Supporting Just-in-Time Coordination: The Design of GoNow

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CHI 2007, April 28 – May 3, 2007, San Jose, USA
ACM 1-xxxxxxxxxxxxxxxxx.

Abstract
In this paper, we describe an initial investigation of a Just-in-Time Coordination system called GoNow. Just-in-Time Coordination systems are designed to allow non-collocated individuals to easily coordinate shared activities at the time of decision. We discuss the design of a particular instantiation of such a system, which aims to more easily enable individuals to carpool either to or from a shared location. From our initial investigation we derive design requirements for such a system as well as an early prototype we call GoNow.

Keywords
Coordination, Carpool, Ubiquitous Computing, Communication, Ride Sharing

ACM Classification Keywords
H5.2. Information interfaces and presentation (e.g., HCI): User-centered Design.

Introduction
The coordination of activities shared by multiple people, each with their own dynamically varying constraints, is a dizzyingly complex task. Additionally, when this type of coordination occurs between individuals who are not collocated, there is an increased demand on communication between individuals, which further

increases the complexity. Information technology holds a huge potential for more easily enabling humans to accomplish these types of coordination tasks with each other. However, whereas most current offerings satisfactorily support routine or recurring coordination tasks, they fail to account for the type of spontaneous activity coordination that happens between groups of individuals everyday. In particular they fail to allow for the just-in-time coordination between groups of non-collocated individuals.

Just-in-time coordination has a lot of inherent advantages, in particular, it supports activities that would be difficult to plan in advance. For example, the selection of a restaurant for a group dinner largely depends on the tastes of the individuals attending and may be related to other activities occurring that evening. In many cases, the number of individuals attending, their preferences that evening (which are may be influenced by what they ate earlier that day), and any other activities are all dynamic pieces of data and therefore may not be known a priori.

Many information technology systems that strive to mitigate much of the burden during these types of tasks fail because they force users to set their preferences at a prior time, which may not match their preferences at the time of the decision.

In our paper, we present the results of an early exploration of a Just-in-Time Coordination system: GoNow. GoNow was designed to more easily enable individuals to offer and find rides to and from a shared location. It is our hope that in creating this system, we encourage individuals to carpool more often, which we believe will lead to increases in safety, strengthened relationships between individuals, as well as the environmental benefits of reducing traffic.

Related Work

Our initial literature reviews included prior work within mobile communication and coordination [6] [4] [5], ambient displays [2], and alert and awareness systems [8] [1]. However, we found the most relevant work in this area within the study of prior ridesharing systems.

Paul Resnick outlines some of the challenges with creating these types of systems [7]. In particular these include: the coordination of routes and schedules, safety risks, social discomfort with sharing private spaces, and the imbalance of costs and benefits among affected parties. In a further implementation of this work, they found that a monitor placed near the entrance of a location provided awareness of the system and encouraged its use [10].

Joireman et al. studied how individuals make commuting decisions [3]. They found that the two main factors were personal comfort and travel time. Personal comfort is an individual criterion and when this is an individual's main criterion, others do not affect it. When travel time is an individual's main factor, they operate interdependently with others; mainly, they choose the opposite method of transportation that they think others will be using.

Approach

In our early brainstorming sessions, we examined a number of issues that we felt were perceived needs from users that we were familiar with. Included with our early ideas were systems that helped match musical tastes between people in a shared space and

Figure 1. Our Design Process

systems that created social networks and utilized collaborative filtering with bar patrons. However, we decided that the need of individuals trying to find a ride home from a shared space was a more compelling problem to solve.

Our design process is shown in Figure 1. Based on this perceived need, we engaged in a literature review of related areas of research to learn more about existing work in this area. From this we were able to gain a tighter definition of our problem domain and were also able to benefit from the insights provided by previous work. We then designed and performed a series of generative research methodologies, which helped us gain a better understanding of the needs, values, and feelings of individuals when they either offered or received rides from others. These methodologies will be discussed in greater detail in the methodology section below. After analyzing our findings we were able to create a series of high-level use scenarios, which we presented to a focus group of peers for validation.

Because our project was limited to a nine-week period, we were unable to complete our entire design process, which we admit was overly ambitious. In this paper, we do present design requirements we learned from our early research along with a prototype of the GoNow system, presented in a video sketch.

Methodology

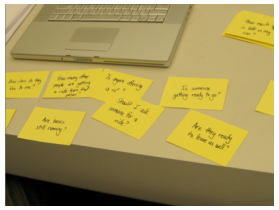
Since we were unable to perform an evaluation of GoNow, we will focus our discussion on the methodology utilized during our generative research concept validation phases.

To aid in gaining a better understanding of our target users, we performed six techniques, which are described in further detail below:

Online Survey

We created an online survey so we could learn the frequency of current use from a larger range of individuals than we could observe in person. This allowed us to understand the perceived usefulness of the system from users who lived in a variety of geographical areas. We felt this was especially important to understand because the utility of a ridesharing system is related to the driving/public transportation culture, which varies by region.

We created this survey with SurveyMonkey.com, an online survey generation tool [9]. For the survey, as with the other methods, we primarily gathered general background information about our participants. The survey then asked participants the frequency in which



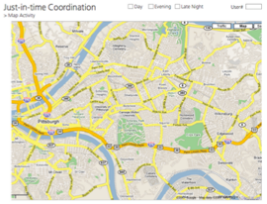


Figure 2. Some of our generative research methods. Diary study journals, card sorting cards, and map activity map (from top to bottom)

they request rides from others or drive others. We additionally asked when the arranging of rides took place and whether they would find a service, which allowed them to more easily coordinate rides, useful.

Despite posting a link to our survey on many carpooling forums and social networking sites we were unable to achieve a high number of responses. However, the 23 responses we received did validate that our perceived need for a ridesharing service was felt by our target users.

Diary Study

We utilized a diary study format to help capture a more detailed account of current ridesharing practices. By providing many individuals within our target user group with travel journals, they were able to capture the intricacies of the variety of aspects involved with ridesharing activities when the event happened. Additionally, we were able to better understand how the patterns of individual users varied over a period of time.

We were able to enlist three participants for the diary study, in addition to completing the travel journal ourselves. One drawback of this method was that we only allowed one week for the study, which we do not feel was sufficient to capture enough ridesharing instances. Additionally, we found that many participants forgot to note down these instances close to the time of action, which limited the utility of the journal format.

Directed Storytelling

We performed a series of directed storytelling activities to understand users' mental models and emotional needs when coordinating a ridesharing activity. Directed storytelling was performed similarly to a grounded interview, where we asked users to walk us through the last time they gave someone else a ride home, as well as the last time they requested a ride home from another.

We performed directed storytelling sessions with six participants over the course of one week. We found that this was one of the most beneficial methods we employed because we were able to gather a wide range of use case scenarios across our users.

Map Activity

We created a map activity, which would help us better understand how factors such as distance, time of day, and relationship between driver and passenger, affected the choice to request or offer a ride. In the activity, we showed participants a map of Pittsburgh and had them draw their ideal driving or requesting regions for a variety of relationship-level and time of day combinations.

Since we paired this activity along with the directed storytelling, we were able to run six participants. Although the activity in itself didn't yield as much interesting data as we expected, we found that by having users reflect on their maps and talking about their rationale for their preferences, we were able to gain a deeper understanding of the factors that influence ridesharing and how they affect each other.

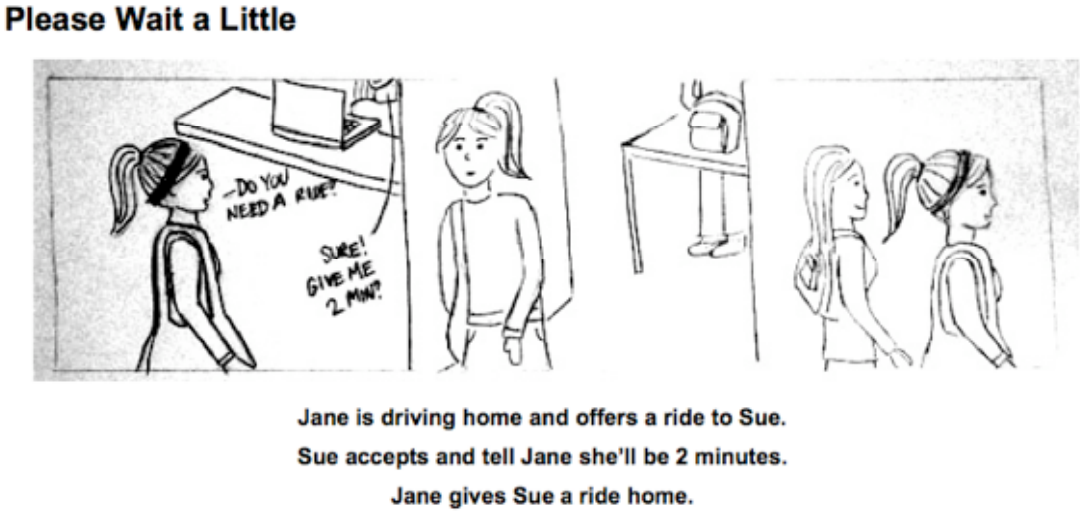


Figure 3. One of the use case scenarios we presented during concept validation

Card Sorting

We attempted to do a variation of a traditional card sorting activity. In our case, instead of sorting cards into similar stacks, we had planned to ask users to arrange cards with parameters related to ridesharing decision-making in the order in which they are typically thought of. For example, some cards were, "what time is it now?", "what other transportation is available?", "what is the weather outside?", etc. Participants could add new cards to the set if we failed to account for a factor that was important in their decision-making process.

Unfortunately, this technique did not survive our pilot testing. Even with individuals of our own research group, we found that it was nearly impossible for individuals to accurately recall their decision-making process. Additionally, we found that the order in which factors were considered varied heavily by each occasion, such that it would be difficult to generalize the results of this method.

Concept Validation

We conducted a concept validation session with four of our target users. During this session we presented four use case scenarios that we generated from our initial research findings and asked our participants to reflect on them. The goal of this activity was to gain insight into which use cases resonated most with our users and to better understand the factors that mattered most within each. We found this technique to be the most

valuable for our generative research phase. An example scenario is shown in Figure 3.

Results/Design Requirements

Much of our data was qualitative in nature and emphasized our depth, rather than breadth, approach. Because of this, we chose to present the following design requirements as our results. These requirements drove our prototype interface and interaction, which can be seen with our video sketch.

Supporting "offline" communication

We learned that individuals completed the final stages of the ridesharing negotiation in a variety of ways; these include face-to-face communication, phone calls, sms messages, instant messages, emails, etc. Since many of these methods have an extremely high bandwidth and are very efficient for coordination, we believe a Just-in-Time Coordination system should be designed to support, not supplant, these standard communication practices.

Avoiding negative social obligation

Often times an individual's true preferences are not used because of the social obligation factor (e.g. a driver wants to offer a friend a ride, but cannot because that person is working with someone who the driver doesn't want to drive). Users expressed this, in many cases quite directly, "…Sometimes you get forced to give a ride. Then, I'll make up excuses – like I'm going the opposite way, or I'm in a hurry". We believe that users must be informed of the possible consequences of any action prior to the commitment of said action. This type of awareness must be accommodated in the design of the system.

Difficulty of predicting preference

We found that users were more willing to offer rides to others at night, mainly for reasons of safety; however, they were less willing to offer rides to others when it was very late. Interestingly, users expressed an increased desire to get to sleep as soon possible during the late night, which made them less likely to offer a ride. We believe this example is compelling and indicative of the difficulty involved with trying to understand how these factors influence one's ridesharing preferences. For this reason, we believe the design should easily allow both riders and drivers to set these preferences in a direct and subjective manner.

Appropriate notifications

We found that people want to be notified of a drive offer or passenger request only when the information is potentially relevant for them. Excessive notifications when a user does not need it will be seen as annoying, while a lack of notification when it would have been valuable will discourage use. Because, in practice, achieving this level of accuracy is quite hard, we believe that a combination of a globally accessible and persistent list of relevant ride offers/requests along with a ephemeral, unobtrusive notification would work quite well.

When driving isn't a burden

In contrast to the findings of much of the existing literature, we found that people actually enjoyed driving others for a variety of reasons. These reasons include helping a fellow colleague, gossiping with a friend, etc. We believe that these are a direct result of the community-aspect of a shared location, so this may not necessarily hold true in ridesharing environments with complete strangers as pointed out by Resnick [7].

Figure 4. The GoNow system consists of a web interface, kiosk placed at the entrace of a location, and client-side taskbar application.

Description of GoNow

GoNow is our initial prototype for a Just-in-Time Coordination system that supports the finding and offering of rides to others.

We designed it as a multiplatform system that utilizes a web interface, a client-side toolbar application, as well as a kiosk placed in the entrance/exit to a shared location. The web interface allows users to proactively view any currently offered or requested rides, or create a new offer or request. The toolbar application provides an unobtrusive method for notifying users of a currently offered ride offer or request. The kiosk is utilized to further encourage participation between individuals, at the point of decision (in this case, departure); this result follows from the work of Wash et al [10].

The interfaces of the GoNow system provide users with the relevant information they need prior to committing to a decision. For example, passengers are able to see information about available drivers' destinations and flexibility to help them make a decision about whether to accept a ride offer. In this way, passengers can avoid asking for a ride when it is inconvenient and drivers are not put in a position where they feel forced to offer a ride out of social obligation. Similarly, drivers are able to see who is requesting a ride, where they live, and their urgency to get a ride and can then make a decision on whether and to who to offer a ride.

Our design allows users to opt-in to notifications (in the form of RSS feeds) that they believe may be interesting to them. This ensures that users are only receiving information that is relevant to needs that they have stated. For example, a user subscribing to the "ride home after 10pm" feed would therefore not be inundated with all ride offers that occur before the desired time.

We avoid forcing users to predict and pre-set static preferences that do not scale to all scenarios by providing an easy way for users to set preferences at the time of a decision. For example, when offering a ride, drivers are able to indicate their flexibility which is a setting that may vary according to external factors, such as time of day or their schedule. Similarly, when viewing ride offers, passengers are able to filter drivers based on flexibility and desired leave time – both of which may vary according to the current use case.

We also allow drivers to set their preferences for how they would like to be contacted by potential passengers. Since we found that offline communication is an important aspect of negotiating rides, our system serves to provide information and increase user awareness so that users can better negotiate ridesharing. For example, when selecting a ride, GoNow allows passengers to find information about specific drivers and their routes. They can use this information to make informed decisions and then contact the desired drivers offline.

Our design is based on the notion that driving is not necessarily a burden. We found that drivers often want to give rides out of goodwill and sometimes feel that car rides provide them with an opportunity for valuable interaction with the passenger. For this reason, we developed the driver view for both the kiosk and web interface with the belief that drivers will take the initiative to check if someone needs a ride on their way out of a shared location.

We built in " driver karma" ratings to allow drivers to have a tangible reminder of how much they've helped others. This visible social capital can also be viewed by others, so their benefits to the community as a whole may be recognized.

We have created a video sketch to help communicate a typical use of GoNow.

Future Work

We believe that this work has a great deal of potential, but must be evaluated through a series of empirical studies before we can be confident in its ability to serve our observed user needs. We propose that this evaluation start with lo-fidelity prototyping of the interfaces and continue to successively high-fidelity and functional prototypes. Finally, a longitudinal deployment would be necessary to accurately understand how users' feel about and use GoNow.

Additionally, we believe that GoNow is only one of many possible instantiations of a Just-in-Time Coordination system.

Acknowledgements

We would like to thank our professor, Jason Hong, for all his guidance as well as the entire Ubiquitous Computing class for their great ideation and feedback.

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