Bluetooth Friendly Names: Bringing Classic HCI Questions into the Mobile Space

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ABSTRACT
We explore the use of Bluetooth friendly names within the mobile space. Each Bluetooth-enabled device possesses a short string known as a 'friendly name' used to help identify a device to human users. In our analysis, we collected friendly names in use on 9,854 Bluetooth-enabled devices over a 7-month period. These names were then classified and the results analysed. We discovered that a broad range of HCI themes are applicable to the domain of Bluetooth friendly names, including previous work on personalisation, naming strategies and anonymity in computer mediated communication. We also found that Bluetooth is already being used as a platform for social interaction and communication amongst collocated groups and has moved beyond its original intention of file exchange.

Categories and Subject Descriptors
H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems; H.1.2 [User/Machine Systems]: Human Factors; H.5.2 [Information Interfaces and Presentation (e.g., HCI)]: User Interfaces; H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces

General Terms
Design, Human Factors

Keywords
Bluetooth, friendly name, mobile phones, mobile computing.

1. INTRODUCTION
Bluetooth is a short-range wireless communications protocol designed to allow mobile devices to easily exchange information between one another. In order to facilitate this communication, each device is given a unique hardware id. This identifier is a 12 digit hexadecimal number and as such is not designed for human use but rather by a computer. To make the device easily identifiable by a person, each device can also be labeled with a short '*friendly name*' which can be changed by the user at any point, and potentially many times over short spaces of time. Typically, out of the box, a mobile phone will use a default manufacturer friendly name normally comprised of the phone manufacturer's name and the model number.

Published by the British Computer Society
Volume 2 Proceedings of the 21st BCS HCI Group Conference
HCI 2007, 3-7 September 2007, Lancaster University, UK
Devina Ramduny-Ellis & Dorothy Rachovides (Editors)

Today there are over 1 billion Bluetooth equipped devices in use and it is expected that this number will double by 2009 [4]. Bluetooth is typically used on mobile phones, but it is not limited to them and can be used to interact with PDAs, computers, laptops, earpieces, keyboards and mice, for example. Bluetooth is typically enabled on personal devices, the overwhelming majority of which are portable and always in the presence of the owner. Bluetooth has a wide range of applications such as the exchange of personal contact information between phones and computers, exchange of pictures, video and other digital content and the synchronisation of personal information between portable and static computing devices.

Despite the technology's firm roots in the exchange of file-based media, we are increasingly seeing Bluetooth leveraged in more social applications. *Bluejacking*, for example, is a simple exploitation of the protocol to send unsolicited messages to Bluetooth enabled devices [17]. While essentially harmless, it can sometimes be used to socially engineer access to the recipient's device [3]. More recently some mobile applications have popularised the use of Bluetooth in social situations. The BlueTunA [1] application allows users to find music of interest on proximal Bluetooth enabled devices while Nokia 'Sensor' [10] and 'Serendipity' [6] are designed to enable socialising and dating amongst co-located groups. These solutions have, however, yet to gain mass adoption. As these applications gain traction, we expect that Bluetooth will rapidly transition from being seen as a file-exchange platform to a platform for social communication and interaction. There are however already small numbers of users leveraging Bluetooth for social interaction. This is typically achieved through the alteration of their friendly name to convey personal or demographic information, attracting others to interact with them (normally by sending a text message via Bluetooth.)

In this paper, we investigate the Bluetooth friendly name scheme as a means by which we can explore the degree to which Bluetooth is currently being used for social interaction. In our studies we uncovered novel and interesting applications of the Bluetooth friendly name, which stimulate further discussion of classic HCI research questions such as personalisation, the effects of anonymity and perspective in naming. We expect that in the next few years, with the anticipated greater adoption of Bluetooth, we will see it transition towards a new enabler of person-to-person computer mediated communication. These HCI issues are explored across a range of domains and will become more and more applicable to the mobile space as usage increases.

2. DATA GATHERING
Between August 2006 and February 2007 we collected a large log of Bluetooth data. A custom Java ME application was run continuously on a mobile phone during this period recording

each and every Bluetooth enabled device, which was encountered proximal to it. One person carried the mobile phone during their daily life, 24 hours per day, to naturally record Bluetooth encounters. Information recorded included the unique hardware ID of the device encountered along with the friendly name of that device (if available) and the timestamp of the encounter. Data was collected from a broad range of locations, however the majority were either on the University campus or in its vicinity, but also from trips abroad and visits to the city centre. Data was collected from a wide range of events including social events and conferences where high numbers of devices were encountered. At the end of the study, over 165,000 unique encounters with devices had been recorded over the 144 days. These encounters were recorded for 9,854 individual Bluetooth-enabled devices, which possessed 2,105 unique friendly names. Multiple devices possess the same friendly name and this explains the disparity in the two figures. Due to the nature of Bluetooth, demographic information could not be attributed to encountered devices or their users.

3. CLASSIFICATION

When the Bluetooth friendly names were analysed, each identifiable type was given a category to fit into a coding frame. By attempting to identify key attributes of the friendly names used to label devices, categories for coding were created. This activity was completed by two evaluators for inter-coder reliability [7]. This resulted in each of the encountered friendly names being assigned to one of 12 broad categories. The categories are outlined, with examples, in Table 1. A simple correlation co-efficient test showed 89% agreement between coders. The small degree of variance between coders demonstrates that the resulting framework was robust and the arrangement into categories was effective for the dataset.

4. RESULTS & DISCUSSION

The results, listed in Table 2, demonstrate some very interesting uses and issues relating to Bluetooth as a communication technology. The results are discussed in detail below.

4.1 Use of Manufacturer Default Name

From observational analysis, it was anticipated that a large proportion of the results would be found in the "Manufacturer Default" category. Almost 20% of all friendly names used were the manufacturer default and this correlates with the findings of previous studies which investigated vulnerabilities in Bluetooth [15]. It also highlights a problem for those wishing to interact with these devices. For example, in a crowded room, there may be several devices labeled "Nokia 6230i" so how does the user know which one they want to select? Additionally, it raises interesting questions about the general level of education of users about Bluetooth, and to why people are not personalising the friendly name on their devices. Are they, for example, unaware as to what Bluetooth is; that it is available and operating on their device; and that they can indeed customise the friendly name of their device?

4.2 Use of Person Name Combinations

The 'person name only' and 'person name and device' categories accounted for over 40% of the friendly names encountered. While one might expect that this is a reasonably unsurprising result, what is interesting about this category is the issues of naming for retrieval by self and others. Almost 26% of friendly names encountered specifically mentioned the type of device. There are two possible explanations for this. First and most simply, that the owner has multiple Bluetooth-enabled devices and wants to distinguish them clearly. Secondly, the owner may be attempting to specify as much detail about the

Table 1. Bluetooth Friendly Name Classification Categories and examples from the collected dataset.

Category Name	Explanation	Actual Example(s)
Manufacturer Default	Each manufacturer provides a default friendly name, which it is intended would be changed by the user. If the user is still using this name it is assigned to this category.	"Nokia 6230i", "BlackBerry 8100"
Person Name Only	When a user labels their device with their first (and/or last name) or some minor variation of this.	"Neil"
Person Name + Device	When a user labels their device with their first (and/or last name) and explicitly defines the type of Bluetooth device they own. This may simply involve defining the type but they may also provide the model number.	"John's Phone", "Alans Intel Mac"
Custom – Extravert	Those who labeled their device with something distinct, memorable and recognizable. The label was, also, deemed to be highly expressive.	"SWAT_SNIPER", "Beet Bopping Barry"
Custom – Intravert	Some of the labels given to a device appeared to be attempting to conceal as much information as possible. These include short strings, initials, blank names, or the use of punctuation solely as the name.	"DD", "?", "R.C."
Inviting Interaction	These names appear to be asking other Bluetooth users to engage in some activity with them. Often this is the exchange of files such as adult material.	"find me if u can", "Can u send me porn"
Declining Interaction	These names are explicitly declining any and all forms of interaction from other Bluetooth users. This may be perhaps as a result of *Bluejacking*.	"T630 Go Away", "F*** OFF!"
Provocative	These labels seemed to be designed to provoke annoyance, anger or some strong reaction but were not necessarily offensive in nature.	"Behind You!", "Your Ma!"
Offensive, Explicit or Sexual	These names, whether intentional or otherwise, have sexual connotations, and may be deemed to be offensive or explicit by someone viewing them. These include lewd and crass phrases and/or expletives.	"8 Inches", "9 Inches", "12 inches", "W***er",
Promotional	These friendly names are used to promote an event, company, product or a website.	"Traesti 4th Nov"
Popular Person / Character	These are devices which have been labeled using the name of a well-known person, such as a movie-star, or a popular fictional character such as from a TV show.	"Mel Gibson", "Ron Burgundy", "Batman"
Phone Number	User's belong to this category when they use a mobile phone number as their Bluetooth friendly name. These were recognized as starting with the typical dialing codes of 00353, +353, 086, 087 or 085 (the standard prefix dialing codes for mobile phones in Ireland)	"087 123 4567"

device to enable others to locate it with greater ease. The latter clearly relates to previous research on naming conventions. Pitman and Payne [12] explored such issues in relation to hierarchical file systems and naming of files for collaborative groups. They cited challenges to retrieval of files by name to be consistency and consensus of name choice, but also indicated that users adapt their naming strategies when they know they are intended for use by other people. It is likely that since Bluetooth is intended for communication, this will, to some degree, influence the naming strategy employed.

4.3 Use of Customisation (Introverted & Extraverted)

It was not anticipated that such a high proportion of encountered friendly names would be uniquely customised and personalised. 30% of all friendly names exhibited highly memorable "non-person" names (see Table 1 for explanation.) These names appeared to be counter-intuitive to general interactions and file exchanges envisaged for Bluetooth. It could be assumed that people seeking to interact with a specific device could anticipate a standard name, a name and device combination or a default device name, and so initially locating the intended device with a more expressive name might be more cumbersome. Alternatively, this result may indicate that the names in this category are, more often than not, designed for a subset of users (presumably close friends) who will easily recognise this nickname.

However, what it does clearly indicate is that the Bluetooth friendly names currently being used are very expressive and rich both in nature and language. It implies that these names have social importance and may be designed intentionally to be playful and meaningful within a collocated group or alternatively to replace some of the contextual cues, which are typically removed by computer-mediated communication. Pseudonyms are "*often chosen to hide explicitly identity yet simultaneously reveal a personal facet of the author*" [8]. This certainly appears to be the case in a large proportion of the Bluetooth friendly names encountered. Furthermore, a person may, for example, use this friendly name to influence their perception of others towards them within the mobile space. Previous studies have shown it not uncommon for users to alter their persona or even "gender swap" in computer-mediated communications (CMC) by presenting a particular image via the user's nickname [2]. Unfortunately the degree to which this may occur within the Bluetooth space is difficult to determine due to the inherent lack of demographic information afforded by the Bluetooth technology.

4.4 Use of Offensive, Explicit, Sexual and Provocative Names

Bluetooth like other forms of CMC lacks many contextual cues as to who the person behind the name is. Consequently, those interacting in this medium can gain greater social anonymity. Unlike traditional CMC, Bluetooth only allows interaction with devices proximate to the user (normally within 10m). Despite this, there is still difficulty in associating a person to a device, especially in crowded or public places. This preserves a relative degree of anonymity for the users and also removes features of social identity such as race, physical appearance and gender in interactions in the mobile space. It has been clearly demonstrated that this anonymity, combined with an absence of socio-emotional and contextual information, can often remove the social norms and conventions of face-to-face communication, opening the door to offensive or abusive language [9, 13, 14, 16]. Bluetooth brings this virtual anonymity to a new context of interaction and we can see that people are clearly using offensive names within this domain (over 3% of all names.) This result seems to be in line with previous work by Bechar-Israeli [2] in which 4% of IRC chat users adopted nicknames relating to sex or provocation.

It is also conceivable that these names were not intended to be offensive or provocative by their owners, but rather humorous or engaging. Previous work by Kruger and Epley [10] demonstrates that within e-mail, people engaged in communication inherently apply their own perspective in interpreting the emotional state of the sender from the message's content. The inability of communicators to accurately discern the intended tones and emotions conveyed is worrisome, and the authors indicate that this problem is not limited to email communications, but rather a wide range of communication's media such as instant messaging. It is reasonable to assume that similar factors may operate in interpreting Bluetooth friendly names.

Table 2. Distribution of 2105 Friendly Names.

Category Name	Number	Percentage
Manufacturer Default	374	17.77
Person Name Only	350	16.63
Person Name + Device	540	25.65
Custom – Extravert	519	24.66
Custom – Intravert	130	6.18
Inviting Interaction	13	0.62
Declining Interaction	6	0.29
Provocative	25	1.19
Offensive, Explicit or Sexual	46	2.19
Promotional	40	1.90
Popular Person / Character	57	2.71
Own Phone Number	5	0.24

4.5 Use of Names for Interaction

Only a relatively small number of friendly names relate to inviting or declining interaction. This is, however, particularly important as it clearly demonstrates that Bluetooth is not simply a means of file exchange between users but it also, and already, mediates social communication between small numbers of users. While less than 1% of encountered friendly names were explicitly named for interaction purposes, it can safely be assumed that there are more than this 1% actually interacting via Bluetooth, but they just have their device labeled with names belonging to other categories. These friendly names appear to be used to encourage relative "strangers" to interact, as opposed to people known by the owner. Although the reasons for this are somewhat dubious, we found that several of the encountered friendly names in this category were asking other users to send them material of an adult nature. The remainder of these names were often playful in nature, some inviting others to "Pick me, Pick me."

A very small number of friendly names encountered were very clearly declining any interaction from other users (see Table 1 for examples). An interesting question here is why would users choose to expressly decline interaction from others by altering the Bluetooth Friendly name as opposed to simply switching off Bluetooth on their device?

The results in this category demonstrate that Bluetooth is being used over short ranges to allow people to communicate and interact socially. While this may currently be limited to a small subset of "early adopters," we anticipate that the social aspects of Bluetooth will increasingly be exploited, and that interactions via Bluetooth will increase over the next few years.

4.6 Use of Mobile Phone Numbers

Despite an extremely small number of user's belonging to this category, it does raise some serious concerns about personal security and privacy on mobile devices. Once the device has been labeled with a mobile number, personal information typically not exposed by Bluetooth is available to anyone within range of them. Perhaps the Bluetooth device owner is simply unaware that they have made their number available via Bluetooth. More worrying is that it may potentially leave them open to social engineering. Interestingly, using a numerically based friendly name may defeat the purpose of the friendly name concept. By replacing the 12 digit hardware ID with a phone number (between 10 and 14 digits in length and only even potentially recognisable to a small group of close associates), the Bluetooth device may no longer 'human readable' and may cause issues for those wishing to locate it and interact with it.

5. FUTURE WORK

We are currently collecting an extended set of Bluetooth friendly names and have several participants actively using the Bluetooth logging device. Once a sufficiently large and diverse set of data has been collected we will explore some of the issues outlined in this paper in greater detail. This is likely to involve the detailed lingual and affective analysis of the friendly names, which have been encountered. We are also considering means by which demographic information may be collected on Bluetooth users to add further value to this analysis. We also wish to explore the effect of setting and social context on choice of friendly name.

6. CONCLUSIONS

As Carroll [5] suggests a person's name choice reflects the idiosyncrasies of their own cognitive system. As expected a wide variety of friendly names for Bluetooth enabled devices were encountered. These fell into 12 broad categories and exhibited very interesting characteristics. Most interestingly, we can see that there appear to be three characteristics in the naming styles applied: first, the majority of users name with their own first and/or last name in order to allow broad interaction with the device (Person Name Combinations); second, some users seem to use nicknames to limit knowledge of ownership of the device to a small subset of users who will recognise the 'handle' or to preserve relative anonymity within the mobile space (Custom - Extravert); and finally, a very small number of users attempt to completely obfuscate their "friendly name" to completely maintain their anonymity and perhaps to avoid some interaction with others (Custom - Intravert).

We have also clearly demonstrated that these naming choices and conventions beg further and more detailed investigation, and that many HCI studies relating to personalisation, perspective, naming choices for self and others, anonymity, identity and computer mediated communication, will if not already, increasingly apply to Bluetooth and the mobile space as it evolves into a collocated social interaction platform.

7. ACKNOWLEDGMENTS

We would like to thank the Irish Research Council for Science, Engineering and Technology and Science Foundation Ireland under grant number 03/IN.3/I361 for support.

8. REFERENCES

[1] Baumann, S., Jung, B., Bassoli, A. and Wisniowski, M. BluetunA: let your neighbour know what music you like. *In Extended Abstracts of Conference on Human factors in Computing Systems (CHI '07)*, (San Jose, USA, April 2007). ACM Press, New York, NY, 1941 – 1946.

[2] Bechar-Israeli, H. (1995) From <Bonehead> to <cLoNehEAd>: Nicknames, Play, and Identity on Internet Relay Chat, *Journal of Computer-Mediated Communication*, 1, 2 (Sept. 1995).

[3] Bialoglowy, M. Bluetooth Security Review, Part 1. (Apr. 2005) Retrieved from: http://www.securityfocus.com/infocus/1830

[4] Bluetooth SIG. *Bluetooth Technology in Hands of One Billion*. (Nov. 2006) Retrieved from: http://www.bluetooth.com/Bluetooth/SIG/Billion.htm

[5] Carroll, J.M. What's in a Name? An Essay in the Psychology of Reference. W. H. Freeman and Company, New York, 1985.

[6] Eagle, N. and Pentland, A. (2005), Social Serendipity: Mobilizing Social Software. *IEEE Pervasive Computing, Special Issue: The Smart Phone*. (April-June 2005), 28-34.

[7] Gwet, K. Handbook of Inter-Rater Reliability, Gaithersburg,StatAxis Publishing, 2001

[8] Jaffe, J.M., Lee Y.E., Huang, L. and Oshagan H. Gender, Pseudonyms, and CMC: Masking Identities and Baring Souls. *Paper presented at the Annual Conference of the International Communication Association,* (1995) Albuquerque, New Mexico. Available: http://research.haifa.ac.il/~jmjaffe/genderpseudocmc/.

[9] Kiesler, S., Siegel, J., and McGuire, T.W. Social psychological aspects of computer-mediated communication. *American Psychologist*, 39, 10 (1984), 1123-1134.

[10] Kruger, J., Epley, N., Parker, J. & Ng, Zhi-Wen (2005) Egocentrism Over Email: Can We Communicate as Wellas We Think? *Journal of Personality and Social Psychology,* 89, 6, (2005), 925-936.

[11] Nokia Europe. *Nokia Sensor.* (2005) Retrieved from: http://europe.nokia.com/A4144923

[12] Pitman, J. A. and Payne S. J. Creating names for retrieval by self and others. *Behaviour & Information Technology*, 25, 6 (Nov. – Dec. 2006), 489-496.

[13] Rice, R. E. *The New Media: Communication, Research, and Technology.* Beverly Hills, CA, Sage, 1984.

[14] Rice, R. E. *Issues and concepts in research on computer-mediated communication systems*. In J.A. Anderson (Ed.), Communication Yearbook 12 (pp. 436- 476). Newbury Park, CA, Sage, 1989.

[15] Solon, A. and Callaghan, M. (2006) Case Study on the Bluetooth Vulnerabilities in Mobile Devices. *IJCSNS International Journal of Computer Science and Network Security*, 6, 4 (April 2006), 125-129.

[16] Sproull, L., and Kiesler, S. *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA MIT Press, 1991.

[17] Thom-Santelli, J., Ainslie, A. and Gay, G. Location, location, location: a study of bluejacking practices. *In Extended Abstracts of Conference on Human factors in Computing Systems (CHI 2007),* (San Jose, USA, April 2007). ACM Press, New York, NY, 2693 – 2698.