Small Details: Using One Device to Navigate Together.

Derek F. Reilly[1], Bonnie Mackay[1], Carolyn R. Watters[1] and Kori M. Inkpen[2]

[1]Faculty of Computer Science
Dalhousie University
Halifax NS, B3H 1W5 Canada
{reilly,mackay,waters}@cs.dal.ca

[2]Microsoft Research
One Microsoft Way
Redmond WA, 98052 USA
kori@microsoft.com

Figure 1: route segments from a task in our study. A: task starting point. B: a complex decision point. C: a winding hallway.

ABSTRACT

We present results from a study examining the sensitivity of group navigation strategies to changes in route presentation on a shared mobile device. Two content-equivalent interfaces are compared. An interface providing textual instructions linked to regions on a route map yields reliance on text primarily, encouraging route planning and a divide-and-conquer strategy we term 'navigator and scout'. An interface combining text instructions with map segments on individual pages yields less planning, still permits nav/scout, and sees an increase in an ad-hoc 'sync and go' strategy involving more gathering around the device. Finally, when the route map is used without text, the frequency of the nav/scout strategy drops markedly as sync and go increases.

Author Keywords

Mobile maps, group navigation, sharing mobile phones.

ACM Classification Keywords

H5.3. [Information interfaces and presentation]: Group and Organization Interfaces---Collaborative computing.

INTRODUCTION

Navigating on foot in small groups is a reasonably common activity. A number of mobile applications research projects involving navigation have considered a one-person one-device configuration (see [2,4,5] for example), however the configuration of multiple-persons one-device is in general understudied. We believe it is reasonable to expect that many ad hoc collaborative navigation scenarios will involve the use of a single device.

Previous work has considered how mobile devices are used in small groups, at close proximity, and when focused on the same activity or looking at the same object [2,3]. Ethnographic studies have added to our understanding of the domain of group navigation [3,5]. Theoretical groundwork for device mobility in collaboration has been established [6] and to some extent corroborated by practical evaluation [4,7]. What is missing is an understanding of specifically how the interfaces we provide on a shared device influence mobile collaborative activity.

In this note we illustrate how a simple difference in interface can influence the dynamic of group navigation with a single device. In an experimental simulation, we assessed two interfaces, providing identical route descriptions and depictions, differing solely in how this route information is combined. Results show a difference between interfaces in when graphical depictions are used vs. text descriptions, and a corresponding difference in the navigation strategies employed.

STUDY

Pairs conducted four wayfinding tasks through buildings in downtown Halifax, Canada. For each task, pairs shared a single mobile phone providing one of two route interfaces (figures 2,3). Interface conditions were fully crossed with wayfinding tasks. Each task took between 5-15 minutes to complete. Twelve pairs participated in the study, and participants were familiar with their partners[1].

[1] The experimental design is fully described in [1]

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Interfaces

Two interfaces were compared in the study. In the *textual* interface (Figure 2) all route instructions are presented on a single screen. Each instruction links to the corresponding region of the route drawn on a scrollable map. This is similar to the current route format used by major online map services. In the *paged* interface (Figure 3), graphical route segments are presented with their corresponding textual instruction on a single page. Pages are presented in route sequence. This format is similar to that used by some GPS navigation systems. As previously stated, text instructions and graphical route depictions were identical in both interfaces.

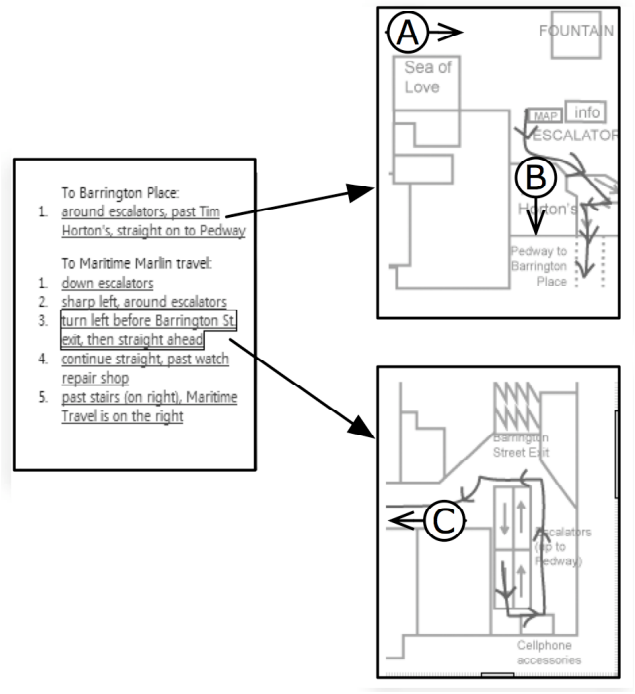

Figure 2: the "textual" interface. The regions in Figure 1 are indicated here as perspectives A, B, and C.

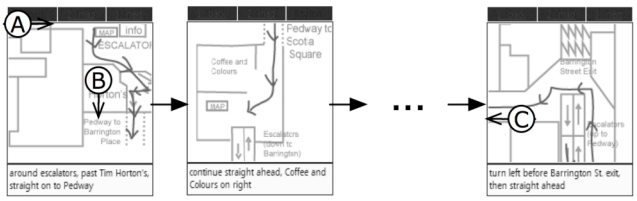

Figure 3: the "paged" interface.

Analysis

Each of the four routes was broken into segments. Segments were delineated by a sudden change in building layout (e.g. hallway vs. open area), and whether a route was beginning, at a major decision point, or ending. There were 28 segments in total across the 4 tasks.

Pair interactions with the phone were classified according to the activities described in Table 1 and Figure 4. Activities were determined by analysis of audio transcripts of all tasks, and through supporting materials including coding sheets, observational notes and questionnaire data.

Table 1: basic wayfinding activities involving the mobile phone

Plan	Study route detail prior to following route
Orient	Get orientation and position along route
Review	Study route detail after following route
Set up	Process route detail just before it is needed
Sync	Relate route detail to landmarks and layout

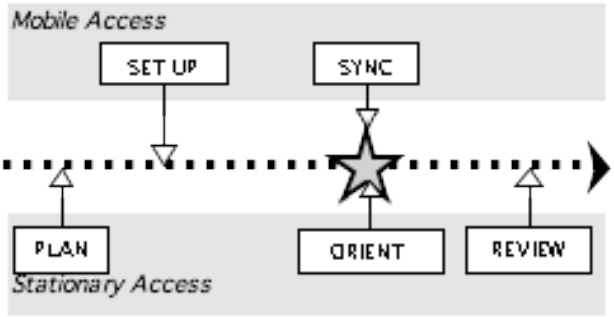

Figure 4: The dotted arrow indicates progression along a route, and the star represents the location being referred to on the device. Activities are primarily mobile or stationary, and occur at different locations relative to a referred location.

The overall strategy employed by a pair in each route segment was determined as the culmination of these lower-level activities, as follows:

Plan and go (p+g): initial concerted *plan* activity followed by minimal *sync* activity en route.

Sync and go (s+g): frequent *sync* and *orient* activity, often involving sharing the device.

Navigator and scout (n+s): periodic cycles of *set up* then *sync* activity, often one partner "scouts" without the phone.

Go and validate (g+v): traversing the route on a hunch, followed by *review* and *orient* activity.

Of the (12*28=336) potential classifications of activity by route segment, we were able to classify 310 of them (the remaining data was unclassifiable due to missing or ambiguous detail). If a pair clearly shifted strategy during a route segment, we assigned multiple (proportional) classifications.

RESULTS AND DISCUSSION

Building layout along the route path strongly impacted wayfinding strategy. For example, consider the task presented in Figures 1-3. Figure 4 gives the wayfinding strategies employed per route segment for this task. At the route's starting point (segment A), pairs used the wide vantage to quickly embark on the route. The high number of sync+go reflects this lack of planning. Segment B was a complex decision point: pairs slowed down, often shared the device here, and sometimes mixed strategies. Similar

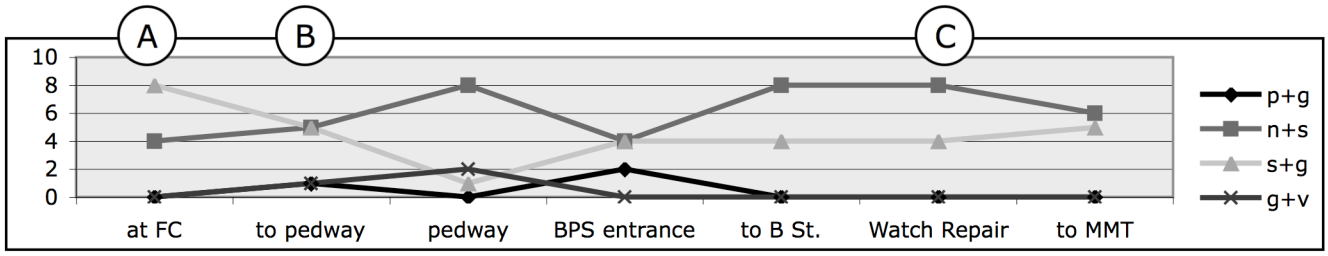

Figure 5: number of pairs employing each strategy, by route segment. The segments shown in Figure 1 are marked A, B, C.

behaviour occurred at the entrance to a new building (marked "BPS entrance" in Figure 4), and at decision points in other tasks. Segment C is a hallway with landmarks referenced on the device (e.g. the Watch Repair shop shown in Figure 1). With few decisions to make, many pairs adopted a nav/scout strategy here and in similar regions along this route and other routes.

Importantly, these overall trends were not equally represented in the two interfaces. This is because, while each interface provided both textual route descriptions and graphical depictions, they were not accessed in the same way or with the same frequency. Text was easier to verbally communicate, facilitating nav/scout, while graphics were more amenable to sync+go. To help illustrate, Figure 6 plots the predominant resource used by interface condition. When using the paged interface, participants tended to read instructions aloud (the map may have been used, but wasn't verbalized), while sometimes focusing on the depiction (~20% of the time), or switching over to the scroll map (~10% of the time). In the textual interface, almost 70% of interface time was spent using text alone, with <10% actively mixing text and the scroll map, and >10% using the scroll map only.

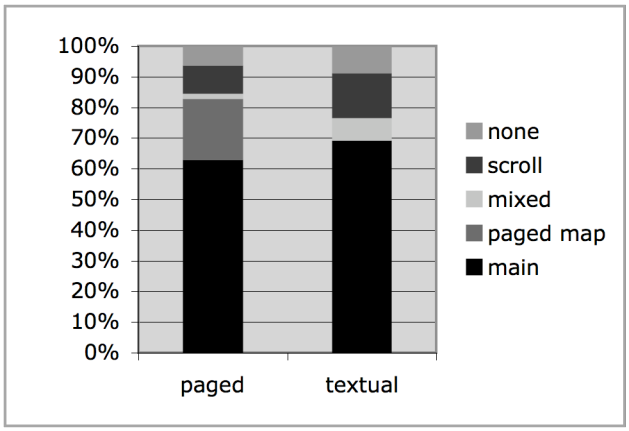

Figure 6: predominant resource used, by interface condition.

Figure 7 breaks down the frequency of each strategy by interface used. Here we see that while instances of the nav/scout strategy are about equal for the textual and paged interfaces, the paged interface, with its integrated map and text, shows an increase in collaborative sync and go. There is also a reduction in plan and go, presumably due to the sequential, "paged" presentation of route detail. Since the scroll map was used in isolation in 38 of 310 recorded classifications, we present it here as a third interface. The map-only scroll interface shows markedly less nav/scout with a corresponding increase in sync and go. We provide one concrete example of these differences. As Figure 5 shows, segment C saw a high level of nav/scout as well as some sync+go. Of the 8 nav/scout, 5 were using the textual interface and the remaining 3 used paged, while 3 of 4 sync+go were either paged or scroll and utilized the graphical depiction.

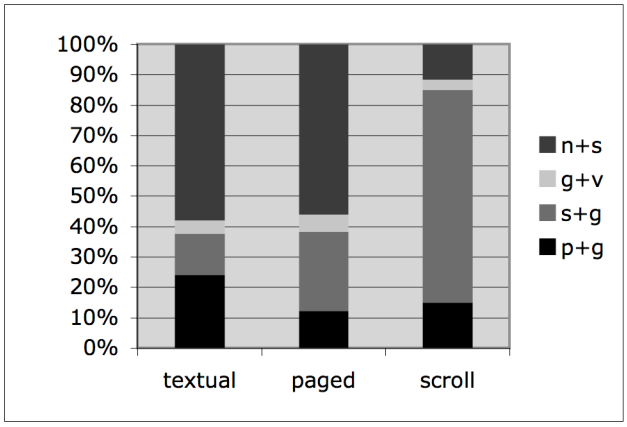

Figure 7: wayfinding strategy by interface. The "scroll" category includes instances where only the scroll map was used. There are ¼ as many instances (38) of this category.

Conversation, Interface, and Strategy

The nature of the wayfinding strategies and their relationship to interface can be illustrated in the way pairs conversed. We consider four contrasting examples here.

To communicate graphical route detail without a shared perspective, the speaker needs to interpret what she sees, then present it in language the listener can understand. Often, pairs who relied on graphics maintained a shared perspective, working closely around the phone to refer to map detail and sync it with the environment. In this example, the pair use the phone together in a sync+go mode, while on the route near segment C (see Figure 1):

P4 straight – then take a left turn over here (2s) then straight and around this little bend here

P3 Go around the watch repair area thing

P4 Yup and just keep going straight basically ((muffled)) to the right

Reading a route description aloud allowed both parties to work on interpretation simultaneously. This permitted less gathering around the phone, and less engagement with the phone interface overall. In this nav/scout example, P14 interrupts an ongoing conversation with text instructions so they can continue moving along route segment C, leaving the phone at his side between instructions (in quotes):

P14 "Turn left before the Barrington St. exit and … straight ahead" (2s) "(is) the watch repair shop." You could [work there

P13 [I don't think I'm qualified

P14 hey it can't be that hard

P13 to work in a watch repair shop? Were you there when I blew up Don ((muffled)) watch?

P13 Nooo…

P14 Apparently when you [put the ((muffled))

P13 ["Past the stairs"

P13 Wait a minute- it actually blew up?

P14 Um, well springs and stuff shot everywhere

When using the paged interface, some pairs would actively combine the textual instructions and the graphical route depiction. While text could be spoken and reiterated without the phone, the depiction was often returned to for synchronization with the environment. Here a pair adopt a sync+go strategy in route segment B (see Figure 1):

P19 "turn left"

P20 "turn left, past"

P19 start from the map, not Tim Hortons

P20 no… this is "past the info booth", this is the info booth, right?

P19 oh pass that "on right", "on rIGHT" ((laughs))

P20 (there's) upstairs (2s) that's Tim Horton's (2s) you understand?

P19 here. ((points at steps to pedway)) "Up stairs"

P20 there? oh, let me see (2s) here, oh maybe

Participants who chose to use just the textual instructions sometimes experienced difficulty at complex decision points. In this nav/scout example, P10 has the phone in route segment B, but cannot answer his partner's question using the text instructions, so they continue in silence:

P10 "Around the escalators past the (2s) ..straight on to Pedway" (2s) We go straight.

P9 Hmm?

P10 We go (2s) …straight

P9 Here?

((walking)) (9s)

P9 Ah… (5s) OK

Overall, participant conversation illustrates how text facilitated collaborating at a distance, while graphical depictions encouraged gathering around the device. Textual instructions are easy to communicate, letting pairs work simultaneously on interpretation without having to be right beside each other, while graphical depictions encourage sharing the visual: when mobile, this often meant slowing down to gather around the phone.

CONCLUSION

Sharing mobile devices presents unique design concerns. For example, an interface may promote sharing data verbally, reducing the need to gather around the device. Just providing text does not guarantee that it will be used, however. In a dynamic activity like wayfinding, seemingly trivial differences in content organization can mean different patterns of access, affecting collaboration.

When our study participants used an interface providing textual route instructions on a single page with links to targeted regions on a scrollable route map, they primarily used text. This encouraged both planning and a 'navigator and scout' strategy. When using an interface that presented each text instruction with the corresponding route map segment on an individual page, the nav/scout strategy was still used, but we also saw an increase in device sharing en route in a 'sync and go' strategy, and a drop in planning. We attribute the drop in planning to the fact that the route was not presented in a single page. Finally, the scrollable route map was sometimes used without text instructions. In these cases, the frequency of the nav/scout strategy dropped markedly and sync and go increased.

ACKNOWLEDGEMENTS

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