The Rules of Beeping: Exchanging Messages Via Intentional "Missed Calls" on Mobile Phones

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Abstract

This article explores the practice of "beeping" or "missed calling" between mobile phone users, or calling a number and hanging up before the mobile's owner can pick up the call. Most beeps are requests to call back immediately, but they can also send a pre-negotiated instrumental message such as "pick me up now" or a relational sign, such as "I'm thinking of you." The practice itself is old, with roots in landline behaviors, but it has grown tremendously, particularly in the developing world. Based on interviews with small business owners and university students in Rwanda, the article identifies three kinds of beeps (callback, pre-negotiated instrumental, and relational) and the norms governing their use. It then assesses the significance of the practice using adaptive structuration theory. In concluding, the article contrasts beeping with SMS/text messaging, discusses its implications for increasing access to telecommunications services, and suggests paths for future research.

Introduction

"When someone beeps you, you know the reason."—Rwandan University Student

This article explores the widespread practice of "beeping" or "missed calling" between mobile phone users. Beeping is simple: A person calls a mobile telephone number and then hangs up before the mobile's owner can pick up the call. If the beeper's name and number have been programmed into the recipient's mobile, then the recipient will see the beeper's name on the call log as a missed call. If not, the recipient will see only the number of the telephone placing the call. In either case, the missed call is often intentional; the beeper has sent a signal to the recipient without saying a word or typing a character. Better yet, sending a beep is nearly free.

This practice is known by many names. English terms include "beeping," "flashing," "missed calling," and "pranking." Spanish people speak of *llamadas pérdidas* (*lost calls*). In Indonesia, the term is *memancing* (*fishing*). The following examples from the popular media suggest that these terms refer to common practices among the rapidly growing ranks of mobile phone users throughout the developing world.

In Africa, a lighthearted book called *How to Be a Kenyan* was published in 1996. The revised 2002 edition includes a new chapter called, "Of beepers, flashers, and vibrators" (Mutahi, 2002), reflecting the rapid spread of mobiles in Kenya. A Ugandan columnist wrote:

I was angry with my so-called friends who 'beep' me all the time—blackmailing me into calling them back. … I can understand someone beeping me once and a while. My problem is that so many Ugandans—from MPs to senior military officers and at least one government minister—have turned beeping into a profession. And, they never seem to realize that if they perennially don't have "units" or airtime to complete a call, it must be the same for me too. (Pajero, 2004, n.p.)

Similarly, on the *GhanaHomePage* website, columnist Rodney Nkrumah-Boateng described his difficulties acquiring "Efie Nkomo" (flashing skills) as a returning visitor to his country. "I got loads of flashes on my phone in the days following my arrival. So many, dear reader, that I almost got blinded by them" (Nkrumah-Boateng, 2004, n.p.).

In South Asia, Pakistan's *Daily Times* described a construction worker who earns US$4 per day receiving a missed call from a friend on his US$41 handset (Ahmad, 2007). India's *The Financial Express* (2006) lamented the lack of voicemail, noting instead India's penchant for missed calls, while an online list of SMS messages includes a suggestion from one reader to send the following: "Ur miss call is beat of my Heart. … So plz keep my Heart Alive" (Ejalgoan.com, 2007, n.p.).

Reliable estimates of the frequency of this behavior are not yet available, but there are indications that the practice is widespread enough to merit closer investigation by the research community. The consultancy firm Gamos (McKemey, Scott, Souter, Afullo, Kibombo, & Sakyi-Dawson, 2003) found that 38% of users of public payphones and telecenters in Uganda, Botswana, and Ghana regularly beeped mobile users from these phones. A Kenyan GSM company suggested in 2005 that its network carried four million flashes per day (Mutung'u & Gakuru, 2006). *The Financial Express* (2006) article from India suggests that "while cell phone operators are reluctant to give the exact share of missed calls, according to industry estimates, it is somewhere around 20-25%" (n.p.). Another Indian report estimates the proportion as over 30% (Kurup & Gupta, 2007). These proportions are of significant concern to network operators, since missed calls burden often-crowded mobile networks and do not always generate revenue for the operators.

As the above media quotations illustrate, not all beeps mean the same thing. Some are requests to call back; some are little signals that the beeper is thinking of the recipient. Others convey a pre-negotiated instrumental message, such as: "I'm done with my work, pick me up." This study draws on interview data from Rwandan mobile users, along with observations from secondary sources such as popular media articles, to identify three kinds of beeps—callback, pre-negotiated instrumental, and relational—and to synthesize unwritten "rules" governing their use (Murtagh, 2001). The article assesses the significance of the practice

using adaptive structuration theory (DeSanctis & Poole, 1994) and other recent approaches to technology appropriation, contrasts beeping with SMS/text messaging, and suggests paths for future research.

Various theoretical lenses could be brought to bear on the phenomenon. The practice raises interesting sociolinguistic questions and is undoubtedly influenced by the varied contexts and cultures of its adherents. This article draws on adaptive structuration theory to describe beeping for several reasons. First, beeping is a nearly-global example of an ongoing interaction between social practices and technological factors. Although its roots are in behaviors "invented" in the landline era, the practice has evolved, become more nuanced, and spread more widely in response to a combination of social, economic, and technological conditions most common in the developing world.

Moreover, beeping now utilizes the technological capabilities of the mobile (the call log and the address book), and of the billing structure (prepay cards, calling party pays). By accounting for economic and technological constraints and affordances, the application of a socio-technical lens like adaptive structuration helps re-frame some questions about the role of mobile communication technologies in developing countries. The data are from Rwanda, but the quotations from the popular press in Africa and South Asia suggests that the practice—and the theoretical questions it raises—are more widespread in scope.

Beeping and Its Analogues

Although the social practices surrounding mobile telephones are a topic of increasing interest to sociologists and communication researchers (Castells, Qiu, Fernández-Ardèvol, & Sey, 2007; Katz, 2003; Ling, 2004), there have been relatively few mentions of beeping or missed calls in the literature, and even fewer in-depth investigations.

In their overview of Finnish teens' mobile phone behaviors, Oksman and Turtiainen (2004) describe "bomb calls," calling them a "recodification of the ring tone through mutual agreement." They explain that "these no-calls are made to get attention, for amusement, to save money, or to communicate through a system devised for the purpose" (p. 327). The researchers suggest that bomb calling was particularly popular among young teens in the earlier period of mobile diffusion in Finland, but that the practice was viewed as "childish," even by older teens.

Reports from the economic development community suggest that the practice is common across many African nations (Chipchase & Tulusan, 2007; McKemey et al., 2003; Oestmann, 2003; Samuel, Shah, & Hadingham, 2005) and is not limited to teens. Slater and Kwami (2005) describe flashing as both an economic and symbolic practice, noting how "Michael, a man who flashes the same five people every morning, is not merely keeping in touch but also discharging obligations and responsibilities" (p. 10). Sey (2007) describes flashing in Ghana as one of a set of cost-saving strategies developed by users. Others note that beeping conventions in Africa differ between men and women (Alhassan, 2004; Chango, 2005).

Researchers have observed the practice elsewhere in the developing world. Aminuzzaman (2005) and Chakraborty (2004) each describe the messages conveyed by "miss call culture" in Bangladesh, citing examples of coded beeps and those that simply mean "I'm thinking about you." A large survey in India and Sri Lanka found frequencies of missed call use ranging from 10% of light users in Sri Lanka to 35% of heavy mobile users in India (Zainudeen, Samarajiva, & Abeysuriya, 2006). Pertierra and his colleagues (2002) report that some Filipinos "'miscall'…to remind friends about unanswered texts. Prudent texters do it to save credit" (p. 89) Barendregt (2005) observes the same process in Indonesia, "where it is called *memancing* or fishing" (p. 56).

Bar et al. (2007) refer to beeping/flashing as a notable example of appropriation in Latin America, in which users do "new things in new ways" using technologies available to them (p. 26). Horst and Miller (2006) describe social practices surrounding the "call me" feature provided by Jamaica's Digicel. The feature essentially replicates a beep in text form, allowing users low on credit to send a few free texts per month to other subscribers, requesting a callback. They cast the company's actions as a response to a "micro-economy of credits" and suggest that in so responding, the company has helped Jamaican mobile users create and maintain broad-reaching, intertwined social support networks.

Pagers, of course, allow their owners to receive requests for a callback wherever they might be. However, pager use has also received relatively little scholarly attention; exceptions include studies of the pager's uses and gratifications (Leung & Wei, 1998) and its symbolic functions (Kotamraju, 2003). Yue (2003) considers the evolution of a distinctive pager culture in Singapore, while Okada (2005) traces some of the antecedents of Japan's mobile messaging/SMS boom to the widespread use of pagers by teenagers in the mid 1990s.

Other techniques to send free messages make use of the landline infrastructure. For decades, landline users in the U.S. and elsewhere have been able to place an operator-assisted collect call, in the hope that the

target will either accept the charges or reject them and call back at a cheaper rate. Haddon and Silverstone (1996, p. 67) describe another low-cost "signaling system" among the elderly, including between one interviewee "and his new lady friend":

Frank Payne: I telephone her every evening to see that she's all right and if she's coming here, which she does a couple of times a week—we've got it down to a bit of a fine art—she rings me, I let it ring three times and then she hangs up. So I know that a) she's coming, b) she's OK. And when she leaves here, she does the same; she gets home and the first thing she does is rings me three times and then I know that she's home.

To save money and still maintain a relationship at a distance, the couple had pre-negotiated an instrumental meaning to their intentional missed calls—differentiated in this case from any other calls by the specific number of rings. The discussion will return to Frank later and consider why this cost-saving behavior has blossomed so dramatically in the 21st century.

Interview Participants

This study primarily draws on interviews[1] conducted in September 2004 with owners of small and informal businesses in Kigali, Rwanda. The interviews were originally designed to augment earlier findings on the social and economic impacts of mobile telephony on small enterprises in Rwanda (Donner, 2006b); other results from the interviews are reported elsewhere (Donner, 2006a). Participants were selected primarily to reflect an array of small enterprises, and thus, are not representative of all mobile users in Rwanda. However, during the interviews, beeping emerged as a concept worthy of particular exploration, and the results are presented here as a preliminary assessment of the practice.

Most of the interviews were conducted in local languages (Kinya-rwanda or Luganda) with the help of a translator. Additional interviews with two university students captured the perspective of a different segment of the population. All interviews with the business owners were recorded, transcribed, and translated for later analysis.[2] Table 1 lists the participants and their vocations:

Annette, Arts & Crafts Vendor (F)	Speciose, Tailor (F)
Lillian, Restaurant Owner (F)	Rasirsa, Jewelry Maker (M)
Fred, Plumber (M)	Yousef, Mechanic (M)
Immanuel, Dairy Sales (M)	Angel, Market Stall Owner (F)
Innocent, Garbage Collector (M)	Liban, Taxi Driver (M)
James, Baker (M)	Nicole, Computer Science Student (F)
Patrick, Chicken Farmer (M)	Filicien, Marketing Student (M)
Celestine, Traditional Healer (M)	
Summary: 5 Women, 10 Men. 13 Small Business Owners, 2 Students	

Table 1. List of participants

As in most nations in sub-Saharan Africa, mobile penetration in Rwanda (1.6 lines per 100 people at the time of the interviews) is a fraction of that in higher-income nations, but it is growing quickly, particularly in the urban areas, where mobile use has eclipsed that of landlines (ITU, 2004). In Rwanda, mobiles are perhaps the single most advertised product—a symbol of prosperity and individuality in a nation still coping with the aftermath of the 1994 genocide. Fueled by prepaid cards, which allow users without bank accounts or lines of credit to use mobiles and by a steady addition of towers on its many hillsides, many of Kigali's residents have embraced the mobile as part of daily life. Their usage patterns, including beeping, are likely to be similar to those found throughout sub-Saharan Africa and elsewhere where mobiles are replacements for, rather than complements to, landline telephones (Hamilton, 2003).

In 2006, Rwanda's gross national income (GNI) per person was $230. That sum goes further in Rwanda than in Washington or London, equivalent to $1320 when one considers "purchasing power parity" (World Bank Development Indicators Database, 2005). However, at the time of the interviews, a used mobile phone sold for $50—a large sum of money for most Rwandans. Mobile use is also expensive. Outgoing calls in 2004 cost a minimum of $.20 per minute, text messages, roughly $.10. Most users pre-purchased credit in increments of $2, $5, or $10. In addition, all Rwandan prepay users purchased "access" on a monthly basis for approximately $2.50, which represents the minimum outlay per month for the privilege of sending beeps and receiving calls. Skillful beepers can stretch that $2.50 quite far. The sums involved are not large, but over the course of a year, a user who bought a $50 handset and paid only for access would spend $80—nearly 35% of GNI per person. Although not as large as food or housing, household expenditures on mobile phones are nontrivial and must be managed carefully (Ureta, 2005).

A Repertoire of Beeps and Rules for Their Use

This section details three major kinds of beeps and the rules governing their use, as derived from the conversations with the interview participants and supported by the previous literature.

Callback Beeps

Beeps can be used to "request" that a recipient return the beeper's missed call with a voice call. Why do such a thing? Rasirsa the jeweler explains: "Here in Rwanda people are not rich enough to call every time. That is why they beep you. Many people only have access cards. When they want to call someone, they go to a public kiosk or use their mobile to beep someone…it is cheaper." These *callback beeps* seem to be the most common.

Pre-Negotiated Instrumental Beeps

Many participants cited examples of beeps used as prearranged, shorthand codes. One comes from Liban, the taxi driver, who said "There are times I can give my wife a ride and I leave her somewhere, then we'll agree that when I am back at the spot, I'll just flash her number…she meets me there without calling." Nicole, a university student, suggested that her friends send "reminder" beeps to each other to signal that a class or a test has begun. The beep means, "the test is now" or "where are you?" Some people arrange more complex codes, designating one beep to mean one thing, and two or three beeps to mean another (Mutung'u & Gakuru, 2006). These can be called *pre-negotiated instrumental beeps*.

Relational Beeps

Some users send another kind of beep, expecting no reply or action on the part of the recipient. Nkrumah-Boateng writes:

Sometimes, very much like a rhetorical question, one is not supposed to call back after receiving a flash. This is where the sole purpose of flashing someone is just to say 'hello, how are you doing?,' or 'goodnight.' The idea, apparently, is to communicate without spending units to call or send a text message. This appears to be a common trend on the university campuses and among the youth. (2004, n.p.)

Filicien, a university student, compared these beeps to waving. His classmate Nicole added, "Sometimes I just scan through the mobile phone book and see who I have not seen in a while and beep them. Sometimes they call back, but I don't expect it."

This kind of beep is perhaps particularly attractive to shy teens, who can express interest in another person without having to compose a customized message. Users may reciprocate these "waves" with a reply beep, but sometimes no reply is required or expected. Angel, the market trader, received one such beep during her interview, from a relative who had purchased the mobile for her. Immanuel, the dairy merchant, also beeps his family in this way. These are *relational beeps*.

Rules

Rule 1: Send Callback Beeps to People with More Money

Regarding the most common kind of beep—the callback beep—there are clear conventions as to who should and should not beep. The negotiation centers on who should pay for the voice call. Upon returning to Ghana, Nkrumah-Boateng learned this rule from his cousin:

> Noticing my confusion, she laughed and patiently explained it all to me…Obviously, because I had just come home from abroad, the automatic assumption was that I could afford to call her back. (2004, n.p.)

Such calculations are not restricted to interactions between friends and family. In a media interview, telecommunications expert Andrew Dymond called this the "richer guy pays" rule; he suggests that it is part of "the accepted way of doing business in Africa" (York, 2002, n.p.).

Employers and employees represent a special case of "richer guy pays." Generally, employees can beep employers to request a call back, as long as the resulting call is about business matters. Indeed, Innocent purchased used handsets for each employee of his garbage-hauling business, providing only enough access to allow for beeping and transforming the handsets into one-way call receivers. He encourages his employees to beep him to stay in touch, but says he ignores the beeps on days when his employees are not working.

Rule 2: Send Callback Beeps to Friends and Family When You Have Run Out of Minutes

Among equals who trust each other and call each other often, the "richer guy pays" approach may not apply. Instead, there is an understanding that if one person runs out of money on his or her prepay account, he or she can beep the other. Husbands and wives can do this, or, as Fred, a plumber, notes, colleagues: "I beep people I work with so that they call me when I don't have money."

Rule 3: If You Are Asking for Favorable Treatment, Do Not Send a Callback Beep

In the course of daily life, there are occasions where it is important to start off with a good impression or to keep a favorable impression. The subtle obligations and expectations that tie people together influence when it is acceptable to send a callback beep, even beyond the "rich guy pays" rule. Two examples—customers and courtships—came up in the interviews. Patrick, a supplier of live chickens to restaurants, explains: "With customers I have to take care, because it's me who wants their orders, and mostly they can't spend their airtime on me, so it's me who always calls. I can't beep them." Like supporting a toll-free number in the U.S., some Rwandan customers expect their suppliers to foot the cost of communication.

Lillian's lunchtime customers at her restaurant beep her daily, demanding a callback. She explains, "Customers beep to check on whether there is food left. Some are customers who are going to bring me money. So, when I see a number that I know, I have to call back, so I use a unit or two. They are some whom I don't call back because they have nothing constructive [profitable] to tell me." Like Patrick, Lillian says she never beeps customers.

There are exceptions. James is a baker. His client at the local university accounts for half his business. He sometimes beeps this client when he is low on airtime, but tries to keep it to a minimum so as not to abuse the trust they have built up. As described above, Immanuel's rural dairy suppliers beep him, because they think he has more money than they do. He explains: "The supplier only calls when he wants to be paid."

Romance and beeping have their own rules (Alhassan, 2004; Chango, 2005). Nkrumah-Boateng (2004) observes, "No self-respecting man would dream of merely flashing his wife or girlfriend…Never mind the fact that it was Sugar Daddy himself who bought the phone and regularly buys her units" (n.p.). Filicien makes a similar point:

If you are chasing after a lady, you cannot beep. You have to call. Beeping is for friends. When a girl you do not know well beeps you, you have to call back if you are interested. You cannot even text. She has to see that the effort is being made. Borrow a friends' phone if you do not have airtime.

Also single, Fred puts it bluntly: "I don't beep girls because it's me who needs them." In Jamaica, Horst and Miller (2006) found a similar attitude: Male suitors who sent a "call me" message to their prospective partners were considered "cheap" (p. 120).

Rule 4: Do Not Beep Too Much

A second beep between two people who know each other can remove confusion as to whether the beep was intended to request a callback or something else. If beeping from a number that the recipient will not recognize, the beeper must be prepared to beep multiple times just to get a response. Immanuel explains: "When the number is not programmed in my mobile, I can't call back, but if he/she insists, beeping me again and again, I finally call back." Filicien reiterates the unwillingness to return calls from unknown beepers: "Recently, someone has been beeping me, but I don't have his name. If it were really important, he'd call."

But Innocent, the garbage collector, complains that his daughter beeps "too much," and Filicien explains: "There is gossip if someone beeps too much. If my friend beeps once in the morning, I smile. If she does it two or three more times in the day, and is doing it to others also, it gets bad." Indeed, it may be a *faux pas* to force others into calling you back to talk about nothing in particular. In Uganda, Pajero (2004) complains, "In 99.99% of the time, there is even no serious issue to beep you about. It is a beep and when you call back someone simply asks: 'Where are you?'" (n.p).

Beeping and Adaptive Structuration Theory

This article has combined primary interviews with secondary accounts in the popular and economic development media to detail the "rules of beeping." Together, these sources reflect the existence of a complex and widespread phenomenon, which could be examined from a variety of perspectives. Although this discussion will briefly consider some cultural and linguistic implications of beeping, its primary focus is at the socio-technical level, on the interplay between social structure and technology that has enabled the spread of the practice across the developing world. In that vein, the analysis turns first to a discussion of adaptive structuration.

Simultaneous, Multi-Regional Adaptation of a Communication Technology

Beeping is a widespread, transnational adaptation to (or appropriation of [e.g., Bar et al., 2007]) the basic mobile/cellular infrastructure. Rogers (2003) provides one perspective on this adaptation via the "reinvention" process within the diffusion of innovations theory, according to which users modify technologies for their own purposes. In the case of beeping, however, users have created a set of distinct social practices around the technology, rather than altering the technology itself. Thus, a better lens might be adaptive structuration, which accounts for complex interplay among individual action, social structures, and information and communication technologies (DeSanctis & Poole, 1994; Yates & Orlikowski, 1992). According to this model, users select and amplify particular features of a technology, which in turn helps shape how the technology will affect the structure of the group. At the same time, preexisting group norms influence which features are selected and how they are used. In this way, the system, comprised of both technological features and group structures, evolves over time (Contractor & Eisenberg, 1990). Using this general perspective, it is possible to identify distinct genres of communicative practice—sets of scripts or "interaction templates" for common forms of interrelated mediated communication messages (Ling & Julsrud, 2005; Orlikowski & Yates, 1998).

The adaptive structuration model has traditionally been applied to emergent practices within organizational settings. In the present case, the settings in question are much broader—the streets and homes of Delhi and Dhaka, of Kigali and Kinshasa—but mobile telephony has emerged so quickly in the developing world that it is not unreasonable to consider an entire nation as an organization of sorts, developing the social practices to accompany a rapid introduction of a new technology. Thus, adaptive structuration is a helpful model to explain the growth of beeping; the model accounts for the interplay between users (in this case, a sudden growth in resource-constrained new mobile owners) and the technologies available to them (in this case, the introduction of the call log, the address book, calling party pays, and the pre-paid account). These two broad shifts in the telecommunications landscape are intertwined to the point where it is impossible to attribute a clear causality to the growth in beeping. However, adaptive structuration suggests that without both shifts, it is unlikely that beeping (or flashing, pranking, etc.) would have so many names, or be so pervasive on mobile networks around the developing world.

Changes to the User Base

It seems unlikely that the beepers in Rwanda or the Philippines learned directly from the "bomb calling" of teens in Finland (Oksman & Turtiainen, 2004) or the cost saving landline strategies of Frank and his lady friend in the U.K. (Haddon & Silverstone, 1996). It is curious, however, that neither Frank and his lady friend nor Haddon and Silverstone had a particularly evocative name for the practice beyond a "signaling system." It is only now, in the midst of a sudden surge in accessibility of telecommunications services over a much broader range of the planet, that this practice has exploded, has been named (beeping, bombing, fishing, pranking, flashing, missed calling, etc.), and has entered into the popular discourse of countries around the world. No matter what kinds of messages are exchanged—callback, pre-negotiated instrumental, or relational—the most important point of commonality is the desire to lower telecommunications expenses in the face of economic constraint (McKemey et al., 2003; Sey, 2007; Zainudeen et al., 2006). What Zainudeen et al. (2006) call "telecom use on a shoestring" is more common than ever; much of the growth in the mobile phone market in recent years has come in developing countries, where users, many on quite modest incomes, are buying mobiles as their first telephone, rather than as a complement to landlines at home and/or at work (Hamilton, 2003). More likely to be operating under conditions of economic constraint, these new users are also more likely to beep.

Changes to the Technology

Differences in both the mobile handset hardware/software and the billing structures offered by mobile providers, as compared to landlines, have also helped create the conditions for a beeping explosion. On the handset itself, beeping is supported by an interaction of the call log—which records missed calls in addition to completed incoming and outgoing calls—and the address book, which associates many of the missed calls with a recognizable name. Contrast this utility with that offered by landline technology, which until recently had not allowed for widespread use of Caller ID. The ring of a traditional landline phone carries no details; all calls are equal, because one never knows who is calling (Ball, 1968). Thus, individuals trying the trick with landlines have a more limited range of options; a family with three children, for example, might never know which one was calling to request a callback. Frank and his lady friend could only use the trick with each other. (That said, people without a mobile of their own can and do beep from public payphone/landlines and from mobiles borrowed from friends.)

Another factor in the spread of beeping in the developing world is the evolution of a billing/tariff structure with two common (albeit not universal) characteristics: a) a pervasive pre-pay card system, which makes each distinct call valuable and creates situations where a user lacks the credits on his mobile to make a call; and b) the "calling party pays" system, which encourages users to receive long calls and make short calls (Robbins & Turner, 2002). In India, for example, 88% of the 185 million mobile users in June 2007 held prepay accounts; GSM users spent an average of 297 rupees (roughly US$7.50) per month (Telecom Regulatory Authority of India, 2007). Together these conditions encourage the development of cost-saving strategies (Haddon, 2004; Sey, 2007; York, 2002; Zainudeen et al., 2006). Some, particularly the "rich guys," are pressured to pay for a larger proportion of their voice conversations, while others, the more successful beepers, may not pay much at all.

Pre-existing Social/Cultural Factors

Beeping behaviors have been enabled—but not entirely predetermined—by these shifts in the telecommunications landscape and user base. The interviews suggest that existing social norms also influence beeping rules. For example, emerging expectations like "rich guy pays" and "women do not like beeps from suitors" reflect norms of economic hierarchy and gender roles that existed long before mobiles came along. In terms of network structure, too, it appears that beeping helps amplify and strengthen existing relationships, rather than enable new ones (Harper, 2003). Beeping works best with people whose phone numbers are programmed into each other's phones—with call partners that are likely to be strong ties, rather than weak ones (Donner, 2006b).

Synthesis and Evolution

Another tenet of adaptive structuration theory is that the interplay between users and technologies shifts the equilibrium of a system's use patterns over time. Indications of this evolution can be seen in two areas in the case of beeping. First, there is evidence that providers are trying to encourage alternatives to beeping *within* their networks to increase overall network traffic, but in ways that are less burdensome to the network than the missed call. In Tanzania, Vodacom's network offers a free SMS which allows users to request another Vodacom subscriber to call the sender back; interestingly, the service is capped at three "please call me" messages per day. Horst and Miller (2006) describe a similar call-me-now service in Jamaica, and Sey

(2007) describes attempts by Ghanaian mobile carriers to educate users as to when (and how much) to flash.

Second, beeping's prevalence may be having an influence on individual behaviors and communication norms. Interview participants mentioned a form of beep fatigue, which led in one case to turning off the caller ID function and an erosion in the desirability of the coveted "083" designation (in Rwanda) as a monthly contract holder and one who would always have credit to pay for a call. In addition, the popular articles mentioned above indicate a widespread normative backlash against unnecessary beeping.

At the same time, experienced users are training new users in the rules of beeping on a daily basis. For example, Nicole sends (pre-negotiated instrumental) beeps to confirm the receipt of a text message. "Sometimes people don't get this at first, then after one mistake, it works…With new people, it is tricky. They need some orientation." She explained that new users also tend to call back too frequently when they get a relational beep, but later relax. Not so her aunt: "Whenever I beep her, she calls back! She does not get many beeps. So, I never beep to just say hi. Now I only call with a reason." Speciose, the tailor, needed no training. After saving for months, she purchased her first mobile (her first telephone of any kind) earlier that year. Having observed others, she was prepared to beep from day one: "After buying it, I beeped lots of friends and family to show them that I had a mobile. Some called back and some, I called." Although the phenomenon seems to be worldwide, people learn it from each other, through observation and interactions. Global in scope, the behavior is local and viral at its core.

Beeping in Context

The previous section applied adaptive structuration theory to explain the emergence of beeping in the developing world. The discussion that follows raises three additional points: (a) despite some similarity to text messages, the practice is a distinct form of communication; (b) contextual awareness (by users and researchers alike) is the only way to ascertain the meaning of beeps; and (c) at the same time, beeps help reinforce and re-structure the social contexts in which users are situated.

Similar, But Not Equivalent, to Text Messages

Both the *callback* and *pre-negotiated instrumental* beeps have direct analogues in text messaging (SMS), a behavior which has been studied more extensively (Harper, Palen, & Taylor, 2005; Ling, 2004, Pertierra et al., 2002). Each day, countless "coordinating" text messages are sent, imploring their recipients to "call me back," or "pick me up now" (Ling, 2004). Similarly, Ling identifies a second class of SMS messages whose function is "grooming," rather than coordination. These messages serve to nurture or reinforce relationships between friends, family, or romantic interests (Ellwood-Clayton, 2003; Taylor & Harper, 2003; Thurlow & Brown, 2003). Like grooming SMS messages, relational beeps are a form of "phatic" communication (Malinowski, 1923), where messages (words or utterances) are used to signal and reinforce a relationship.

However, beeps differ from text messages in two ways. First, beeps are free, which is likely to lead to different decisions about when to beep, as opposed to texting or calling, for which a fee is charged. Second, beeps themselves have no unique content—the message is simply that x called at y time. It rarely stands on its own without some contextual or relational cues to support it. For these reasons, the beep/flash/missed-call should be considered as another tool in a repertoire of communication options (Haddon & Vincent, 2005).

Further research on the role of the beep in the communications repertoire could explore the criteria or factors individuals use to decide when to beep versus when to call or send a text message.

Context is Required to Interpret a Beep

As mentioned above, there is a trade-off between the ambiguity of the content-less beep and the higher price of a (clearer) SMS or voice call. With the exception of sequences (one beep means one thing, two means another…), all beeps look alike. To senders and receivers, however, the distinctions among the beeps are surprisingly clear, based on what they know of the situation, the time, and the people involved in the exchange. Thus,

> *Beeps are constrained to specific relationships*: One could, in theory, beep anyone, but the beeps described by the interview participants were rarely random. Filicien says it best: "You can't just beep. Only when they know it. Only when there is an understanding."
> *Beeps vary across relationships*: As Immanuel explains, a beep can mean the exact opposite of the one before it. In his case, some of his dairy farmers beep to say, "there is no milk," others to say, "there is milk." The only difference in what Immanuel sees is the number on the missed call log; he

uses his knowledge of the relational context and the meaning of past beeps to determine which beeps "mean" what.

Beeps vary within a relationship, according to context and time: Patrick's case illustrates how multiple beeps from the same person can mean different things during the course of a day: "When my wife sees a morning beep, she knows I am just saying 'hi,' but if my wife beeps me twice in the late evening, I know that she is done with her work and then I always go to pick her up. I always call back if she beeps more than once."

On occasion, misunderstandings arise. Nicole reported that sometimes her friendly beeps are misconstrued and that instead of a return beep she gets calls from friends; however, she can explain it to them, and it rarely happens twice. Immanuel sometimes gets confused:

Some suppliers beep me when they want to tell me that there is no milk, and that I should not send my truck; some suppliers beep me when they want their money, and others may beep when they want to say hi or we miss you. There are times I am mixed up and I cannot figure it out what it means. If the number is not programmed, I get confused. When there is no milk and all of a sudden I receive a beep, I just expect that it's those guys who want to tell me that there is milk now…it really frustrates me if I call and I don't hear what I wanted to hear.

Both the reliability with which most beeps are interpreted and the counter-examples provided by the descriptions of the occasional errors illustrate that like car horns before them (beeps in a more traditional sense), beeps mean different things to different people at different times. They are digital homonyms; the differences in meanings are delineated in the minds of the sender and the receiver. In this way, beeping is a new illustration of an established sociolinguistic perspective, namely, that many communication exchanges simultaneously rely on and reinforce relational and contextual cues (Hymes, 1964) and that the rules governing their forms and flow, including sequences and responses, are "locally managed, party-administered, interactionally controlled, and sensitive to recipient design" (Sacks, Schegloff, & Jefferson, 1974, p. 696).

In future research, ethnomethodological or conversation analysis (Sacks et al., 1974) approaches could productively be applied—for example, in a turn-taking analysis (Arminen & Leinonen, 2006) and/or further examination of the situatedness of the "rules" (Brown & Perry, 2000; Murtagh, 2001) of beeping (and their evolution and reinforcement over time). One potentially fruitful approach might be to examine what occurs when the rules of beeping are violated—what social penalties or stigmas follow? How are deviant beepers treated by those around them?

Beeps Reveal and Reinforce Social Contexts

More broadly, all beeps, including pre-negotiated instrumental and the most common callback beeps, reinforce and shape the relational structures between communication partners: between husband and wife, employer and employee, customer and supplier, and so on. Callback beeps, for example, serve as a vehicle for micro-negotiations or micro-affirmations between two actors about who has more money (and more status). The accumulation of "phatic" Malinowski, 1923) relational beeps serves to reinforce perceptions of popularity, intimacy, and acceptance. Even pre-negotiated beeps serve to remind the sender and receiver of their common bond—their secret, specific, "restricted" code (Bernstein, 1971) that they share with one another.

One of the interview participants began his explanation of beeping with the phrase, "You see, in Rwanda, we have a culture." Indeed, beeps may also reinforce a sense of shared national identity—although the practice is transnational and widespread, users may not *perceive* it that way. Whether in a book about "How to Be a Kenyan" or in the online observations of a Ghanaian returnee, the popular articles discussed earlier treat beeping as a distinctly national phenomenon, not as an import that arrived with the mobile.

Future research could use beeping as a new lens for examining complex social contexts and relationships. An example of this approach is Horst and Miller's (2006) analysis of the patterns of use of the "micro economy of credits" around the "call me" feature in Jamaica. Another approach would be to examine the practice's significance to the creation and maintenance of social capital (Coleman, 1988; Goodman, 2005). As beeps reflect and reinforce relationships (rich guy, spouse, employee, friend, etc.), they become a new part of an ongoing re-negotiation of a beeper's location in a social structure and of the resources available to him or her. Despite the commonalities stressed by this study, a closer examination of differences in beeping across various cultural or social-structural contexts would likely prove fruitful.

A Beep for Many Occasions

Some of the contextual analyses described above could shed further light on beeping's use as part of a communications repertoire. Like others (McKemey et al., 2003; Sey, 2007; Zainudeen et al., 2006), this study asserts that beeping has a strong cost-saving rationale and that it may be more popular among people of modest economic means. However, anecdotes from Africa (Pajero, 2004) and India tell of prosperous government ministers and captains of industry engaging in the practice, as well. Apparently the head of

India's Cellular Operators association and the chairman of one of India's largest telecommunication companies exchange (*pre-negotiated*) missed calls when they do not want to disturb each other (Kurup & Gupta, 2007). Similarly, this researcher has observed colleagues using beeps to exchange contact information while standing right next to each other—a beep motivated by convenience, not cost.

One can also imagine scenarios where people are compelled to use beeps, but for non-economic reasons: People who are illiterate, or speak languages not supported by handsets, may use beeps in contexts where SMS messages are impossible. The same person could beep sometimes to save money and other times simply because it is convenient. These counter-examples point to a clear need for research designs that examine the importance of cost-saving relative to other motivations for beeping and do so across a wider range of beepers and non-beepers than this small study has done.

At the same time, economic incentives—the desire not to pay for a phone call—have played a major role in wide propagation of beeping behavior in the developing world. As the adaptive structuration lens applied by this paper helps illustrate, the interplay among user needs/motivations, technological factors, and billing structures can vary across regions. The technical and billing conditions were in place for beeping to become popular many years ago in prosperous Europe, where calling-party-pays is the norm and prepaid plans are not uncommon, yet the practice is not as widespread there, probably because user motivations and social norms were different. In contrast, that the practice has now become acceptable even to captains of industry and government ministers speaks to its ubiquity and tenacity in the regions where it has become established as mainstream practice.

Research Implications for Policy and Industry

Additional research would help strengthen (or challenge) the preliminary conclusions arising from this study's application of adaptive structuration theory and may be interesting for audiences with concerns beyond socio-technical theory.

First, researchers interested in telecommunications policy, pricing, and system design might usefully undertake a quantitative assessment of the prevalence of beeping on various networks around the world. Traditional or constructed predictors around economic constraints (for example, the price of a call as a proportion of GNP per capita), as well as topic-specific indicators such as the relative prominence of "calling party pays," prepay flexibility, and the ratio of landlines to mobiles may also impact the prevalence of

beeping. For example, as some markets replace fixed-denomination recharge cards with variable-denomination virtual top-ups (Smith, 2004), users may run out of credit less frequently, which in turn may alter their desire (or excuse) to beep. Similarly, the introduction of load sharing and airtime transfer systems may reduce beeping, as people can turn to friends and family to recharge their account even at times when they have no money available.

Second, this study's delineation of callback versus relational versus pre-negotiated beeps helps distinguish beeps that will eventually result in a voice call from those that will not. This has implications for providers, as they grapple with high levels of beeping on their (often strained) national networks. It also has implications for policy: Since beeping is particularly valuable to users who have the fewest resources to spend on telecommunications, it may be a way to spread connectivity and increase teledensity. The consultancy firm Gamos (McKemey et al., 2003) suggests that beeping adds value for end users by prompting more overall communication and by effectively redistributing payment for those calls to those who can afford it. Because of interconnection and termination charges, carriers can earn money on both incoming and outgoing calls and thus might be happy to facilitate callback beeping.

Finally, the study suggests directions for design at the handset and software levels. Taylor and Harper (2003) argue that basic mobile handsets do not have the memory to store all the text messages teens receive and exchange, although teens might value this feature. Similarly, might teens in beeping environments value a running list of the number and times of the beeps coming from each person in their address book? There could be advantages to customizing handsets, software, and network services in ways that allow users to manage their beeping behavior more effectively or give them opportunities to replace their beeping with other forms of communication.

Conclusion

Nkrumah-Boateng's (2004) opinion piece on the GhanaHomePage includes a call for scholarly inquiry: "Perhaps the Philosophy, Sociology, and/or the Economics gurus at [Accra's local university] can put it in technical parlance by way of an academic theory." This article has begun that process, identifying three major kinds of beeps (*callback*, *pre-negotiated instrumental*, and *relational*), as well as the rules governing their use. Haddon and Silverstone's (1996) work provides evidence that beeping has roots in landline practices. However, as the adaptive structurational analysis in this article has made clear, a combination of

technical and social changes associated with the spread of mobile telephony in developing nations has given new life and vibrancy to this old form. The various forms of beeps are governed by a common set of "rules" that are indicative of a broad, multi-regional practice.

This study of beeping is a first step. Further research is necessary, if only because the analysis of the behaviors of a small and non-representative sample of interview participants does not do justice to a worldwide phenomenon. Nevertheless, this study and its accompanying discussion have illuminated additional avenues for research from a variety of methodological and theoretical perspectives.

The study has argued that beeping is distinct form of communication, governed by and creating its own social structures. In that sense, it joins a repertoire (Haddon & Vincent, 2005) of voice conversations, texting, image-exchange, emailing, and even purely visual "display" (Lycett & Dunbar, 2000) facilitated by mobile telephones. Nicole's interview, in particular, raised issues with respect to the full range of meanings of beeps; she described using callback beeps, pre-negotiated instrumental beeps, and relational beeps all in the course of a day. Participants' discussions about when it is appropriate for suitors, friends, customers, and employees to beep (versus call or text) illustrate that there is a calculus at work in the minds of users that could be explored in more detail along the paths for further research suggested above.

The practice is still evolving, as carriers change policies and gently encourage their users to beep less frequently (Sey, 2007), and as new technologies such as balance transfer and mobile instant messaging become available. It is possible that beeping in the developing world will go the way of "bomb calling" in Finland (Oksman & Turtiainen, 2004), dismissed by more experienced users as a transitional practice. However, given that it has already spread beyond teen use into the general population, and given that a high proportion of the next wave of mobile users will live in low-resource settings, it is more likely that beeping will persist, both as a simple strategy to redistribute telecommunications costs and as a form of code which, intentionally or not, serves to strengthen relationships and reinforce social norms.

Notes

1. The research was conducted with the support of the Postdoctoral Fellows Program of the Earth Institute at Columbia University. The author is grateful to Joseph and Nicole for their contributions as research assistants during the fieldwork. Nicole was also an interview participant.
2. The interview participants gave permission to record their responses. They were instructed about the nature of the research and their roles and rights, in accordance with the guidelines of Columbia University's Institutional Review Board. Small enterprise participants' names have been changed to protect their confidentiality.

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