of the stations from which the train to be reserved would start its journey. Later, the ticket centers would be concentrated in Tokyo, Nagoya, and Osaka. The traveler would go to a ticket counter and ask for a reservation. The staff at the ticket counter would phone up a free employee at a reservation center, asking for the reservation. About twelve employees were seated in front of a file cabinet drum that was rotating quite fast with a speed of two meters per second, completing a turn every eight seconds. They would snatch the file of the train in question, search for a free seat and tell the station employee the seat number via telephone. The station employee would issue a reservation ticket and return the ticket number to the employee in the management center. The latter would record the ticket number in the reservation file and return the file into the cabinet drum at the next opportunity.

This system had numerous problems. Not only did acoustic misunderstandings make the system prone to error, especially in peak times the number of employees who could work on the reservations could not be added at will, as the spatial dimensions of the cabinet drum allowed only a certain number of persons to work on the reservations. This put workers in the reservation center under a lot of stress, as the task-speed demanded of the workers was very high. While only a small amount of all passengers reserved their tickets, the tickets centers combined issued up to 20,000 reservations a day.[19]

Japan National Railways computerized seat reservation system called MARS or Marusu (Magnetic-electric Automatic Reservation System) was introduced on January 18, 1960. MARS had been in the making since the early 1950s when the head of the Signal and Communication Bureau, Landline Office, Onoda Tatsutarō (1910–1982) had initiated an electrification of the JNR's signaling system along the theory of cybernetics. Orienting along the already existing reservation system of American Airlines, JNR imported an US mainframe computer, a Bendix G15D, to Japan and test-ran the system until 1957. Together with makers like Hitachi, JNR founded a consortium called "Research Committee for the Examination of a Communication Network for Administration Modernization" (Jimu kindai-ka tsūshinmō chōsa kenkyū iinkai) to implement the reservation system based on a real-time computing network. The system was very successful. Although it had been a prototype, the system was not very error prone and began to serve two Express trains on the Tōkaidō-Line.[20]

In its early days, MARS 1 was only automatizing the reservation of about 3000 seats a

[19] Marusu bunkakai, *Marusu hattenshi* (Tōkyō: Nihon tetsudō denki gijutsu kyōkai, 2013), 5.

[20] Marusu bunkakai, 7.

day, a number that began to rise with the introduction of the Tōkaidō Shinkansen in 1964. Introduced in 1965, MARS 102 was a real-time network of 467 machines that could serve up to 100,000 passengers a day. In 1969 another system was introduced, MARS 201, that was dedicated to the reservation of travel groups when JNR tried to expand its business into the field of inland tourism. In 1975, all systems from 105 to 203 were united into one system, now serving 1 million reservations a day. Very often, national events like the Olympics in 1964, the EXPO 1970 in Osaka, or the opening of new Shinkansen-Lines would push the development of a new system, expanding the capabilities of real time reservations dramatically.[21] By then, the system was able to reserve up to fifty times as many seats as the old human-run Reservation Management Centers of the 1950s. Still, even with the introduction of the "Green Window" (Midori no madoguchi), a ticket counter connected to MARS that served as ticket and reservation machine, JNR employees would sell the tickets and the reservation. Only by the 1980s, automatic vending machines that printed tickets with magnetic tape and which connected to MARS interacted directly with the traveler, making human-human interaction obsolete.

Apparently, JNR's trade union, Kokurō (Kokuyū tetsudō rōdō kumiai) in the early 1960s had no understanding of the threat MARS posed to the railway workers. At that time, Kokurō was occupied with other pressing issues, like the electrification, the introduction of the Shinkansen, and the rationalization of railway and bus services. Additionally, to these immediate concerns, the protests against the US-Japanese Mutual Security treaty in 1960, the support of the Japanese Socialist Party's campaign against inflation during the mid-1960s, and the protest against the War in Vietnam dominated much of the articles published in the weekly "National Railway Newspaper" (Kokutetsu Shinbun). Some commonalities can be seen in the support for the workers at the Telephone Office at JNR, who lost their jobs due to the introduction of automated relay circuits. Still, as this affected only a few workers among the 450,000 employees at JNR, most of them female and young, no larger campaign effort seems to have followed. While a report in March 1964 discussed the computerization of JNR's Statistics Bureau, the computerization of work was still seen mostly as a rather far-future problem of "foreign countries" that had comparatively high wages. The first time, MARS was mentioned in October 1965, corresponded to the introduction of the "Green Ticket Window (Midori no madoguchi)" in the previous month. Here, as well, the reservation system was understood to link into JNR's rationalization efforts. While raises in ticket prizes was hinted at, as well as a "threat towards disorganizing the workers," no concrete mention was made about the

[21] Marusu bunkakai, 11.

effects of automation on the workforce, like job losses.[22] Another report on the update of the system to MARS 102 stated that university graduates would be employed in its set-up, but not much was known about the working conditions.[23] Thus, it is not surprising, that Kokurō's trade unionists did not understand the impact of networked computing on labor during most of the 1960s. Tellingly, a comic strip with the words "against rationalization (*gōrika hantai*)" that functioned as a recommendation to create a protest poster for May Day 1966, featured a male worker, backed up by a female worker, who strangled a 1960s popcorn-sci-fi robot with his enlarged fist.[24] While the cliché of a robot represented worker's resistance against automation, to the trade unionists the network of computer-machines remained invisible.

The MARS system was the first commercial computer network in Japan, that connected the user by a computer terminal (JNR employee and customer) to the data centers of JNR, accelerating the reservation of seats exponentially. The idea of MARS was conceived by engineers at JNR because the sudden advent of a new theoretical framework, that tried to understand computer, machine, and humans as being part of a very complex system. Controlling the flows of information in this system would mean controlling how smooth the system would do its job.

MARS, Japanese National Railways and Cybernetics

Hosaka Mamoru (1920–2016) was a main inventor behind the MARS-system at Japan National Railways, a proponent of cybernetics, and one of the "founding fathers" of Japanese computer technology. He claims to have had the original idea of the computerized reservation system in summer 1955, when he was not able to get a seat on a crowded train, imagining the passengers to be bits of ones and zeros. According to him, he had also been the driving force behind the acquisition of the Bendix-computer, that was finally delivered in 1957. After the deployment of the MARS-system, Hosaka did another career in academia, becoming Professor at multiple universities, like Tōkyō University, Tōkyō Kogyō University and Tōkyō Denki University.

His prewar career was quite impressive as well. Hosaka graduated from Tōkyo Imperial University in 1942 and was immediately sent to China to be trained as commis-

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[22] Kokutestu rōdō kumiai, "Unchin neage fukusen mo. Rōdōsha ni ha danketsu midasu kiken.," *Kokutetsu shinbun fukuzatsuban 1965-nen*, no. 1989 (n.d.): 114.

[23] Kokutetsu rōdō kumiai, "Yōin, yōsei korekara mo 'marusu 102' kensa hoshū mo senmon'i de," *Kokutetsu shinbun fukuzatsuban 1965-nen*, 1989, 116.

[24] Kokutetsu rōdō kumiai, "Purakāto hinto-shū.," *Kokutetsu shinbun fukuzatsuban 1966-nen*, 1989, 65.

sioned officer in the Imperial Navy. After that he was moved to the Yokosuka Naval Air Technical Arsenal (Kaigun kōkū gijutsushō) and was involved as engineer in the development of Navy planes under the command of his teacher Yamana Masao (1905–1976). There he was involved in designing the structural integrity of the air frame of ship-based bombers for the Navy. Later he also was tasked in developing the air frame of the "Ohka" (Ōka), the rocket propelled manned-suicide bomb that had been developed by the Navy in the last years of the war as a "*wunderwaffe*." Apparently Hosaka was involved in the first and second model, from which the first model was used by Tokkō-units in battle. While he seems to indicate in an interview that he was not working on the Ohka by free will, in hindsight the work at the Yokosuka Arsenal seems to have had a positive impact on his career. He himself remembered his time as the Arsenal to be decisive, as "…at the Navy, I received a harsh training as a technical expert building things. That was an experience that I could not have had under normal circumstances."[25]

The continuities of Hosaka's involvement into Japan's War in Asia and his success as a researcher in the postwar period are apparent. This was no coincidence, as wartime mobilization of Japanese society had impacted the sciences and engineering in a positive manner. Most of the research institutions, be it in higher education at a university or higher technical college, were continued in the postwar period, and their use for wartime mobilization hidden by often just renaming the research projects. For example, the Institute for the Development of Air frames at Tōkyō Imperial University, where Hosaka graduated, was renamed into "Applied Mathematics." Research Institutions like the Riken, that was instrumental in the Japanese research on a nuclear weapon under Nishina Yoshio, was renamed into Scientific Research Institute (Kagaku Kenkyūjo) in 1947.[26]

In the computer sciences, that started to take of in Japan after the End of the War, the fundamental research that was undertaken since the late 1940s was based on the high-budget funding of communication sciences for military purposes. Virtually all research undertaken in electronic sciences in the postwar period was inseparably connected to wartime military application.[27] For Hosaka this scenario played out as well. After the war Hosaka moved to the Central Aviation Research Institute (Chūō kōkū kenkyūjo) were he had been hired from Tōkyō University before being drafted into the Navy. The Institute was dissolved under the occupation and its assets used for reparation. As the Railway

[25] Jōhō shori gakkai rekishi tokubetsu iinkai, *Nihon konpyūta-shi* (Tōkyō: Ohmsha, 2010), 1173–74.

[26] Hans Martin Krämer and Till Knaudt, "Die Naturwissenschaften in der Entscheidungsschlacht. Die Mobilisierung von Wissenschaft und Wissenschaftlern in Japan im Zweiten Weltkrieg," in *Mit Feder und Schwert. Militär und Wissenschaft. Wissenschaftler und Krieg.* (Stuttgart: Franz Steiner Verlag, 2009), 273–74.

[27] Yamazaki Toshio, *Gijtsu no shakaishi*, vol. 6 (Tōkyō: Yūhikaku, 1990), 208–9.

Ministry took over administration, Hosaka used his engineering expertise to do research on train coaches.

In 1949, Matsudaira Tadashi (1910–2000) of the National Railways Research Institute (Kokutetsu tetsudō kenkyūjo), famous for solving an very difficult aerodynamic problem in the development of the Mitsubishi Zero, also a Tōkyō University graduate and engineer at the Yokosuka Arsenal, took interest in Hosaka. While working on smoothing the ride in 1950s train coaches, in 1952 Hosaka received a Fulbright scholarship and moved to the U.S. to the Massachusetts Institute of Technology (MIT).[28] The move of Japanese scholars to MIT was connected to former military research as well. As most research in electronic communication, be it wireless or wired, had been developed for military application, MIT was the most logical rallying-point for Japanese researchers in the postwar period. MIT had been very instrumental during the war in developing the science for the build-up of the U.S. military-industrialization, from aircraft carriers to fundamental research of the nuclear bomb.[29] Thus it made sense for Japanese scientists to learn why the U.S. military-applied sciences had worked out better than their own.

At MIT, Hosaka started to concentrate on research in electronics. He was able to get invited into the house of Nobert Wiener, engaging in discussions about information and language that made a "profound impression" on Hosaka. Also, it was the talk with Wiener that convinces Hosaka to implement computation at JNR: "When I came back to Japan in July 1953, I remembered the words by Wiener who said that information is control, and I thought I had to challenge myself", Hosaka remembers.[30] The talk with Wiener impressed him so much that he decided to change his field of expertise into computer research.

After his return, Hosaka used the opportunity of his MIT credentials to get hold of books that were not available in Japan, as well as access to the Library of GHQ which held several U.S. journals on modern electronics.[31] Next to his own socialization in war-mobilized sciences, Hosaka used the assets of the U.S. military occupation, and military-born scientific theory—cybernetics—that was based on war-time experiences as well. Cybernetics at that time became hugely influential in discourse about postwar society, as Benjamin Peters has argued:

> "The first methodological hallmark of cybernetics is that it is not one thing but that its key concepts, especially human-machine interaction and feedback, outline a kind of vocabulary

28 Jōhō shori gakkai rekishi tokubetsu iinkai, *Nihon konpyūta-shi*, 1175.
29 Jōhō shori gakkai rekishi tokubetsu iinkai, 209–10.
30 Jōhō shori gakkai rekishi tokubetsu iinkai, 1176.
31 Jōhō shori gakkai rekishi tokubetsu iinkai, 1176.

> for working analogically across different systems—computational, mechanical, neurological, organic, social—that rendered its vocabulary fecund for other sibling fields embedded in U.S. military-industrial research."[32]

The word "Cybernetics" is found in a lot of loan words. From "cyberspace" to "cybersecurity" and "cybercrime" the term is used on a day to day basis. The word "Cyber" in its meaning thus remains rather obscure but is based on a scientific framework that was thought to be revolutionary in the 1950s, as it tried to connect technology with society. Cybernetics was a "postwar systems science concerned with communication and control" that failed to institutionalize as a field of studies on the long term, but was one of the few ideologies of the postwar period that expanded rapidly on a global scale, reaching even the Soviet Union were it became a influential scientific system as well, and was used in the 1960s failed attempt to build a pan-soviet computer network for industrial distribution.[33]

The term cybernetics was coined at MIT by the mathematician Nobert Wiener in 1948 through the publication of his book "Cybernetics, or Control and Communication in the Animal and the Machine". During the war Wiener had worked on human-machine interactions by designing antiaircraft artillery that was to become not just a tool for its user, but also would integrate the gunner into the system through "feedback." This process of the flow of information, or "messages," from the guns hair-cross to the trigger to the eye and finger of the gunner had to be controlled or steered—thus the classic-Greek etymology of "*kybernetes,*" the steersman or governor. Wiener took his inspiration for cybernetics from the fields of biological sciences, much from the neuronal networks of animals, and biological systems with their tendency, in his understanding, to form either an equilibrium (or "homeostasis") or decline into chaos.[34]

Cybernetics employed an analogy, that was very close to the Marxian understanding of the "organic" factory. In "Cybernetics," Wiener had contrasted the pre-Darwinist understanding of the machine in relationship to the functioning of the bodies of animals—"nature's technology" in Marx' words. Until Darwin, Wiener reasoned, animals were understood as mechanical automatons, who ran constantly and were "soulless" like clockworks. Modern biology had started to understand the complex functions and uses of the body, and therefore these functions had to be projected on the automaton itself, now possessing eyes, hands, feet, and a nervous system.[35] The automaton, the cybernetic

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[32] Benjamin Peters, *How Not to Network a Nation: The Uneasy History of the Soviet Internet* (MIT Press, 2016), 20.

[33] Peters, 15.

[34] Peters, 17–18.

[35] Norbert Wiener, *Cybernetics or Control and Communication in the Animal and the Machine*, (Cambridge, Mass: MIT Press, 2000), 36–42.

machine, became thus a complex system of input, output, feedback and noise:

> "To sum up: the many automata of the present age are coupled to the outside world both for the reception of impressions and for the performance of actions. They contain sense organs, effectors, and the equivalent of a nervous system to integrate the transfer of information from the one to the other. They lend themselves very well to the description in physiological terms. It is scarcely a miracle that they can be subsumed under one theory with the mechanisms of physiology."[36]

Hence, cybernetics along Wiener's physiological understanding had played a quite huge role in the development of complex systems, like computer systems, computerized machines, and networks, but also in the effort to understand the "durability" of social systems.

Outside the U.S., two prominent cybernetic-social experiments stand out. The first being project "Cybersyn" in Chile under the socialist government of Salvador Allende in 1971—aborted with the coup d'état against Allende by the military junta in 1973. The second followed the flourishing of cybernetics in the Soviet Union after Stalin's death, that led into the development of the OGAS-network (All-State Automated System of Management) that tried to de-bureaucratize soviet planned economy by introducing a socialist-rationalist cybernetic planning-network, or "electronic socialism":

> "[The]...kernel vision [of the OGAS-network] as an expression of the nervous system of a factory, writ large across a nation, magnified the image of the workplace until it incorporated the whole command-economy-a sort of simultaneously metaphorical and mechanical collectivization of the industrial household...preceding, although not precipitating trends [today] in so-called cloud computing."[37]

Although OGAS failed during the 1970s because of the resistance from the Soviet military, it is important to note how computer- and production-systems were brought together, in this case in the hope to develop a rational-scientific socialism by raising Soviet industrial productivity.

In this context, the Japanese fascination with cybernetics that accompanied the MARS project must be understood both in the context of its military-industrial background and its applicability in the rationalization of industrial production (even with a socialist taste of equality) in Japan.

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[36] Wiener, 43.

[37] Peters, *How Not to Network a Nation*, 109.

While Hosaka had been instrumental in developing the MARS network, the engineer Oda Tatsutarō sought to implement cybernetic concepts to totally reorganize JNR. Oda, having quite a similar biography as Hosaka, joined National Railways before the War in 1932. From the very start he was involved as an engineer in the colonization of Manchuria, namely in research & development of communication lines for the Railway signaling system of a future transcontinental railroad through northern China. While the project, like the wired communication networks, in continental Asia had to be abandoned with the Japanese surrender, Oda made a name for himself by solving complex mathematical problems which later were applied in the construction of the Shinkansen.[38]

In the postwar period Oda stayed at JNR, and, after reading Bertrand Russel's 1919 "Introduction to Mathematical Philosophy," in 1949 he became highly interested in Norbert Wiener's cybernetics. From Wiener's standpoint he became convinced that the future management of Japanese National Railways would be based on the development of communication technology.[39] After visiting the United States in 1950, this cybernetic viewpoint seems to have been solidified. Writing about U.S. railways Oda stated that "The thing that has the highest influence on the rationalization of all systems (*zen-shisutemu*) of the Railway is communication." The "overhaul" of the system would include bi-directional information transmission using teletype "terminals," mechanization, micro-wave transmissions and the electron tube, that is vacuum tube-based computers.[40] All these technologies were developed in the context of the Second World War. Accordingly, in his 1951 published book on the U.S. railway system[41], Oda employed battle-field analogies to make a point for his cybernetic visions for JNR:

> "When a new weapon (*shinheiki*) appears, a new stratagem, a new instrument of warfare is born. New communication machines will create new formulas for railway operation."[42]

As Nobert Wiener resented the weaponized use of cybernetic machines—not at least because he designed one weapon himself—his metaphors describing cybernetics did not employ notions of warfare, but a physiological-naturalistic understanding of automata functioning like biological organisms. Oda, in contrast, seems to have drawn an analogy between wartime Japan and the postwar railway operation. America had developed a "new weapon"—like in the wartime era—and Japan had to follow suit not to lose the

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38 Tetsudō tsūshin kyōkai, *Saibanetikusu to tetsudō* (Tōkyō: Tetsudō tsūshin kyōkai, 1983), 6–7.
39 Tetsudō tsūshin kyōkai, 8.
40 Tetsudō tsūshin kyōkai, 4–5.
41 Oda Tatsutarō, *Beikoku no tetsudō to tsūshin* (Nagoya: Kōyūsha, 1951).
42 Quoted in: Tetsudō tsūshin kyōkai, *Saibanetikusu to tetsudō*, 5.

post-War. The deficits of the Japanese wartime machinery, that had been glossed over by so-called "spiritual mobilization" of soldiers and populace, and that had been quite apparent to the wartime scientist and engineers, would not be repeated but corrected by the implementation of "perfect" mechanization: "Such a mechanization, the pillar of rationalization, has the absolute condition of machines operating perfectly without any defect," Oda stated.[43]

These efforts to introduce Wiener to Japan were quite successful, as cybernetics continued to play an important role at JNR's computerization and rationalization efforts. In October 1963, JNR send a delegation to the First Railway Cybernetics Symposium of the International Union of Railways (UIC) in Paris, were 300 delegates discussed the cybernetics-based automation of railways. Before the conference, in June, JNR had founded the Japanese Railways Cybernetics Committee (Nihon tetsudō saibanetikusu kyōkai) that was headed by Tōkyō University Professor Yamashita Hideo (1899–1996). Over the next years the conferences held by the committee had eight thousand participants and produced thousands of papers.

The automaton of the computer machine in its early stages was tight closely to the "networks" of nineteenth until mid-twentieth century communication and transport: the railway. Computerization was hence understood to better the efficiency of the system. Slow and overworked JNR-employees at the turntable of the reservation bureau were exchanged by a computer. But apart from automation, a brand-new framework of "system-thinking" was brought to Japan, that resonated quite neatly in the Japanese scientific-military complex of engineers: Norbert Wiener's cybernetics. JNR build the first real time computer-network in Japan, that continues its operation until today. The crisis of the lost Second World War had changed the expansion of railway networks from space into time: instead of enlarging the network, the Shinkansen and the reservation system "MARS" accelerated it. JNR's network was not publicly accessible nor was it decentralized. But based on this new "organ," in the late 1970s, Kyōto University Students experimented how they could democratize, decentralize, and diversify a computer network, this time based on microcomputers.

[43] Tetsudō tsūshin kyōkai, 16. JNR was quite prone of accidents. 1951, the year in which Oda's call for a cybernetic approach to railway operation had been published, saw a major accident that was caused by human error and safety-neglecting engineering. On April 24, 1951, close to the train station Saragichō in Yokohama (Kanagawa prefecture), over 100 passengers died in an electric railway cart that was lit on fire because of a short circuit in the overhead wires, that had been cut by a worker and come into contact with the wooden roof of the carriage. Reducing the risk of accidents must be understood as pragmatic goal of cybernetic approaches at JNR.

Growing the new organ: A few notes on "home computers"

Fifteen years after the cybernetics conferences at JNR the landscape of computing had changed in Japan. Miniaturization of integrated circuits had led to the miniaturization of computers. From the computer mainframe with machines installed in air conditioned rooms, to the development of "minicomputers" that could fit into the trunk of a car, to "microcomputers" that could fit under a common keyboard, industrial mass production lowered the prices for computers. At the same time, the programming of computers had become more accessible. Since the mid-1960s, BASIC (Beginner All-Purpose Symbolic Instruction Code)—a simplified version of the mathematical higher computer language FORTRAN—spread from Dartmouth College to many U.S. schools, and became the main command line interface for microcomputers until the late 1980s.

In Japan, the low wages of middle-school graduate women in the electronic industries, that had propelled the Japanese radio and television industry to compete against the U.S., made microcomputers affordable. Japanese companies also had access to U.S. technology patents, and if not, Japanese companies send their employees to the U.S. west-coast to spy on U.S. electronic companies. Thus, the ICs, like the Intel 8080 CPU —the instruction core of the computer, or the "brain" in cybernetic language— that was copied by NEC and once had cost several hundred-thousand dollars, were now available for under 1000 yen. In 1976, NEC produced the first "kit", that is a main board to which the peripherals like monitor and keyboard had to be attached by the user. The first usable microcomputer, soon to be called "*maikon*" (microcomputer/my computer) was the Sharp MZ-80 series, an all-in-one system that included a monitor, keyboard, cassette drive and the computer itself. Costing around 120,000 Yen, the computer was in the price range of a technology-interested "middle class" household.

The way the Sharp *maikon* was presented to its users shows clearly, how in 1978 microcomputers were understood to function: they were machines of higher education. The machine was provided with its own version of BASIC and a special manual, that was supposed to teach how to program the MZ-80. This knowledge of BASIC was necessary to the users for two reasons, first most micro-computers came with BASIC in default, often using the BASIC as interface to the computer. That meant that the user could not use the computer much if he did not understand BASIC. Second, magnetic data storage in the 1970s and early 1980s was still quite expensive. Most of the programs were not distributed on disks or even cassettes, but printed out in BASIC listings and published in Magazines like "I/O." The user had to type them down along the BASIC variant used and save it to a cassette tape.

The cover of the MZ-80 series BASIC manual[44] featured one symbol of elite education, namely Greek antiquity. In the background of the image drawn in a comic-magazine style, the Map of Ptolemy shows us the Mediterranean world. The mythical ship Argo—according to the legend the first ship ever build and to sail the seas of the seafaring Greek civilization in the search of the "Golden Fleece"—seems to row away from the map like a space-ship. The map must have been copied from a German language textbook, as the transcription by using "*umlaute*" and nineteenth century German-style names for certain locations (Phönicien) suggests. The BASIC course in the manual is illustrated with some effort. Computer-dwarfs, spaceships, pirates of the eighteenth-century colonial Caribbean-seas, and a comic-illustrated Archimedes show that the well-educated teenager or young adult was addressed. Also, mostly male users seem to have been the intended audience for the BASIC manual, although there are depictions of women including one schoolgirl doing her homework on the MZ.

Its lighthearted design aside, the manual had a very serious message about the use of computers. Calculating the hours used in a single lifetime, the manual claimed that people used 10.6 percent of their time to work, and 4.1 percent for learning. Some 52 percent was spend mostly sleeping and—illustrated with a comic figure idling on a sofa-set—without either learning or working. The manual implored on the reader to "analyze the use of one's time" and to "please, really spend some time keeping company with the computer, right?"[45] Already in 1981, Sharp Company clearly suggest the possibility of the computer to use the individual's Marxian "social disposable time" more efficiently by not idling but using the computer—for the time being—as a learning tool.

In 1982, home computers had become a commercial success when over one million machines were sold in Japan. In July 1982, NHK started to broadcast an "Introduction into the Microcomputer" (Maikon nyūmon) every Wednesday from 7:30 to 8:00 pm. The BASIC course ran along the same lines as in the case of the MZ Basic manual, mainly going after mathematical-scientific programming examples, plus simple games and horoscopes. This was the high point of computer knowledge and BASIC being understood as educational asset, that had to be learned in high school or higher education. It also ended the experimental phase, in which the home-computer as "computer-terminal" was developed and scrutinized for its potential use beyond factory automation. As we will see in the case of the Kyōto University Microcomputer Club, and the development of the PLANET-network, the first steps were undertaken of unifying the very different hardware platforms to be as much simple to use as possible.

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44 Shāpu kabushiki kaisha, *BASIC. MZ-80 Series. [BASIC SP-5030]* (Ōsaka: Shāpu kabushiki kaisha, 1981).

45 Shāpu kabushiki kaisha, 138.

Unifying the automaton: the PLANET network

Kyōto University Microcomputer Club was founded by Tanaka Kazuhiko in 1977. Tanaka came from a background of a family of highly skilled workers, or the "middle-class." During the war, his father had served in the signaling corps in the Army and after the war he had joined the state-owned public Nippon Telegraph and Telephone Public Corporation (Nihon Denshin Denwa Kōsha). As a kid Tanaka had access not only to an old army radio set, but also read the monthly science and technology magazine "Kodomo no kagaku," owned a tape cassette recorder, and a single-lens reflex camera. Already at elementary school he had gained a license for a ham radio and progressed to the Shizuoka University Department of Education Affiliated Shizuoka Junior High School (Shizuoka daigaku kyōku gakubu—Fuzoku Shizuoka chūgakkō), a reform school that helped him focus on math and science. The school gave their students access to tools like programmable calculators—like a Canon Canola 1614P that used punch cards—and digital multimeters to engage in science projects. Tanaka excelled and received the Suzuki Umetarō Price for one of his science projects. After graduating high school, Tanaka became interested in the research done at the Institute for Informatics and Engineering at Kyōto University. Here, Ōno Yutaka had worked on the MARS-system, a project Tanaka found very intriguing. He enrolled in Spring, 1977.

At that time students did not attend much of the classes after the initial sessions in May and returned just in time in Summer to pass the exams. Students like Tanaka had much time to engage into their personal hobbies and interests, in his case into the electronic game "Space Invaders" (Inbēda gēmu). Space Invaders had become such a hit in Japan that organized crime-syndicates sought for cheap clones of the game machines, that looked like coffee tables to fit into the coffee houses Japanese students were frequenting. Space Invaders used the technology of the first generations of home computers at that time and Tanaka started to tinker with the system, burning the program code on programmable ROM-chips (PROM). Still, when Tanaka got interested in founding a microcomputer club at Kyōto University, he did not own a computer and his access to the technology was limited. Although the department gave access to minicomputers, the access to the main frames was limited to third-year students. When they finally got access, another problem was to get hold of a personal machine to do so. A Teletype Model 33—a electric teleprinter that gave a printout of the connected computer and enabled the user to send commands via its keyboard—that was standard to access the main frames' time-sharing systems at that time was still too expensive for university students. Tanaka build his first own home computer called PENELOPE out of parts of non-working computer junk when he found out that the CPU was still working. His goal was to connect it to a mainframe like a Teletype.

PENELOPE for its time was a quite capable machine using a Zilog Z80 CPU and 32 kilobytes of RAM, having a front panel that gave programming access to the memory by 16 manual switches. The name itself was chosen after Odysseus' wife Penelope, a character of the Greek epic Odyssey. Tanaka was impressed by the characters patience, weaving the burial shroud to fool her suitors and wait for her husband's return. As we have seen in the case of Sharps MZ80 Basic Manual the references to Greek antiquity shows how the values of classic-modern elite education were still used to identify as educated class.

Kyōto University Microcomputer Club was founded in 1977 and one of its first activities was performing electronic music on the Kyōto University Festival in late-autumn, 1979. This was one of Tanaka's ideas, as he did a side job for the company Roland, teaching musicians how to use the programmable hardware synthesizers. He borrowed the equipment and KMC performed on a large stage, rather creating mild curiosity than dance-floor atmosphere. What was special about the performance was that the KMC members used home computers as sequencers, programming well known classical tunes or melodies. These melodies were played live on stage by analogue music synthesizers and accompanied by a musician's live performance on a stage piano. To that purpose they had to build and program the analogue-digital controller, that made it possible for the computer to trigger sounds on the Roland-700 synthesizers.

It seems the music performance by KMC was not repeated after the 1979 university festival. Rather, the main activity of the club, that until 1981 had only male members, was to assemble usable home computers out of hardware kits like the NEC TK80 by connecting keyboards, monitors and expanding the RAM storage. This male-centered tinker culture was not excluding women per se, but the absence of women was based on systemic discrimination: both Engineering and Physics departments at Kyōto University had so few female students that nobody even bothered to provide separated bathrooms for both sexes. Although KMC struggled to include female members into its ranks, this was not to change until 1981, when the first female full members joined the club.

Between 1980 and 1981, KMC developed a network protocol they called PLANET. Two years later, in September 1982, PLANET was presented in a working version at a computer exposition organized by the ASCII publishing house at Sunshine City-complex in Tokyo-Ikebukuro. The computer magazine ASCII had enthusiastically written about PLANET in 1981, featuring the project in three consecutive issues and offering four booths at the show, something quite extraordinary for a student project.[46]

PLANET was an acronym for "Personal Local All-purpose NETwork" and ASCII

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[46] Tarumi Hiroaki, "Hakubutsukan," Hakubutsukan, 2019, http://www.eng.kagawa-u.ac.jp/~tarumi/research/museum/.

magazine connected it to research done at the Palo Alto Research Center at XEROX in the U.S., where the Ethernet network technology had been revealed to the public just a year before PLANET. Unlike Ethernet, PLANET was a local area network not developed by a highly funded corporate research center, but handmade by KMC's undergraduate students. The purpose of the "loop network" was to connect the students 8-bit home computers which were not of the same type of hard- and software. Thus, the goal was to exchange data and multi-platform software on a local area network (LAN). The first prototype, still called "P-Net," was programmed in November 1979 and shown at the university festival in November 1980 for the first time. The system enabled users to play games, especially "Orthello", over the network. After the successful demo, in the next year the network protocol was rewritten from scratch and renamed "PLANET."[47] To copy files over the network the students wrote a program called "file transceiver" that was written in "GAME," a programming dialect of BASIC that had been described and its source code published in ASCII since 1979. But the main purpose was to play games. The students programmed three network games for PLANET: "Net Tennis," (Netto tenisu), "Naval Battle," and "Orthello" (Osero). Net Tennis could be played by four people at the same time, but Orthello was not to be played among human players but between the computers. The actual "game" was not about playing Orthello itself but writing BASIC code that resulted in a strong Orthello program that could win against another program.[48]

A simplified version of the board game "Go," Orthello was developed in Japan in 1974 and had been quite popular. During the early 1980s, the Orthello game was used in U.S. academic research to experiment on gaming algorithms and early AI projects.[49] In the case of PLANET, the communication between different Orthello programs was possible, because the computers could exchange data over the network automatically and in real-time between different hardware. Also, at a comparatively high speed of 436 bytes per second, data of a 360-kilobyte floppy disc could be downloaded in just over 13 minutes, and simultaneous use of peripherals like a matrix printer was possible as well. The ASCII author was struck in awe, and wrote: "Anyways, this is something one has really to experience in practice. Even for the people developing PLANET it becomes a feeling of extraordinary wonder to see the network running for real."[50]

But special about PLANET was its cross-platform compatibility. Different home computers of different manufacturers with different CPUs and BASIC interpreters could

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47 ASCII, "Computer Network," *ASCII (Asukī)*, no. 7 (1981): 85.
48 ASCII, 97–99.
49 Paul S. Rosenblom, "A World-Championship-Level Othello Program," *Artificial Intelligence* 19, no. 3 (1983): 279–81.
50 ASCII, "Computer Network," 87.

communicate with each other, thus making PLANET an open system. During development of PLANET the students connected fifteen computers simultaneously to the network: seven NEC PC-8001, two Sharp MZ-80, two Apple II, one Sord M-100, one Basic Master L3, one NEC 1 TK-80/BS computer kit and one self-made Zilog Z80 based model, Tanaka's PENELOPE. All computers were connected both by electric loop cable and optic fiber cable and by a network protocol based on simple UART data exchange and written on the Apple II, the 8001, the MZ, and the Basic Master L3, readdressed and sent per assembler machine code to the TK-80, the M100, and PENELOPE. As an open system, PLANET was designed to be used by (penniless) students. The network had to be cheap, the network had to be easy to set-up, and the network had to be easy to use. Therefore, the network had no dedicated hardware control unit, like networks connected to contemporary mainframes and minicomputers, and ran on top of the home computers. Also, there was no need for modification at the computer's hardware and the user did not need to know anything about the protocol to use the network.[51]

The authors of ASCII were extremely enthusiastic about the project, hinting that it might bridge the gap between the Japanese computer clubs that ran along the line of the "*hereness,*" the "civilized Greeks" or users of the same system, and the "*barbaroi*", the users of different systems: "Even if the Planets run on their particular trajectories, as a whole they maintain harmony through forming a union of the same type. The source of the name of PLANET stems from this fact"[52] stated one of ASCII's articles introducing PLANET. This understanding of PLANET, also quoting the opening sequence of the contemporary Star Wars film series, was that of a cohesive socio-political entity, as the network protocol, the inner working of the network, was explained in an anthropomorphic manner as King Arthur's "round table:"

> "Long time ago on a PLANET far, far away, the envoys (*giin*) of Country P (Protocol P) and Country C (Protocol C) gathered at a round table to conduct a conference."[53]

ASCII magazine emphasized the "democratic" aspects of PLANET. Not only did the "protocols" discuss on an equal level, but the controller subroutine also democratically distributed talking time to each "envoy" who thus is able to address the other envoys. The notion clearly states that a networking protocol had to reflect a democratic distribution of access to each node, or computer, in the network—the so-called "net neutrality."

The PLANET network inherited the humanist spirit of the first computer tinkerers.

[51] ASCII, 85–86.
[52] ASCII, 87.
[53] ASCII, 99.

Computers, like other items of technology, were supposed to work for the people, easing social interactions and smoothing humanities engagement with its natural environment. Of course, PLANET was a student project which, first and foremost, sprang out of the enthusiasm of the club members. Connecting any home computer to the network, no matter which maker or operating system, meant participation of its user in the community. Still, no matter what the creators of PLANET intended to do in the first place, the effect of projects like the PLANET Network in tendency was the standardization of the computer automaton. Democratic communication with any other given computer meant that the computer-machine as automaton started slowly to become the standardized and unified system that could be used as a universal means of labor for the capitalist mode of production. This was nothing but the great unification of societies, cultures, religions, and political systems that Marx had attributed to the nineteenth century expansion of global capitalism. The metamorphosis of the home computer into the automaton of the computer-terminal and its network had begone.

Conclusion

Unfortunately, this paper could only give a few hints about this research project, but now it might have become clearer that its method is that of a micro-history connecting people and computers to capitalism. It will not take a "macro-economic" approach on the developments of capitalism but rather tries to reconstruct its history from bottom up. Thus, this paper gave a glimpse of the progress that was made in establishing the machine and using it to access the social disposable time of labor power.

It became clear that the roots of the Japanese home computer lie withing the world of industrial capitalism mobilized for war. Thus, it is no coincidence that the first commercial computer network in Japan was bearing the name of the Roman god of war. Following these first experiment in cybernetic capitalism, the capitalist mode of production in Japan generated electronic technology that was cheap enough to be usable beyond the realm of pure research or state-run infrastructure projects. The high education level of the Japanese workforce made it receptive to computer education, one reason why computers sold so well. Still, the home computer had to go through a metamorphosis. This metamorphosis changed the home computer's character from a tool of learning, like through teaching BASIC and math to an educated audience and school children, to a networked machine. Enthusiasts at Kyoto University, members of the highly educated and skilled working elite, helped creating this universal networked machine, the computer automaton, by using their own social disposable time. As Utopian in its approach and humanistic in its intentions, KMC's PLANET contributed to the metamorphosis of the home computer into a unified means of labor. The computer indeed became "democratic" as in Japan, during the second half of the 1980s, non-specialist children of the working class began to tinker with the computer machine. During the mid-1980s the advent of the computer machine branded by corporations as "Personal Computer" for the first time moved office labor into the homes. While the creation of the computer might have started in the minds of engineers and was executed in the R&D laboratories of industrial corporations, the metamorphosis of the network computer-machine and its human users happened "on the ground," in higher education universities, living rooms, schoolyards, city-ward offices, in books and magazines, and in the virtual space of bulletin board systems. During the 1980s, many agents of history were involved creating the "interface" between humans and the machine, the software interface. More research will have to look at this interface, that was proliferated to the users' homes during the mid-1980s to the early 1990s by creating interactions with the machine in the form of office software, and games, as well as recreational software, like music and painting programs, digital comics, and pornography. This software connected users and computer-machines to each other, experimenting on the most efficient ways of data input, manipulation, and output.

The subject-matter of the research that must be undertaken when writing a social history of computerization in Japan will be the agents of this historical change. These agents were female programmers and male office workers, small shop owners, teenage hackers, and legions of schoolchildren, collecting, copying, and sharing software. They all contributed into creating a machine with a social impact that had not been seen since the invention of the mechanical loom. This collective invention, the networked-computer machine, began transforming labor to an extend that still is hard to grasp and unfolding before our eyes. But much of roots of the computerized capitalist mode of production, or cyber-capitalism, grew from the social disposable time of the working classes, the knowledge specialists, and small-scale entrepreneurs during the 1980s, until the Internet, finally, allowed corporate capital to move the factory into peoples' homes.