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Say Goodbye . . . Let's Roll: The Social Dynamics of Wireless Networks on September 11[1]

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ABSTRACT *This article describes the use of wireless telecommunication media within the different locations directly affected by the hijackings on September 11. Comparisons across these different contexts provides an empirical anchor to more general themes concerning the social dynamics of wireless in the unfolding events of this day. An indication is given of how the important social role of wireless phones in this crisis could redefine public views on wireless media and thereby shape policy and regulation in the years ahead.*

Keywords: cell phone, wireless, social impact, crisis, telecommunication policy.

Introduction: The Power of the Untethered Human Voice

A major theme emerging from news coverage of the events of September 11 was the power of the untethered human voice, enabled by wireless telecommunication media. These anecdotal accounts of wireless mobile cell phone and air phone[2] calls by hijacked airline passengers and the occupants of the World Trade Center (WTC) were important elements of stories about the hijacked planes and rescue efforts. This news coverage was so thorough, that it created the opportunity for a comprehensive analysis of this unique case of the use of wireless telephones, which also addresses and illuminates more general questions about the social role of electronic communication.

Wireless media supported flexible and spontaneous networks of communication on September 11, while they circumvented and undermined more formal hierarchical systems of communication. This reinforces a theoretical argument about the bias of new information and communication technologies (ICTs) in facilitating one-to-one and many-to-many networks of communication, in contrast to more controlled forms characteristic of hierarchical networks. The hijackers themselves were a network that employed the cell phone to coordinate their attack. Passengers on hijacked planes were able to get information from outside the official channels of communication, which evaded the hijackers rapidly enough to enable a spontaneous network to form and overtake the hijackers on one plane. On

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the ground, WTC occupants used cell phones to network with individuals outside the buildings to obtain information counteracting unsafe official announcements.

The way wireless media were used by both heroes and villains also highlights the broader double-edged nature of communication. Similarly, the same technology that was used to help search for victims at WTC Ground Zero could be used for unwarranted surveillance in other contexts. The ability of digital 'e-technologies' to reshape access to information and people to alter outcomes in sometimes dramatic ways was a poignant motif in the September 11 story. The role of ICTs in reshaping access, or 'tele-access', took the form of both instrumental changes in behavior as well as conveying love, sorrow and other deep social emotional values.[3]

After describing our approach, the scene is set by detailing key wireless events at the heart of the analysis. This is followed by a discussion of themes that emerge from examining these cases and a concluding section which explores some significant implications of this experience for society at large.

Our Approach

Analytically, it is useful to view the unique events of September 11 as a set of embedded case studies of how wireless media were used in each of the four separate hijacked planes, within the three different structures that were struck and within the underground rubble of the WTC.[4] We therefore collected online, print and other news coverage about the use of wireless media in these incidents.[5]

There are notable limitations to our approach. First, there are inconsistencies across media reports. For instance, without better records, it is not possible to be precise about the exact times and sequences of many events, including wireless calls. Secondly, incorrect information can be consistently reported as journalists pick up each other's news reports. Unintentionally, the words of a journalist or family member paraphrasing a call can be taken as the exact words of a victim. Finally, journalistic reports are neither random nor comprehensive, raising issues about the bias of any sample represented in coverage. However, the details that might be problematic are taken into account in drawing conclusions and the broad sweep of wireless interactions, not just the details, is also indicative of general patterns and themes that have a foundation in communication theory and practice.

The Social Dynamics of Wireless Calls on September 11

Each plane and crash site for which we have records presents a unique set of circumstances that help understand the social dynamics of wireless calls made in parallel sequences as events unfolded.

Aboard the Hijacked Planes

The first plane to crash into the WTC in New York City was American Airlines Flight 11, which left Boston's Logan Airport at 7:59. Two critical calls are reported from this plane (Table 1). The first, made before take-off, was by Mohammed Atta, a hijacker on AA 11, who called an accomplice on United Airlines Flight 175. While no content was recorded from this call, which lasted less than a minute, investigators assumed that this was one go-ahead signal between the hijackers. The

Table 1. American Airlines Flight 11 (AA 11) chronology

5:45	Mohamed Atta passes through security checkpoint in Portland, Maine, on route to Logan Airport in Boston, where he boards AA Flight 11.
7:45	Atta calls Marwan Al-Shehhi, aboard United Airlines Flight 175, in cell phone call of less than 60 seconds.
7:59	AA 11, a Boeing 767, departs Logan for Los Angeles International Airport with 92 people aboard.
Approx. 8:15	AA 11 is hijacked.
Approx. 8:40	Flight Attendant Madeline Sweeney calls AA Operations Center, alerting them to hijacking, ending her call with: 'I see water and buildings. Oh My God! Oh My God!'.
8:46	AA 11 flies into the 90th floor of WTC north tower in New York City.
10:29	WTC's north tower collapses.

second call was from flight attendant Madeline Sweeney to American Airlines' Operations Center. Sweeney was composed enough to provide details of the stabbing of two other flight attendants, the death of a passenger and the storming of the cockpit by the hijackers, who she described as appearing 'Middle Eastern'. When asked by an American Airlines ground manager at Logan Airport in Boston to give her location, she reported seeing water and buildings just before hitting the north tower of the WTC. Her last words were: 'Oh my God!'

The second plane to hit the WTC, United Airlines Flight 175, took off at approximately the same time as AA 11 (Table 2). A passenger, Peter Hanson, used a cell phone to reach his father, telling him that the plane had been hijacked and that the hijackers were stabbing flight attendants and forcing the crew to open the cockpit door.

Between 10 and 20 minutes after AA 11 and UAL 175 took off, American Airlines Flight 77 departed Dulles Airport in Washington DC for Los Angeles (Table 3). After the hijack, journalist Barbara Olson made two cell phone calls from the rear of the plane to her husband, US Solicitor General Theodore Olson. During the first, she had time to tell him of the hijacking and how the passengers were separated into groups, with the pilot and some crew forced to the back of the plane. Olson believed the hijackers were armed only with knives and cardboard-box cutters. When she contacted her husband again, she gave him more information and he told her of two planes crashing into the WTC. When Olsen asked him what

Table 2. United Airlines Flight 175 (UAL 175) chronology

7:45	Marwan Al-Shehhi, aboard United Airlines Flight 175, receives cell phone call from Atta, possibly giving a go-ahead or coordinating their actions.
7:58	UA 175, a Boeing 767, departs Boston for Los Angeles with 65 people aboard.
Approx.	Passenger Peter Burton Hanson uses a cell phone to call his father, saying the 'plane [was] hijacked, flight attendants stabbed, hijackers in cockpit'.
9:06	UA 175 plows through the WTC south tower.
10:00	WTC's south tower collapses.

Table 3. American Airlines Flight 77 (AA 77) chronology

8:10 or 8:20	AA 77 departs Washington, DC Dulles Airport for Los Angeles with 64 people aboard.
Approx. 9:25	Passenger Barbara Olson, a journalist, makes first cell phone call to her husband, US Solicitor General Theodore Olson, telling him of the hijacking. Signal is lost.
Approx. 9:30–9:40	Barbara Olson reaches her husband a second time. Her husband ends call to prevent her from being discovered and harmed.
9:43	AA 77 crashes into the west side of the Pentagon, outside Washington, DC in Arlington, VA.

she should do, he advised her to hang up and call back later as he was concerned she would be discovered. Minutes later, AA 77 crashed into the west side of the Pentagon.

The last flight to depart, and crash, was United Airlines Flight 93. It left the gate at Newark International Airport approximately the same time as the other flights, but its departure was delayed about 30 minutes until 8:40. UAL 93 was still climbing towards its cruising altitude when AA 11 hit the north WTC tower. At least nine wireless phone calls were made from UAL 93.[6] One reason for this relatively high number was that one or more hijackers told UAL 93 passengers to call their families and 'say goodbye' (Table 4).

Table 4. United Airlines Flight 93 (UAL 93) chronology

8:01	UAL 93, a Boeing 757, leaves gate at Newark, bound for San Francisco.
8:41	UAL 93 departs, after delay, with 45 people aboard. Only 37 of 182 seats occupied.
8:46	UAL 93 climbing to cruising altitude when AA 11 hits north WTC tower.
9:35	UAL 93 is hijacked, with hijackers soon telling passengers to call their families to 'Say Good bye'.
9:35–	Male passenger calls 911 from locked bathroom, saying 'We are being hijacked. We are being hijacked'. Passenger Thomas Burnett makes four calls to his wife, providing information for authorities and telling of plan for passengers to attack hijackers. Flight attendant CeeCee Lyles calls her husband and tells him she loves him and their four boys. Passenger Sony Garcia calls his wife. She heard only 'Dorothy' through static. Passenger Lauren Gandcolas calls home about hijacking, saying: 'They are being kind. I love you'. Passenger Jeremy Glick provides information about hijackers during a 20 minute call with his wife, Lyz, who contacts authorities at his request. Passenger Mark Bingham calls his mother, leaving a message on her answering machine that describes hijacking. Passenger Elizabeth Wainio calls her stepmother, saying: 'They're going to storm the cockpit'. Passenger Todd Beamer is unable to use his credit card in air phone, but is connected to Verizon/GTE Airfone supervisor. He provides her with information, says the Lord's Prayer with her, and leaves line open as he and other passengers attack hijackers. She hears: 'Are you ready guys? Let's roll'.
10:10	UA 93 crashes in Shanksville, PA, 80 miles SE of Pittsburgh.

Many callers from UAL 93 did, indeed, say goodbye. But a significant number also provided information to families and authorities, as well as receiving relevant news. An unidentified passenger locked himself in a lavatory and called 911, the US emergency number, to report the hijacking in progress. Another passenger, Thomas Burnett, reached his wife on four separate calls. He told her of the hijacking, the knifing of a passenger and the hijackers' bomb threat. Mrs Burnett called the FBI after the first call. When Burnett called his wife back, he told her that the hijackers were talking about crashing the plane—and she was able to tell him about the planes hitting the WTC. During a third call, they concluded there was probably not a bomb on the plane. On the fourth and final call, Mrs Burnett learned that her husband and other passengers planned an action against the hijackers, who were positioned near the pilot's cabin.

Flight attendant CeeCee Lyles, a former police officer, reached her husband by phone. He could hear screaming in the background while she expressed her love for him and her children. Passenger Jeremy Glick contacted his wife, Liz, and in-laws on his cell phone, saying that three men, one with a red box strapped to his waist, had hijacked the plane. He asked about the truth of another passenger's report that planes had crashed into the WTC. He told his wife to call authorities, adding: 'the men voted' to attack the terrorists.

When another passenger, Todd Beamer, was unable to use his credit card for an air phone call from UAL 93, he was directed to the telephone company's air phone supervisor. Beamer gave her information about the hijacking and asked her to recite the Lord's Prayer with him. He then left the phone line open as he and other passengers stormed the hijackers, saying: 'Let's roll'. A few moments later, 'Get out of here. Get out of here' was heard on a radio transmission from the cockpit; then sounds of a struggle; followed by silence. UAL 93 had crashed in an open field about 80 miles southeast of Pittsburgh, PA.

Calls in the Targeted Structures and from the Rubble of the WTC

Once AA 11 crashed into the 90th floor of the north WTC tower, the use of landline and wireless telecommunications increased dramatically—and communication infrastructures in the immediate vicinity of the crash began to be overwhelmed. When the towers collapsed, as many as 10 local cellular sites were knocked out. Some cell phones were picked up by nearby sites, but wireless phone use was generally unreliable. For instance, John Labriola, who escaped from the 71st floor of the north tower, said: 'People were constantly checking their cell phones . . . but no one's calls could get out'. Similarly, Jennifer Daly was late getting to work at the WTC when the north tower was hit. She ran from the scene. Checking her cell phone, she found 27 missed calls from worried friends and family. Difficulties were not only tied to the telecommunication infrastructure. Broker Robert Matos, on the 55th floor of the south tower, was shaking so much after seeing 10 people jump to their death that he could not dial his cell phone.

However, an example of how crucial information was passed to occupants of the towers by wireless calls that did get through was the way a cell phone call received in WTC's south tower helped to save the lives of the recipient of the call and a nearby colleague because they were alerted to the fact that a plane had caused the damage to the north tower. This led the pair to ignore announcements that the south tower was now safe and that they should return to their building.[7]

Later, in the rubble of the north and south towers, at least one victim and two police officers were reported to have used their cell phones to direct rescuers to their locations. The mere possession of a cell phone created the potential to locate survivors. The Federal Emergency Management Agency (FEMA) sent the Wireless Emergency Response Team (WERT) to the WTC. WERT has electronic equipment to pinpoint cellular and pager devices that are turned on by tracking the source of their signal.

The Social Roles of Wireless: General Patterns and Themes

Analysis of the details of calls across these varied contexts of key September 11 events surfaces a number of more general themes concerning the use and impact of wireless media.

The Double-edged Sword of Communication

In supporting networks, wireless media can be employed by hijackers and the hijacked, victims and criminals. Wireless phones helped save lives on September 11, as much as they were employed to kill and maim. Not only did the hijackers use cell phones to give the go-ahead to the plot, but a series of telephoned bomb threats to the control centers monitoring the hijacked flights were apparently orchestrated to confuse controllers and weaken their ability to understand and respond to the rapidly unfolding events.[8]

Similarly, the technology of wireless enabled rescuers to track victims, yet the same technology can be used for unwarranted surveillance. This was emphasized in the aftermath of September 11 by heightened discussion of privacy concerns raised about wireless and enhanced 911 services that enable tracking of wireless 911 calls. In such ways, the uses of wireless reflect earlier observations about the telephone having what Ithiel de Sola Pool called 'inherently dual effects', in that the 'telephone is an agent of effective action in many directions'.[9] Understanding this feature of the social implications of communication media can lead analysis to more subtle types of effects, such as in reshaping physical and electronic access to information, people, services, and technologies—what has been called the 'shaping of tele-access'.[10]

The Instrumental Value of Wireless: Reconfiguring Access to Information

Wireless media on the planes and in the buildings played a critical role in getting information from the inside to the outside and vice versa. Cell phone calls from the planes informed authorities of the hijacking as it was in progress. Families were able to inform passengers of events they were watching on TV. Occupants in the WTC towers were able to get information on the big picture from friends and associates outside the towers. A few individuals buried in the rubble of the WTC were able to direct rescuers to their locations using cell phones. These events show how ICTs can reshape not only access to information in ways that reconfigure who knows what and when, but also access to people—changing who is in, and who is out, of any network of communication.

Social Emotional Values: Reshaping Access to People

The instrumental value of wireless in performing various surveillance functions—getting and giving information—was emphasized by news coverage. However, the

manner in which individuals made social connections using wireless to give and receive emotional support was as important as exchanges of instrumental information, and possibly more prevalent. A striking feature of reported calls is the degree to which so many carried relatively little or no instrumental information exchange. Instead, people wanted to say goodbye, reassure, say their last words or convey their love to their family. In doing so, wireless appeared to play a major calming influence that reduced the level of panic. The social and emotional support gained by access to people helped passengers shore their courage, such as suggested by Todd Beamer's conversation and the value he saw in leaving the line open as he and others marshaled the action with 'let's roll'.

Networks versus Hierarchies

In reconfiguring access to information and people, wireless media supported the formation of flexible and spontaneous networks of communication on September 11, while they circumvented and undermined more formal hierarchical systems of communication. This reinforces a theoretical argument about the bias of new ICTs in facilitating one-to-one and many-to-many networks of communication, in contrast to more controlled one-to-many, center-to-periphery forms more characteristic of hierarchical networks.[11]

The hijackers themselves were grouped in more or less loosely-coupled networks and able to employ the cell phone to coordinate their attack. The passengers aboard more than one plane were able to get information from outside the official channels of communications aboard the aircraft and also circumvent the hijackers in time to enable a spontaneous network to form on at least one plane to overtake the hijackers of UAL 93. In the WTC, occupants were able to network with individuals outside the buildings to obtain information that was useful in convincing them to evacuate even in the face of official announcements that it was safe to return.

An important exception to this pattern is the Pentagon, where military culture and security systems appeared to erect an effective barrier to the formation of unintended networks of communication with outsiders. We found no reports of any calls into or out of the Pentagon. If this is indeed the case, it underscores the point that new ICTs might bias communication, such as in favoring networks over hierarchies, but they are not deterministic, since they are facilitated and constrained by their social and institutional settings.

Longer-term Social and Policy Implications

The circumstances of September 11 were unique. However, the prominence of wireless media in the ways chronicled above could have longer-range implications on the meaning people attribute to different communication media—and therefore on policy and practice.

The Very Meaning of Wireless

Since the late 1990s, pagers, cell phones and other wireless media have diffused widely within most industrialized nations, but in the months preceding September 11, phone shipments had slumped worldwide. In the aftermath of September 11, the wireless industry experienced a major boost. Stocks rose. More phones were

sold. More minutes were billed. People and the press began to talk about the cell phone as a 'lifeline' in the case of an emergency, for example with some schools in the US giving cell phones to teachers and lifting bans on students having cell phones on their campuses.[12] To some degree, this emergency role was a factor in cell phones' early diffusion, but the rapid expansion of colorful covers, sharp designs and ubiquitous use enabled notions of fashion, conviviality and easy contactability to define the cell phone more as a luxury or necessary everyday social and business aid—until September 11.[13]

Reshaping Policy and Practice

A significant impact on telecommunication policy and practice could be made if the cell phone continues to be perceived as a more central and safety-critical medium for communication. There is support for such a view outside of September 11, but the maintenance of this perception is not a certainty.[14] Telecommunications has played an important role in earlier disasters, such as earthquakes, without having a lasting effect. However, no previous disaster has brought such attention to wireless technology, which has rapidly become a highly visible element in public debate.[15] For instance, the words of a wireless conversation were incorporated in US President George W. Bush's 2002 State of the Union Address, when he implored Americans to embrace 'a new ethic and a new creed: "Let's roll" '.

Public officials have argued that a higher priority should be placed on developing more reliable, universal and standard forms of wireless connectivity in the light of September 11.[16] This new significance assigned to wireless could support the allocation of more spectrum space to wireless ensuring more universal coverage. Clearly, present systems were unable to handle reliably the congestion and other special requirements of wireless media on September 11. This experience will raise the priority given to designing and building the infrastructures to support wireless communication in times of crisis, when the instrumental and social emotional values of connecting with another human voice arises once again.

Notes and References

1. The authors thank the guest editor of this symposium, A. Michael Noll, and a London-based colleague and journalist, Malcolm Peltu, for their comments on earlier drafts.
2. Cell phone networks are a combination of wireless radio signals and hard-wired land lines that connect by radio frequency to cell sites with the equipment to receive and transmit radio signals within the circular footprint of its geographical area. The mobility of cell phone use is maintained seamlessly by automatic transference of calls between adjacent sites. Air phones on board planes work with similar principles, but the ground stations are further apart and are designed specifically for air-to-ground signaling.
3. This theme of reconfiguring access, or tele-access, is further developed in W. Dutton, *Society on the Line: Information Politics in the Digital Age*, Oxford University Press, Oxford, 1999.
4. Embedded case study designs are discussed by R. K. Yin, *Case Study Research: Design and Methods*, 2nd edition, Sage, Thousand Oaks, CA, 1994.
5. Using electronic search engines, we located over 30 articles that dealt explicitly with the use of cell phones, air phones and other wireless networks on September 11. Sources included stories by major news outlets, such as the *Associated Press, BBC News*, CNN, *Newsweek, New York Times* and Reuters, as well as more local, trade and online news media, such as the ABC News.com, Akron.com, the *Baltimore Sun*, the *Cincinnati Enquirer, Computerworld*, CTIA's *World of Wireless, EQE Publications* and The Yankee Group.

6. A particularly detailed account of events on this flight, on which we draw, is given by K. Breslau, 'The final moments of United Flight 93', *Newsweek Web Exclusive*, September 22, 2001, published online at http://www.msnbc.com/news/
7. There are a number of similar accounts of individuals outside the WTC observing developments and informing those within the structure to evacuate.
8. We do not know if wireless or landline calls were used for some or all of these threats.
9. I. de Sola Pool, 'Introduction', in I. de Sola Pool (ed.), *The Social Impact of the Telephone*, MIT Press, Cambridge, 1977, p. 4.
10. Dutton, *op. cit.*
11. This argument is comprehensively developed by M. Castells, *The Rise of the Network Society*, 2nd edition, Blackwell, Oxford, 2000; and J. Arquilla and D. Ronfeldt, *Networks and Netwars: The Future of Terror, Crime and Militancy*, RAND, Santa Monica, CA, 2001.
12. M. Brown, 'Area schools may rethink ban on cellphones', *Tampa Tribune*, January 16, 2002.
13. This general point is argued, for example, by The Yankee Group, 'What changes for wireless: taking stock of the industry after September 11', October 4, 2001.
14. For example, research on the role of another wireless technology, pagers, in the aftermath of a blackout suggested that they play a far more central role than often attributed by the press. See W. H. Dutton, A. Elberse, T. Hong and S. Matei, ' "Beepless in America": the social impact of the Galaxy IV pager blackout', in S. Lax (ed.), *Access Denied in the Information Age*, Palgrave, London, 2001, pp. 9–32.
15. In some respects, this case is comparable to the Challenger disaster, which riveted attention over a sustained period of time on the management of the National Aeronautic and Space Administration.
16. For example, see the speech by N. J. Victory, Assistant Secretary of Communications and Information, US Department of Commerce to the Latin American Wireless Industry Association on November 26, 2001. Available online at: http://www.ntia.doc.gov/ntiahome/speeches/2001/alacel_112601.htm