The Sociology of Digital Communication: From Signal Digitization to the Engineering of Social Interaction

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Abstract:

This study aims to examine the issue of "illusory digital liberation" through a sociological reading that answers a central question: How did the digital actor transform from an engineer of his practices to an algorithmically alienated actor? The work is done by following the theses of Castells, Van Dijk, and Stalder in their analysis of the concepts of collective self-communication and referential agency, leading to critical Bourdieusian insights that reveal the position of the digital actor within the network society. The most important conclusion of the study is that the digital actor experiences a sharp paradox between "granted sovereignty" and the challenge of alienation from his cognitive output.

Keywords: digital communication, productive user, interaction engineering, digital alienation, algorithmic panopticon.

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1- Introduction

The digital revolution has brought about a qualitative shift in communication structures, transforming interactive phenomena from their traditional form to digital levels based on binary systems. This process has led to the engineering of roles and the transformation of the digital actor from a recipient to a "productive user" who possesses the tools of "collective self-communication" that enable him to engineer his interactions. This empowerment has given the actor absolute sovereignty in sorting, selecting, and creating a knowledge reference within what is known as the digital commons.

Based on the above, the study focuses on the paradox of "illusory digital liberation." While the digital revolution promotes genuine independence for social actors in shaping their interactions within the digital sphere and the production of meaning away from the angle of forced consumption, in-depth sociological logic reveals to us the futility of this technological optimism in light of the growing mechanisms of digital alienation and algorithmic violence practiced by platform capitalism through panoptic monitoring and surveillance mechanisms.

Our research raises the question of whether we are dealing with an actor who is free to act as he pleases or an actor who is technically subjugated and whose output is directed to serve the goals of interactive platforms.

First section: The socio-technical nature of digital communication and its functional determinants

1- The conceptual approach to digital communication and the shift towards dual systems:

The present era has experienced a profound transformation due to the advent of the digital revolution, stemming from the convergence of information technology and communication. This digital revolution represented a significant advancement in communication evolution and fundamentally transformed our existence and interactions with the world. Digital communication, from a mathematical standpoint, entails the conversion of letters, images, and sounds into digital data (binary code) that can be stored, processed, and transmitted by computers. Digital communication depends on linking computers to the internet and converting information, including text, images, and sound, into binary codes composed of numerical sequences.

0 and 1 and relies on electronic communication technology on the one hand and on web technologies and services on the other; thus, it is a predominantly virtual connection (Amroush F., 2021, pp. 1-19) . Another definition of digital communication is that it is communication that operates on the principle of a binary system and is characterized by its strength and high quality compared to analog communication. Examples of devices that rely on digital communication include digital television and satellite communications, which are produced by breaking analog signals into parts, each of which includes a set of 0s and 1s. (Madi and Kayhou, 2023, pp. 78-87)

It cannot be reduced to a mere binary (1.0) technology but is rather an integrated interactive system, which is what the sociological view has concluded by giving this concept a social dimension. This perspective is evident in Mohamed Abdelhamid's definition of digital communication as "the social process in which remote communication takes place between parties who exchange roles in transmitting and receiving various communication messages through digital systems and their means to achieve specific goals." There is a methodological intersection between the views of Mohamed Abdel Hamid and Al-Mekkawi, who sees it as communication used to transmit computer data, voice over the telephone, and radio, television, and music recordings with a high degree of accuracy and quality. (Khawla and Mabni, 2022, pp. 200-217).

Christy Aho also believes that digital communication is "the ability to create effective communication through digital means." This concept is not far removed from the concept of computer-mediated communication, computer-assisted communication, or computer-based communication, all of which emphasize the role of computers in the communication process, such that we cannot ignore them as extensions and relationships through digital systems. This is in line with the thesis of Fadel Daliou, who believes that digital communication is characterized by a high degree of artificial intelligence, whereby a system can be designed to continuously monitor the status of the digital network and correct the path of its data, with its ability to control the echo while achieving harmony between sounds and comprehensiveness, as it allows the transmission of data in various forms: symbols, numbers, texts, sounds, images, graphics... individually or in combination, all with a high degree of accuracy, reliability, and speed. (Delio, 2014, p. 84)

2- Determinants of digital communication and contexts of remote communication

There are a series of determinants that give meaning to digital communication, which we explain below:

* Digital communication goes beyond traditional human communication, which is based on movement, flow, continuity, and the relationships between its elements, as well as the effects of the context and communication environment in which this process takes place, by incorporating asynchronous interactions, multimedia elements, and global connectivity that reshape how messages are created and received.

*Establishing relationships among elements and their functions occurs within the context of economic, technical, and professional influences. These sub-processes are part of a larger, constantly changing and evolving process that impacts other aspects of communication, either by facilitating interactions or aiding in the achievement of goals.

* Although the concept of isolation has emerged to describe individuals' exposure to the global information network (the Internet) ،the social dimension of communication with the information network—in addition to bilateral and collective communication—is clearly evident in the affirmation of the social roles that communication via networks can play, as reflected in the writings of many experts and in UNESCO resolutions.

*Communication between individuals is called "remote communication," regardless of the level of communication (bilateral or collective) and the technologies used to bring the parties together through writing, sound, or images. All of these are innovations that bring the parties closer together, but they do not bring them as close as face-to-face communication, which is based on the parties meeting in person in one place.

* Although communication takes place remotely, innovations in digital systems have provided the essentials for face-to-face communication, such as communication circles, the exchange of communication roles, and the reinforcement of their functions. (Madi and Kayhou, 2023, pp. 78-87) **.**

3- Structural characteristics and socio-technical dimensions of digital communication

Ibrahim and Hussein list the characteristics of digital communication in a series of points, as follows:

*** Interactivity:** This was specific to face-to-face communication, as the parties involved in the process exchange influences through continuous communication, in addition to the multiplicity of participants.

* **Diversity:** It provides recipients with more options to use communication in a way that suits their needs and motivations, such as voice and text communication, email, and discussion forums, as well as diverse content. This diversity has led to the emergence of what are known as "smart media systems."

*** Integration:** The internet represents a communication umbrella that brings together different communication systems, forms, and digital media, helping individuals choose the media content that suits them best. (Al-Shafei and Al-Hamdani, 2019, pp. 1242-1272)

*** Individuality and fragmentation:** Digital communication enhances the value of the individual by offering multiple programs and a wide range of options, allowing researchers and internet users to browse and select what satisfies their communication needs, which in turn elevates individuality and increases its value by distinguishing between individual communication requirements and the specific capabilities of the parties involved in the process. In this way, digital communication contributes to meeting the needs of the user and maintaining the privacy of communication.

*** Transcending cultural boundaries:** The global information network (the Internet) is defined as a "network of networks" where hundreds of thousands of international and regional networks converge, increasing every year, and with them, the number of Internet users in each country as a result of the availability and low cost of connectivity, which has led to the transcendence of geographical boundaries and the global and universal nature of digital communication, melting cultural barriers between the parties involved in the communication process.

* **Transcending space and time:** Digital communication at its various levels does not require the parties involved to be in the same place, as encoding devices and remote communication networks—such as easily transportable mobile devices, telephones, computers, etc.—and other means have facilitated the process regardless of distance.

On the other hand, "synchronization," which is a prerequisite for traditional communication, is no longer necessary in digital communication, as users can store, upload, send via email, and receive messages at a time that is convenient for them.

*** Immersion in the communication process:** One of the distinctive features of digital communication is its low cost of use, given the availability and widespread use of communication infrastructure and digital devices.

4-The basic principles and functional advantages of digital communication

The elements of digital communication are similar to those of other forms of communication, with the exception that they digitized through the digitization of both the communication source and the receiving device, as well as by digitally processing the message.

5- Advantages of digital communication:

The use of digital systems offers many advantages over analogue systems, including:

* Digital communication takes the form of a digital network from the point of transmission to the receiving port, where the stages of transmission, channel, and reception are a single integrated process, and the elements of the system can be controlled and monitored in a unified digital circuit. This digital network does not permit any interference at any stage; it embodies an integrated system of processors that directs the original content and controls the transmission process, the channel, and the decoding of messages at various stages, resulting in greater advantages compared to analog communication.

* Digital communication systems are dynamic and powerful, establishing and maintaining communication as a high-quality, integrated unit, especially in environments where analog signaling is costly and inefficient. Digital communication also excels in transmitting information over long distances through use of fiber optics, which maintain signal strength from start to finish. The strength and effectiveness of digital communication lie in several dimensions, such as resistance to interference, resistance to talkback, electronic error correction, and signal strength maintenance.

* Digital networks are highly intelligent; digital systems can be designed to continuously monitor changes in channel conditions and correct their course, whereas this is not possible with analog connections.

* Computer software typically controls digital networks, ensuring a high level of usability.

* Communication is comprehensive; the digital system allows data to be transmitted in the form of text, sound, images, and graphics with a high degree of accuracy. All forms of communication are carried out using digital signals, and the digital network can transmit multiple conversations or complex sounds simultaneously.

* Digital communication is characterized by a high degree of security. Digital communication systems were previously used for military purposes and to transmit confidential government data before this type of communication became available to the general public. Digital communication is also used in banking networks, electronic data transmission, and the transmission of sensitive information that requires a high degree of confidentiality. (Abu Al-Saoud, E., 2005)

Section II: Sociology of the Digital Actor

1-The shift from passive consumption to the "productive user"

1-1 Manuel Castells' socio-spatial approach: The supremacy of mass self-communication:

If information literature has reduced the essence of digital communication to a mathematical logic based on duality (1.0), sociology has gone further and explored the true essence of this digital revolution by seeking to understand the sociology of the contemporary digital actor, an actor who has transformed from a passive consumer within traditional communication systems (radio, television, and print media) to a networked actor who possesses the tools of "mass self-communication" that enable him to produce and distribute his content to a global audience.

This is precisely what Manuel Castells highlights in his thesis, emphasizing that individuals in the digital age are no longer mere consumers of content broadcast by large institutions but have the ability to produce and distribute their messages to a global audience. This type of communication is "personal" because the individual generates the content, and it is "mass" because it reaches the global network. (Castells, 2014, p. 88)

Based on Manuel Castells' definition, it is clear that the network actor has been liberated from institutional media control and has transformed from a mere recipient to an actor who engineers his practices according to the logic of the "productive user." Mohamed Abdelhamid was drawn to this central concept, emphasizing that digital systems have eliminated the distinction between sender and receiver. Users now consume and produce simultaneously; they consume information and then re-edit and republish it (e.g., commenting, sharing, or blogging), making them essential partners in the creation of communicative meaning. (Hamid, 2007b, p. 54)

2-1 Jan Van Dijk's structural approach: the architecture of interaction in network society:

In the context of Manuel Castells' discussion of self-production, we find an intersection with Jan Van Dijk's ideas. While Manuel focused on the ability of the network actor to produce, create, and broadcast messages, Van Dijk focused on the structure of this production by concentrating on two central concepts: interactivity and network society. Van Dijk thus moves us from studying "What does the network actor produce?" to studying "How does this actor produce his practices within the network structure?"

Van Dijk answers the question: How does the actor engineer his practices? Through his analysis of the structure of production, he sees that the network society has not only changed the tools but has also brought about a radical revolution in the structure of communication. The social actor is no longer a passive recipient, and the communicative relationship is no longer a vertical sender/receiver relationship imposed by traditional media (such as radio and television). Instead, the actor has become an "active user," resulting in a horizontal, participatory communicative relationship.

As for the interactive engineering mechanisms at Van Dyck within this structure, they manifest themselves through three fundamental transformations:

*** Delegation of transmission centralization (from forced reception to self-control):**

Van Dijk, who named it the "flow control mechanism," considers this mechanism to be the first in interactive engineering. He believes that communication flow has shifted from being unidirectional in traditional media, which is dominated by the power of the media agenda, to a mechanism of self-control of communication flow in the network society. Thus, the power of the agenda has shifted from the media institution to the sovereignty of the personal agenda. The actor has therefore transitioned from being forced to receive information to exercising self-control; today's social actor in the network society creates his practices based on his selection power, deciding what to produce and engage with according to his socio-cultural representations.

*** Interactivity as a mechanism for production (turning response into participation):**

In the interactive mechanism, Van Dijk deconstructs the relationship between the actor and the digital structure; this is the central point of his thesis, which represents the architecture of the fusion between human action and algorithmic logic. Here, the actor does not produce his practices in isolation from the digital interface, but rather in a state of interactive negotiation with the machine; by understanding the language of the machine, he adapts its algorithms to his own ends. Sociologically, this interactivity is not merely a technical feature but a structural engine through which the actor moves from a passive future position to that of a productive user, who has the ability to intervene in the structure of the message by modifying or commenting on it, thus becoming an essential partner in the creation of meaning within the network community.

* **The emergence of the "expert user" and the mechanism of shared knowledge production:**

Van Dijk's thesis of the transition from individual action to collective knowledge production manifests in this mechanism. At this level, the communication process shifts from mere sending and receiving to dialogue and collective production, where the actor produces his practices through collaboration with others in participatory work within the network (such as contributing to digital platforms or knowledge groups). This leads to the emergence of the "expert user," an actor who has the ability to produce content and build their own interactive environments. In this way, the actor goes beyond the stage of producing content for themselves to become an engineer of collective digital consciousness characterized by continuity and sharing. (Van Dijk, 2012, pp. 11-14)

3- 1"Reference Effectiveness" and the Shift Towards "Productive Users" at Felix Stalder:

If Van Dijk's thesis dismantled the mechanisms of interaction engineering to understand the structural mechanisms governing the relationship between the digital

actor and the network, Felix Stalder's work takes us from the level of machine mechanisms to a more profound understanding of the level of cognitive reference. According to him, the digital actor does not exercise interactivity as a mere technical act, but rather as a sociological act related to how this interaction is transformed into a collective culture, thereby transcending the boundaries of traditional consumption to become a "referential actor." This shift in roles is considered a genuine gateway to what Stalder calls the "digital condition," where the ability to sort and select becomes the ability to formulate meaning within a shared referential context.

Felix Stalder believes that the shift from consumption to production cannot be understood without considering cognitive reference. Therefore, we can deduce the manifestations of this shift by examining three structural changes that redefine the act of production:

* **Participation in the formulation of collective culture (the mechanism of referential circulation):**

Stalder believes that what distinguishes the productivity of digital actors in the digital network is their superior ability to reuse and recycle information. Actors treat cultural content as raw material, storing it, recycling it, modifying its context, and re-injecting it into the network as a new reference. This makes them "producers of context," transforming them from passive recipients to contributors to the formulation and production of prevailing cultural meaning.

*** The productivity of the "commons" and structural interactivity**:

In this context, Stalder emphasizes that the digital environment has broken down the isolation of the productive user, transforming their status from that of an "isolated individual" to an "active community." This radical transformation has had a direct impact on the identity of the digital actor, who no longer produces for the purpose of passive consumption but rather from a sense of "collective belonging" and a participatory reference aimed at building shared knowledge capital. Thus, this structural effectiveness has been able to re-engineer roles, transforming the network from a mere chat space into a "paradigm" that functions as a global factory for the production of knowledge and services.

* **Personal space engineering (sorting and evaluating as a productive activity):**

Stalder emphasizes that the practice of sorting and selecting is in itself the highest level of productive action; in the digital age, production no longer necessarily means writing new content but rather the ability of the actor to select and sort. Here, the actor becomes the architect of their reality by filtering the flow of information in their personal space. This takes them out of the framework of forced reception and into referential production, which in turn gives them independence in shaping their digital identity, allowing them to curate their online presence and express their individuality through the selective sharing of information. (Stalder, 2018, pp. 75-86)

In conclusion, it is clear that interactivity in the digital age has led to a structural integration between the actor and the network structure, transforming the digital actor from a passive consumer to an "active engineer." This transformation takes us from the

actor's "intrinsic capacity" to possess communicative power (as proposed by Castells) ، through "interactive engineering" in Van Dijk, which gave the actor technical control and integrated algorithmic logic into his practices, to "referential agency" in Stalder, which added a collective consciousness to this interaction and transformed it into a participatory productive act and a knowledge industry that serves the general digital commons.

2- Digital communication in the sociological balance (challenges and obstacles):

If the theses of Castells, Van Dijk, and Stalder have proclaimed the supremacy of the "productive user" in the digital space and his transformation into a liberated digital actor par excellence, equipped with the tools of sorting, selection, and engineering, an in-depth sociological perspective leads us to question whether this digital actor can maintain their sovereignty and exercise their agency freely in a digital environment that is not neutral and is subject to the logic of profit and algorithmic governance.

On this basis, we move on to the section "Digital Communication in Sociological Balance" to highlight the obstacles and challenges that may render the digital actor passive within platform algorithms. These obstacles can be analyzed in greater depth through the following dimensions:

First: the dominance of algorithms and the prevalence of knowledge bubbles:

Algorithms in the digital space exercise soft power over the choices of actors by acting as the "new gatekeepers." If, according to Van Dijk, digital actors can engineer their interactions, platforms perform "reverse engineering" through which algorithms impose cognitive isolation within what is known as the "filter bubble."

From a sociological perspective, this phenomenon is referred to as "knowledge fragmentation"; the algorithm employs a technical mechanism to guide users towards content that reinforces their preconceptions, as if the algorithms were mirroring the user. This is evident in "reference effectiveness," which becomes merely an echo of identical opinions. In reality, this is what the TikTok platform's algorithms reveal, presenting videos that reflect your reality and inner self. Based on this, it can be said that independence is merely an illusion governed by pre-made software matrices. (Pariser, 2011, pp. 52-54)

Second: The second-degree digital divide and the lack of "knowledge sovereignty":

Sociological criticism here goes beyond the issue of "technical empowerment" to address the problem of "knowledge empowerment," where the second-degree digital divide emerges as a structural obstacle that prevents the realization of the values of "digital citizenship." The fact that an actor possesses the technical skills to use a tool does not necessarily mean that they can deconstruct and critique digital discourse. The absence of "information literacy" skills transforms the actor from a "reference producer" to a mere "random transmitter" of information, turning supposed independence into "unconscious dependence."

From Pierre Bourdieu's perspective, we observe ourselves facing a process of reproducing hierarchy within the "digital field," where a cognitive class distinction is formed between elites who possess the "power of understanding" and analysis and an

audience that is content with the "power of publication," which remains a formal activity that reproduces the mainstream without awareness of its mechanisms. (Van Deursen and Van Dijk, 2014, pp. 110-118)

Third: Digital alienation and the emergence of the "data proletariat":

Digital alienation represents the most serious challenge in the relationship between the actor and the platform. From a Marxist sociological perspective, the digital actor experiences a state of alienation from their intellectual output. This raises the question: how does this happen?

When the actor sorts, selects, and disseminates, he thereby feeds the platforms' algorithms with immense amounts of data; here, this "productive user" believes that he is exercising freedom through participatory production, but in reality, he is practicing alienation. This act is manifested in the fact that the user possesses the technical tool but does not possess the basic means of production (the algorithm and the platform), causing them to lose sovereignty over the "digital surplus value" they produce, thus transforming them from a creator of meaning to a mere supplier of raw data to the coffers of large digital companies. (Fuchs, 2014, pp. 245-252)

Fourth: The challenge of "soft surveillance and control":

It is impossible to discuss the sovereignty of the "productive user" over their digital practices in isolation from the reality of surveillance that has permeated the current communication structure; every act of selection or sorting leaves a "digital trace" that is monitored and analyzed statistically. This process sociologically embodies the concept of the "digital panopticon," where the producer/user exercises self-control (consciously or unconsciously) over their productivity.

This submission is explained from Pierre Bourdieu's perspective as the result of the exercise of "soft symbolic violence" by platforms. This procedure is done for two reasons: the first is fear of "negative social evaluation" due to the content's association with certain socio-cultural values, and the second is "algorithmic monitoring" that may exclude it (as in TikTok's algorithms that restrict certain types of content). Here, the user finds themselves in a situation that undermines the principle of spontaneity and freedom, transforming interactivity from a liberating act into a response to a predetermined behavioral pattern. (Stalder, 2018, pp. 140-148).

3-Conclusion

At the conclusion of this sociological reading of the mechanisms of digital interaction engineering, the study ultimately concluded that social actors experience an existential paradox. While the "digital situation" has granted them technical sovereignty that has transformed them from passive recipients to "productive users" and creators of knowledge references, they now discover themselves trapped in the trap of "disempowered empowerment," where they are transformed—consciously or unconsciously—from creators of meaning to suppliers of raw data.

Under this algorithmic system, digital actors are subject to invisible symbolic violence, transforming the "digital commons" into an algorithmic panopticon that molds human

behavior and harnesses participatory freedom to serve the profit agendas of platform capitalism. Based on this, the study recommends the need to sociologically rethink ways to resist this alienation through a renewed critical reading of the dialectical relationship between the digital actor and the algorithm as one of the most complex forms of subjugation and domination in the modern era.

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