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Digital sociology: origin, development, and prospects from a global perspective

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Abstract

To explore the rapid development of digital technology and its profound impact on human behavior and social functioning and to study the mechanisms by which digital technology and the social environment interact, a new branch of sociology—digital sociology—has emerged and rapidly entered a stage of vigorous development. This article briefly introduces digital sociology and outlines the research progress of digital sociology in six areas: labor economy and production, digital politics and power, social relations and interaction, body and self, social inequality, and methodological innovation. Based on this, the article compares digital sociology research in China and the West. The rapid development of digital technology in China provides a superb opportunity for sociology, and digital sociology has great potential for development in China.

Keywords: Digital sociology, Digital society, Digital technology, Digital governance

Introduction

In 2009, Jonathan Wynn officially proposed the concept of "digital sociology"[1] in a brief journal article published in *Sociological Forum* (Wynn 2009). The author recounted his experiences of using digital technology in sociological research and teaching and keenly noted that digital technology has brought new challenges that sociology needs to explore and study in depth. Since the publication of this article, digital technology has undergone a new round of rapid development worldwide, and human society has accelerated its transition into the digital age. At the same time, the research field of "digital sociology" has continued to expand, with theoretical and methodological innovations that have gone beyond the original meaning when Wynn first used this concept. This article will provide a brief introduction to digital sociology, outline the main research progress of Western digital sociology in six core areas, and compare the relevant research in China and the West to provide a reference for the further development of digital sociology in China.

[1] In 2007, the term "digital sociology" appeared in the form of a keyword in a French literature titled "Digital Visual Sociology" (Losacco 2007). However, the academic community generally considers Wynn's article as the official introduction of the concept of "digital sociology".

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What is digital sociology?

Digital technology and digital society

Digital technology emerged with the development of modern computers and the appearance of the World Wide Web. Through hardware (physical computer equipment), software (encoding programs that provide operating instructions for computers), and the infrastructure that supports the software and hardware, various forms of traditional information are transformed into binary digits (0 and 1) that computers can recognize and then store, process, and disseminate. The birth and development of digital technology are important milestones in the history of technology, which have had a profound impact on human society. Computer scientist Mark Weiser (1991) predicted that humanity would enter an era of ubiquitous computing, in which digital technology would be closely interwoven with people's lives to the point that people would not realize its widespread existence. Negroponte (1995) also noted that all media would rapidly digitize, and computers would be able to perform facial and speech recognition and interact intelligently with users. These predictions, which appeared to be science fiction at the time, have been realized one by one over the past thirty years, and the depicted scenes have become commonplace in people's daily lives.

With the rapid development of digital technology, human society has entered a brand new era of digital society. As of the end of 2021, mobile network coverage has reached 95% of the global population, with 88% covered by 4G mobile networks (ITU 2022). People widely use digital devices such as laptops, tablets, smartphones, and smartwatches to access information, communicate, consume, entertain, and participate in public life through applications. Digital technology has not only reconstructed the basic appearance of social life but also triggered fundamental social changes. Helbing (2021) believes that while we are buried in our smartphones, the world is quietly changing around us—digital technology will not only construct human discourse and institutions but also reshape the entire world. Scholars in China hold similar views. Zeqi Qiu (2022) noted that digital society penetrates the original division of labor and organizational structure through network interconnection, making the individual a basic node of the digital network and forming a new social form with the individual as an independent unit. The relationship between individuals and society, the underlying logic of social differentiation, and the basic principles of social operation will also undergo profound changes. In addition, the coexistence of information explosion and "information cocoons," the coexistence of the inclusiveness of cyberspace and the polarization of discourse, and the coexistence of flattening structures and expanding gaps have also aroused much attention (Wang 2021). In the face of the social changes brought about by digital technology and the new problems in digital society, in-depth sociological research needs to be conducted. In this context, digital sociology has emerged.

The scope of digital sociology

The concept of "digital sociology" was officially proposed in 2009 and gradually gained recognition in international academia. In just over a decade, digital sociology has rapidly

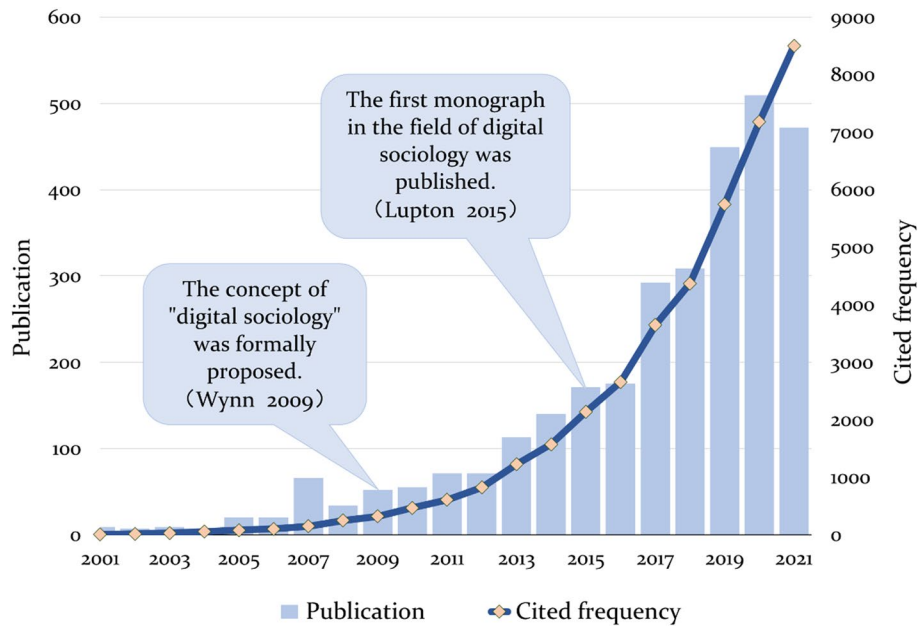

Fig. 1 Distribution of publications and citation frequency related to digital sociology (2001–2021). Data source: Web of Science Core Collection. Topic = "The digital", research field = "Sociology", publication year = 2001–2021. A total of 3050 articles were retrieved with a total citation frequency of 39,966. The search was conducted in April 2022

developed and grown, with various specialized works being published,[2] greatly increasing the audience of digital sociology. At the same time, sociological associations in various countries have begun to establish research branches related to digital sociology.[3] Many universities have also started to offer degrees and courses related to digital sociology.[4] The academic community in the field of digital sociology is gradually developing worldwide, and research related to digital sociology continues to increase (see Fig. 1). Since its inception, digital sociology has rekindled the imagination of sociology regarding many issues and provided a new lens for understanding the digital transformation of human society and the relationship between individuals and society in the digital world.

Despite the widespread adoption of and attention to the concept of "digital sociology" among scholars, there is still no unified understanding in the academic community, and scholars continue to have debates on two core issues: first, whether digital sociology should be understood as a comprehensive revolution of sociology in the digital age or as a new branch of sociological research; second, how the research scope of digital sociology should be defined.

[2] British scholars Orton-Johnson and Prior (2013) compiled a collection of scholars' research into a book titled "Digital Sociology: Critical Perspectives," and Australian scholar Lupton (2015) published the first monograph in the field, "Digital Sociology," followed by other works (Marres 2017; Selwyn 2019).

[3] In 2012, the British Sociological Association established a digital sociology research group; in 2013, the Australian Sociological Association held its first digital sociology forum at its annual conference; and in 2015, the Eastern Sociological Society in the United States held an academic conference in New York on the theme of digital sociology.

[4] In 2013, Goldsmiths, University of London established the world's first master's program in digital sociology, followed closely by the University of Edinburgh, the University of Glasgow, and Virginia Commonwealth University in the United States.

Regarding the first issue, there have been two opinions. According to the first, if sociology aims to thrive in the twenty-first century, it must have theoretical explanatory power for the digital revolution and digital transformation. Since the digitalization process involves many areas of sociological research, each area should respond to it. Therefore, digital sociology does not have a unified agenda and should not be discussed in singular form but in plural form as "digital sociologies" (Gregory et al. 2017). Selwyn (2019) emphasized that digital sociology emerged from the research tradition of sociology but also provided an opportunity for sociology to move away from the industrial revolution and toward modern society. There may not be a digital sociology per se twenty years in the future because all elements of sociology will be digital by then. The other perspective considers digital sociology a branch of sociology (Lupton 2015). Digital sociology provides a perspective for understanding society but should not be understood as all of sociology in the digital age. Similarly, any social phenomenon involves environmental factors, but such aspects may not need to be emphasized in all sociological research (Marres 2017).

Although the scope of research on digital sociology has been debated, most researchers agree on the core of digital sociology, which is concerned with the shaping of social structures and social relations by digital technology and how the development and application of digital technology is affected by the social environment (Orton-Johnson and Prior 2013; Lupton 2015; Marres2017; Selwyn2019; Fussey and Roth 2020). Beyond the binary relationship of digital technology and society, some scholars note that digital sociology also involves the threefold relationship of digital technology, society, and knowledge production (Marres 2017). The application of digital technology not only shapes social life and knowledge production processes, but its interactive properties and universality also make it possible for academic analysis to be more effectively combined with social intervention, thus opening up new possibilities for the interaction of these three elements (Marres 2017). Digital sociology not only focuses on this new possibility but also critically reflects on its own knowledge production process (Lupton 2015). Some scholars believe that digital sociology also includes a more general research scope, such as focusing on the operational logic of information and data flows themselves, as well as their management and usage methods (Webster 2013). Some scholars have claimed that, in addition to being understood as an object of study, digital sociology can also be treated as a research tool and a platform for engaging with the public (Lupton 2015).

There is ongoing academic debate regarding the abovementioned issues, and no consensus has yet been reached. Regarding the first issue, this article tends to define digital sociology as a new branch of sociology. Only by focusing on digital technology or related social phenomena can a study be considered to have a research topic of digital sociology. Regarding the second issue, we tend to define digital sociology based on the core research areas widely explored and discussed in the academic community. Combining our opinions on the two issues above, this article defines digital sociology as follows: digital sociology is a subdiscipline of sociology that employs sociological perspectives and research methods to explore the development and application of digital technology, focuses on the impact of digital technology on human behavior and the operation of society, and examines the mechanisms of the mutual construction between

digital technology and the social environment. It is worth noting that this definition is mainly based on the current development of digital sociology. With the expansion of the research scope, the understanding of digital sociology may also change accordingly. Next, based on the above definition, this article will focus on six main themes of current digital sociology in the West and make a comparison with digital sociology in China.

Six major research themes in Western digital sociology

Labor economics and production

At the birth of sociology, classical theorists engaged in profound thinking in response to the changes brought about by large-scale machine production in the economic and social domains. Among these theorists, Marx systematically analyzed the changes in the labor process and production relations brought about by technological innovation, which aroused sociologists' sustained attention to labor issues. Currently, digital technology is widely applied to the production process, contributing to economic growth while also bringing about a series of profound changes. Digital sociology has conducted initial research on this, focusing mainly on the following three aspects: the new economic forms and production modes in traditional industries spurred by digital technology, changes in labor conditions and the establishment of new labor-capital relations, and issues related to 'prosumption' and new forms of exploitation in the digital economy.

First, the widespread application of digital technology has given rise to new forms of economy. With the booming digital economy, industries such as ride-hailing, online sales, and short video operations, relying on the Internet and various platforms, have absorbed a large number of employment populations. Some scholars believe this new economic model has transformative power (Parker et al. 2016). Compared to traditional business operations, digital platforms can reduce transaction costs, weaken market barriers, and establish an interconnected economic form of "microentrepreneurs." Ordinary people can also improve the value of idle goods and earn income through digital platforms, enabling those who cannot enter the labor market to gain more opportunities (Sundararajan 2017).

The application of digital technology has also driven changes in the production mode of traditional industries. According to an analysis of 32 member countries in the Organization for Economic Co-operation and Development (OECD), AI and automation technology will make 14% of jobs machine-dominated, and another 32% of jobs may undergo significant changes. Industries that are heavily impacted include agriculture, transportation, primary manufacturing, and some service industries (Nedelkoska and Quintini 2018). In addition, some technically and professionally demanding occupations are also affected. For example, the traditional news industry is facing transformation, and the news production process is constantly being reshaped. Some media companies are using algorithms to replace human labor, and news related to sports and finance is being automatically generated by computers (Cohen 2015). Digital technology has lowered the threshold of the traditional news industry, and the public is also involved in the process of producing news content. Thus, journalists need to quote more from other sources and seek cooperation with the public (Wheatley 2020).

Second, the development of the digital economy has also led to changes in laborers' working conditions. Flexible employment and gig services have become new

employment models, increasing job flexibility yet leading to greater instability for workers (Duffy 2020; Kalleberg and Vallas 2018; Vallas and Schor 2020). Platform competition, price wars, and increased transaction volume can erode workers' labor conditions, and digital platforms may reduce workers' benefits and labor protections through temporary contracts (Schor and Attwood-Charles 2017). Wood et al. (2019a) found that digital platforms establish reward and punishment mechanisms based on algorithms, and consumers can rate platform workers' services. To obtain a higher reputation rating, platform workers may face consequences such as overtime work, sleep deprivation, and excessive fatigue. However, some researchers have argued that this description is oversimplified and ignores the heterogeneity of digital platforms and workers. For example, laborers who rely on digital platforms to earn supplementary income have higher job autonomy, hourly wages, and satisfaction with the platform. On the other hand, for those who rely on these platforms to obtain basic income, their job stability is poorer, and they are more likely to have strong dissatisfaction with the platform (Schor et al. 2020).

Moreover, digital technology has also facilitated the establishment of new labor-capital relations. Digital platforms have reduced the cost of labor replacement by extensively decomposing and refining the labor process, resulting in a lack of intrinsic motivation to protect workers and leaving them in a more vulnerable position than ever before (Wood et al. 2019b). Platform workers are increasingly atomized and isolated, facing more difficulties in internal solidarity and collective action (Gray and Suri 2019). However, it has been found in some studies that workers still express dissatisfaction and resist labor control through various means (Tassinari and Maccarrone 2020). When the platform's technological, legal, and organizational management controls are superimposed on each other, the grievances and dissatisfaction of platform workers are intensified, and their demands for collective action are strengthened (Lei 2021).

Third, "prosumption" creates hidden forms of exploitation. In the digital economy, individual users gradually transform from single consumers or producers into compound "prosumers." Many users contribute vast amounts of information and large profits to digital platforms through massive "prosumption" behaviors for which compensation is not needed (Ritzer et al. 2012). Some users become "Internet celebrities" or "microcelebrities" by regularly sharing their daily lives, and they manage their self-image to achieve "self-commodification" while assuming various types of invisible labor, including emotional labor (Abidin 2017; Raun 2018). In the view of Fuchs (2014), the "prosumer" behavior of users should be regarded as a kind of digital labor, which, like domestic labor, is mostly completed during leisure time and creates a large amount of surplus value, but in most cases, it is not compensated or regarded as genuine labor. Therefore, exploitation exists not only in the digital economy but also in more covert ways.

Digital politics and power

Starting with Weber's classic discourse on power and authority, classical social theory and STS[5] research have become the theoretical pioneers of digital sociology in this field. For example, Winner (1980) analyzed how technology has political attributes. As a typical representative of emerging technologies, digital technology reflects power relations and its designers' subjective intentions while also affecting power operations and people's political behaviors. Currently, the scope of digital sociology in this field mainly focuses on four aspects: panoramic surveillance and power characteristics in digital society, the nonneutrality of algorithms, political participation in digital society, and the connotations and challenges of digital governance.

First, the panoramic surveillance of actors has been achieved in digital society, reflecting more fluid power features. Through mobile devices, social media, and ubiquitous data collection facilities, dynamic and real-time data collection is realized in a digital society, leading to a higher degree of surveillance of actors. Digital surveillance technology differs from previous forms of surveillance in its wide-ranging, cross-temporal, and strong covert characteristics (Mann and Ferenbok 2013). Initially, digital surveillance mainly manifested as the activity of governments or power institutions collecting public data for management and regulation purposes (Brayne 2017), which constitutes surveillance of the many by the few. With the popularity of the Internet and the application of digital technology, the general public is no longer a single target of surveillance but also becomes a surveillance subject. For example, the public monitors politicians through social media platforms (Trottier 2018), forming surveillance of the few by the many (Doyle 2011). There is also mutual surveillance among subjects on social media, where people track others' information and status through social platforms while accepting others' attention and scrutiny (Marwick 2012). Therefore, surveillance in the digital society is no longer a unilateral exercise of power. It is ubiquitous, penetrating many areas of life that were previously difficult to reach (Bauman and Lyon 2013).

Furthermore, algorithms are nonneutral as an important foundation of the digital society. For example, the existence of algorithmic authority means that human life is influenced to different degrees by algorithmic programs. Rogers (2013) used the Google search engine as an example and showed that under specific algorithmic logic, some information will be prioritized and presented over other information. Cheney-Lippold (2011) found that internet marketing companies observe, analyze, and identify people's online lives through complex algorithmic programs and use inferred anonymous user identity information for commercial profit purposes. To some extent, people's information features are shaped by individual online practices on the Internet (Rogers 2013), but individuals have little knowledge of how their behavioral data will be processed by algorithmic "black boxes" (Pasquale 2015).

Third, political participation in digital society has drawn increasing attention in recent years. The widespread use of digital technologies, especially social media, affects people's political engagement. Boulianne's (2015) meta-analysis showed a positive correlation between using social media and political participation. However, these studies

[5] There are two mainstream views on STS internationally: Science and Technology Studies (STS) or Science, Technology, and Society (STS).

mainly rely on cross-sectional survey data, and recent diachronic studies have presented more complex empirical results (Theocharis and Lowe 2016; Kahne and Bowyer 2018). Some scholars (Bimber 2017) believe that digital media increases people's opportunities for political participation, but others point out that the popularity of the Internet does not change the existing unequal political participation situation, and online authorities often occupy an advantageous position in the existing political and economic structure (Mariën and Prodnik 2014). In recent years, scholars have begun to focus on the role of digital mobilization in various political rallies and protests. "Slacktivism," which expresses political attitudes through sharing, liking, and forwarding behaviors, may reduce people's actual offline participation and erode traditional forms of political participation (Morozov 2011). However, some studies have shown that online political participation is a supplement to offline participation rather than a substitute and can have an important impact (Freelon et al. 2020). For example, digital platforms and social media played a key supporting role in information dissemination, organizational mobilization, and collective identity formation in the "Arab Spring" and "Occupy Wall Street" movements (Castells 2015). This kind of social movement that mobilizes through social media platforms and widely applies digital technologies in the process is becoming increasingly common in Western countries (Caren et al. 2020).

Finally, digital technology has become an important means of social governance. Digital governance has two aspects. First, the governing authority introduces digital technology into the governance system. For example, in the face of a public health emergency, the government and users can use digital technology to identify risks through interaction (Chatterjee et al. 2020). Second, the governing authority sets rules for the application of digital technology and expands the governance field to the digital space. In a digital society, some new social problems have emerged. For instance, social media has greatly expanded the audience and influence of online rumors, and those who create false information use various means to mislead their audiences' perceptions (Innes 2020). To address this, many governments have issued laws or decrees to regulate the development and application of digital technology. Currently, digital governance faces significant challenges in both of these aspects. The former may have the problem of a "digital Leviathan" (Langford 2020), while the latter faces many difficulties in areas such as digital antimonopoly and effective regulation of digital platforms (Flew et al. 2019).

Social relationships and interactions

The study of social relations and interactions has always been a focus of sociologists. According to Georg Simmel (2002), sociology needs to investigate the mutual influence between people to answer the question of "how is society possible." The widespread use of digital technology has changed the mode of interpersonal interaction and the construction of social relationships, promoting the formation of online communities and providing new possibilities for shaping collective identity and consciousness.

First, the popularization of digital technology has changed the way in which interpersonal interactions and social relationships are constructed. Traditional interpersonal interactions are based on face-to-face communication, but technological progress has blurred the boundary between "present" and "absent" in interactions. People can participate in "present" interactions without physical presence. This kind

of interaction and communication mediated by technology form "connected relationships" (Licoppe 2004). According to Wajcman (2015), such interactions maintain the connection between users, friends, and family and broaden the construction of social relationships. Turkle (2011), on the other hand, expresses concern that in interactions mediated by digital technology, people are more frequently connected, but interpersonal relationships may become shallow, leading to increased loneliness in the midst of tighter connections. Although these two views differ in their perspectives, they both reflect the same understanding that digital media is changing the nature of social relationships (Baym 2015).

At the same time, interactions that transcend time and space are eroding the boundaries of different social relationships. Digital technology keeps people constantly online, blurring the boundaries between work and life and requiring individuals to engage in multitasking and thus endure additional psychological pressure (Tammelin 2018). Social media expands the visibility of users' daily lives. People may not necessarily want to make interactions between friends public, but social media platforms complicate the situation (Boyd 2010). Meanwhile, people's clicking and sharing behaviors on social media also actively bridge the boundaries between personal and public life (Boccia Artieri et al. 2021). Van Manen (2010) refers to this situation as "the privatization of the public and publicization of the private," suggesting that mobile terminals and social platforms may change young people's experiences of privacy, secrecy, solitude, and intimacy.

Second, digital technology is driving the formation of online communities. In online communities, users' identity characteristics are more personalized, and their sense of belonging has higher variability and diversity. Online communities can also consolidate offline networks and enhance the continuation of relationships (Robards and Bennett 2011). However, social media also provides a breeding ground for extreme speech. The traditional view is that social media amplifies the "echo chamber effect" by pushing content that users like, reinforcing their own biases in a homogeneous stream of information (Pariser 2011). Recent experiments by Bail et al. (2018) have shown that breaking the "social media echo chamber" does not reconcile different stances. Furthermore, Bail (2021) found that extremists with similar stances will also form small groups on social media, establish a sense of belonging by connecting, supporting, and attacking opponents together, and become increasingly extreme in the process.

Finally, digital technology provides new possibilities for shaping collective identity and consciousness. Research has highlighted that overseas immigrants use digital technology to establish connections, share information, sustain culture, and find a sense of belonging, maintaining emotional connections and collective identity beyond the spatial range of their homeland (Ponzanesi 2020). People also create online digital memorial spaces to digitize old memories and reconstruct collective memory and identity (Recuber 2021). In addition, digital technology helps create collective effervescence. Physical gathering is no longer necessary, and spiritual resonance can be generated through interactive public opinion topics and digital platforms (Gong 2015). Social media can gather people's emotional expressions through topic tags (Lorenzana 2018). The moments of collective effervescence in the digital space enable people to transcend atomized existence and become symbols of the connection between individuals and society in the digital age.

Body and self

Body and self is another classic theme of sociology. From the sociological perspective, the body is shaped by the forces of social structure and significantly impacts self-construction. In the digital age, the body and self have richer meanings, and digital sociology explores them in two dimensions: one is the interconnection of the body and the quantification of the self, and the other is digital avatars and the construction of the self in virtual space.

First, digital technology is driving the formation of the "Internet of Bodies." The development of the "Internet of Things" will bring humanity into the era of the "Internet of Everything." With the expansion of the "Internet of Things," the human body is connected through networks to form the "Internet of Bodies" (abbreviated as "IoB") (El-Khoury and Arikan 2021). IoB devices are continuously innovated from external devices such as smartwatches to implanted devices such as smart sutures and to third-generation devices that aim to externalize human thinking. Countless sensors are unprecedentedly monitoring, analyzing, and even altering the human body, opening up new spaces for the medical and health fields but also challenging the integrity and autonomy of the human body and raising new requirements for human safety and privacy protection (Matwyshyn 2019).

With the development of the IOB, self-observation and quantification practices have increased. People use digital devices to collect and track body data. Their self-measurement and recording practices are called "the quantified self" (Lupton 2016). Understanding oneself through data is not only a reflective practice but also a computational process, a means of external self-understanding, and its presentation of results may be more comprehensive and accurate than our own descriptions of ourselves (Brubaker 2020). While helping people achieve health goals, the practice of the "quantified self" is also a process of monitoring, disciplining, and molding the self. In this process, scientific indicators and authoritative knowledge are more valued than subjective and specific self-awareness, and people continuously reproduce socially and culturally recognized self-images through continuous self-disciplining (Berry et al. 2021).

Furthermore, digital sociology is concerned with "digital avatars" and self-construction in virtual space. "Digital avatars" are digital surrogates that people create in virtual spaces (such as online games) based on the imagination of their bodies and selves. In the virtual world, they can coexist with other users in the same digital space and communicate in real time (Coleman 2011). At this point, the surrogate body is achieved through technology and can only be achieved through technology (Hansen 2006). With the advancement of virtual reality technology, this experience has become more realistic. For example, the latest virtual reality communication system captures users' body movements, facial expressions, and voice data in real time, creating a digital avatar that enhances the user's presence in the virtual space and makes real-time interactions more authentic (Aseeri et al. 2020).

These practices and experiences based on digital avatars can also affect people's self-perception and self-construction. Virtual space is similar to a screen on which people can project different versions of themselves and various imaginations about themselves (Gálik 2019). Since the construction of self-identity is completed through interactions between individuals and others, users may adjust themselves based on the feedback of

social media, which may lead to a deviation between the true self and the ideal self and even to the seeking of acceptance at the expense of losing individual authenticity (Deh and Glodovic 2018).

Social inequality

Sociology's attention to issues of inequality has been a consistent theme throughout its history, and digital sociology continues this tradition by focusing on two key questions: first, what role do digital technologies play in reproducing existing social structures such as class, gender, and race? In other words, does the development of digital technology exacerbate or alleviate social inequalities? Second, does the widespread application of digital technology result in new forms of social inequality?

Regarding the first question, some scholars believe digital technology has enormous potential to promote resource sharing and break information monopolies. For example, education platforms such as MOOCs have lowered the cost of education and widened access to education for more people (Bowen 2013). However, some scholars also argue that the widespread use of the Internet does not truly alleviate social inequality. People with higher levels of education tend to have better internet skills and are more inclined to use the Internet for upwardly mobile activities, such as political participation and job seeking, rather than just entertainment (Hargittai and Hinnant 2008). This gap in skills and benefits leads to further social inequality, accelerating the reproduction of the original social structure (Hargittai 2018).

Moreover, the application of digital technology may make racial and gender discrimination more covert. For example, the US healthcare system constructs models for predicting patients' medical needs based on their healthcare costs in the previous year rather than their illness severity, resulting in medical resources skewed toward White patients (Obermeyer et al. 2019). Lambrecht and Tucker (2019) found that even when gender neutrality is maintained in advertising, men are still 20% more likely to see recruitment ads in the fields of science, technology, engineering, and mathematics than women. This is because advertising targeted at women in other marketing sectors creates a "crowding out effect," resulting in higher advertising costs for women and putting them at a disadvantage if algorithms are used purely based on economic rationality.

Regarding the second question, the application of digital technology may cause new social inequalities. Initially, scholars divided people into those with access to the Internet and those without access based on differences in internet access rights (Castells 2001). This distinction, which arose due to differences in access rights, was called the "first-level digital divide." As internet infrastructure developed, differences in access rights gradually diminished, giving rise to the "second-level digital divide" based on differences in digital skills and usage, as well as the "third-level digital divide" based on differences in benefits and outcomes (Hargittai 2001; Van Dijk 2005; Wei et al. 2011).

Under these digital divides, new forms of inequality have emerged in human society. Those who master digital technology, such as senior software engineers and technology executives, have formed a new group—programming elites. Their power almost entirely relies on their control of technology rather than on institutional processes of professionalization (Burrell and Fourcade 2021). In contrast, those lacking digital devices or skills face a new type of poverty—digital poverty—and may encounter various social

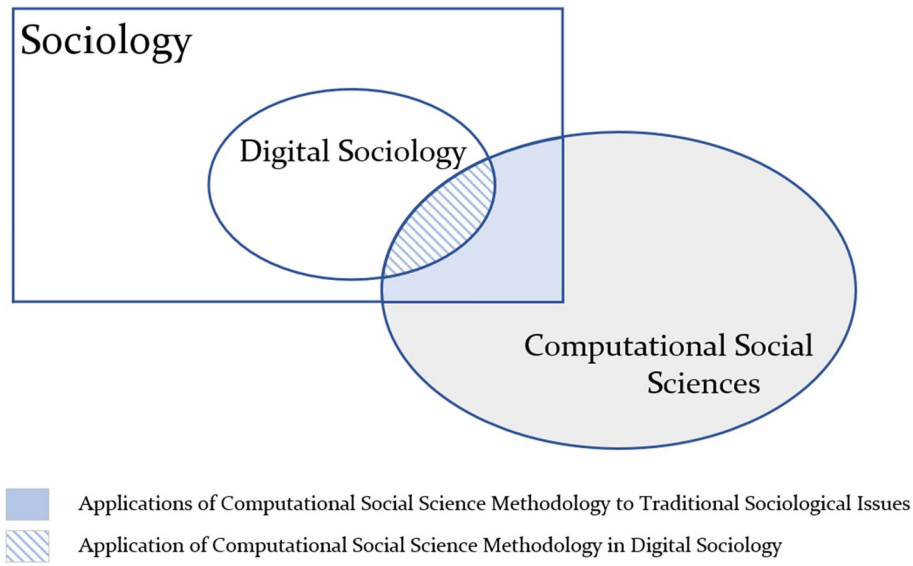

Fig. 2 Relationship among sociology, digital sociology, and computational social sciences

problems, such as resource scarcity and social isolation (Donaghy 2021). There are also some users who, due to a lack of sufficient digital literacy (such as identifying the authenticity of information and protecting data privacy), have also become vulnerable groups in digital society, which may include people with higher socioeconomic status (Lee 2018).

Methodological innovation in digital sociology

Digital sociology adheres to the research tradition of sociology, not only exploring theoretical issues related to the application of digital technology but also advancing innovative research methods. Digital sociology research currently focuses on mining diverse data sources and innovating traditional analysis tools.

First, digital sociology makes full use of traditional structured data and in-depth interview data while also attaching importance to the exploration and use of new data sources. In digital sociology research, big data complements traditional survey and interview data and provides a new data source. Researchers can analyze users' digital footprints (text, action trajectory, images, and videos) to promote an understanding of human behavior and macro-social structures (Lazer et al. 2009, 2020). While exploring diverse data sources, digital sociology applies computational social science methods such as computer simulation and machine learning to empirical research. Notably, digital sociology and computational social science belong to different categories: digital sociology is a branch of sociology, while computational social science stresses methodology (see Chen 2022a; Fan 2020). The latter provides powerful research tools for digital sociology, but it is not the only tool. The distinction and connection between the two are shown in Fig. 2.

Furthermore, digital sociology emphasizes the innovation of traditional analysis tools. With the increasing prevalence of social interaction in the online space, researchers have expanded the scope of field research to new media spaces and developed new research

methods such as digital ethnography (Murthy 2008). Digital ethnography follows the principles of traditional ethnographic research; researchers usually participate in observations in the network space where the research subjects are located and conduct interviews using the digital technologies commonly used by the subjects, reflecting a research perspective in which digital technology is viewed as a part of the living world (Pink 2016). Some scholars also combine digital ethnography with data mining and develop methods such as ethno-mining. For example, researchers collect participant behavior data through smart devices, conduct visualized analysis, and then show the results to the participants, carrying out observations and interviews to explore the meaning behind the behavior data (Anderson et al. 2009).

From the current development, the methodological innovation of digital sociology still has a long way to go. For example, research ethics and norms in using big data still need to be clarified and improved (Lazer et al. 2020). In addition, although big data provides new data sources for digital sociology, it usually lacks meaning and value because it is "out of context." Therefore, some scholars advocate combining big data with other types of data (Bornakke and Due 2018). Edelmann et al. (2020) believe that sociologists should not only use new data to examine traditional sociological issues that were previously difficult to address but also explore new problems arising from the application of digital technology and use big data to promote theoretical innovation. For digital ethnography, data collection and sharing also require new academic norms. How to balance protecting the privacy of respondents while improving data transparency has become a key concern in the academic community (Murphy et al. 2021).

A comparison between digital sociology in China and the West

Digital technology has been vigorously developed and applied extensively in China in recent years. At the same time, the research topics of digital sociology have also received increasing attention. In terms of theoretical exploration, some scholars have conducted inspiring discussions on issues such as macro social changes brought about by digital technology, changes in social differentiation mechanisms, new types of risks, the transformation of social governance, and new ethical challenges (Chen 2022a; Qiao et al. 2022; Qiu 2022; Wang 2021; Xiang 2021; Zhang 2018; Zhang and Li 2022). In terms of empirical research, relevant research in digital sociology has developed rapidly with diverse perspectives and rich content.

Table 1 lists Chinese academic papers related to digital sociology published in the three major journals of Chinese social science research since 2005, namely, "*Social Sciences in China*," "*Sociological Research*," and "*Chinese Journal of Sociology*." 80% of these papers were published after 2015, reflecting the recent development of digital sociology in China. These papers have been roughly classified according to the six research themes and specific research content summarized in this article. Compared with Western digital sociology, the development of digital sociology in China has both commonalities and local characteristics, mainly reflected in the following four aspects.

First, the research scope covers the main research fields of digital sociology, with obvious emphasis on certain areas, while others still lack attention. As shown in Table 1, Chinese digital sociology has a broad range of research scope covering the six major research themes listed in this article. However, the development of Chinese digital

Table 1 Overview of Chinese digital sociology research

Research topics	Content	Representative work[a]
Labor economics and production	The impact of digital technology on economic form and production mode	Fan and Ning 2021; Qiu 2005; Qiu and Huang 2021a; Qiu and Qiao 2021b; Ren 2012; Shao and Zheng 2022; Wang 2021; Xu and Ye 2020; Zhang 2021; Zhang and Qiu 2022; Zheng 2019; Zhou 2021
	Changes in labor conditions and capital-labor relations	Chen 2020; Jia and Yan 2022; Li and Jiang 2020; Liang 2016; Wu and Li 2018; Xu and Zhang 2019; Zhao and Han 2021
	Blurred lines between production and consumption and new forms of exploitation	Qiu 2014
Political power and governance	Panoramic surveillance and power features	
	Algorithmic non-neutrality	Zha 2022
	Political participation	Bu 2015; Chen 2013; Chen 2015; Huang 2010; Huang and Gui 2009; Ji et al. 2016; Wang and Meng 2021
	Digital governance	Chen and Li 2019; Lv et al. 2022; Shan 2022; Tan et al. 2015; Wang 2016; Yang 2015
Social relationships and interactions	Interpersonal interaction and construction of social relations	Bian and Miao 2019; Chen 2013; Huang et al. 2014; Wang and Wang 2016; Wang 2021; Cheng 2010
	Online community	Chen and Xu 2017; Chen 2022b; Feng 2021; Gui et al. 2015; Huang 2017; Ma and Wang 2015; Mao et al. 2021
	Collective identity and collective consciousness	
Body and self	Internet-connected body	
	Quantified self	Tang and Xie 2019
	Digital avatar	
	Self-construction in virtual space	
Social inequality	Digital technology exacerbates/alleviates existing social inequalities	Zhuang et al. 2016
	Digital divide and new social inequality	Li 2006; Qiu et al. 2016; Wang 2005; Zhao 2015
Methodological innovation in digital sociology	Mining diverse data sources (such as big data)[b]	Chen 2015; Chen and Fei 2017; Chen et al. 2017; Gong et al. 2019; Gui et al. 2018; Sun and Chen 2016
	Innovating on traditional analytical tools (e.g., digital ethnography)	Bu 2012

[a] The literature listed in the table includes academic papers related to digital sociology published in the three major Chinese journals "*Social Sciences in China*," "*Sociological Studies*," and "*Chinese Journal of Sociology*" since 2005. The "*Social Sciences in China*" literature selection criteria are based on an article categorized as having a sociological topic on the CNKI database or having a sociological research institution as the author's affiliation. As some papers' research perspectives are not limited to specific topics, the author selected the essence of the research for classification based on personal understanding to avoid redundancy

[b] Using new data sources to explore topics related to digital sociology overlaps with computational social science. The empirical research listed in this section uses big data as a data source while exploring related theoretical issues in digital sociology

sociology is not balanced. Overall, existing research shows a trend of "more emphasis on the macro level and less on the micro level," with a clear focus on social issues such as labor economics and production, political power and governance, social relations and interactions, and social inequality. However, less attention has been given to

areas focusing on individual life practices, such as the body and self. In addition to further developing advantageous fields, future research can be expanded to more research topics.

Second, the research content of Chinese digital sociology has its own distinctive features, reflecting the characteristics of China's local digital technology development and application. However, there is still a need to strengthen the exploration of new phenomena in the digital society. As shown in Table 1, most of the literature is deeply rooted in Chinese society, and research on many topics, such as rural e-commerce and digital platform participation in social governance (Qiu and Qiao 2021b; Qiu and Huang 2021a; Zhang and Qiu 2022; Lv et al. 2022; Shan 2022), shows distinct characteristics of Chinese society. These studies are based on China's unique digital transformation process and make an important contribution to international digital sociology. In future research, more attention can be given to new phenomena in digital society. Compared to Chinese researchers, Western digital sociologists have shown greater interest in the development of digital technology frontiers and young people's digital practices and have conducted more in-depth research on new phenomena emerging in digital society.

Third, the existing research in Chinese digital sociology has leveraged the discipline's strengths and demonstrated initial efforts to integrate multiple disciplines. However, more cross-disciplinary research needs to be encouraged. Among the abovementioned research achievements in Chinese digital sociology are outstanding contributions made by scholars from fields such as law, political science, public administration, and journalism. Regarding the development of digital sociology in the West, cross-disciplinary integration has become a distinct characteristic of digital sociology. The development of digital technology and its impact on human life do not respect disciplinary boundaries, and researchers in digital sociology cannot be limited by these boundaries either. The future development of Chinese digital sociology requires further dismantling of disciplinary barriers. Researchers should be encouraged to propose research questions and seek academic cooperation from a cross-disciplinary perspective. This will lay a more solid scientific foundation and support the future development of Chinese digital sociology.

Fourth, while the existing research has drawn from traditional sociological methods, there is a need for more innovative methodologies. Although a few studies have employed innovative data sources or methodological tools (Chen and Yan 2017; Gui et al. 2018; Qiu and Huang 2021a; Feng 2021; Mao et al. 2021), they are still in the minority. Looking at the development of digital sociology internationally, the continuous innovation of methodology and research tools has almost become another distinguishing feature that sets digital sociology apart from other subdisciplines of sociology. This requires breaking down the opposition of quantitative and qualitative research methods at the epistemological level and analyzing and discerning diversified data sources to address research questions better.

Conclusion

Digital technology has swept the world, pushing human society again onto the path of transformation. In this context, digital sociology has emerged. We argue that digital sociology should not be understood as sociology in the digital age, nor is it the same as computational social science, which mainly focuses on methodology. Digital sociology

explores the development and application of digital technology and the related social changes from a sociological perspective. Due to space limitations, this article is far from an exhaustive review of digital sociology. However, it still outlines the main features of this new field: digital sociology covers multiple themes, shows continuous innovation in methodology and research tools, and reflects the mutual promotion of empirical research and theoretical exploration. However, digital sociology is still in its infancy, and many core issues need to be addressed, providing a superb research opportunity for sociologists worldwide.

It should be noted that although the application of digital technology crosses national borders, research in digital sociology still needs to focus on specific social and cultural environments while maintaining international dialogue. The development and application of digital technology in China are at the forefront of the world, creating rare opportunities for related research in digital sociology. Domestic scholars have carried out a series of studies and explorations in labor economics and digital governance with fruitful results. For the future development of digital sociology in China, researchers need to broaden their research perspectives, keenly grasp new phenomena in a digital society, strengthen interdisciplinary exchanges, and innovate at the methodological level to conduct a more in-depth exploration of the social transformation process driven by digital technology. Digital sociology in China shows great prospects and calls for the participation and joint efforts of more colleagues in the academic community.

Abbreviations

IoB Internet of bodies

STS There are two mainstream views on STS internationally: Science and Technology Studies (STS) or Science, Technology, and Society (STS)

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