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Socio-technical Morphogenesis of Electrical Technologies and Everyday life:

A Diachronic Study on Technology and Society Interactions

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Abstract : This study explores the co-production of electrical technologies and the everyday life, especially the domestic sphere. While synthesizing the evolution of electrical technologies with the Social Construction of Technology, this study investigates as to how everyday electrical technologies such as radio, washing machine, television, refrigerator and microwave owen have played the role of agents of 'domestication' that have redefined spatio-temporal domestic regimes. During the course of this work, electricity is not simply viewed as a utility but as a socially constitutive force and and an infrastructure of promise reconfiguring social relations. It has been argued that the evolution of domestic technics constitutes a transition from simple mechanical substitution i.e replacing manual labor with electrical power, to a state of totalized infrastructural dependency. In this regime, the 'everyday' is rendered as a socio-technical assemblage where domestic routines are fundamentally determined by the grid.

I. INTRODUCTION

The introduction of electrical technologies into the household world is one of the greatest structural changes in modern history where the home becomes a center of localized, manual energy conversion into a node, in a far-reaching, centralized network of technological infrastructure (Hughes, 1983). Electrification goes further than an easy story of increased efficiency or uncontrollable advancement; it is a multidimensional socio-technical negotiation where material possibilities intersect with cultural imperitives. To understand this transition in the domestic realm, one must move beyond the reductionist perspective that electrical tools or appliances are only neutral artefacts, and instead constitute an active force in the reorganization of social life.

To ground this sociological question it is necessary to discuss the empirical conditions outlined by Vaclav Smil (2005), whereby he discusses the revolution that took place at home, and was based on radical transformation in 'energy density'. Before the late 19th century, the home was powered by "animate" energy i.e human and animal muscle, and the inefficient combustion of biomass. The "Age of Synergy" (Smil, 2005) introduced the induction motor and the incandescent bulb, allowing for the fragmentation of power: the ability to deliver precise, metered amounts of energy to specific domestic tasks via a thin copper wire. This shift liberated the household from the physical constraints of wood and coal, but simultaneously tethered it to a rigid, external grid.

Many scholars have looked at the penetration of electricity and electrical technologies into everyday life of people across temporalities, geographies and societies through varied lenses. Some of these include Jonathan Coopersmith's concept of what he called an Electro-technical society(1992), Vaclav Smil's 'Age of Electricity'(2005) or the more recent concept of an 'Electriscape' theorised by Diana Montano(2021).

Whereas electricity in the 'West' (Europe and North America precisely) had a different meaning both for the state, the employees, the officials, the consumers and businesses associated with it, but in their colonies in Asia, Africa and South America , its meanings and motives were completely different. However, it is important to note that electrification is not solely driven by capitalist and imperialist forces. In Asian countries, the spread of electrification was uneven, locally mediated, and belated, challenging the dominant narrative that focuses on capitalism and imperialism as explanatory variables for the climate crisis and the

Anthropocene(Kumar, 2022). The studies on electrification in the global South are still emerging and have been less studied compared to North America and Europe .

Electricity has played a significant role in everyday life from 1900 to 1960, transforming various aspects of society. The availability of electricity brought about numerous changes in consumption habits, work patterns, and leisure activities. Research has shown that electricity services have had a profound impact on everyday life, influencing not only the way people consume but also shaping their expectations of comfort, convenience, and cleanliness. One of the key areas where electricity had a transformative effect was in the home. With the advent of electricity, household chores became easier and more efficient. Electric appliances such as washing machines, refrigerators, and vacuum cleaners revolutionised domestic work, freeing up time for other activities. The introduction of electric lighting also extended the hours of productivity and leisure, allowing people to work and engage in recreational activities well into the evening . Furthermore, electricity had a significant impact on the workplace. The availability of electric power enabled the development of new industries and technologies. Factories and manufacturing processes became more efficient and productive with the use of electric machinery. This led to increased production and economic growth. Additionally, the electrification of transportation, such as the introduction of electric trams and trains, facilitated urbanisation and improved mobility. The impact of electricity on everyday life can also be seen in the realm of entertainment and leisure. The rise of radio and later television brought about a new form of mass media and entertainment. People could now access news, music, and entertainment from the comfort of their own homes. This had a profound effect on social interactions and cultural practices, as people began to gather around the radio or television to listen and watch together66

II. THE COMING OF AGE OF ELECTRICAL TECHNOLOGIES

By the late nineteenth century, electrical technologies were proverbially coming of age and electricity was produced at a larger scale than ever before, either as a motive force to powering electric drives or for lighting or running electrical appliances. Jules Verne's *Twenty Thousand Leagues Under the Sea* which was published in 1870, echoing the optimism and promises of electricity around that time, as it caricatured electricity being a powerful agent that provided for lighting and heating, and was the 'soul' of his mechanical apparatus(Verne,1870). The interest in studying electricity and electrical phenomena became increasingly more by the time of the 18th century. The Google n-gram in Figure 1., analyzes written records from 1800 till 2019 and there are many important trends that can be noticed.

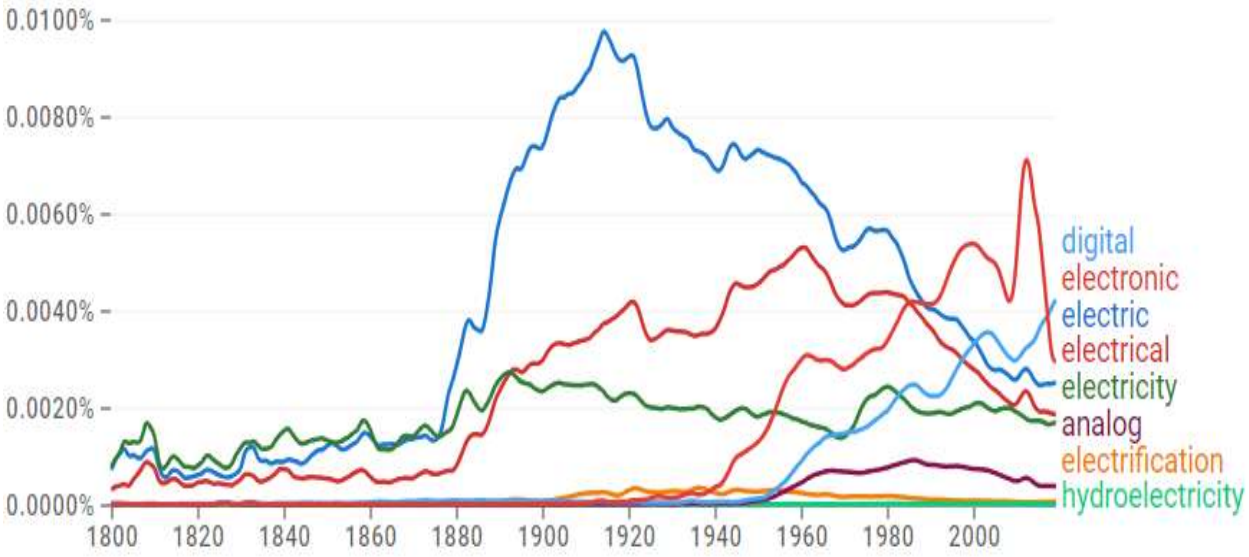

Figure 1

From the above figure, we infer, that there is a lot of interest in 'electricity', 'electric' and 'electrical' which are the keywords associated with electricity and electrical phenomenon at large, and around 1890's a peak is noticed for the keyword 'electricity' and around 1915 a peak is noticed for the keyword 'electric'. The optimism associated with electricity discussed in the previous chapter can be gauged from this peak, as this was the time when the 'Age of Electricity' was coming of age as described by Vaclav Smil in his book, *Creating the twentieth century: Technical innovations of 1867-1914 and their lasting impact* (Smil, 2005).

III. ELECTRICAL TECHNOLOGIES AND THE EVERYDAY LIFE

As has been illustrated in the N-grams below (Figure 2,3 and 4), from 1900 to 1960, there were significant advancements in electrical technologies such as radios, electric lights, electric fans, and other related devices.

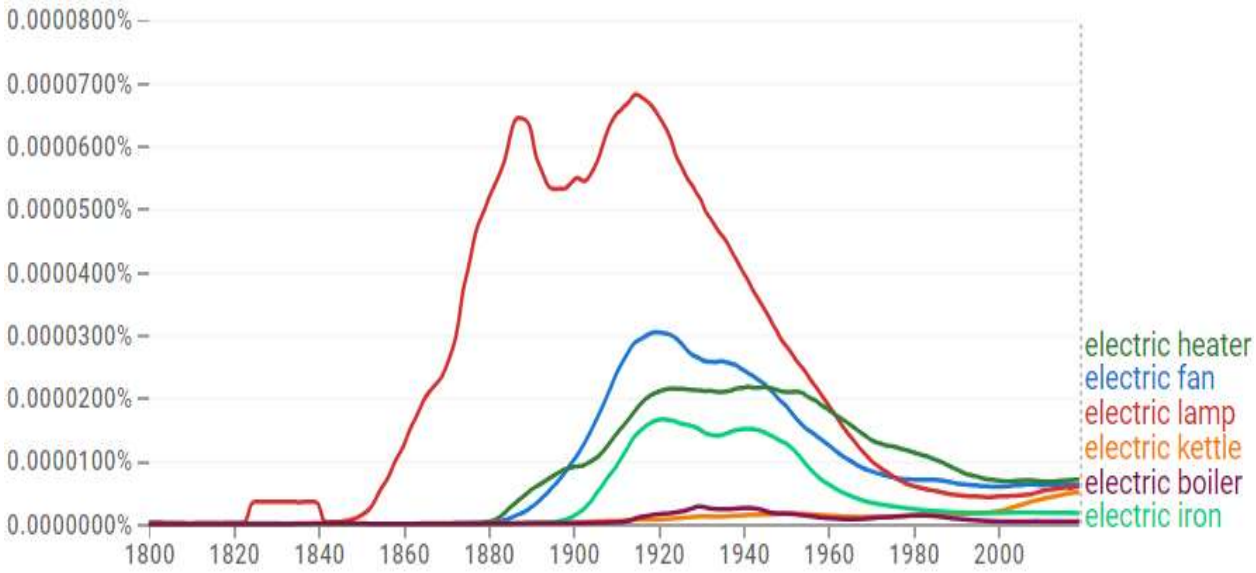

Figure 2.5a

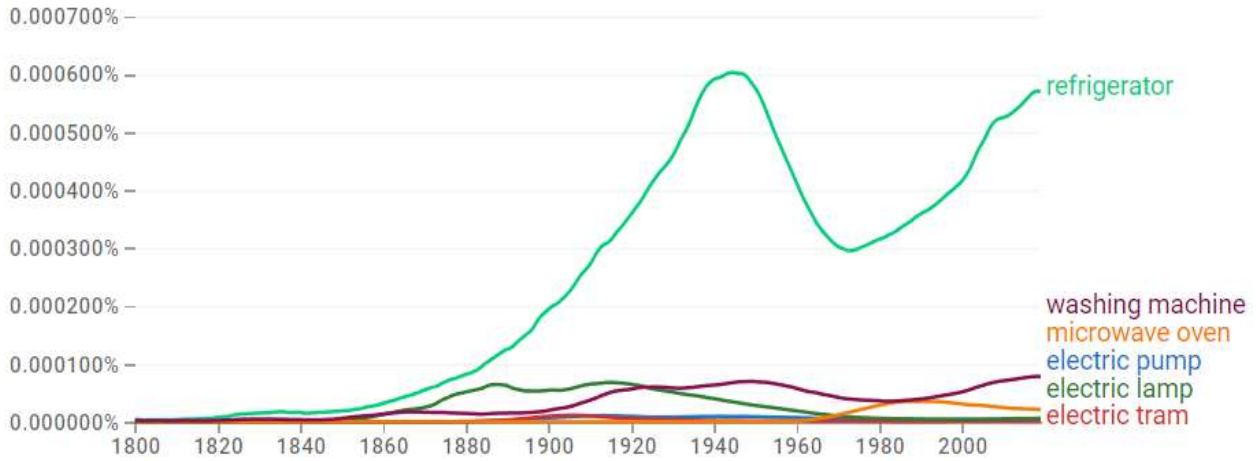

Figure 2.5b

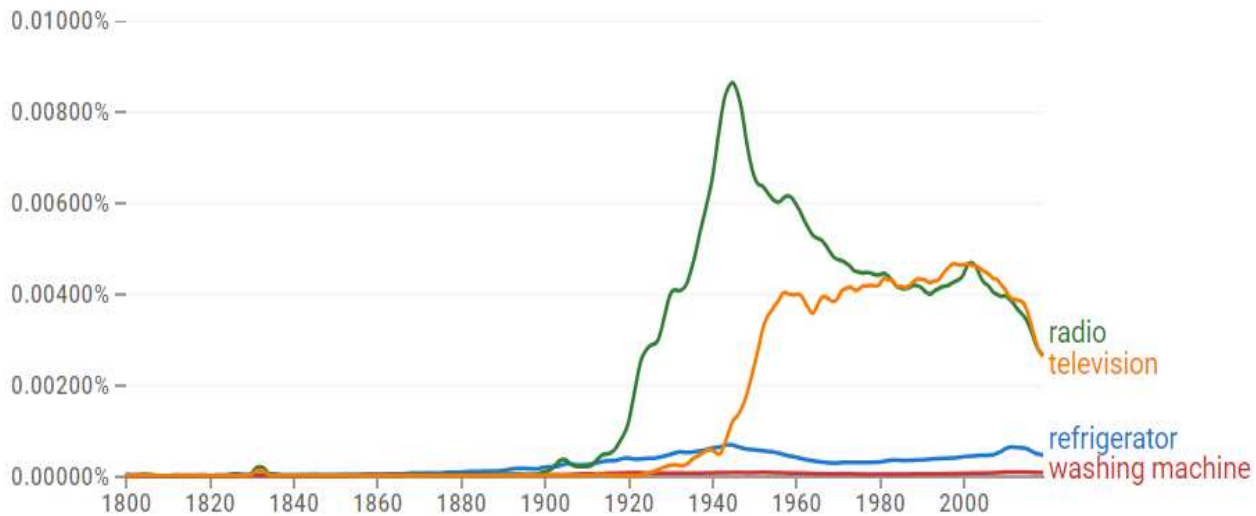

Figure 2.5c
Source: Google Ngram (1800-2019)

As has been illustrated in the N-grams above, from 1900 to 1960, there were significant advancements in electrical technologies such as radios, electric lights, electric fans, and other related devices. These innovations revolutionized various aspects of daily life and had a profound impact on society. Radios played a crucial role in the dissemination of information and entertainment during this period. They became increasingly popular and accessible to the general public. The development of vacuum tube technology in the early 20th century enabled the creation of more efficient and reliable radios. Radios became a common household item, providing a source of news, music, and entertainment for families across the globe. Electric lights also underwent significant advancements during this time. The introduction of incandescent light bulbs by Thomas Edison in the late 19th century paved the way for widespread adoption of electric lighting . Electric lights replaced gas lamps and candles,providing a safer and more convenient source of illumination. The efficiency and affordability of electric lights improved over time, making them more accessible to the general population. Electric fans were another important electrical technology that gained popularity during this period. The development of electric motors allowed for the creation of more efficient and powerful fans. Electric fans provided relief from the heat and improved ventilation in homes, offices, and public spaces. They became a common feature in households and workplaces, enhancing comfort and productivity. From 1900 to 1960, radios, electric lights, electric fans, and other electrical technologies underwent significant advancements. These innovations transformed various aspects of daily life, providing access to information, improving illumination, and enhancing comfort. The development of more energy-efficient solutions was driven by the need to conserve resources and minimise the negative ecological impacts of artificial lighting. These advancements in electrical technologies laid the foundation for further progress in the field and continue to shape our modern world. Electricity has been considered the best embodiment of the nature of modern human societies . Electricity is the bedrock of modernity. Its cheap and reliable lighting broke the human experience from the confines of the solar day. The energy stored within it powered industry and began to minimise the amount of time the masses had to dedicate to labour. Its use in locomotion ushered in the first instances of urban sprawl and provided the first stable connection between suburbs and cities. It allowed for the separation of power consumer and power generator, greatly reducing the pollution present in population centers. Electrical access allowed for the first medium of instantaneous mass communication via the radio. Contemporaries of the first ventures into electrification heaped onto the new technology all of their expectations for an advanced and utopian world, and while utopia is certainly still wanting, the nearly century and a half since electrification began has seen unprecedented advancements.

IV. THE SOCIO-TECHNICAL ASSEMBLAGE OF DOMESTIC ELECTRICITY

The following analysis synthesizes the material, social, and anthropological dimensions of electrification to demonstrate how the domestic sphere has been diachronically reconstructed as a site of totalized technological dependency.

1. Material Energy Transitions and the Black-Boxing of the Grid

Central to the evolution of the home is the transition from localized, animate energy to centralized, high-density power. Utilizing the materialist history of Vaclav Smil(2017), we see that the introduction of the induction motor and the lightbulb represented a "quantum leap" in domestic power density. However, as these systems reached technical maturity, they underwent a process of "black-boxing" (Latour, 1987). The infrastructure became so reliable and embedded that it retreated into the background of the social consciousness. This "invisibilization" created a sociological paradox: as households became more fundamentally dependent on the grid for survival (heating, food preservation, and communication), the user's awareness of the material energy throughput decreased. The modern everyday is thus characterized by a profound alienation from the physical resources—the coal, gas, and turbines—that sustain domestic comfort.

2. Interpretive Flexibility and the Scripting of Gendered Labor

The evolution of "labor-saving" devices like the washing machine demonstrates the Social Construction of Technology (SCOT) in action. Early appliances possessed "interpretive flexibility" (Bijker, 1995); they could have been communal tools, luxury items, or even industrial equipment. However, they were eventually stabilized as private, individual household assets. This stabilization had deep implications for the gendered habitus (Bourdieu, 1977). As Ruth Schwartz Cowan (1983) identified, these technologies were "scripted" (Akrich, 1992) for the solo housewife. The "irony of automation" is that while the physical effort of scrubbing was removed, the social expectations of "cleanliness" were amplified. Consequently, the washing machine did not liberate time; it increased the frequency of the task, reinforcing the domestic sphere as a site of unpaid, high-frequency labor.

3. Mobile Privatization and the Reorganization of Domestic Space

The arrival of the radio and television represented a shift from the "mechanical" home to the "communicative" home. These technologies facilitated what Raymond Williams (1974) termed "mobile privatization." Sociologically, this represents a spatial and temporal reorganization:

- The Electronic Hearth: The television replaced the fireplace as the architectural focal point, dictating the orientation of furniture and the proximity of family members.

- Synchronized Subjectivity: Through broadcast media, the private household was synchronized with national time. The everyday rhythm of the family was no longer dictated by the sun or local tradition, but by the "prime-time" schedule of the state and the market.

4. Infrastructure as Promise and the Precarity of the Everyday

By incorporating the anthropological work of Akhil Gupta and Tanja Winther, we can analyze electricity as a moral economy. In many contexts, electricity is an "infrastructure of promise" (Gupta, 2015)—a signifier of the state's commitment to modernization and a citizen's right to participate in the modern world. When we examine the "everyday" through Winther's (2008) ethnography, we see that electrification is not a neutral transition. It creates new social hierarchies and alters the "speed" of life. The ability to extend the day into the night via electric light transforms domestic sociality into a period of "silent proximity," where family members are physically present but cognitively dispersed. In areas where power is precarious, the everyday becomes a constant negotiation with the grid, where social value is often tied to one's proximity to functioning electrical infrastructure.

V. CONCLUSION

The diachronic evolution of electrical technologies—from the flickering carbon-filament bulb to the stabilization of mass-media and labor-saving appliances—reveals a trajectory of increasing socio-technical enclosure. Building upon the the materialist rigor of Vaclav Smil, the structural insights of the Social Construction of Technology (SCOT), and the ethnographic depth of Akhil Gupta and Tanja Winther, it becomes evident that the modern home has transitioned from a shelter from the elements into a high-density node within a global energetic matrix. The "electrification of the everyday" was never a mere matter of utility; it was a fundamental reorganization of the human habitus and domestic labor. As demonstrated through the Google N-gram analysis of electrical terminology, the linguistic "coming of age" of these terms in the early 20th century mirrors the stabilization of these technologies within the social imaginary. Once "radio," "electricity," and "appliances" became common parlance, they successfully shifted from being novel curiosities to becoming structural prerequisites for modern life.

This evolution is best understood through the lens of socio-technical morphogenesis, where the domestic sphere undergoes a structural transformation that is both irreversible and self-reinforcing. In the Global South, this morphogenesis takes on a distinct character, defined by an "infrastructure of promise" rather than seamless integration. As explored through the works of Diana Montaño, Akhil Gupta, and Tanja Winther, electrification in these contexts is frequently a site of profound social negotiation. In cities like Mexico City or rural Zanzibar, the morphogenesis of the everyday does not lead to a "black-boxed" invisibility but to a visible, precarious relationship with power. Here, the structural elaboration of the home develops through "hybrid" practices—where high-tech appliances coexist with manual survival strategies—challenging Western-centric narratives of linear progress. This highlights that while the global trajectory moves toward an energized domesticity, the material reality of the Anthropocene ensures that this morphogenesis remains uneven, making the "everyday" a constant negotiation between the desire for modernity and the material constraints of a struggling grid.

This evolution takes on a distinct character when viewed through the lens of the Global South, where the morphogenesis of the domestic sphere is often defined by the "infrastructure of promise" rather than seamless integration. As explored through the works of Diana Montaño, Akhil Gupta, and Tanja Winther, electrification in these contexts is frequently a site of profound social negotiation and state-citizen struggle. In cities like Mexico City, the everyday is not defined by an invisible, "black-boxed" grid, but by a visible and often precarious relationship with power. Here, the domestic habitus develops through "hybrid" practices—where high-tech appliances coexist with manual survival strategies—challenging Western-centric narratives of linear progress. This highlights that while the global trajectory moves toward an energized domesticity, the material reality of the Anthropocene (Kumar, 2022) ensures that this transition remains uneven, making the "everyday" a constant negotiation between the desire for modernity and the precarity of the physical grid

This history of domestic technics is, essentially, a history of the vanishing interface. As machines like the washing machine and television reached technical maturity, they became infrastructure—so embedded that they retreated into the "black box" of the social consciousness. We no longer "use" electricity in the modern home; we inhabit it. However, this perceived seamlessness is a sociological illusion; the everyday life of the 21st-century subject is tethered to a massive, physical under-structure of turbines and transmission lines that remain a non-negotiable foundation for civilization. This morphogenesis of the home has created a state of path-dependency where the domestic social order is now inextricably linked to the grid. Whether through the "irony of automation" that intensified gendered labor standards or the "silent proximity" induced by broadcast media, electricity has successfully re-scripted human behavior and familial sociality. The "everyday" is no longer a natural category, but a highly engineered state of existence maintained by a constant, invisible flow of electrons. For the sociology of technology, the task remains to render this invisible grid visible again, critiquing the material costs of our comforts and reclaiming human agency within the high-energy assemblages of contemporary life.

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