

**The Social Life of Wireless Urban Spaces**  
**Internet Use, Social Networks, and the Public Realm<sup>1</sup>**

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**Abstract**

*In recent years, changes to the structure of people's social networks, the mass media, and the form of public spaces may represent a confluence of social trends that constrain exposure to diverse issues, ideas, and opinions in the public sphere. This study examines these trends within the public realm: the impact of wireless Internet use (wi-fi) on urban public spaces, wi-fi users, and others who inhabit these spaces. Through extensive observations of seven parks, plazas, and markets in four North American cities and surveys of laptop users in those sites, we explore how this new technology is related to processes of democratic participation, privatism, and social interaction. Findings reveal that wi-fi use within urban public spaces affords interactions with existing acquaintances that are more diverse than those associated with mobile phone use. However, the level of social diversity to which wi-fi users are exposed is less than that of most users of these spaces. Although urban public spaces are not a public realm for wi-fi users, the activities in which they engage do contribute to broader participation in the public sphere.*

**Keywords:** public space, mobile phone, cell phone, wi-fi, Muni Wi-Fi, wireless, portable, community, public sphere.

## **Introduction**

Internet access is a ubiquitous feature of the American home and workplace. Seventy-seven percent of adults in the United States use the Internet, with 93% accessing the Internet from home and 52% from work (Hampton, Sessions, & Her, in press). Although home and workplace are the dominant locations from which people access the Internet, it has become increasingly possible for them to incorporate Internet use into their everyday experiences in urban public spaces.

Internet access in public parks, plazas, markets, and streets has been made possible through the proliferation of broadband wireless Internet in the form of municipal and community wi-fi (e.g., Philadelphia Wireless, NYC Wireless) and advanced mobile phone networks (e.g., 3G, EVDO). The experience of wireless Internet use in the public realm contrasts with traditional wired Internet use, which is confined primarily to the private realm of the home and the parochial realm of the workplace. An extensive literature has addressed the influence of Internet use on the composition of people's social networks (Boase, Horrigan, Wellman, & Rainie, 2006; Hampton et al., in press; Zhao, 2006), their engagement in political, voluntary, and other organizational activities (Shah, Cho, Eveland, & Kwak, 2005), and their interactions within home and workplaces (Bakardjieva, 2005; Kennedy & Wellman, 2007; Quan-Haase & Wellman, 2006). But, Internet use in the public realm has remained relatively unexplored. This type of use carries with it significant implications for urban planning, the structure of community, and the nature of democracy.

The upsurge in Internet access in public spaces may reshape the public realm. Because of its location, it may revitalize, repopulate, and improve the safety of public spaces. Because of the electronic connectivity it offers, it may reduce social inequalities and increase the use of public spaces. As a result of the diversity of those who are copresent, it may increase social cohesion, tolerance, and exposure to diverse messages. And, given that participation in both physical and virtual spaces can contribute to public discourse, it may develop political action and stimulate democracy. Or, it may not. Wireless Internet use may push out existing public life; previously private activities may shrink the public realm; and the availability of this technology on the street, in parks, and in plazas may do nothing to increase exposure to diverse ideas and diverse others, but, instead, contribute to existing trends toward privatism that are augmenting the structure and composition of people's social networks.

## **The Importance of the Public Realm**

The *public realm* is a specific social setting. It typically includes urban public spaces, such as a city's streets, parks, and plazas, and is part of a much larger *public sphere*. The public realm plays host to planned encounters with existing acquaintances, as well as to serendipitous encounters with strangers. What differentiates the public realm from all public spaces is that it includes only those "locals" (Strauss,

1961) or social settings that minimize the segregation of people based on “life-styles”: values, opinions, gender, race, ethnicity, stage in the life course, and other forms of diversity. The proportion of copresent others in the public realm is dramatically in favor of the unfamiliar and leans toward a diversity of interests, behaviors, and beliefs rather than to the familiar or the homophilous. It stands in deep contrast to the private realm, those social settings that are principally the domain of intimate, homophilous social ties - generally kinship ties, with whom people share many to most things in common. The public realm is also differentiated from the parochial realm, or those spaces that may be public or “third places” (Oldenburg, 1989), but are nonetheless “home territory” (Lofland, 1973; Lyman & Scott, 1967), in that people are surrounded by others with whom they share much in common, such as in a neighborhood, small town, or workplace (Lofland, 1998). Whether a space is part of the public realm is an empirical evaluation regarding the existence of social diversity and a low density of acquaintanceship.

As a setting for exposure to, and interaction among, people with diverse backgrounds, opinions, and values, the public realm is a natural and important component of a broader public sphere (Harvey, 2006). Indeed, in the preindustrial city, with a primarily illiterate population, where co-location was a necessary component of information exchange, the public sphere and the public realm were nearly synonymous. Idealized versions of the public sphere are often depicted as urban public spaces, such as coffee house and salons (Oldenburg, 1989). However, with the advent of mass media, increased literacy rates, and new transportation and interpersonal communication technologies, co-location was no longer a necessary component of the public sphere. Today, mass media, such as the press, radio, film, and television (Curran, 1993; Habermas, 1989), and interactive media that provide for *copresence* without *co-location* (Goffman, 1966; Zhao & Elesh, 2008), including the telegraph, the telephone, and, most recently, the Internet (Bennett & Entman, 2001), are additional components of the public sphere. The structure of the public sphere is best depicted as a multistep process, which involves mass media and interpersonal communication within social networks (Katz et al., 1998 Metzger, O’Connell & Stokes, 1998). However, exposure to diversity of opinion or issues is not guaranteed within the public sphere. Diversity of exposure depends on media diversity as well as the extensity of people’s social networks; the degree to which everyday interactions are embedded within the private, parochial and public realms.

During the last two decades, the structure of people’s social networks has changed significantly. The interpersonal component of the public sphere has become increasingly private. People are more-and-more home-centered (Fischer, 1982; Putnam, 2000), and the number of people with whom most people discuss important matters has declined (McPherson, Smith-Lovin, & Brashears, 2006). People’s closest social ties increasingly consist of densely-knit networks that center on the home, with fewer strong ties to more loosely coupled networks. This trend toward privatism (Fischer, 1992) supports cohesion within tightly-knit personal networks but sacrifices interaction with more diverse social ties. Dense networks

provide generalized social support and are high in reciprocity (Wellman & Wortley, 1990), but they can also be repressive and tend to be culturally and ideologically homogeneous (McPherson, Smith-Lovin, & Cook, 2001). Close, homophilous ties are also the first stop for social comparison and validation in attitude formation (Cross, Rice, & Parker, 2001; Erickson, 1997). The likelihood of attitudinal similarity, reinforcement, and conversion among strong, tightly bound, homophilous ties means that these ties are also likely to be the last stop in opinion formation.

Although there are interpersonal sources of information beyond the private home and the closest social ties, participation in activities that are likely to be socially, culturally, and ideologically cross-cutting (such as voluntary organizations) are in decline (Putnam, 2000). Similarly, although other prominent foci of activity (mainly the neighborhood and workplace - the parochial realm) offer more diversity than the private realm (Mutz, 2006), such spaces are still more likely than public spaces to be a focus of activity for those with common interests, lifestyles, backgrounds, behaviors, and beliefs (Feld, 1981; Marks, 1994).

As people's personal discussion networks have increasingly centered on the private realm – they have become more private, closed, and homogeneous – the forces of consumerism and corporate and state control have generated parallel consolidating effects on the mass media. An increase in mass media cross-ownership and conglomeratization (Bagdikian & Bagdikian, 2004; Klinenberg, 2007), the global influences of media (Arsenault & Castells, 2008), the convergence of media (Jenkins, 2006), refeudalization (Habermas, 1989), and intermedia surveillance (Boczkowski, in press), cooperation, and agenda setting (Golan, 2006) act to reduce the diversity of messages and exposure to local content within the public sphere.

Interpersonal communication and the mass media are experiencing a transformation that constrains diversity. At the same time, while undergoing their own pressures toward privatization (Kohn, 2004; Lofland, 1998; Zukin, 1995) as a result of commercialization, business improvement districts, surveillance, etc., urban public spaces remain not unmediated but a less mediated medium for exposure to diverse social issues. The public realm has relatively few barriers to entry and provides exposure across ethnic, social, behavioral, and ideological boundaries. As a result of physical visibility and accessibility, such exposure potentially provides access to messages that are ideologically divergent or absent from the intimate networks of the private realm. Whereas exposure is generally primitive and fleeting, in comparison to more formal (Price & Cappella, 2002), informal (Mutz, 2006), or even casual political discussion (Wyatt, Katz, & Kim, 2000), the public realm can provide a provocative, potentially disruptive, and contested setting that, although incomplete (Fishkin, 1995), is an important component of public deliberation (Carpini, Cook, & Jacobs, 2004) in an increasingly shrinking public sphere.

## Wireless Internet

Starting in 1905, when the first pay phone was installed on a street in Cincinnati, urban public spaces have hosted a range of telecommunication devices. In the 1980s and 1990s it was the pager, followed by the now nearly ubiquitous mobile phone. Mobile phone networks have been used primarily for voice communication and short message exchange (SMS; “texting”). With broadband wireless Internet access, people can use a greater range of devices and applications and are not restricted to the limited processing, display, and data entry capabilities of the mobile phone. Although mobile phones have offered limited forms of Internet access since the late 1990s, low cost, alternative wireless telecommunications networks became widely available only recently. People can now readily use mobile devices in urban public spaces and expect an Internet experience that is similar to wired Internet access at home and work.

Although mobile phone networks are increasingly capable of providing broadband Internet access to phones, laptops, and other mobile devices (i.e., 3G networks), the primary focus of this paper is *wi-fi networks*. Wi-fi networks range from the formal to the accidental and from corporate to counter-culture. Unlike mobile phone networks, where the primary device is the mobile telephone handset, the primary device that operates on a wi-fi network is the laptop, portable computer. The various options for wi-fi connectivity provide near universal, and often overlapping, capability for Internet access in urban public spaces. These options include:

Municipal Wi-Fi (Muni Wi-Fi) – Government-sponsored networks that provide broadband wireless Internet access over areas that range from a full city to a few blocks. In 2008 there were more than 300 Muni Wi-Fi projects in the United States, covering a total of 6,750 square miles; more than one-third of them were fully operational (ABIResearch, 2007; Farivar, 2008). Muni Wi-Fi networks are built on various business models. Some provide free access and others charge a monthly fee or subsidizing based on socioeconomic status.

Wireless Community Networks – Grassroots, not-for-profit organizations that provide local, typically free, wireless Internet access (Sandvig, 2004; Schmidt & Townsend, 2003). Like Muni Wi-Fi, wireless community networks provide access over areas that range from less than a city block to larger urban areas.

- Hotspots – Wireless internet access provided in and around a limited location, such as a coffee shop (Hampton & Gupta, 2008), bookstore, or airport lounge. Access is typically associated with pay-per-use or the purchase of a product (e.g., a cup of coffee). Hotspots have become a ubiquitous feature of the urban environment.
- Residential Wi-Fi – More than 19% of US home Internet users have a wireless network (Horrigan, 2007) that typically extends beyond the private walls where the network originates. A 2004 study of Seattle neighborhoods found that 52% of wireless home networks were open to anyone on the street (Howard,

2004). A 2007 study of neighborhoods in Toronto found that 22% of wireless home networks allowed anyone to access the Internet (Wong & Clement, 2007).

### **Mobile Phones and the Public Realm**

There are few studies of how wi-fi use influences urban public spaces, but there has been much research on the use of mobile phones. Within this body of work, there is considerable agreement on the influence that mobile phone users have on co-located others, and on how the adoption of the mobile phone may be influencing the structure of social networks and larger patterns of engagement with the public sphere.

The mobile phone has been nothing short of revolutionary in how people maintain their social networks. Mobile phones make those who are already familiar always available; they connect people with existing members of their social network, anytime, anywhere (Wellman, 2001). Studies of mobile phone users have consistently identified a tendency for interactions over the phone to be dominated by intimate, close social ties (Ishii, 2006). This includes both voice and text-based (SMS) contact (for a review see Ling, 2008). Some have pointed out that this may lead to intense participation in closed networks at the expense of broader social participation (Gergen, 2008). Empirical evidence of this retreat is preliminary and mixed (Castells, Fernandez-Ardevol, & Sey, 2007; Sugiyama & Katz, 2003), but it is easily conceived that this trend may lead to a homogenizing of social networks, so that the most familiar and most similar are frequently and primarily the focus of interpersonal interaction for companionship, support, and opinion formation. The result may be a contraction in the size and diversity of active discussion networks, as was observed by McPherson et al. (2006).

In urban public spaces, the mobile phone is frequently lamented as an unpleasant distraction for strangers and co-located companions (Katz, 2006). Within the public realm, mobile phone users tend to give precedence to phone interactions over those with co-located others, particularly those around them with whom they are less familiar (Hoflich, 2006; Ling, 2008). The result can be felt by strangers and co-located companions, who are suddenly more vulnerable and alone outside of the conversation (Humphreys, 2005). The resulting interaction space resembles other temporary private or parochial “bubbles” that protrude into the public realm, such as weddings, birthday parties, and reunions held in public parks (Lofland, 1998). These bubbles provide the individual with a space of comfort, familiarity, and security within what is primarily a realm of strangers (Ito, Okabe, & Anderson, 2008; Kopomaa, 2004). However, with the mobile phone, such bubbles need not be temporary. They can be used habitually to insulate the individual from the social diversity of urban public spaces and completely remove the public realm from everyday experience that provide access to messages and people that are absent from the intimate networks of the private realm.

Mobile bubbles of private and parochial interaction within the public realm erase or significantly curtail the potential for interaction between strangers and mobile users (Ling, 2004). These users who were once a source of social diversity and a potential point of interaction become little more than the microcosm of a spectacle (Rousseau, 1758/1960; Sennett, 1977). Although interactions in the public realm are admittedly more likely to be primitive and fleeting than nearly all other forms of public deliberation, the simultaneous physical presence and situational absence of mobile phone users nevertheless reduces the density of people available for interaction within the public realm. This creates a “neighborhood” or “contextual effect,” so that those who might engage with others are less likely to have the opportunity to do so, if only because the number of others available for interaction has decreased (Hampton & Gupta, 2008; Sampson, Morenoff, & Gannon-Rowley, 2002). This leads to the presence of silent spectators rather than potential participants (Sennett, 1977). The mobile phone thus changes the character of urban public spaces not only for the mobile user, but for all participants in that space.

### **New Media in the Public Realm**

What differentiates wireless Internet use from mobile phone use is the potential for a wi-fi user to access a full range of applications and experiences associated with home- and work-based Internet use. It is not clear if the experience of public wi-fi use will resemble that of the mobile phone or of other mobile media, such as the portable music player (Bull, 2005; Katz, Lever, & Chen, 2008) or even the book (Goffman, 1966). Because the laptop is a common device used to access wi-fi networks, it may be that wireless Internet use is more likely to afford behaviors that resemble those of Internet use at home and work. Like the mobile phone, traditional wired Internet use has been linked to more frequent communication with intimate social relations. Boase, Horrigan, Wellman, & Rainie (2006) found that in an average week, Internet users contact a full 40% of their closest and most significant social ties via the Internet. There is also evidence that participation in some types of online activities contributes to larger and more diverse social networks (Ellison, Steinfield, & Lampe, 2007; Rice, Sheperd, Dutton, & Katz, 2007 2007; Tufekci, 2008; Zhao, 2006). Yet, it is only with the introduction of wi-fi networks that Internet use has been freed from its dominant loci of activity – home and workplaces. The scant research that has been done on Internet use and home-centeredness – privatism – is mixed. There is some evidence that home-based Internet use increases interaction and exposure within the parochial realm but not the public realm (Hampton, 2007).

An extensive literature has developed around technical and regulatory issues related to the deployment of the infrastructure that supports wi-fi networks, but there has been limited empirical study of the social implications of these networks (Forlano, 2008; Hampton & Gupta, 2008; Powell, 2008). Policy makers associated with the deployment of large scale wi-fi networks generally describe the benefits



of wireless Internet networks in terms of opportunities and efficiencies for the provision of city services, economic development, and the reduction of social inequalities (Bar & Park, 2006; Gillett, 2006). Pundits and providers of wi-fi networks have also speculated about additional social benefits, such as community building, promotion of social cohesion, stimulation of democracy, and revitalization and re-population of parks, plazas, and other civic spaces (Lehr, Sirbu, & Gillett, 2006; Middleton, Longford, Clement, & Potter, 2006). However, no study has attempted to test these claims or explore the implications of wi-fi use in urban public spaces on social interactions, social networks, and the public realm.

This study examines the impact of wireless Internet use on urban public spaces, wi-fi users, and others who inhabit those spaces. The approach is comparative and the method is mixed. Qualitative and quantitative observational methods, as well as quantitative survey methods, are used to examine a variety of urban public spaces in four cities in two countries. Direct comparisons are made between the observed behaviors of wi-fi users and those using other media, such as mobile phones, music players, and books, in order to evaluate the complex ways in which this new technology is implicated in contemporary social processes in the urban public realm.

## **Method**

Observations were conducted in seven public parks, plazas, and markets located in four cities in the United States and Canada. The sites were selected to be geographically and culturally diverse to capture a wide variety of wi-fi-related practices and identify sources of variation that might be specific to place, local culture, or urban design. The seven field sites were:

- *New York City*: (1) Bryant Park and (2) Union Square – two large public parks with free wi-fi access provided by NYC Wireless.
- *Philadelphia*: (3) Rittenhouse Square – a large public park with paid wi-fi access provided by Wireless Philadelphia (Earthlink) and some free wi-fi provided in portions of the park by nearby cafés, restaurants, hotels, and residences. (4) Reading Terminal Market – a large indoor public market with free wi-fi provided by Wireless Philadelphia.
- *San Francisco*: (5) Union Square – a large public plaza bordered by some green space with free wi-fi access provided by Google.
- *Toronto*: (6) Dundas Square – a public plaza with free wi-fi access provided by Toronto Wireless and paid wi-fi by OneZone (Toronto Hydro Telecom); (7) Nathan Phillips Square - a public plaza with paid wi-fi access provided by OneZone and sporadic free wi-fi provided by neighboring hotels and cafés.

Between May and August 2007, five different observers made a total of 151 visits to the seven sites. Each visit lasted between one and one-half and five hours, with the average visit lasting approximately two and one-quarter hours. Overall, each site was observed for a minimum of 44 hours.

Each visit involved a series of standardized observational procedures that used a combination of person-centered and place-centered behavioral mapping approaches (Ittelson, Rivlin, & Proshansky, 1970; Sommer & Sommer, 2001).

The place-centered approach required the observer to walk the observation site and complete a map and worksheet. The map recorded the location of each laptop user within the site, as well as the people interacting with the user. The worksheet recorded a series of observable demographic characteristics (e.g., sex, age range) and a predefined list of behaviors engaged in by the people observed, including use of technologies, additional activities (e.g., eating, people-watching), socializing, and level of involvement with the devices they were using and their nearby environment. The length of time required to complete a place-centered map and worksheet varied by site and time of day, but generally ranged between 10 and 40 minutes. Extensive training and pretesting were carried out to ensure inter-observer reliability. The place-centered approach was repeated approximately every 30 minutes several times throughout the site visit, allowing observers to record the laptop users' length of stay and changes in behavior over the duration of the visit.

Between place-centered observations, observers used dice to randomly select one laptop user (and accompanying group, if such existed) for detailed observation. This person-centered approach lasted 30 minutes, unless the user left the site earlier. In such a case, a new place mapping was carried out and a new user randomly selected for observation. The person-centered observation included a more detailed worksheet of user behaviors and extensive ethnographic field notes that documented everything the user did. For comparative purposes, when no laptop users were present within a site, observers conducted observations on people who were using other media. Each observer's field notes were reviewed on a daily basis; observers received regular feedback to ensure that they were all calibrated to a similar level of detail. Two hundred seventy-four person-centered observations were completed for laptop users, 79 for mobile phone users, 67 for readers of books, magazines, or newspapers, 9 for people listening to portable music players, 7 for PDA users, and 2 for those using portable gaming devices.<sup>1</sup>

In August and September 2007, observers returned to the project sites and conducted 15-20-minute surveys with laptop users. The survey included information about the participant's past and current activities within the site, use of technology, and established social network measures (McPherson et al., 2006). Researchers attempted to interview every laptop user they encountered. When there were too many users present to make this possible, they sampled randomly.

Observations and surveys were conducted on several days, on weekdays and weekends, and during a range of daylight hours. In return for participating in the survey, participants received a \$5 gift certificate for a coffee chain. Sixty-five percent of those contacted agreed to participate, providing 227 completed surveys.

## Findings

### Wireless Urban Public Spaces

The number of wi-fi users was highest in Bryant Park (664), followed by New York's Union Square (220), Union Square in San Francisco (180), Reading Terminal Market in Philadelphia (133), Rittenhouse Square in Philadelphia (92), and the two Toronto locations (21).<sup>2</sup> The average laptop user visited the same public space two times per week (with less than a 0.5 visit variation across sites), but used wi-fi only 75% of the time. Most users (61%) stayed in place between one and two hours; visitors to Bryant Park typically stayed somewhat longer, and users of Dundas Square (Toronto) stayed for a shorter period of time. Twenty-five percent of laptop users reported that they had not visited the park before wi-fi became available. Of those who had previously visited, 70% reported that they visited more often since wi-fi had become available; none reported that they visited less frequently.

Site popularity appeared to be driven by a number of factors. Reputation was central, but there was a strong correlation between the length of time the primary wi-fi network had been operating (i.e., when the technology was launched) and the total number of observed laptop users at each location. However, a number of other factors influenced use and, in some cases, were more important than early site adoption. These included the availability of free wi-fi access, population density, urban design, surveillance/harassment, and local culture.

The most active wi-fi space that was observed – Bryant Park – was one of the first urban parks to provide free wi-fi access. Located in the heart of New York City, Bryant Park has a near constant flow of pedestrian traffic and park users. The design of Bryant Park also offers a mix of public uses, including three acres of open green space, tree shade, food and beverage kiosks, a children's carousel, and more than 1,000 moveable chairs. Other popular wi-fi spaces offered some combination of free wi-fi access, high population density, and good urban design, but rarely all three. This was particularly evident in the case of the two Toronto sites, where there were fewer than two dozen wi-fi users in over 40 visits and 90 observation hours.

Nathan Phillips Square (Toronto) offered ubiquitous paid wi-fi access and was part of a large and well known wi-fi network (McEwen & Potter, 2007), yet it was the only site observed that offered very limited free access. Although the square is located in the heart of the city, directly in front of City Hall, and is surrounded by considerable pedestrian activity, it is not heavily utilized. The modernist design – predominantly concrete construction, with a large ornamental pool and few trees – makes it a popular architectural attraction, and it is regarded as Toronto's most important public space for community events

("Design Exchange," 2008). Yet, it offers little shade or green space and has been criticized for being underutilized by the public when planned community events are not taking place.

Dundas Square is located at one of the busiest pedestrian intersections in Toronto. It is geographically the smallest and the newest of the places studied. It lacked open green space but did provide free wi-fi access. In addition, Dundas Square is operated through a public-private partnership that frequently limits park use to commercial events (e.g., fashion shows) and is far more restrictive of public use than similar partnerships, such as the one that manages Bryant Park. For example, Dundas Square employs private security guards who boldly enforce a norm that "anybody who is doing anything needs a permit" (Kuitenbrouwer, 2008). On one occasion, a researcher observed a security guard approach a laptop user to inform him that he could not sit on the ground and use a laptop but must move to a bench or leave.

Although "good" design of public spaces helps drive use of all types (Whyte, 1980/2001), we do not believe that design was the only factor that led to more limited use in Toronto. Computer logs obtained from a wi-fi provider indicated a lower frequency of use by a smaller number of users across a significant number of Toronto's public spaces than were found in other field sites. People in Toronto, and possibly in Canada more generally, are apparently less likely to use wi-fi in public spaces.

### **Wi-Fi Users in Urban Public Spaces**

The demographic composition of wi-fi users was consistent across sites, with single, white, male young adults predominating. Three hundred forty-four women and 966 men were observed using laptops. The ratio of men to women was consistent across sites, about 3:1, except at Reading Terminal Market, where near gender equality in wi-fi use was observed (41% female).

Observers categorized the majority of users within the age range of 31-64 years (62.5%), followed by 19-30 year olds (35.6%), and a negligible number of seniors and teens. The survey supported this finding, with a mean age of 31.4 years (S.D. 9.4 years). There was modest variation in age across sites: a slightly younger population was found in Union Square, New York City and Dundas Square. This finding may be attributed to the proximity to major universities of these two sites.

Sixty-eight percent of users were not married or living with a partner. With the exception of the one indoor space, Reading Terminal Market, which had a slightly smaller proportion of singles (53%), there was little variation in the dominance of young singles across sites.

The majority of wi-fi users interviewed categorized themselves as white or Caucasian (62%), with a slightly larger number of Caucasians in San Francisco (71%), and a smaller number in Toronto (50%).<sup>3</sup>

Although the demographic profile of wi-fi users was remarkably consistent across sites, the differences observed are of interest, in particular the deviation between users in indoor and outdoor public

spaces. Thus, Reading Terminal Market attracted more women and fewer singles. Although only one indoor site was observed, this observation may be attributed to a larger trend in which women perceive indoor public spaces to be safer from harassment and to contain fewer social cues that promote the exclusion of women than are found in similar outdoor environments (Gardner, 1995; Rosewarne, 2005).

## The Co-Located and the Copresent

The large majority of wi-fi users had a low density of co-located acquaintanceships. Of observed laptop users, 78.5% were alone, 18.1% were in dyads, and only 3.4% were in groups of three or more. However, when wi-fi users were interviewed, they were less likely to report being alone than was observed: 68.7% of those surveyed reported being alone, 17.6% arrived with companions, and 15.4% met up or planned to meet up on site with an existing tie. The modest discrepancy between observed and reported behavior is likely accounted for through missed opportunity to observe future planned meetings and the likelihood that some respondents misstated the presence of existing ties as a cover for having no specific purpose for being on site (Goffman, 1966). Female laptop users were as likely as males to be alone.

Among the wi-fi users who had companions, there was considerable social diversity in co-located role relationships (Table 1). Most laptop users were with non-kinship companions: friends (71.8%), co-workers (11.3%), voluntary group members (8.5%), advisors (5.6%), neighbors (4.2%), and other non-kin (15.5%). Only a minority of groups, 23.9%, contained any kinship relation; of those, spouse was the most prevalent (14.1%). Half of all groups were of the same sex, and men's groups were as gender homophilous as women's.

**TABLE 1**

Sixty-one percent of wi-fi users in groups were actively socializing with co-located ties. Given the composition of these ties, tending toward friends and workmates rather than kinship relations, the public sociability afforded by wi-fi uses resembled the parochial rather than the public realm. However, public sociability varied, depending on the concentration of wi-fi use within a group. Interaction between co-located ties was most likely when only one person in the group was using a laptop. In 25% of all groups, everyone had his own laptop, and in only half of these groups did existing ties engage in any verbal communication. In groups in which everyone did not have his own device, during 59% of the time, at least one other group member was looking at a wi-fi user's laptop screen (although not personally holding or manipulating the device). About two-thirds of these laptop voyeurs were engaged in verbal exchanges with the wi-fi user. In remaining configurations, when group members did not have their own computers and did not share a computer, a similar two-thirds of companions verbally engaged with wi-fi users. A high density of wi-fi use thus appears to reduce public sociability among co-located companions.

In addition to co-located interaction, a majority of wi-fi users used their wireless Internet connection to communicate with social ties that were not physically present (66%). This was primarily accomplished through email (65%), although a small number also used instant messaging (17%), chat rooms (4%), and phone calls placed over the Internet through services such as Skype (3%). The range of

roles maintained through email contact was more extensive than those of co-located companions (Table 1). Of wi-fi email users, 51% exchanged email with a kinship tie while they were in the public space. However, a full 99% of those who used email had contact with at least one non-kin relation. The pattern is similar for those who used instant messaging (IM). The small number of wi-fi users who participated in an online chat room rarely did so with kin. Similar to observations of mobile phone users, the small number of wi-fi users who placed phone calls over their laptops communicated predominantly with kin.

In addition to direct online communication with existing social ties, a substantial proportion of wi-fi users participated in Internet-based activities that included other forms of online interaction. These included the 29% of users who visited a social networking website (e.g., Facebook, LinkedIn) and the 8% who created or contributed to a blog. Only 19% of all wi-fi users reported online activities that did not involve active participation within existing social networks (e.g., email, IM, etc.), other interaction with existing network members (e.g., social networking websites), or other forms of online information sharing (e.g., blogging). Digital activities that were not directed at immediate communication or information sharing included casual web surfing, doing online research related to work or school, and using a word processor or spreadsheet. However, even when involved in online activities that were more passive than direct communication or online content creation, a substantial number of wi-fi users participated in the public sphere by consuming online news or political information (43%).

### **Attentiveness and Availability**

Within urban public spaces, exposure to social diversity is mediated through the presence of existing acquaintances and personal activities and preferences. Some activities are more likely than others to put an individual into the “thick of things.” At other times, individuals actively work to shield themselves from the gaze of others and minimize opportunities for interaction with others (Goffman, 1966; Hampton & Gupta, 2008).

Wi-fi users tended to occupy areas within urban public spaces that were relatively sparsely populated. Forty percent of laptop users were found in areas that were less densely populated than the public space as a whole, 50% were in areas that were as dense, and only 10% were in areas that had a more concentrated population.<sup>4</sup> For example, users in Philadelphia’s Reading Terminal Market often sat next to columns, using the column to reduce the number of people who could possibly position themselves nearby and to achieve some degree of seclusion. This observation is similar to what has been observed of mobile phone use, where mobile users temporarily withdraw into the niches of public spaces – corners, next to fountains, behind market stands – when using their devices (Hoflich, 2006), although for wi-fi users, niches are not temporary retreats, they are permanent shelters.

When wi-fi users did position themselves near others, it was often near another wi-fi user. This clustering behavior of wireless Internet users appeared to be the result of the assumption made by newly arrived users that the presence of other laptop users in a specific area indicated the presence of a strong wi-fi signal (an assumption that was most often verified by our measurements of signal strength). This was particularly true for those sites where wi-fi access was not always reliable, such as in Philadelphia’s Rittenhouse Square and New York’s Union Square. In locations where signal strength was normally strong throughout the entire site, such as in New York’s Bryant Park and Philadelphia’s Reading Terminal Market, wi-fi users were spread more evenly, and their locations were dictated more by other infrastructure needs (e.g., the presence of power outlets or comfortable seating) and the aforementioned preference for relative privacy. The combined influence of wi-fi users’ inclination toward sparsely populated areas and their self-segregation into clustered areas of wi-fi use suggests reduced opportunity for interaction and exposure to social diversity within a place.

Compared with some other media users and non-users, wi-fi users were also less active in their search for exposure, particularly when in co-located groups. One measure of exposure is the tendency of people to concentrate attention on the activities of strangers – “people watching.” When in an urban public space by themselves, 20% of wi-fi users engaged in people-watching. We did not record observations of people who were alone and not using any media, but this rate of people-watching (20%) was similar to those who were companions of wi-fi users but not using any media. However, when wi-fi users were with co-located companions, their rate of people-watching was only 10%.



Observers recorded two additional measures of attentiveness – one based on passive attention and the other on response to external stimuli. Based on observations of how often wi-fi users looked up from their devices, 24% of wi-fi users were described by observers as infrequently attentive to their surroundings, compared with 15% of book readers, 10% of those using a portable music device, 7% of those using PDAs and portable gaming devices, and 3% of mobile phone users. In contrast, 55% of those listening to portable music players looked around their environment in response to a loud noise, compared with 21% of PDA and portable gaming users, 16% of book readers, 12% of wi-fi users, and only 3% of mobile phone users. Although wi-fi users fared less favorably than mobile phone users in terms of an “eyes-up” measure of attentiveness, they were notably more attentive than mobile phone users when reacting to an abrupt auditory stimulus, although still less than users of all other media.

The reduced attention to surroundings, in the form of people-watching, a focus on private, head-down activities, and limited response to stimuli from the environment suggests that wi-fi users are exposed to significantly less social diversity in urban public spaces than those who use other portable media, with the possible exception of mobile phone users.

### **Serendipity**

Serendipity is defined as an interaction with a stranger in an urban public space. Wi-fi users were notably less approachable than users of other media. During extended person-centered observations, 11% of wi-fi users were judged by observers to be “frustrated,” “tense,” or “serious.” This percentage is compared with 7% of mobile phone users, 7% of those using PDAs and portable gaming devices, 2% of book readers, and none of those using a portable music device. The outward display of tension or intensity may have influenced how at least one segment of the public space’s occupants – panhandlers, the homeless, and those handing out flyers – interacted with wi-fi users. This segment of the park population predictably and systematically approached almost every person within public spaces (even our observers who were busy taking notes), but were much more likely to avoid wi-fi users than the users of any other device.

Interaction with other types of strangers was not observed to be significantly lower than for users of other mobile media. Person-centered observations revealed that 10% of wi-fi users engaged in at least one extended interaction with a stranger, and an additional 12% participated in a more modest social exchange. Examples of extended interactions included “friendly chatter” about topics such as the weather; more modest exchanges included requests to share a table or borrow a chair. Those who were reading a book or other print media were slightly more likely to engage in extended exchanges (13%), as well as more modest exchanges (13%). Mobile phone users were considerably less likely to participate in serendipitous social exchanges of any type (5%). No one using a portable music device was observed interacting with a stranger.

When surveyed, 28% of wi-fi users reported meeting someone new in the public space where they were interviewed. One in six of those who met someone new reported that he maintained contact with that person over time. However, only four respondents directly attributed this serendipity to their use of wi-fi.

### **Contextual Effects**

In only one of the seven field sites, Bryant Park, was there a sufficient density of wi-fi users at any one time to observe the influence of wi-fi clustering on strangers within the same space. Observations of Bryant Park suggest that there is a tendency for less social interaction to take place in the areas immediately around a cluster of wi-fi users (Figure 1). However, the influence is not directly attributed to wi-fi use.

### **FIGURE 1**

Only a limited number of wi-fi users were observed in this configuration, and only in Bryant Park. These Internet users represent a segment of the population that is particularly task-orientated within public spaces; they are there to work, and reduced sociability is the result of the task, not the technology. In fact, depending on the time of day in Bryant Park, a large number of people of all types can be found using the space as an “escape.” They are *busy* shuffling papers, scribbling notes, etc. As described by Hampton and Gupta (2008), like public spaces more generally, wi-fi use in public can provide a space of productivity away from the distractions of the home and workplace. Indeed, when interviewed, 51% of Bryant Park wi-fi users described their purpose in the park as “primarily work.” This was nearly twice the rate of “work” reported by wi-fi users in the other field sites (27%).

Wi-fi “workers” tend to be less open to sociability with both strangers and copresent companions than other users of public spaces. Bryant Park’s facilities encourage this behavior: there is an abundance of small tables and chairs with desk attachments, and this type of arrangement provides limited opportunity for physical contact and for companions to casually share a laptop display. Overall, more interaction was observed where shared seating was provided, such as benches, steps, picnic tables, and low walls. As a result, for laptop users, Bryant Park functions primarily as a workers’ park – workers typically seek empty tables and desks. In other locations, contextual effects were more likely to be avoided, not only because of the lower density of wi-fi use, but also because most laptop users did not arrive with work as their primary goal, and, when the space was crowded, urban design required that they sit beside others whether they wanted to or not.

### **Social Networks of Wi-Fi Users**

Participation in the public realm increases exposure to social diversity. This exposure may be manifest in the formation of larger, more diverse social networks. Recent surveys of the U.S. adult population, which enumerated the size of people's discussion networks, have found that the average American discusses important matters with approximately two social ties (Hampton et al., in press found 1.93; and McPherson et al., 2006 found 2.08). The present survey of wi-fi users found that the average user has a considerably larger core discussion network with 3.82 ties. In addition, whereas national surveys find that between 12% (Hampton et al., in press) and 24.6% of Americans have no discussion ties (McPherson et al., 2006), only 3.5% of wi-fi users found in public spaces had no discussion ties. Moreover, whereas between 48.7% (Hampton et al., in press) and 57.2% (McPherson et al., 2006) of the average American's core discussion networks contain non-kin, 89.1% of wi-fi users had at least one non-kin confidant.

Wi-fi users' core discussion networks tend to be larger and more diverse than those of the average American. However, wi-fi users are by no means representative of the American population; they are older, have a higher level of educational attainment (75% have at least a four-year university degree), and are primarily white (Caucasian). Previously, these demographic factors have been found to contribute to network size and diversity (Marsden, 1987; McPherson et al., 2006). The study's findings cannot definitively conclude that use of wi-fi networks in public contributes to larger, more diverse discussion networks. Similarly, the lack of longitudinal data limits the ability to determine the direction of the relationship observed – whether wi-fi users build better networks as a result of their public participation, or if those with better networks spend more time in public spaces. However, the magnitude of these findings makes it hard to ignore the possibility that a relationship exists and largely excludes the possibility that wi-fi use in public does significant harm to personal discussion networks. Certainly, social isolation does not characterize the behavior of wi-fi users found in urban public spaces.

## **DISCUSSION**

### **Are wireless urban spaces a part of the public realm?**

The infrastructure of urban public spaces is undergoing a transformation; broadband wireless Internet access will soon be as pervasive as sidewalks, benches, trees, and water fountains. Internet use, once primarily restricted to private spaces in the home and workplace, will become a part of everyday life on streets, in parks, and in other public spaces. This study addresses the implications of this transformation for the public realm – those urban spaces that are notable for the exposure to social diversity that they provide. The public realm is one component of a broader public sphere, intertwined with mass media and interpersonal networks. The public sphere is undergoing many simultaneous pressures that constrain diversity of interaction and exposure, including privatism within social networks and the convergence and conglomeratization of media. It has been the goal of the study to evaluate the role of wi-fi use in urban

public spaces from within this frame; to examine the social implications of wireless Internet use in terms of its influence on the social diversity experienced by wi-fi users, companions, and strangers who share the public realm.

An urban public space is a public realm only to the extent that the space offers: 1) a low density of acquaintanceship and 2) exposure to social diversity.

For wi-fi users, the number of co-located ties in urban public spaces was low: only a minority was in *co-located* groups, and when groups were present, the number of companions was typically small. Yet, for wi-fi users the number of *copresent* ties was high. That is, although they were not physically surrounded by acquaintances, they were in direct contact through email, instant messaging, and other social tools, such as blogging and social networking websites.

When online and offline contact were combined, the number of acquaintances wi-fi users maintained while in urban public spaces was very high. However, the intimacy of those acquaintances was mixed. Those co-located ties that accompanied wi-fi users were not typical of those found in the private realm; they were predominantly friends and workmates, not kin. In addition, the extensity of email and IM contact afforded by wi-fi diverged from the tele-mediated contact afforded by the mobile phone, in that there was considerable role diversity. Moreover, other dominant activities engaged in by wi-fi users online, such as using social networking websites and blogging, are associated with maintaining and forming large and diverse social networks (Ellison et al., 2007; Marlow, 2005; Tufekci, 2008). Density of acquaintanceship is a function of both size and intimacy. If the intimacy and number of acquaintances in urban public spaces afforded by mobile phone use are characterized as resembling the closeness of a family dinner, the breadth of connectivity afforded by wi-fi use resembles that of a large wedding party.

Wi-fi use within urban public spaces affords interactions with existing acquaintances that are broader and more diverse than the private “bubbles” of interaction characterized by mobile phone use. At the same time, although the density of acquaintanceship is not so extreme that it resembles the private realm, wi-fi use in public provides enough familiarity among copresent actors that it resembles the “home territory” of the parochial realm, in that people are surrounded by others with whom they share much in common.

The diversity of social ties maintained by wi-fi users is high, but these users are not exposed to the same level of social diversity within places as other participants in urban public spaces. Wireless Internet users tend to shelter themselves in areas within public spaces that are less populated and less active than the space as a whole. The “heads-down” nature of laptop use suggests that users are less attentive to their surroundings than users of any other media, including book readers with a similar posture. This tendency toward private activities on screen over public activities in place is amplified when accompanied by co-located acquaintances. Similarly, in response to place-based stimuli, such as a sudden loud noise, wi-fi

users were found to be more attentive to their surroundings than mobile phone users but less attentive than those using portable music players, reading a book, or using a PDA or portable gaming device. The outward appearance of wi-fi users was also more likely to be one of “frustration,” “tension,” and “seriousness,” when compared with those using any other media. This appearance made wi-fi users less approachable by some – the homeless and panhandlers – but also by those engaged in the time-honored practice of distributing informational flyers, a media unique to urban public spaces. The reduced contact with “undesirables” may obviously appeal to those who wish to sweep them from public visibility, but it also represents a reduction in cross-class exposure of the type so aptly described in Charles Baudelaire’s “The Eyes of the Poor” (1864/2008). The tendency for reduced exposure to surroundings was modified only by direct social contact with strangers (other than “undesirables”). The serendipity or frequency of chance encounters experienced by wi-fi users resembled that of book readers and was markedly higher than observations of those using a mobile phone or portable music player. Thus, with the exception of serendipitous encounters, the level of social diversity to which wi-fi users were exposed within urban public spaces was typically less than that of most, with the possible exception of those using mobile phones.

Findings reveal that wi-fi use affords both a high density of acquaintanceship and reduced exposure to social diversity within urban public spaces. Wireless Internet use makes existing social networks even more portable and readily accessible than what is afforded by the mobile phone. However, the laptop affords interaction that is more extensive than the small, intimate, private sphere of the mobile phone. This leads to more diverse social interaction with a larger segment of existing networks than is typical of mobile phone use. Yet, within urban public spaces even this level of social familiarity is inconsistent with the public realm. In addition, the activities associated with wi-fi use reduce the ability of urban public spaces to afford exposure to social diversity for wi-fi users, because they are simply less attentive to their surroundings. It is also possible that the spatial patterns of wi-fi use, through clustering of activity within specific areas, reduce the opportunity for interaction and exposure to social diversity for non-wi-fi users who share the same space. However, this tendency was observed within one field site, but it was a result of site-specific issues related to urban design and the type of wi-fi users attracted to that place. Therefore, although wi-fi users are, to some extent, excluded from the public realm, for other urban inhabitants, public spaces do not become less of a public realm as a result of a wi-fi infrastructure. This is unlike public spaces where people are surrounded by dense mobile phone use and suffer reduced opportunity for interaction as a result.

### **Will wi-fi use reshape the use of urban public spaces?**

The influence of wi-fi use on urban public spaces is uneven and heavily influenced by the character of the space. Some public spaces are more likely to experience heavy wi-fi use than others. The popularity of a site for wireless users is determined by the role of reputation, free wi-fi, pre-existing population density, urban design, surveillance/harassment, and local culture. As with mobile phones (Campbell, 2007) and wired Internet use (Wellman et al., 2003), there is likely to be significant cultural variation in public wi-fi use across countries, to the point that wi-fi use in urban public spaces may never become a common feature or face a long adoption curve in some areas of the world.

Observations within the United States suggest that those public spaces that are successful, i.e., they benefit from a good urban design and a pre-existing population of users, are most likely to attract wi-fi use. Indeed, many wi-fi users are new users of urban public spaces, and preexisting users of a public space become more frequent visitors as a result of wi-fi availability. However, we cannot definitively conclude that wi-fi attracts new participants to urban public spaces. Likely, there is a modest effect, but probably many of those interviewed were at a stage in their life (young, single adults) when they would have begun to inhabit urban public spaces with more regularity, regardless of the wireless infrastructure. A wi-fi infrastructure by itself will not populate an urban public space, nor will it revitalize urban public spaces that are in decline as a result of poor design or other factors.

The composition of wi-fi users in urban public spaces is far from diverse: they are young, single, well educated, and predominantly male. If anything, social inequality in urban public spaces may increase through the addition of users who are exceptionally privileged in human, social, and financial capital. However, as already stated, although there is modest evidence in favor, it is not at all clear that wi-fi use attracts new people to urban public spaces. It is clear, with the exception of the limited examples from Bryant Park, that wi-fi activities do not significantly disrupt urban public spaces for other people. There is, in fact, something of a paradox here: wi-fi use represents yet another diverse activity within urban public spaces, like book reading, picnicking, and “undesirables.” At the same time, participation in this activity largely precludes participation in the public realm.

### **The public sphere and wireless Internet use**

Perhaps the most striking finding of this study relates to the types of activities participated in by wi-fi users while online and in urban public spaces. Although urban public spaces are not a public realm for wi-fi users, findings indicate that the activities engaged in by wi-fi users contribute to broader participation in the public sphere. Wi-fi users found in urban public spaces were imbedded in large, diverse social networks. While in urban public spaces, their online activities were directed at maintaining those networks – networks described as an extension of the parochial realm. They were heavily involved in email and instant message exchanges and were using social networking websites; a substantial number were

consuming online news and political information. Access to news and political information, in concert with interpersonal communication with networks of both homophilous and heterophilous ties, represent many of the variables commonly equated with ideal participation in the public sphere. This may generate positive outcomes related to the quality of opinion formation and political participation.

The online activities of wi-fi users may provide more opportunity for deliberation and broader discursive participation than the casual, fleeting exposure offered by the public realm. The availability of ubiquitous wireless Internet access may allow people to renegotiate time to consume a broader range of news and political information online than they otherwise would. It may also facilitate communication within existing social networks. The character of these networks is not that of the closed, inward looking private realm or the truly diverse and broadly reaching public realm, but somewhere in-between. The informal interactions of the parochial realm, whether centered on the workplace (Mutz, 2006), the neighborhood (Hampton, 2007), or communicative practices – like the Internet – that allow for the maintenance of overlapping networks, may better balance opposition and like-mindedness to maximize tolerance, deliberation, and broader discursive participation than exposure to provocative and contested public settings. Indeed, for some segments of the population, the public realm may be a setting of extreme provocation and opposition. Middle-class youth, raised in the homogeneity of the suburbs and accustomed to a “Disneyfied” main street (Zukin, 1995), may feel entirely alienated in the urban public realm. The finding that young adults, who are, in general, less civically engaged than previous generations (Carpini, 2000), use wireless connectivity in urban public spaces to communicate with broad reaching networks and to consume and create information, suggests that an infrastructure for wireless Internet connectivity within urban public spaces may have unanticipated and positive consequences for participation in the public sphere – including political and diverse social engagement – beyond what could have previously been afforded by urban public spaces that are free of Internet connectivity.

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<sup>1</sup> Some people were using more than one device. The categorization for users of devices other than laptops is based on the primary device used as judged by the observer. The small number of observations of users of portable music devices, PDAs, and portable gaming devices makes it more difficult to generalize about these users. Thus, comparisons with these users are made only when their patterns of behavior were distinct.

<sup>2</sup> Throughout the Findings and Results sections, the term “wi-fi users” refers to people using laptops. Some people may have been using wi-fi on other types of devices, and some laptop users may not have been accessing wireless Internet.

<sup>3</sup> Although the racial diversity of Toronto wi-fi users is consistent with the finding that Toronto’s population is more diverse than most North American cities, the small number of wi-fi users who were interviewed in Toronto limits a generalization from this finding.

<sup>4</sup> The density of each public space was recorded by observers during place-based observations, with separate density measures estimated for the area surrounding laptop users. The area around a laptop user was defined through the location of natural environmental features, such as pathways, trees, and benches.



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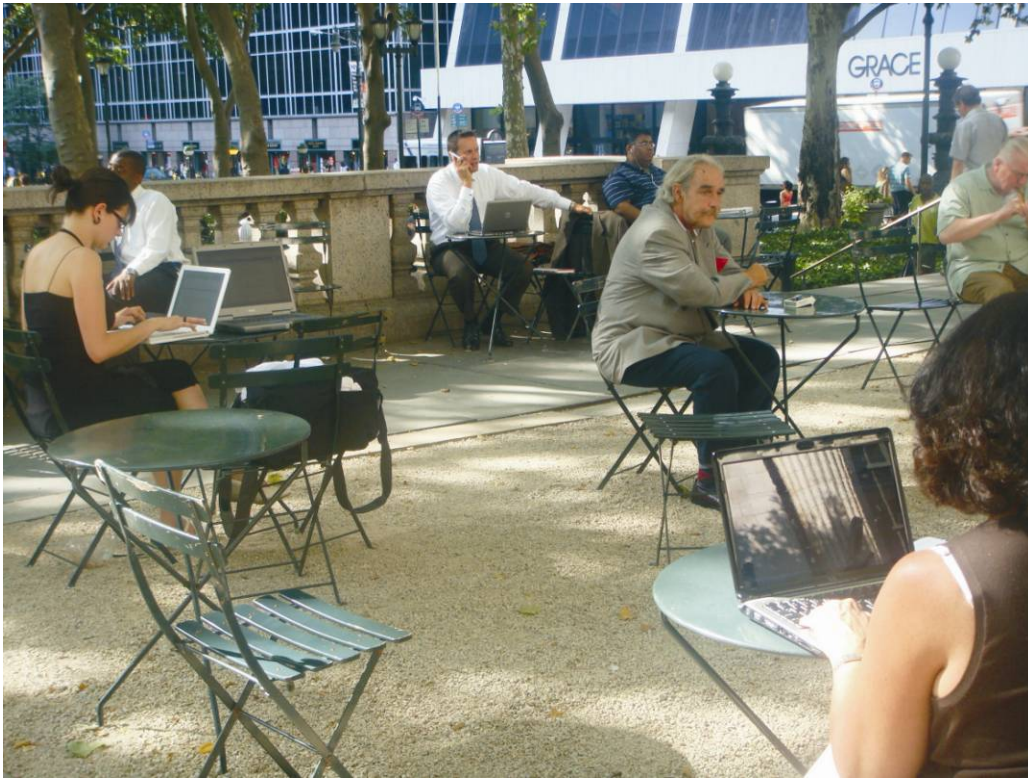
**Table 1: Co-located and copresent interaction**

	<i>C</i>	<i>S</i>	<i>R</i>	<i>I</i>	<i>C</i>	<i>I</i>
	<i>o</i>	<i>e</i>	<i>e</i>	<i>M</i>	<i>h</i>	<i>P</i>
	-	<i>n</i>	<i>a</i>		<i>a</i>	
	<i>L</i>	<i>t</i>	<i>d</i>	(	<i>t</i>	<i>P</i>
	<i>o</i>			<i>N</i>		<i>h</i>
	<i>c</i>	<i>E</i>	<i>E</i>	=	(	<i>o</i>
	<i>a</i>	<i>m</i>	<i>m</i>	<i>3</i>	<i>N</i>	<i>n</i>
	<i>t</i>	<i>a</i>	<i>a</i>	<i>8</i>	=	<i>e</i>
	<i>e</i>	<i>i</i>	<i>i</i>	)	<i>9</i>	
	<i>d</i>	<i>l</i>	<i>l</i>		)	(
	(					<i>N</i>
	<i>N</i>	(	(			=
	=	<i>N</i>	<i>N</i>			<i>6</i>
	<i>7</i>	=	=			)
	<i>l</i>	<i>l</i>	<i>l</i>			
	)	<i>4</i>	<i>4</i>			
		<i>7</i>	<i>7</i>			
		)	)			
S	1	7	7	2	0	1
P	4	.	.	.		0
o	.	5	5	6		0
u	1					.
s						0
e						
P	4	2	2	2	0	1
a	.	1	3	1		6
r	2	.	.	.		.
e		1	1	1		7
n						
t						
S	2	1	1	7	0	1
i	.	2	3	.		6
b	8	.	.	9		.
l		2	6			7
i						

n							
g							
C	0	1	2	2	1	1	
h		.	.	.	1	6	
i		4	0	6	.	.	
l					1	7	
d							
O	4	1	2	7	1	1	
t	.	9	1	.	1	6	
h	2	.	.	9	.	.	
e		7	8		1	7	
r							
F							
a							
m							
i							
l							
y							
C	1	5	4	1	2	1	
o	1	1	7	0	2	6	
-	.	.	.	.	.	.	
w	3	0	6	5	2	7	
o							
r							
k							
e							
r							
M	8	1	2	2	1	0	
e	.	7	2	.	1		
m	5	.	.	6	.		
b		7	4		1		
e							
r							
o							

f							
G							
r							
o							
u							
p							
N	4	2	3	0	0	0	
e	.	.	.				
i	2	7	4				
g							
h							
b							
o							
r							
F	7	6	7	8	5	3	
r	1	7	2	1	5	3	
i	.	.	.	.	.	.	
e	8	3	8	6	6	3	
n							
d							
A	5	9	8	2	0	0	
d	.	.	.	.			
v	6	5	2	6			
i							
s							
o							
r							
O	1	1	2	5	0	0	
t	5	7	0	.			
h	.	.	.	3			
e	5	0	4				
r							





**Figure 1.** Bryant Park: Contextual effect.