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Three Network Dynamics in Iran: A McLuhanian Account

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This article offers a new macrohistorical model of telecommunication and social relations with a focus on Iran as a case study. It shows how networks, as complex interacting forms of social associations, undergo historical changes through developments in telecommunication practices. By reworking Marshal McLuhan's notion of three ages of communication, we identify three forms of social associations with distinct communicative spheres: (1) oral-scribal networks, (2) tele-networks, and (3) digital networks. The three network models propose to explain how emerging technologies mediate social relations with multifaceted historical developments. Using Iran as a case study to expand on the proposed models, we aim to map out historical trajectories of distinct social networks, to underscore how interruptive telecommunication processes continue to shape history shared with vast regions around the globe. The network model, intimately tied with telecommunication practices, is proposed set of socioepistemic transformations, underscoring complex sets of new mediated experiences, from oral-scribal to many-to-many communicative actions, in which new forms of global modernity manifest various assemblages.

Keywords: social network analysis, networks, telecommunication, global history, Iran; Marshal McLuhan

Since the term was first coined by John Arundel Barnes, social network analysis (SNA) has fav considerable contributions to the field of social studies (Barnes, 1954). With a focus on relations rather than units of analysis, SNA studies have gained ground in showing the significance of individual, organizational, and social relations in terms of communication networks (Barnett & Danowski, 1992; Barnett & Feeley, 1996; Himelboim, Golan, Moon, & Suto, 2014; Ibarra & Andrews, 1993; Knoke & Kublinski, 1982; Meyer, 1994; Monge & Contractor, 2003; Wasserman & Faust, 1994). In what Everett M. Rogers (1986) has described as "interconnected individuals," connected by "patterned communication flows," networks are formed as affective exchanges of ideas, goods, services, and money by which the

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communication structure of social relations becomes realized in various institutional or organizational settings. Networks are social processes operational through various modes of communication.

SNA is used to study changes and patterns of social actors linked to specific historical periods, with an emphasis on how types of relations can be understood and measured between pairs of nodes with distinct meanings and forms of communication (Barnes, 1972; Freeman, 2004). For the most part, SNA has been concerned with communication networks and their role in social change through microlevel analysis. Likewise, since the 1990s, SNA has increasingly focused on information communication technologies (ICT) as an emergent network reality, characterized by ubiquitous computer systems that link organizations and knowledge (Danowski, 1982; Wellman, 2001, p. 2031). The overwhelming focus on computer-mediated or other forms of social dynamics in recent years has relied heavily on groups or clusters of social ties with network dynamics that depend on communication technologies employed in a specific time and space.

Networks maintain older and newer forms of technological relations in changing contexts, marking spaces of associations in the course of historical development that are specific to localities and regions while being operative in connection with global processes. In a complex sociospatial setting, technological changes play an integral role, not as a determining social signifier but as a set of complex practices through which humans build relations in situated everyday contexts—hence, redrawing the boundaries of sociability and power relations across the globe.

The aim of this article is to contribute to SNA by focusing on the formation of network associations in global histories. We argue that major telecommunication practices, associated with communications technology, have shaped distinct networks since antiquity, highlighting changing patterns of communication over long distances, sustained in technological practices in innovation and design. In broad historical processes, such networks have characteristics resulting from the interplay of long-distance communication and technological framing through the interaction of actors (Bijker, 2012).

While reconceptualizing Marshal McLuhan's basic notion that the history of technological invention has led to the reconfiguration of world history, we identify three historical—though by no means teleological—forms of networks: (1) oral-scribal networks, (2) tele-networks, and (3) digital networks, each representing an ideal type of social association characterized by changing technological practices. By "telecommunication" we specifically refer to social performances that involve long-distance communication, in what Jan van Dijk (2012) refers to as "bridging space" (p. 5).[1] Such long-distance

[1] In this study by "telecommunication," particularly in the second type of networks (or "tele-networks"), we do not necessarily include media technologies such as radio or television, although such technologies remain contingent to their design and specific use in history. Although radio is a form of telecommunication, we are mainly concerned in the forms of communication technologies and associated social dynamics that go beyond the mere means of media communication. Rather, we focus on the forms of telecommunication that encompass distant signal messaging, such as watchtowers; horse and pigeon messaging; postage; telegraphs; telephone; and digital telecommunications, such as the fax machine; and, finally, the Internet.

communication may shape or project within wider, crossing, or deviating paths across geographical regions, generating interconnectivity in the spread of civility, tastes, manners, habits, and everyday practices that, in turn, can shape geographical landscapes, communities, and subjectivities.

Ancient Roman roads, for example, administrated by the imperial order, would enable emperors, military officers, troops, and civilians to travel long distances between cities, towns, and military bases. But they would also enable communication by messengers riding horses or mules (though the speed of travel would depend on the physical and security infrastructure of the roads). However, in terms of broader communication practices, ways of road travel would also involve the spread of new civil and military languages for increasing standardization of communication across the imperial domains. In addition, Roman roads would serve as transportation hubs in the spread and exchange of ideas, knowledge, commerce, alliances, objects, animals, and disease. As overland movement domains, roads would comprise complex networks that would expand because of commerce, trade, and political stability, or cease to exist because of economic or natural crises and war.

Likewise, networks overlap with similar forms of associations, largely as a result of technologies in use or shared by communities in a particular locality. Technology mediates relations as social practices, shaping convergence in modes of communication that in turn give rise to new forms of sociability. This is primarily the case with oral-scribal networks built around telecommunication practices of oral messaging, or documented postage in the form of courier service, as practiced in the Achaemenid Empire (550 BCE–330 BCE) or the Han Dynasty (206 BCE–220 CE) (Mosenian-Rad, 2011–2012). In the postal system, various social relations, fragmented across continents, loosely communicated through a vast and efficient courier system, especially during the era of Eurasian imperial antiquity (Mosenian-Rad, 2011-2012, pp. 77–195).

For its ancient past, Iran shares a long, transregional history of complex telecommunication practices, which allows us to provide examples of the three networks discussed here, especially oral-scribal networks, as predominately a feature of the classical form of telecommunication (Mohsenian-Rad, 2011–2012). Yet modern Iranian history, distinct from its ancient past, also provides us with examples of "tele-" and "digital" networks, as the West Asian country underwent major sociotechnological changes in the rapid growth of information communication technologies from the 19th century to the present.

Second, our interest in macrohistory is not to advance an evolutionary narrative or a telecommunication *teleos* of progressive history but to show how in complex ways the three networks can develop and even at times coexist throughout history, including the contemporary era. The theme of historical development in this study is primarily based on a path-dependency model, which views historical changes and developments in limitations to past trajectories, many of which form on the micro level. However, the basic assumption is that such trajectories are connected with global processes that enable telecommunication to become operative in the first place.

Third, our aim here is to advance ways in which networked-formed social history can be discussed through changing technological practices, which are imagined as part and parcel to our human condition in its perceived "modern" manifestation. How Iran, within a transnational context, differs in the

production of social imaginaries of technological developments largely depends on cultural innovations and the institutionalized ways they are adopted in shifting sociohistorical contexts, through which new social realities emerge in complex and indeterminate ways.

Rethinking Marshal McLuhan's Eras of Communication

In *The Gutenberg Galaxy* (1962) and *Understanding Media* (1964), Marshal McLuhan famously argued that technologies—in particular, communication technologies, such as the printing press—were both a means of communication and also a mode of perception. It is not the media content that is important but the form of media technology in which communication becomes possible. Technology is intimately related to human perception not because it determines consciousness but because, as a cultural phenomenon, it exhibits experiences that shape relations within historical frameworks. The notion of the "Gutenberg man" identifies a new form of consciousness that emerged with the historical transition from oral to literate cultures. Telemedia such as the telegraph, radio, and, one can add, cell phones and the Internet, entail various affective processes of the human "sensorium," which McLuhan described as adoption of perspectives, emotions, and sentiments in carving out social spaces of interaction. All media technologies, as extensions of senses, cause "deep and lasting changes" (McLuhan, 1969, p. 54) and accordingly transform environments wherein social relations take shape. His famous case of a light bulb is about how social ambience for people is assembled at nighttime with a distinct form of sociality. It is not the light that determines social relations, but how people come to interact with the technology and, as a result, form new social realities.

Although different forms of interaction with various technologies can have "cool" and "hot" degrees of participation with varied sensory involvement, technologies are essentially social processes entailing complex consequences. These "consequences" are historically embedded within the social history of societies around the globe. What these consequences involve are the formations of networks that historically take the shape of technologies in which they partake.

Building on Harold A. Innis and Lewis Mumford, McLuhan divided historical changes in terms of three ages of communication: oral, literate, and electric. The oral age, stretching from the time humans (*Homo sapiens*) began to speak to the birth of literacy (2500 BCE), underscored the role of oral performance as the medium of social interaction. For Innis, written culture maintained a distinct reality that historically grew out of stone, clay, and other nonprinted literate material cultures (Innis, 1950). Media mediates through material record. For McLuhan, the "literate" era identified an age of literacy, when humans used various forms of textual technologies, especially the printing machine, to communicate across a vast region of geographical spaces. The "electric" age marked a break from the previous two periods, although the new mode of communication can be described as a return to orality. With the invention of the telegraph in 1844, electronic technologies unleashed a new era of mass media communication and, especially in the 21st century, digital technologies (though Innis and McLuhan did not live long enough to see these changes), which could be described as a paradigm shift in our modes of perception. Changes in our epistemological framework have been as fast in the "electric" age, a process that has proven to be more gradual than in the previous cultural ages. Hence, the notion "global village,"

as McLuhan argued in *Understanding Media*, is ultimately about an integrative perceptual formation on a global scale.

Our proposed notion of oral-scribal, tele-networks, and digital networks is meant to advance McLuhan's conceptions of technology and societal change by reframing these historical periods in terms of network analysis. But in doing so, our aim is to show how the relationship between telecommunication technologies, society, and, by extension, economics and politics reveals a complexity of ways the three networks can compete or coincide, not just in historical time but also in social space. The proposed macrohistorical network analysis underscores the social connectedness of associations and new forms of cultural memory that emerge in embodied, textual, and material forms. Such emergence is viewed in terms of human interaction, with technologies that are historically situated in various network measures or "density" (Wellman, 1988) that identify social ties in a given time and space.

Oral-Scribal Networks: From Antiquity to the Telegraphic Revolution

Whether seen in social or technological changes, the history of telecommunication begins with the network of oral traditions and scribal practices in Eurasia. Such changes are manifested in the transmission of oral traditions but also in books, documents, letters, and manuscripts, produced by primarily an urban-based educated class, who led the way to deep-seated discursive transformations with social implications. The art of handwriting, depicted and reproduced in the form of parchment, clay, stone, and paper (in the case of China) would serve as a distinct social skill, professionalized under imperial orders in China, Egypt, Babylonia, Persia, Greece, and Rome for the purposes of communicating across vast regions and maintaining order (Innis, 1950). Wide-range telecommunication spaces were shaped through networks of trade and commercial transmission routes, such as the Silk Road, that played a key role in the diffusion of ideas, cultures, and material goods across Eurasia. What emerged in the transregional areas were clusters of networks formed through artists, artisans, diplomats, merchants, travelers, government officials, scribes, and missionaries, who forged far distant ties for economic, cultural, and political purposes.

Such transregional networks based on oral-scribal practices, we argue, primarily comprised two distinct forms of social relations: (1) macrosocial and (2) subsocial networks. The macrosocial network, together with its subsocial network units, can be described, recalling Talcott Parsons, as a closed-system unit with institutions and structures operational for close-knit communities A system of information and ideas that, in this process, do not easily transfer beyond the network associations become, therefore, a one-directional mode of communication. The flow of information, ideas, and objects are directed either in or out of the network domain, but hardly shape an expansive system of communication exchanges across vast regions. Networks based on oral-scribal information flows, therefore, do not entirely interact with the wider social network across time and space. The causes for such "closed" network systems can be primarily attributed to geographical circumstances, but more importantly to vernacular languages and, equally significantly, to the absence of transportation infrastructures, such as can be found in the imperial age.

Social boundaries play a significant role. In his classic work, Stanley Milgram began the idea of

the small-world form of social networks in reference to the United States as a sizeable network system (Milgram, 1967). In his work, Milgram showed how small enclaves based on intermediary acquaintances can make up a larger network of ties with distinct boundaries, each boundary marked by variations of connectivity with competing or cooperating network enclaves (Milgram, 1967). We apply Milgram's idea to demonstrate that subsocial networks within a larger network, characterized by short-path linkages and ties, operate between two approximate nodes in wider network contexts.

The most important feature of the oral-scribal network's dynamics can be described in terms of dispersed communities, heterogeneous in broader connectivity of larger networks, including city-based populations that maintain solidarity through loose associations. Such associations are linked to geographical boundaries governed by a governmental administrative apparatus. The small-scale and scattered networks that communicate through various scribal transportation technologies, such as pigeon post, for example, emerged either from an institutional power basis (e.g., imperial capital city) or smaller communities connected through short- and long-distance routes. Within the more restricted scope of oral-scribal technologies, such forms of sociability carried out circulation of cultural and material goods through oral-scribal network operatives. Importantly, the form of technologies, infrastructures, and administrative governance, especially the imperial kind, would shape the extent of connectivity of the oral-scribal networks.

But subsocial networks comprised wider though changing networks across provinces and imperial domains from the Achaemenid (518 BCE–330 BCE) to Sassanid (224 CE–651 CE) periods. Each of the wider social networks, comprising smaller subsocial networks, had loose and, at times, little relations to wider social networks in a larger geographical setting of the Iranian landmass. Connections were limited to a common language, which, with the emergence of official imperial discourses such as clay tablets, inherited from Mesopotamia, along with developments in transportation and military technologies, solidified an integrative discourse for both wider and smaller (sub) social units in oral-scribal networks.

Significantly, the Iran of antiquity and medieval periods represents a complexity of a geographical ecosystem that primarily accommodated dispersive communities linked through imperial communication networks, as discussed above. In geographical terms, the vast desert landscape, which constituted most of the Iranian landmass, included a limited number of rivers that both divided and connected geographical and social enclaves. Along with a mountainous landscape, such geography became conducive for the invention of new irrigation canal networks between arid and fertile lands, where the absence of larger rivers with year-round flows necessitated the support of alternative irrigation systems. *Qanats* are slanting, underground channels or tunnel constructions that enable the flow water from the interior of a hill to a village's agricultural setting. As an irrigation technology, the qanat gave way to the formation of small village-formed communities built around year-round agricultural activities. The forms of sociability that emerged as a result were a set of networks with rigid social mobility in terms of gender, status, class, and familial ties.

Social-network systems were also present within the city landscape, where neighborhoods, known as *mahaleh*, defined enclave territorial boundaries—though urban territoriality and city network associations were configured according to imperial governance on the local level and underwent major

modification after the Arab conquest in the seventh century. Although the relaxation of governance over Iran-based provinces led to the decentralization of power under the Abbasids (750 CE–1258 CE), urban Iran also underwent changes with the expansion of artisan and professional networks as a result of commerce growth for urban markets and long-distance trade across Afro-Eurasia.

In the post-Mongol period, in particularly during the Safavids (1501 CE–1722 CE), Iran witnessed major transformations in the urban neighborhood complexes with the rise in commercialization and cosmopolitanism of Isfahan (Rahimi, 2012). Equally important to the formation of the *mahaleh* system, however, were cognitive enclaves with distinctly shared spaces of affect, information, and tastes: *Hamam* (public baths), *husayniyah* (mosques), *zurkhaneh* ("Houses of Strength"), *ab anbar* (underground water reservoirs), and bazaars served as meeting points and, at times, homosocial spaces—like *zurkhaneh,* where ties became strengthened through face-to-face interaction. Direct contacts involves interactional rituals carried without mediated technology. For example, each village or urban neighborhood would have a *hamam*, which provided gender-segregated public spaces of interaction where networks were maintained and renewed through generational changes. Telecommunication, however, continued to revolve around oral and scribal forms of communication practices.

The neighborhood system played an integral role in the history of the Iranian urban landscape under the Qajars (1781 CE–1925 CE) and well into the Pahlavi era (1925 CE–1979 CE), when major modernization projects restructured urban areas with new architectural, commercial, and labor landmarks. The Pahlavi urban transformation, especially in the 1960s and 1970s, broke up older city quarters and created newer urban spaces, mostly in the capital city and major provincial cities such as Isfahan and Shiraz, where new consumerist and cultural sites gave way to heterogeneous social formations affected and brought into existence by expanding forms of postwar global capitalism.

Changing patterns of telecommunication linked social development differently from one historical context to another. In the early Pahlavi period in the 1940s, while rapid industrialization promoted telegraphic and telephonic forms of communication, Iranian transportation systems lacked infrastructure in the form of asphalt roads and locomotive technology, and social network connectivity across Iran continued to be limited. In 1946, for example, a village cleric in the western Iranian region of Nahavand did not know that Reza Shah, the first Pahlavi monarch who ruled from 1925 to 1941, was dethroned four years earlier and that his son, Mohammad Reza (who ruled from 1941 to 1979), had succeed the throne. The cleric's lack of knowledge about major national news is indicative that 20th-century Iran, which had already experienced significant industrialized developments in urban areas, continued to show a closed system of subsociality, especially in larger rural areas (Mohsenian-Rad, 2011-2012, pp. 1127–1242).

The key component to interconnectivity between closed systems in the oral-scribal network system can be attributed to moments of crisis, epidemic, mass migration, and major commercial transactions across regions, mostly facilitated by the state. The larger the scale of the crisis, the wider the expansion of ties in terms of contact within a wider geographical domain that would include complex sets of interrelated network ties. The expansion of ties, caused by a political crisis or a major social rupture, would also expand each closed network within a broader network complex. The Mongol invasion of the Abbasid Empire in 1258, a major military conflict that led to the spread of disease within Eurasia, is a

good example of closed-system network breakups and the restructuring of wider network associations over a wide geographical landmass. Throughout Iranian history, interaction between rural and urban subnetworks have occurred on many levels, including the spread of news between social networks. For example, Ibn Al-Jawzi, residing in the northeastern regions of the Caspian Sea, described in a letter, written in 1057 and transported by a camel caravan to a merchant in central Iran, about a plague that had inflicted his community. The news was catastrophic, as the plague had, in a single day, killed 18,000 residents of his city (Mohsenian-Rad, 2011–2012, pp. 473–599). Although the Silk Road nexus routes enabled Al-Jawzi to convey his message across Iran, it was the dynamic of a major crisis that enabled the report to be communicated and also to gain a wider news currency within the medieval network system.

Letters were mailed across the vast road infrastructure financed by cities and imperial institutions. Domesticated transports, such as horse and camel, played a significant role in the wide communication across the Silk Road and its greater caravan route. The camel, for instance, served as a mode of transportation that carried messages through the caravan unit (Bulliet, 1975). But its use was limited within the cargo of goods transported and managed by merchants, pilgrims, and travelers traversing through either hostile or friendly regions across Eurasia. The more efficient *chapar* system, the Achaemenidian pony express mail service, however, became a common practice in China and India as well. In Iran, the *chapar* became the standardized system of courier service until the introduction of rail services, primarily because of the establishment of royal roads and postal stations across the empire.

The pigeon post ("letter pigeon"), as the most innovative technology associated with the oral-scribal network system, provided the most efficient postal service. Introduced under the Achaemenid Empire and developed with the Romans under Julius Caesar (100 BCE–44 BCE), pigeon post served as an effective form of telecommunication, mostly for military purposes (Levi, 1977). Homing pigeons were considered an animated technology and were effective because their complex carrying techno-methodology enabled them to deliver communication from a range of locations with speed and unmatched reliability.[2] In the 17th century, under the Safavids, pigeon post operated within the 600 kilometer range between northern and central Iran, the Safavid capital city, Isfahan (Mohsenian-Rad, 2011–2012).

Oral-scribal telecommunication was limited to systems of sporadic transportation and infrastructures that were subject to changing policies of imperial powers and unstable political orders due to civil or foreign wars and administrative incompetence. The key feature of oral-scribal culture was a new awareness of space and time, which oral and scribal networks were able to expand through long-distance communication systems across regions. It would take a new mode of communication to give rise to the development of a new social order.

Tele-Networks: From Telegraphic to Telephonic Interactions

The mid-19th century witnessed an unprecedented spread of communication, measurement, and transportation technologies that led to the standardization of time and space and, more importantly, to

[2] Messages would be placed in small containers attached to the pigeon's leg or written on the wings and then wiped off with oil (*naft*) (Mohsenian-Rad, 2011–2012).

shaping collective identities within and across borders. Transportation technologies, such as the steamship, helped to diminish distance and also loosened the flow of migration across land and sea. Print production triggered new forms of literary and reading publics, many of which created socioeconomic and political implications for countries such as Iran. Along with the diffusion of science, 19th-century technological transformations were tied to colonial projects that justified European hegemony and the ways in which power was institutionalized across continents (Adas, 1989). They marked increasingly transnational political sites of national and colonial practices.

The emergence of such technologies, however, was first and foremost due to nation-state projects, although with imperial implications. The institutionalization of a postal service, for example, served as a system of communication within national boundaries, though international mail was also in limited operation, especially for colonial powers. Growing out of print technology, the postage stamp played a critical role in the formation of distinct networks, or what we call "tele-networks," by which the mailing, delivery, circulation, and consumption of mail evoked a collective sense of belonging across localities that, in previous times, had little contact through oral-scribal networks. Despite the postal service's uneven reach, it remained a nation-building endeavor for the formation of collective homogeneity. As the institutional media technology, it marked a significant break in what Benedict Anderson famously elaborated as imagined communities, which synchronize the past with the present through print media, in particular, through vernacular literature and print news (Anderson, 1991, pp. 24–25). Postage stamps, with textual and symbolic depictions of history and political figures, equally participated in print-mediated practices, fostering an imagined community that promoted shared emotions of solidarity through colonial extensions on maritime routes across imperial dominions.

With the standardization of postage material culture, a greater confidence in the everyday experience of mail-delivery practices also emerged within the state as a source of legitimacy and trust for growing societal connections across regions (Mohsenian-Rad, 2011-2012). The transportation-mail-delivery networks were also boosted with the institutionalization of certified and registered mail by the mid-20th century, assuring privacy and security of information through postal communication. Trust also overlapped with the social practice of an imagined community, as discussed earlier, which envisaged its collective identity in the form of visual cultures of stamp design and symbols as performative sites of shared identity. Felt experiences of belonging played a key role in how citizens and colonial subjects, now in contact across localities, could imagine themselves as part of a transregional community connected through telecommunication networks, although always contested by anticolonial currents.

The first modern postal service was institutionalized in Iran in 1851 under the reign of Nasser al-Din Shah (1848 CE–1896 CD). Nicknamed the "Bagheri" stamps, the Qajar-era stamps were issued with the Lion and Sun as the featured design. The emblem, which, as Afsaneh Najmabadi describes, "condensed the double of *shah*—king and holy man" (2005, p. 69), symbolized the national motif of royal virility and spiritual power. Unlike ancient royal routes across the Iranian landmass, which gradually changed according to changing imperial projects, the postal service was operational with the gradual expansion of roads across Iran and southern Persian Gulf port cities. This was mainly due to the British presence in Bandar Abbas and Bushehr in 1864 and the Anglo-Indian postage networks that facilitated growth of telecommunication across Iran (Mohsenian-Rad, 2011-2012).

The use of the postal service, though limited to major urban areas, coincided with the country's first use of telegraphic communication in 1857 (Mohsenian-Rad, 2011–2012). The telegraph provided an effective means of circulating information and news between the capital and provincial state agencies, even as the British, through the Indo-European Telegraph Department, established after the 1857 India Mutiny, continued to use the new technology for imperial control. However, the expansion of postal service and the telegraph remained limited to the capital city, Tehran, and a number of other major cities, such as Tabriz, until the early 20th century (Mohsenian-Rad, 2011-2012). The telephonic communication that expanded in 1890, which gradually outpaced the development of the postal service in the early 20th century, was also restricted to the capital city. It was in Tehran, where under the Pahlavis, new forms of media communication, such as radio and the phonograph, became increasingly popularized, in tandem with growth of urban leisure spaces.

Equally important was the development of print culture in the expansion of tele-networks in the late 19th century. Although the print revolution facilitated the spread of vernacular cultures with print media production, the 19th-century growth of the steam-powered rotary press signaled the industrialization of print media. What emerged with this development was the globalization of print cultures in line with the formation of diaspora communities through travel and migration, a global shift in information and transportation, in which the Qajar state also participated (Mohsenian-Rad, 2011–2012).

Though the spread of newspapers and periodicals occurred during the Constitutional Revolution (1905 CE–1911 CE), the first printed news appeared in 1837. By the mid-19th century, the state-funded Dar al-Funun school served as the most important public institution to house and use the printing press for the production of news and other printed cultural productions (Mohsenian-Rad, 2011–2012; Nile, 2010). Mass-produced print material—in particular, news—helped forge enclave Iranian diaspora communities in Egypt, India, and Turkey. The Persian language journals not only disseminated global news but also shaped tele-networks of national elastic boundaries with common ethical ideals and political values built around Persianate identity. A new transnational reading public grew and accordingly increased the number of weaker ties that were connected through telegraphic and print media technologies.

By the 1930s, the Pahlavi modernization ushered a new epoch of industrialization and technological development. The rapid change was characterized by the spread of telecommunication centers in major urban centers, where a centralized government initiated massive modernization projects across provinces and tribal regions. With the establishment of National Iranian Radio and Television, or NIRT, in 1966, under the Pahlavi regime, size and range of print, radio, and televised media activities expanded in the country, together with the educated and affluent classes as a key audience group (Tehranian, 1977, p. 259). In the postwar context, the telephone emerged as a key form of communication among urban-based Iranians throughout the 1960s. The institutionalization of communication centers due to government investment in the public sector, together with rising consumerist culture, led to new modes of communication among the rising middle class that saw the new technologies (such as radio, television, and the telephone) as luxury goods. They served both as a means of communication and as symbolic capital, representing social status and increased connectivity for long-distance contact beyond Iran.

In the post-Qajar period, the key to telegraphic and telephonic communication was the capacity to exchange personal or public information simultaneously between far-away networks across the country that had little or no contact before such technologies. The new communication links, though limited to localities where government maintained an infrastructural presence, equally strengthened the strong ties of dispersed social networks across the increasingly territorially bounded Pahlavi Iran, a process that considerably accelerated under Reza Shah's centralization project. In this context, tele-networks emerged as a powerful societal form of personal and public communication, with linkages that became operational beyond the local and provincial territories. This process was primarily evident during public crises and major catastrophes, such as floods and earthquakes, or political upheavals, such as the 1953 CIA-led coup of the Mohammad Mossadeq administration, when internetwork political relations were enhanced by shorter times and wider distances across the nation for political coordination and military operations (Mohsenian-Rad, 2011-2012).

In conceptual terms, the nodal points of tele-network domains gave way to the construction of new associational publics. These were embedded across social segments and generations in cities where new cultural frameworks, shaped by technology, were consumed, shared, and circulated for economic, social, or political purposes. The new urban population, in particular under Mohammad Reza Shah (who ruled from 1941 to 1979) and his postcoup modernization, identified emerging tele-network associations with new experiences of time and space. The imagined community that emerged from this new social experience was contested, primarily because there were multiple forms of tele-networks, some of which were under state control, while others, because of political opposition, were primarily clandestine. The clandestine associations operated through neighborhoods, but mostly enclaves in newly formed urban spaces. The spread of print media, in particular the growing popularity of journals and periodicals, also played a role in shaping new communities, although under censorship in the postcoup period.

The type of associational ties that derived from tele-network processes, especially in the later Pahlavi era, were marked by collective conceptions and emotions of national belonging, though contested in varied forms according to class, ethnicity, gender, and religious discourses. By and large, it was the growing weak-tie associations emerging from tele-networking dynamics within and beyond Iran that paved the path for the emergence of revolutionary movements in the late 1970s. Such weak ties, as famously described by Granovetter, often carried information and affective bonds widely and transnationally, and in doing so brought together different segments of Iranian society (Granovetter, 1973). Through new media such as cassette tapes, emerging networks had the ability to create alternative discourses decoupled from their situated strong ties based in the neighborhood families, through which new imageries and meanings enabled the formation of new informal identities that challenged the state. It was ultimately the rise of postcoup tele-networks of activist orientation that led the revolts against the Pahlavi regime, which was toppled in 1979.

Digital Networks: The Emergence of Many-to-Many Communication

Tele-networks expanded with one-to-one modes of telegraphic and telephonic communication in less than a century. By the mid-20th century, tele-networks marked a relative convergence between mass

media and telecommunication complexes, where the technologies increasingly began to be used for far distant and mobile communication. On a sociocultural level, tele-networks not only offered an effective means of information dissemination, in an era when state and war making defined what Eric Hobsbawm famously described as the "short 20th century," but also expanding forms of translocal mediated experience beyond the limitations of immediate ties of the local and neighborhoods.

The development of cellular technology and cable networks, which provided telephony services through major telephone companies in the 1990s, was not merely an acceleration of the global formation of communication, it was the transfiguration of communication mobility in the increasing personalization of communication spaces. It was the dimension of personalized communication in a transpublic context that redefined the late 20th and early 21st centuries as the era of speed and convergence. In this hypermodern media landscape, the rise of digital networks has defined new forms of sociability shaped by technological temporality and speed of information transmission toward, what the Italian philosopher Paul Virilio has described as, "global time" (Virilio, 1999).

The late 1980s and 1990s witnessed the invention of new technologies such as computer systems and fused television with computer displays. The TV-based Odyssey game system in 1972, together with Commodore PET in 1983 and IBM computer XT in 1988, allowed a wide range of consumers to purchase computers for various purposes, in particular, for entertainment. This period of new telecommunication convergence saw emerging technologies that combined designs and programs of computer and telephonic communication processes, which ultimately gave rise to a new medium of interchangeability (Adler & Rodman, 2009, p. 3). This interchangeability introduced a hybrid dynamic that brought together a tele-media convergence (McQuail, 2010, p. 41). The birth of the first commercial desktop personal computer, launched at the 1964 New York World's Fair, and its mass consumption with the marketing of the Commodore PET in late 1970s, heralded the increasing privatization of telecommunication practices. For the first time actors involved in telecommunication practices were also able to be involved simultaneously in converged communicative practices, shaping a new tele-media landscape. These developments laid the grounds for the creation of digital social networks (Kadushin, 2012).

The arrival of the Internet initiated distinct social practices that increasingly gave way to a new set of networks. Bloggers and e-mail users adopted media practices such as announcements and broadcasting, and in doing so forged communities of weak but interactive association. Also, in light of developments in terms of speed, together with advancements in fiber optics, database servers, and software technologies, the Internet facilitated the rise of electronic modes of one-to-many, many-to-one, and many-to-many communication. Without the need to connect through intermediary switchboard operators, central to the tele-networks, users became participants as both communicators and media consumers in the virtual world, where they could imagine themselves as broadcasters in a personalized studio set.[3]

Digital networks signify patterns of convergence that destabilize private and public spheres of

[3] For example, until the 1990s in Iran, the practice of making telephone calls depended on state-controlled institutions, which controlled the duration and quality of the communication lines.

sociability. The emerging digital technologies of communication gave way to social processes beyond one-directional state regulation, though the market continued to play a significant role in its development. New telecommunication practices, such as texting or faxing, emerged as multidirectional and reciprocal communicative practices, undermining the phenomenon of a stable audience and, by extension, mass public. "New media" produced distinct publics, with users as both audiences and producers of diverse contents and forms. Interchangeability also identified a radical change in the study of communication, as mass media and face-to-face communication underwent correlative convergences in telecommunication practices (Adler, 2009, p. 3).

Understanding self-representation and collective expression in the interchangeability process would require a distinct perspective with a better conception of pervasive digital technologies. Two developments underline the telecommunication convergence transformation of digital networks. First, digital telecommunication emerged through complex technological shifts, with changes in telephone services becoming operational through copper cables, TV cables, radio waves, and the Internet (Bar & Sandvig, 2008, p. 531). Second, the new infrastructural changes, built around software technologies rather than mere ownership network facilities, gave rise to a new converged communication environment that required changes in state intervention. The result has been a rise of global connectivity characterized by the spread of digital information in the formation of complex, multidirectional mediated forms of affiliation, connectivity, and experiences.

As the world's technological geography underwent remarkable change in 1990s, Iran also became a leading consumer and, in recent years, developer of digital technology in the Middle East. As of 2016, Iran was one of the highest Internet users in the Middle East.[4] Although in its earlier years the Internet was a luxury commodity that was primarily used among the educated sector based at universities, it is now a common social technology, popular among both younger and older segments of society.

The Internet was first introduced to postrevolutionary Iran in 1993, just years after the devastating Iran–Iraq War, when Iranian industries were undermined after years of isolation and economic hardship. When the Institute for Studies in Theoretical Physics and Mathematics (IPM) first introduced this new technology, the Internet primarily relied on the higher educational institutions (Rahimi, 2007). In light of major postwar demographic changes, a new young and educated generation of Iranians, mostly based in universities, saw the Internet as an alternative way to communicate with each other and also connect with the broader globe. Networking on the Internet and, later, in the early 2000s, mobile technologies, were perceived as alternative ways to foster social relations that included both strong and weak contacts.

What made networking significant, though, was the management and production of cultural, economic, and political life that extended beyond local spaces and increasingly involved "mobile

[4] An accurate Internet penetration rate based on population percentage is yet to be confirmed. But it is likely that the rate ranges from 30% to 40% of the population (77.45 million in 2013). Internet speed, however, remains one of the lowest in the region. For the latest statistics, see http://www.internetworldstats.com/stats5.htm.

communication" for the enhanced capacity to communicate across local boundaries and beyond. A combination of strong and weak ties, however, formed clusters of relations in diversified and individuated forms, or what Lee Rainie and Barry Wellman (2014) call "networked individualism." Digital networks became, in many ways, less about a bound set of relations and more about porous ties, individuated and loosely knit social interactions, which may have links to off-line complexes, through new modes of communication.

What started as spontaneous networks developed into wider, weaker ties, and, accordingly, a higher level of convergence in terms of media use and social connectivity that spread with transnational interactions. By the mid-2000s, as Iran's political landscape underwent change with the emergence of conservative politics and the election of Mahmoud Ahmadinejad, in 2005, digital networks configured in practice across both rural and urban regions. The rise of social media served as interactive media sites whereby affects, ideas, information, and visuals were exchanged, shared, played, and (re)produced on interactive media platforms. Social capital of a distinct digital form was forged through formal and informal ties as complex clusters and cleavages of associations.

By the mid-2000s, the rise of social media practices led to new network ties that identified a growing wired generation. The launch of Orkut in autumn 2004 began to change patterns of Internet use. Orkut provided a platform for creating and sharing varied contents for social networking. It was, however, with the rise of Facebook, in 2007, that many Iranian Internet users, mostly the younger generation, began to migrate from the blogosphere to the social media sphere. The popularity of Facebook became more politically pronounced with the 2009 presidential campaign, when the site was unblocked by the government in the weeks leading up to the elections. In the context of increasing media censorship after the postelection 2009 uprisings, which saw filtering not only of the Internet but also satellite TV, Iranian Internet users became active on social media sites, where, despite an increasing filtering regime, use continued to grow in the second term of Ahmadinejad's presidency (from 2009 to 2013). The growth of digital networks included counterpublic formation among subaltern segments of the Iranian population, who could now form new online communities for self-expression and civic-political activism (Elahifar, 2015; Golzard & Miguel, 2016).

Since 2013, under Rouhani's presidency, the Internet has seen another sharp rise in use with the growth of the smartphone market. With Internet and mobile telephone convergence, smart mobile use has been rapid and pervasive, an expansive process that also includes various rural regions. The presence of proxies and VPNs, primarily prohibited by the state, has created considerable difficulty in determining accurate statistical data about the percentage of Iranian Internet-mobile users based in Iran. What remains important, though, is that Iranian society, in its diversity of socioeconomic, ethnic, and cultural backgrounds, is undergoing major digital transformations, although such changes continue to depend on policy and economic changes in the postsanction regime period.

In the context of national and transnational digital networks, the increasing convergence between Internet and mobile technologies with the growing popularity of smartphones has introduced a new social dimension within the Iranian digital cultural life (Rahimi, 2007). The growing popularity of mobile app culture in Iran has heightened digital networks of interactivity, especially between Iran-based digital

networks and diaspora communities, whose connectivity to the "homeland" is maintained mostly through digital communication. Telegram, the most popular mobile app since 2012, has provided a new socio-mobile telecommunication opportunity, with text channels formed among friends and families in reconfiguring strong and weak ties across urban and rural areas. The significance of the strong and weak ties convergence through mobile app would be that Telegram group sites, where information, news, audio, and visual cues circulate and are shared by specific members, at times across groups, serve as networking bridges with multiple paths of interconnectivity, especially among family members residing across cities and towns largely because of employment and travel within the country.

What is diffused in mobile app networking is not merely information but relations within and across multiple network cliques that bridge connections that foster both strong and weak ties. Nancy K. Baym (2010) calls this form of digital socialization "networked collectivism," that is, linkages in ways groups of individuals foster social relations "throughout the internet and related mobile media, creating a shared but distributed group identity" (p. 91). The ambiguity of identity in digital networks lies in the porous formation of shared and yet dispersive ties that combine both interpersonal and transpersonal relations in creating distinct communities.

It is this process of digitization that has enabled some Iranians, mostly the middle-class younger generation, to form social relations that transgress official public spaces, ranging from administrative institutions to public schools to urban parks. Digital networks match the changing consumerist practices of urban life characterized by neoliberal modernization projects that have seen an expansion since the later period of Ahmadinejad's presidency. Such modernization projects have also seen a rise in surveillance technologies over digital networks, which have in turn curtailed performance in complex ways. Digital technological developments, which include the state promotion of new media technologies, have led to new social connections, which digital networking identifies an unprecedented transformation across the globe.

Conclusion

Technology is a social practice that involves skills, knowledge, designs, and embodied ways through which new forms of sociability emerge. Such sociability depends on communicative practices that shape webs of interaction in changing historical contexts. Telecommunication technologies, in particular, entail not only the capacity to provide long-distance modes of communication across time and space but also the potential to create associations that emerge in the form of networks, which may differ in size, intensity of relations, and connectivity of actors within and beyond cooperative or competing ties.

In this article, we interpreted Iranian social history from a telecommunication perspective based on ideal types of three networking dynamics: oral-scribal, tele- and digital. Although the lines of separation between these networks have never been stable and clearly distinguishable, each network type has identified a social reality of technological consumption and production unique to a specific historical case. How the three networks have been maintained or disrupted in the course of history has varied from one country to another; nevertheless, in these concluding remarks, we suggest that there are shared

family resemblances between dispersed societies, which merit attention for a possible global history of network dynamics in the three-model scheme that we have proposed in this article.

It is through communication that McLuhan famously showed the way new technology can transform experiences toward a "global village." The long-term impact of technologies entail numerous social manifestations, but they mostly occur in interconnected ways that correspond to histories of perception that inherently arise from changing social relations embedded in technological change. What distinguishes the three discussed networks is a set of historically dependent epistemic transformations. Digital networks mark the latest, but not exclusive, set of new practices of many-to-many communicative action. Similar to McLuhan's notion of the electronic age, though different in terms of mobility and multidirectional transfer of information, digital networks mark an era of new conflicts that are ultimately about how the technological medium identifies arrangements of shifting perceptions that herald a new Gutenberg galaxy of sociocultural transformation. In the Iranian context, the new telecommunication ecology can be described as the coexistence of three models or oral-scribal, tele- and digital networks, with the latter increasingly becoming more pervasive with emerging new technologies, through which the global modernity is reinvented through practice and history.

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