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Towards a Sociology of Information Technology

The technical attributes of the new information and communication technologies (ICTs) increasingly dominate explanations of contemporary change and development. As Judy Wajcman (this issue) points out, many sociologists see technology as the impetus for the most fundamental social trends and transformations.[1] To this I would add a tendency to understand or conceptualize these technologies in terms of technical properties and to construct the relation to the sociological world as one of applications and impacts. The challenge for sociology is not so much to deny the weight of technology, but rather to develop analytic categories that allow us to capture the complex imbrications of technology and society.

Here I want to develop two particular aspects of this challenge, focusing especially on digital technologies. I will argue that understanding the place of these new technologies from a sociological perspective requires avoiding a purely technological interpretation and recognizing the embeddedness and the variable outcomes of these technologies for different social orders. They can indeed be constitutive of new social dynamics, but they can also be derivative or merely reproduce older conditions. Secondly, such an effort will, in turn, call for categories that capture what are now often conceived of as contradictory, or mutually exclusive, attributes. I will examine the question of embeddedness by focusing on three analytic issues for sociology: the complex interactions between the digital and the material world, the mediating cultures that organize the relation between these technologies and users, and the destabilizing of existing hierarchies of scale. In the ensuing three sections I examine these analytic issues as they get instantiated in substantive sociological arenas, each based on prior research: the interactions between capital fixity and capital mobility, the gendering of access to and use of electronic space, and the emergence of a new politics of places on global networks.[2]

The difficulty analysts and commentators have had understanding the impact of digitization on multiple conditions essentially results from two analytic flaws. One of these (especially evident in the USA) confines interpretation to a technological reading of the technical capabilities of digital technology. This is crucial for the engineering side, but is problematic for a sociological understanding. Such a purely technological reading of technical capabilities inevitably neutralizes or renders invisible the material conditions and practices, place-boundedness, and thick social environments within and through which these technologies operate.[3] A second tendency is the continuing reliance on analytical categorizations that were developed under other spatial and historical conditions, that is, conditions preceding the current digital era. Thus the tendency is to conceive of the digital as simply and exclusively digital and the non-digital (whether represented in terms of the physical/material or the actual, all problematic though common conceptions) as simply and exclusively that, non-digital. These either/or categorizations filter out alternative conceptualizations, thereby precluding a more complex reading of the impact of digitization on material and place-bound conditions.

1. The Embeddedness of Digital Technologies

Digital networks are embedded in both the technical features and standards of the hardware and software, and in actual societal structures and power dynamics (Latour, 1991; Lovink and Riemens, 2002; MacKenzie and Wajcman, 1999).[4] There is no purely digital economy and no completely virtual corporation or community. This means that power, contestation, inequality, hierarchy, inscribe electronic space and shape the production of software.

The fact that electronic space is embedded and cannot be read as a purely technological condition, or merely in terms of its technical features, is illuminated by the nature of segmentations evident inside electronic space. One instance is captured in the differences between private and public-access digital networks.[5] The Internet is a different type of space from the private networks of the financial industry; and the firewalled corporate sites on the Web are different from the public-access portion of the Web. The financial markets, operating largely through private dedicated digital networks, are a good instance of private electronic space. The three properties of digital networks – decentralized access, simultaneity and interconnectivity – have produced strikingly different outcomes in the private digital space of global finance from the distributed power of the public-access portion of the Internet. Although the power of these financial electronic networks rests on a kind of distributed power, i.e. millions of investors and their millions of

decisions, it ends up as concentrated power. The trajectory followed by what begins as the distributed power we associate with the public-access Internet, may assume many forms, and, in this case, one radically different from that of the Internet.

This difference points to the possibility that network power is not inherently distributive. Intervening mechanisms which may have little to do with the technology per se can re-shape its organization. To keep it as a form of distributed power requires that it be embedded in a particular kind of structure. We cannot take the distributed power and hence the democratizing potential of digital networks as an inevitable feature of this technology, as is so often the case in utopian readings, perhaps most prominently exemplified by John Perry Barlow's by now famous Declaration of Independence of Cyberspace (1997).

Beyond these issues of intentionality and use, lies the question of infrastructure and access (e.g. Darkwa and Mazibuko, 2000; NTIA, 1998; Petrazzini and Kibati, 1999; Shade, 1998; Sassen, 1998: ch. 9; Thomas, 1995). Electronic space is going to be far more present in highly industrialized countries than in the less developed world; and far more present for middle-class households in developed countries than for poor households in those same countries (Jensen, 1998; Harvey and Macnab, 2000; Hoffman and Novak, 1998). However, what needs emphasizing here is that there are very cheap ways of delivering access to the Internet, far cheaper than the standard telephone system, and hence that once such access is secured, the opportunities for low-income households and communities, especially in the global South, can increase enormously (e.g. ITU, 1998; Nadeau et al., 1998; Mele, 1999).

Recognizing the embeddedness of electronic space, in my research I have come to regard the Internet as a space produced and marked through the software that shapes its use and the particular aspects of the hardware mobilized by the software (Sassen, 1999). These features can also function as an indicator of transformations in the articulations between electronic space and larger institutional orders. There are significant implications attached to the fact that one of the leading Internet software design focuses in the last few years has been on firewalled intranets for firms and encrypted tunnels for firm-to-firm transactions.[6] Both of these represent, in some sense, private appropriations of a 'public' space.[7] Further, the growing interest in e-commerce has stimulated the development of software linked to identity verification, trademarks protection, and billing. The rapid growth of this type of software and its use in the Internet does not necessarily strengthen the publicness of electronic space (e.g. Elkin-Koren, 1996). This is especially significant if there is less production of software aimed at strengthening the openness and decentralization of the Net, as was the case in the earlier phases of the Internet. Far from strengthening the Internet's democratic potential as many liberal and neo-liberal commentators maintain, this type of

commercialization can threaten it. It also carries major implications for the impact of democratizing initiatives.

However, electronic space remains a crucial force for new forms of civic participation, especially in its public-access portion. Non-commercial uses still dominate the Internet, even though the race is on to invent ways of expanding electronic commerce and ensuring safety of payment transactions. But at the same time there has been a proliferation of non-commercial uses and users. Civil society, whether it be individuals or NGOs, is an energetic presence in electronic space. From struggles around human rights, the environment and workers' strikes around the world to genuinely trivial pursuits, the Net has emerged as a powerful medium for non-elites to communicate, support each other's struggles and create the equivalent of insider groups at scales going from the local to the global (e.g. Frederick, 1993; Kobrin, 1998; Ronfeldt et al., 1998).

Looking at electronic space as embedded allows us to go beyond the common duality between utopian and dystopian understandings of the Internet and electronic space generally. For instance, even as it reproduces masculine cultures and hierarchies of power, electronic space also enables women to engage in new forms of contestation and in proactive endeavors in multiple different realms, from political to economic. Further, in the context of globalization these initiatives can go global and bypass national states and major national economic actors, thereby opening a whole new terrain for initiatives by historically disadvantaged peoples and groups (e.g. Ronfeldt et al., 1998; Correll, 1995; Mele, 1999; Cleaver, 1998).

Three analytic issues that capture various features of this embeddedness are the complex imbrications between the digital and material conditions, the mediating cultures between these technologies and their users, and the destabilizing of existing hierarchies of scale made possible by the new technologies. The next three sections develop these issues.

Digital/Material Imbrications

Hypermobility or de-materialization are usually seen as mere functions of the new technologies. This understanding erases the fact that it takes multiple material conditions to achieve this outcome. Once we recognize that the hypermobility of the instrument, or the de-materialization of the actual piece of real estate, had to be *produced*, we introduce non-digital variables in our analysis of the digital. Obversely, much of what happens in electronic space is deeply inflected by the cultures, the material practices, the imaginaries, that take place outside electronic space. Much of what we think of when it comes to cyberspace would lack any meaning or referents if we were to exclude the world outside cyberspace. In brief, digital space and digitization are not exclusive conditions that stand outside the non-digital. Digital space is embedded in the larger societal, cultural, subjective, economic, imaginary

structurations of lived experience and the systems within which we exist and operate.

For instance, producing capital mobility takes capital fixity: state-of-the-art built environments, well-housed talent, and conventional infrastructure – from highways to airports and railways. These are all partly place-bound conditions, even when the nature of their place-boundedness differs from what it may have been 100 years ago when place-boundedness was far more likely to be a form of immobility. Today it is a place-boundedness that is inflected or inscribed by the hypermobility of some of its components, products, and outcomes. Both capital fixity and mobility are located in a temporal frame where speed is ascendant and consequential. This type of capital fixity cannot be fully captured through a description confined to its material and locational features, i.e. through a topographical description (Sassen, 2001: chs 2, 5).

Conceptualizing digitization along these lines allows us to recognize the ongoing importance of the material world even in the case of some of the most de-materialized digitized activities. This can be illustrated by the case of finance, one of the most digitized activities and one that involves a de-materialized instrument. Yet it cannot simply be thought of as exclusively digital. To have electronic financial markets and digitized financial instruments requires enormous amounts of material, not to mention human talent (which has its own type of physicality). This material includes conventional infrastructure, buildings, airports, and so on. Much of this material is inflected by the digital insofar as it is a function of financial markets. And much of the digital composition of financial markets is inflected by the agendas that drive global finance.

Digitization brings with it an amplification of those capacities that make possible the liquifying of what is not liquid. Thereby digitization raises the mobility of what we have customarily thought of as not mobile, or barely mobile. At its most extreme, this liquifying de-materializes its object. Once de-materialized, it gains hypermobility – instantaneous circulation through digital networks with global span. It is important, in my reading, to under-line that the hypermobility gained by an object through de-materialization is but one moment of a more complex condition. Representing such an object as hypermobile is, then, a partial representation since it includes only some of the components of that object, i.e. those that can be de-materialized. Much of what is liquified and circulates in digital networks and is marked by hyper-mobility, remains physical in some of its components.[8]

The real estate industry further illustrates some of these issues. Financial services firms have invented instruments that liquify real estate, thereby facilitating investment and circulation of these instruments in global markets. Yet, part of what constitutes real estate remains very physical. At the same time, however, that which remains physical has been transformed by the fact

that it is represented by highly liquid instruments that can circulate in global markets. It may look the same, it may involve the same bricks and mortar, it may be new or old, but it is a transformed entity.

We have difficulty capturing this multi-valence through our conventional categories: if it is physical, it *is* physical; and if it is liquid, it *is* liquid. In fact, the partial representation of real estate through liquid financial instruments produces a complex imbrication of the material and the dematerialized moments of that which we continue to call real estate. And so does the partial endogeneity of physical infrastructure in electronic financial markets.

Mediating Practices

There are multiple ways of examining the interactions between the new digital technologies and their users. There is a strong tendency in the literature to conceptualize the matter of use as an unmediated event, as unproblematized activity.

In contrast, a long-standing concern with what I have called 'analytic borderlands' has led me to try to detect the mediations in the act of using the technologies. In my research I find that use is constructed or constituted in terms of specific cultures and practices through and within which users articulate the experience/utility of electronic space. Thus my concern here is not with the purely technical features of digital networks and what these might mean for users, nor is it simply with its impact on users. The concern is, rather, with this in-between zone that constructs the articulations of cyberspace and users.

This conceptualization clearly rests on the earlier proposition that electronic space is embedded and not a purely technological event. Thus electronic space is inflected by the values, cultures, power systems, and institutional orders within which it is embedded. If we were to explore these issues in terms of gendering, or specifically the condition of the female subject, we would then posit that insofar as these various realms are marked by gendering, this embeddedness of cyberspace is also gendered at least in some of its components, and, further, that so is cyberspace itself.[9] This is so even though there is enormous variability in this gendering by place, age, class, race, nationality, issue-orientation; at the same time, there are likely to be various situations, sites, individuals not marked by gendering, or marked by hybrid or queered genderings.[10]

The second consequence of this embeddedness is that the articulations between cyberspace and individuals – whether as social, political, or economic actors – are constituted in terms of mediating cultures; it is not simply a question of access and understanding how to use the hardware and the software. To some extent, these mediating cultures are likely to be shaped by gendering as well as other marking conditions.

The Destabilizing of Older Hierarchies of Scale

The complex imbrication between the digital (as well as the global) and the non-digital brings with it a destabilizing of older hierarchies of scale and often dramatic re-scalings. As the national scale loses significance along with the loss of key components of the state's formal authority, other scales gain strategic importance. Most notable among these are subnational scales such as the global city, and supranational scales such as global markets. Older hierarchies of scale dating from the period that saw the ascendance of the national state continue to operate; they are typically organized in terms of institutional size and territorial scope from the international, down to the national, the regional, the urban, to the local. But today's re-scaling dynamics cut across institutional size and across the institutional encasements of territory produced by the formation of national states (Sassen, 2000b). This does not mean that the old hierarchies disappear, but rather that re-scalings emerge alongside the old ones which can often override the latter.

Existing theory is not enough to map today's multiplication of non-state actors and forms of cross-border cooperation and conflict, such as global business networks, NGOs, diasporas, global cities, transboundary public spheres, and the new cosmopolitanism. International relations (IR) theory is the field which to date has had the most to say about cross-border relations. But current developments associated with various mixes of globalization and the new information and communications technologies point to the limits of IR theory and data. Its models and theories remain focused on the logic of relations between states and the scale of the state at a time when we see a proliferation of non-state actors, cross-border processes, and associated changes in the scope, exclusivity and competence of state authority over its territory, all partly enabled by these new technologies. Theoretical developments in other disciplines may prove important; especially relevant in the case of sociology's contribution is the type of network theory developed in economic sociology.

These transformations in the components of international relations and the destabilization of older hierarchies of scale can be captured in a variety of instances. For example, much of what we might still experience as the 'local' (an office building or a house or an institution right there in our neighborhood or downtown) actually is something I would rather think of as a micro-environment with global span insofar as it is deeply internetworked. Such a micro-environment is in many senses a localized entity, but it is also part of global digital networks which give it immediate far-flung span. To continue to think of this as simply local is not very useful. More important, the juxtaposition between the condition of being a sited materiality and having global span captures the imbrication of the digital and the non-digital, and illustrates the inadequacy of a purely technological reading of the technical properties of digitization which would lead us to posit the

neutralization of the place-boundedness of that which precisely makes possible the condition of being an entity with global span.

A second example is the bundle of conditions and dynamics that marks the model of the global city. Just to single out one key dynamic: the more globalized and digitized the operations of firms and markets, the more their central management and coordination functions (and the requisite material structures) become strategic. It is precisely because of digitization that simultaneous worldwide dispersal of operations (whether factories, offices, or service outlets) and system integration can be achieved. And it is precisely this combination that raises the importance of central functions. Global cities are, among other components, strategic sites for the combination of resources necessary for the production of these central functions. The cross-border network of global cities emerges as one of the key components in the architecture of 'international relations'.

2. New Interactions Between Capital Fixity and Hypermobility

Information technologies have not eliminated the importance of massive concentrations of material resources but have, rather, reconfigured the interaction of capital fixity and hypermobility. The complex management of this interaction has given some cities a new competitive advantage at a time when the properties of the new ICTs could have been expected to eliminate the advantages of agglomeration, particularly for leading and globalized economic sectors. We have now come to understand that the vast new economic topography implemented through electronic space is one moment, one fragment, of an even vaster economic chain that is in good part embedded in non-electronic spaces. There is today no fully virtualized firm or economic sector. Even finance, the most digitized, de-materialized and globalized of all activities, has a topography that weaves back and forth between actual and digital space. To different extents in different types of sectors and different types of firms, a firm's tasks now are distributed across these two kinds of spaces; further, the actual configurations are subject to considerable transformation as tasks are computerized or standardized, markets are further globalized, and so on.

To illustrate these issues I focus on three particular aspects of the interaction of capital mobility and fixity: the ongoing importance of social connectivity and central functions for global digitized economic sectors; the variety of locational options available to firms in partly digitized economic sectors; and the multiplication of the possible spatial correlates of centrality made possible by the new ICTs.[11]

The Importance of Social Connectivity and Central Functions

While the new technologies do indeed facilitate geographic dispersal of economic activities without losing system integration, they have also had the effect of strengthening the importance of central coordination and control functions for firms and for markets. Major centers have massive concentrations of state-of-the-art resources that allow them to 'produce' the most strategic and complex of these central functions. It is not enough to have the infrastructure for ICTs. It also takes a mix of other resources: state-of-the-art material and human resources, and the social networks that maximize connectivity. Much of the 'value added' these technologies can produce for advanced service firms and advanced markets represents, then, a new type of urbanization economy insofar as achieving this value added depends on conditions external to the firms and markets themselves and to the technologies as such.

This new type of urbanization economy allows firms to maximize the benefits they can derive from the new technologies and to maximize their capabilities for operating globally. Even electronic markets rely on traders and banks which are located somewhere; for instance, Frankfurt's electronic futures market is actually embedded in a global network of financial centers, each of which concentrates resources that are necessary for Frankfurt's market to thrive.

A second fact that is emerging with greater clarity concerns the meaning of 'information'. There are two types of information that matter to advanced services firms. One is the datum, which may be complex but standardized and easily available to these firms: e.g. the details of a privatization in a particular country. The second type of information is far more difficult to obtain because it is not standardized. It requires interpretation/ evaluation/judgment. It entails negotiating a series of data sets and a series of interpretations in the hope of producing a higher order type of information. Access to the first kind of information is now global and immediate thanks to the digital revolution. But it is the second type of information that requires a complicated mixture of elements, not only technical but also social – what we could think of as the social infrastructure for global technical connectivity. It is this type of social infrastructure which gives major financial centers a strategic role. In principle, the technical infrastructure for connectivity can be reproduced anywhere, but not the social connectivity (Meyer, 2002; Garcia, 2002).

When the more complex forms of information needed to execute major international deals cannot be found in existing data bases, no matter what one can pay, then one needs the social information loop and the associated *de facto* interpretations and inferences that come with bouncing off information among talented, informed people.[12] The process of making inferences/ interpretations into 'information' takes quite a mix of talents and resources.[13]

In brief, urban centers provide the mix of resources and the social connectivity which allow a firm or market to maximize the benefits of its technical connectivity.

Locational Patterns

Information technologies have had a sharp effect on the spatial organization of economic activity. But this effect is not uniform; the locational options of firms vary considerably. It is not simply a matter of reducing the weight of place. The scattered evidence for the last decade which saw the widespread use of information technologies by firms in a broad range of sectors allows us to identify three types of globally operating firms in terms of their locational patterns.

First, firms with highly standardized products/services see an increase in their locational options insofar as they can maintain system integration no matter where they are located. This might also hold for firms with specialized products/services that do not require elaborate contracting and subcontracting or suppliers' networks, all conditions which tend to make an urban location more efficient. Data entry and simple manufacturing work can be moved to wherever labor and other costs might be lowest. Headquarters can move out of large cities and to suburban locations or small towns.

A second locational pattern is that represented by firms which are deeply involved in the global economy and hence have increasingly complex headquarter functions. Perhaps ironically, the complexity of headquarter functions is such that they get outsourced to highly specialized service firms. This frees up the headquarters to locate anywhere so long as they can access a highly specialized networked service sector somewhere, most likely in a city.

The third locational pattern is that evident in highly specialized networked service sectors. It is these sectors, rather than the headquarters, that benefit from spatial agglomeration at the point of production; in this regard, it is these firms rather than large corporate headquarters which are at the core of economic global city functions.[14] These firms are embedded in intense transactions with other such firms in kindred specializations and are subject to time pressures and the constraints of imperfect information discussed in the preceding section. Along with some of the features contributing to agglomeration advantages in financial services firms, this has the effect of rendering the network of specialized service firms more place-bound than the hypermobility of their products and of their professionals would indicate.

The Spatialities of the Center

The combination of the new capabilities for mobility along with the advantages of urbanization economies for leading globalized economic sectors suggests that spatial concentration remains a key feature even in a global digital economy. But it is not simply a continuation of older patterns of

spatial concentration. Today there is no longer a simple straightforward relation between centrality and such geographic entities as the downtown, or the central business district (CBD). In the past, and up to quite recently, centrality was synonymous with the downtown or the CBD. The new technologies and organizational forms have altered the spatial correlates of centrality.[15]

Given the differential impacts of the capabilities of the new information technologies on specific types of firms and of sectors of the economy, the spatial correlates of the 'center' can assume several geographic forms, likely to be operating simultaneously at the macrolevel. First, the center can be the CBD, as it still is largely for some of the leading sectors, notably finance, or an alternative form of CBD, such as Silicon Valley. Yet even as the CBD in major international business centers remains a strategic site for the leading industries, it is one profoundly reconfigured by technological and economic change (Fainstein, 2001; Cicollela and Mignaqui, 2002; Graham and Aurigi, 1997). Further, there are often sharp differences in the patterns assumed by this reconfiguring of the central city in different parts of the world (e.g. Marcuse and Van Kempen, 2000).

Second, the center can extend into a metropolitan area in the form of a grid of nodes of intense business activity. One might ask whether a spatial organization characterized by dense strategic nodes spread over a broader region does in fact constitute a new form of organizing the territory of the 'center', rather than, as in the more conventional view, an instance of suburbanization or geographic dispersal. Insofar as these various nodes are articulated through digital networks, they represent a new geographic correlate of the most advanced type of 'center' (Veltz, 1996; Yeung, 2000). This is a partly deterritorialized space of centrality.[16]

Third, we are seeing the formation of a transterritorial 'center' constituted via intense economic transactions in the network of global cities. These transactions take place partly in digital space and partly through conventional transport and travel. The result is a multiplication of often highly specialized circuits connecting sets of cities. These networks of major international business centers constitute new geographies of centrality. The most powerful of these new geographies of centrality at the global level binds the major international financial and business centers: New York, London, Tokyo, Paris, Frankfurt, Zurich, Amsterdam, Los Angeles, Sydney, Hong Kong, among others. But this geography now also includes cities such as Bangkok, Seoul, Taipei, São Paulo, Mexico City (see Yeung, 2000; Sassen, 2002). In the case of a complex landscape such as Europe's we see in fact several geographies of centrality, one global, others continental and regional.[17]

Fourth, new forms of centrality are being constituted in electronically generated spaces. For instance, strategic components of the financial industry operate in such spaces.

These various trends point to a profound transformation, but it is not one characterized by the neutralization of capital fixity, or of the built environment, or, in the end, the city. Rather than being neutralized, these emerge with renewed and strategic importance in *some* of their features, that is to say, not as a generalized condition but as a very specific condition. It is a particular type of built environment, of conventional communication system, of city, in brief, a particular type of spatiality that accommodates and furthers the new digital dynamics.

3. Mediating Cultures: Women's Cyberpresence and Cyberopportunities

The embeddedness of cyberspace and the larger social reflexivity this entails are evident in the facts about the presence of women in cyberspace. There is still underrepresentation of women even as their Internet usage is growing sharply. This combination captures the contradictory features of women's conditions in the larger social world today. Furthermore, where the specificity of cyberspace enables the emergence of new cultures of interaction between cyberspace and the larger social order, there is also specificity in the opportunities and forms of presence of women.[18]

Aggregate-level data show clearly that in country after country women still account for less than half of all Internet usage but are rapidly raising their share, often at faster rates than men. By the year 2000 women were half of all people online in the USA, about 46 percent to 47 percent in New Zealand and Sweden, and between 42 percent and 45 percent in Singapore, Ireland, Australia, France, and Korea. These aggregate figures contain highly specific trends. In the USA, for instance, among first-time users in the year 2000, women exceeded men slightly, and among girls 12 to 17 years of age, usage increased by 125 percent. Internet usage is also growing faster among women in a country as diverse from the USA as South Korea.

The specificity of cyberspace and the new cultures of interaction it entails are made evident by the presence of women in e-businesses started by women and in the proliferation of new women-oriented websites. Table 1 shows a sampling of women start-ups as of 2000; these are firms owned and operated by women. Clearly, given the dynamism in these sectors, we can expect turnover in ownership, not to mention cessation of operations. We included samples of firms in four distinct categories: (a) portal, content and community ventures; (b) web-based services; (c) e-commerce; and (d) e-business applications and web-technology ventures. The listed websites for each of these women start-ups provide more detailed information. Table 2 lists women-oriented websites created for and/or run by women, and technology and women-oriented e-mail listserves.

Table 1 Select Women Start-Ups – Owned and Operated, 2000

Category	Website
Portal, content and community ventures	Astronet AudioBasket eSampo Ivillage ThirdAge Media
Web-based service ventures	Desktop.com EDGAR Online E-Loan
E-commerce ventures	Della.com – renamed weddingchannel.com oneNest Sparks.com SuperVerticals
E-business applications and web technology ventures	CoVia eCommerce Industries Marimba RightWorks

Source: Dotcom Divas (2000).

Beyond the fact that these sites are largely instrumental, they tell us a wider story about the Internet and women (see, generally, Boneva et al., 2000; Haythornthwaite and Wellman, 2001). They become a collective refutation of a very common representation of cyberspace as reducing sociability and engagement with one's community. On the contrary, it can build local community. At the same time, being located in cyberspace makes it far more possible that the networks connecting each of these types of local sites might become transnational, probably an unplanned trajectory for many of them. In the next section I return to this subject through a discussion of new types of women activists' networks.

The limits of electronic space to bring about changes in existing hierarchies of power and privilege may also be inferred from the fact that existing cybersegmentations can override women-oriented agendas. There is no doubt that cyberspace brings new opportunities for women both in business domains and in larger civic as well as home settings. For instance, in highly digitized sectors, women as professionals have experienced new opportunities and they may fight for greater equality with men in these economic sectors. But they do so largely within the confines of existing hierarchies of economic power. In this regard it may be naïve to overestimate the emancipatory power of cyberspace in terms of its capacity to neutralize gender distinctions (see Adam and Green, 1998; Shapiro, 1998; Hampton and Wellman, 1999).

Table 2 Select Technology and Women-Oriented Email Listserves (Electronic Forums)

Name	Function
AFRO-TECHIES	Discussion group for technically inclined women of African descent seeking to expand the experience and knowledge of black women in technology
ASIA-WOMEN-IT	Discussion of issues and concerns relating to women in Asia and the new global information and communication technology
A-WIA (American Women's Internet Association)	Organization and list for American women and their supporters 'actively involved within the Internet environment'
CYBORG-L	Run by 'Women on the Net', a UNESCO–SID project to provide a multicultural gender perspective on international communication systems
FACES	Cyber-resource and international mailing list for women interested in the media and communication arts to share projects, exhibits, critical opinions, and text
FEMINAMAIL	Affiliated with women-oriented search engine Femina; weekly update to Femina database
FEMINANET	List to ask for help finding online sites for personal, work-related, and academic interests
GK97-GENDER	Connected to Global Knowledge 97 Conference; focuses on gender issues related to knowledge and information technologies
GRANITE	Platform for discussion to stimulate research from a feminist/women's perspective of gender and new information technologies
GRRLTALK	Discussion of GNU/Linux operating system, Open Source Software movement, Free Software Foundation, etc.
ISOC – WOMEN-DISCUSS	Discussing access to the Internet and information
MAC-WOMEN	Macintosh help forum
MAIDEN-L	For women new to the Internet who need help
NOWA.INTERNATIONAL	For women who provide computer training to women, dealing with gaining access to new technology, women-specific training, and a general networking medium
SPIDERWOMEN	Forum for women who manage and/or design websites
UHURA	Collaborative research project online, for women researching some aspect of the net
VS-ONLINE – STRAT	Forum for issues related to women's organizations' utilization of electronic communication and publishing technologies

Table 2 Continued

Name	Function
WEBWOMEN-CHAT	Non-technical list for women on the web, 'to keep the chatter away from the focused, technical lists'
WEBWOMEN-GRAPHICS	Anything related to the creation and/or manipulation of computer graphics
WEBWOMEN-HTML	For women web-content developers
WEBWOMEN-TECH	For women who manage the technical aspects of websites
WISDOM	Women's Internet Site Development and Online Mentoring for Australian women and others interested in Internet literacy
WOMEN-L	Discussing women's issues with a focus on the Internet and technology
WOMEN IN TECHNOLOGY	Both local and national through the list organization Tropica
WOMEN OF KALI	Moderated list for discussions of feminist politics especially concerning misogyny in the media and on the net
WOMEN SPACE	How women and women's organizations are using the Internet

Of central importance for gauging the socio-political implications for women of their presence in, and use of, cyberspace is the potential transformation of a whole range of 'local' conditions or institutional domains where women remain the key actors, into micro-environments with global span. Among these domains are the household, the community, the neighborhood, the local school and health care provider, and other such places. What I mean by their transformation into 'micro-environments with global span' is that technical connectivity will create a variety of links with other similar local entities in other neighborhoods in the same city, in other cities, and in neighborhoods and cities in other countries. A community of practice can emerge that creates multiple lateral, horizontal communications, collaborations, solidarities, supports. It can enable women (or female 'subjects' generally) to pursue projects not easily accommodated in their local, often limiting and oppressive, situation.

This brings with it a number of significant possibilities. Where before women's engagement in these domestic or family-related institutions reproduced their isolation from larger public spheres and cross-border social initiatives, that engagement now can emerge as the anchor for participation (see Henshall, 2000; Bastani, 2000). First, returning to the information in Tables 1–2, several of the websites are centered in female-typed domains, yet by being online open themselves to women from many other communities

beyond their own physical neighborhood or city and country. Second, in a context where globalization has opened up the world of international transactions to non-state actors of all sorts, women, especially through NGOs, have gained a whole new ascendancy.[19] Where before women interested in international relations were typically confined to what was at the time a barely visible or influential world of NGOs, today NGOs are emerging as key players, propelling women into situations they rarely had access to in the past. Cyberspace makes it possible for even small and resource-poor NGOs to connect with other such NGOs and engage in global social efforts. This is an enormous advance for women engaged in certain types of struggles, particularly those concerning women's issues, whether these are fought through women's organizations or through more general NGOs, such as human rights organizations (see Espinoza, 1999; Adam and Green, 1998; Cherny and Weise, 1996).

4. A Politics of Places on Crossborder Circuits: Citizen Networks in a Global Digital Age

Digital networks are contributing to the production of counter-geographies of globalization. These can be constituted at multiple scales. Digital networks can be used by political activists for global or non-local transactions. But they can also be used for strengthening local communications and transactions inside a city. Recognizing how the new digital technology can serve to support local initiatives and alliances across a city's neighborhoods is extremely important in an age where the notion of the local is often seen as losing ground to global dynamics and actors.

We can conceptualize these 'alternative' networks as countergeographies of globalization because they are deeply imbricated with some of the major dynamics constitutive of globalization yet are not part of the formal apparatus or of the objectives of this apparatus: the formation of global markets, the intensifying of transnational and trans-local networks, the development of communication technologies which easily escape conventional surveillance practices. Both the strengthening and, in some of these cases, the formation of new global circuits are embedded or made possible by the existence of a global economic system and its associated development of various institutional supports for cross-border money flows and markets. These counter-geographies are dynamic and changing in their locational features. And they include a very broad range of activities, including a proliferation of criminal activities.

Through the Internet, local initiatives become part of a global network of activism without losing the focus on specific local struggles (see Cleaver, 1998; Espinoza, 1999; Ronfeldt et al., 1998; Mele, 1999). It enables a new type

of cross-border political activism, one centered in multiple localities yet intensely connected digitally. Activists can develop networks for circulating not only information (about environmental, housing, political issues, etc.) but also political work and strategies. There are many examples; for instance SPARC (Society for the Promotion of Area Resource Centers), started by and centered on women, began as an effort to organize slum-dwellers in Bombay to get housing. Now it has a network of such groups throughout Asia, and some cities in Latin America and Africa. This is one of the key forms of critical politics that the Internet can make possible: a politics of the local with a big difference – these are localities that are connected with each other across a region, a country or the world. Because the network is global does not mean that it all has to happen at the global level.

The last few years mark a particular moment in the history of digital networks, one when powerful corporate actors and high-performance networks are strengthening the role of private digital space and altering the structure of public-access digital space (Sassen, 2000a). Digital space has emerged not simply as a means for communicating, but as a major new theater for capital accumulation and the operations of global capital. But civil society – in all its various incarnations – is also an increasingly energetic presence in cyberspace (for a variety of angles, see Rimmer and Morris-Suzuki, 1999; Poster, 1997; Frederick, 1993; Miller and Slater, 2000). The greater the diversity of cultures and groups, the better for this larger political and civic potential of the Internet, and the more effective the resist-ance to the risk that the corporate world might set the standards. From struggles around human rights, the environment, and workers' strikes around the world, to genuinely trivial pursuits, the Internet has emerged as a powerful medium for non-elites to communicate, support each other's struggles and create the equivalent of insider groups at scales going from the local to the global.[20] The possibility of doing so transnationally at a time when a growing set of issues are seen as escaping the bounds of national states makes this even more significant.

This is not the cosmopolitan route to the global. This is about the global as a multiplication of the local. These are types of sociability and struggle deeply embedded in people's actions and activities. They are also forms of institution-building work that can come from localities and networks of localities with limited resources and from informal social actors. We see here the potential transformation of women, 'confined' to domestic roles, who can emerge as key actors in global networks without having to leave their work and roles in their communities. From being experienced as purely domestic, these 'domestic' settings are transformed into micro-environments located on global circuits. They do not have to become cosmopolitan in this process, they may well remain domestic in their orientation and remain engaged with their households and local community struggles, and yet they

are participating in emergent global social circuits. This can enable local political or non-political actors to enter into cross-border politics.

The architecture of digital networks, primed to span the world, can actually serve to intensify transactions among residents of a city or region. It can serve to make them aware of neighboring communities, gain an understanding of local issues that resonate positively or negatively with communities that are right there in the same city rather than with those that are at the other end of the world. Or it can serve to intensify transactions around the local issues of communities that *are* at opposite ends of the world. It is a peculiar mix of intense engagement with the local, with place, and an awareness of other 'local' engagements across the globe. In brief, social activists can use digital networks for global or non-local transactions *and* they can use them for strengthening local communications and transactions inside a city or rural community.

Cyberspace is, perhaps ironically, a far more concrete space for social struggles than that of the national political system. It becomes a place where non-formal political actors can be part of the political scene in a way that is much more difficult in national institutional channels. National politics needs to run through existing formal systems, whether the electoral political system or the judiciary (taking state agencies to court). Non-formal political actors are rendered invisible in the space of national politics. Cyberspace can accommodate a broad range of social struggles and facilitate the emergence of new types of political subjects that do not have to go through the formal political system.[21] Individuals and groups which have historically been excluded from formal political systems and whose struggles can be partly enacted outside those systems, can find in cyberspace an enabling environment both for their emergence as non-formal political actors and for their struggles.

Notes

1 In her opening article of this issue, Wajcman discusses this literature. For critical examinations that reveal particular shortcomings of technology-driven explanations see Loader (1998), Nettime (1997), Hargittai (1998) and more generally Latour (1991), Munker and Roesler (1997), MacKenzie (1999), MacKenzie and Wajcman (1999) and World Information Order (2002).

2 See, respectively, Sassen (2001: chs 2 and 5, 2002a, 2000a, 2002).

3 Another consequence of this type of reading is to assume that a new technology will *ipso facto* replace all older technologies that are less efficient, or slower, at executing the tasks the new technology is best at. We know that historically this is not the case.

4 Although using a different vocabulary, we can see Latour (1991) making a radical statement in this direction. Lovink and Riemens (2002) give us a detailed account of the multiple non-digital conditions (including neighborhood sub-cultures) that

had to come together in order to create the enormously successful city-wide digital internetwork called Digital City Amsterdam.

5 Elsewhere (Sassen, 1999) I have examined the extent to which our thinking about electronic space and network power has been shaped by the properties of the Internet, disregarding the crucial differences between the public-access digital networks of the Internet and private digital networks to which there is no access no matter what one is willing to pay, e.g. private dedicated networks of financial services firms and wholesale financial markets.

6 This saves companies the cost of private computer networks, the associated staffing and servicing, and the cost of frame relay connections or the costs of using intermediaries for firm-to-firm transactions. Peer-to-peer software is a significant development in this direction.

7 An additional issue, one not examined here, is the privatization of infrastructure that has also taken place since the mid-1990s. The backbone has been privatized where before it was financed by the US government, that is to say, taxpayers. This in turn changes the normative issues about private appropriations of Internet space as a public space. But it does so only partly, since it does not override the new distinction between privatized Internet space and public-access space, even if for a fee (for a resource to be public it need not necessarily be free). Internet space can remain public even if there is a fee to be paid for access, but privatized Internet space is not accessible at all.

8 Much of my work on global cities (Sassen, 2001) has been an effort to conceptualize and document the fact that the global digital economy requires massive concentrations of material conditions in order to be what it is. Finance is an important intermediary in this regard: it represents a capability for liquefying various forms of non-liquid wealth and for raising the mobility (i.e. hypermobility) of that which is already liquid.

9 Much of what has been described for cyberspace in the specialized and general literature is explicitly or implicitly far more likely to be about particular groups of men because they have thus far dominated usage and produced many of the cybercultures (Holloway et al., 2000). Thus we also need more information about men who do not fit those particular groups.

10 The concept of gendering has become increasingly problematic and is used here as shorthand for a complex bundle of issues. There is a vast critical literature on various aspects relating to gendering and feminist categories. For a broad range of issues see, for example, Wajcman (1991), Featherstone and Burrows (1995), Ong (1996), and Reaume (1992). The notion of queering gender is, in this context, a powerful repositioning.

11 For a detailed presentation of the subject, see Sassen (2001: chs 2 and 5).

12 It is the importance for firms and markets of this complex type of 'information' that has given a whole new importance to credit rating agencies, for instance. Part of the rating has to do with interpreting and inferring. When this interpreting is 'authoritative' because originating with an established entity for its 'production', it becomes 'information' for the rest of us.

13 With the new interactive technologies information has become an increasingly complex matter in terms of contents, processes, and dynamics. One of the most comprehensive critical examinations is that produced by World Information

Order (2002). It examines the following core components for computer-based information: (a) global networks and data networks; (b) global markets; (c) global 'brainware' (e.g. think tanks); (d) global content channels (e.g. independent media, commercial media, public relations, intellectual property, new media art, net culture); (e) global information rights and censorship; (f) global security and surveillance; (g) global data sets and hubs, privacy, biometrics.

14 These economic global city functions are to be distinguished from political global city functions, which might include the politics of contestation by formal and informal political actors enabled by these economic functions. This particular form of political global city functions is, then, in a dialectical relation (both enabled and in opposition) to the economic functions (see Sassen, 1998: ch. 1; Bartlett, 2001).

15 Several of the organizing hypotheses in the global city model concern the conditions for the continuity of centrality in advanced economic systems in the face of major new organizational forms and technologies that maximize the possibility for geographic dispersal. See new Introduction in the updated edition of *The Global City* (Sassen, 2001). For a variety of perspectives see Fainstein (2001), Orum and Chen (2002), Landrieu et al. (1998), and Salomon (1996).

16 This regional grid of nodes represents, in my analysis, a reconstitution of the concept of region. Further, it should not be confused with the suburbanization of economic activity. I conceive of it as a space of centrality partly located in older socio-economic geographies, such as that of the suburb or the larger metropolitan region, yet as distinct precisely because it is a space of centrality. Far from neutralizing geography, the regional grid is likely to be embedded in conventional forms of communication infrastructure, notably rapid rail and highways connecting to airports. Ironically perhaps, conventional infrastructure is likely to maximize the economic benefits derived from telematics. I think this is an important issue that has been lost somewhat in discussions about the neutralization of geography through telematics. For exceptions to this trend see Veltz (1996), Scott (2000), Landrieu et al. (1998) and Peraldi and Perrin (1996).

17 Methodologically, I find it useful to unpack these inter-city transactions into the specific, often highly specialized circuits that connect particular sets of cities. For instance, when examining futures markets, the set of cities includes São Paulo and Kuala Lumpur. These two cities fall out of the picture when examing the gold market; this market, on the other hand, includes Johannesburg and Sydney (see Harvey, in progress).

18 For a variety of angles see Holloway et al. (forthcoming), Cherny and Weise (1996), Bastani (2000), Marcelle (1998) and Grint and Gill (1995).

19 For a more theorized account of these issues please see Sassen (1998: ch. 5), Knop (1993).

20 The Internet may continue to be a space for democratic practices, but it will be so partly as a form of resistance against overarching powers of the economy and of hierarchical power (e.g. Calabrese and Burgelman, 1999; see also Warf and Grimes, 1997), rather than the space of unlimited freedom which is part of its romantic representation. The images we need to bring into this representation increasingly need to deal with contestation and resistance, rather than simply freedom and interconnectivity.

21 I have made a parallel argument for the city, especially the global city, being a more concrete space for politics. In many ways, the politics of reivindication being enacted in cyberspace resonates with many of the activisms evident in large cities today: struggles against police brutality and gentrification, struggles for the rights of the homeless and immigrants, struggles for the rights of gays, lesbians and queers. Much of this becomes visible on the street. Urban politics is concrete, enacted by people rather than dependent on massive media technologies. Street-level politics makes possible the formation of new types of political subjects that do not have to go through the formal political system in order to practice their politics.

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