What Are You Talking About While Driving?: An Analysis of In-car Conversations Aimed at Conversation Sharing

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ABSTRACT

In this study, we propose an in-car conversation sharing system. People frequently converse in a car. In these conversations, people often talk about points of interest that they have just passed. Because we believe that they contain useful information, the aim of our study is to share the conversations. To develop such a system, we needed to know about the characteristics of in-car conversations. Consequently we collected 120 in-car conversations with their locations over a 10-month period. Our analysis showed that many types of conversation take place in a car; but of the greatest interest is when the subject of conversation is a specific location or area. We discuss the requirements for an in-car conversation sharing system to guide our on-going research.

Author Keywords

in-car conversations; conversation analysis; knowledge sharing; location-aware;

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

INTRODUCTION

The topics of conversation while driving can provide useful information. This study focuses on a conversation sharing system that acquires this information.. We propose an in-car conversation sharing system. Figure 1 shows the framework of our system, which consists of the following two processes:

1. Associating an in-car conversation with a location and embedding the conversation in that location;
2. Sharing the embedded conversation with cars that pass this location.

The aim of our system is to acquire new information for people by sharing in-car conversations. We believe that in-car conversations are worth sharing with others because they frequently relate to a situation. Timely/up-to-date information on a location will be reflected in the situation. Thus, in-car conversations will have timely/up-to-date information about a location. However, the problem with in-car conversations is that they are transient and cannot be shared with others. In contrast, there are wiki systems such as Wikipedia[1] on the Internet where people exchange knowledge, and this knowledge is retained over the long term [15]. We therefore attempted to develop a similar but in-car conversation knowledge sharing system.

Adato observed that participants regularly use the occasion in a conversation to generate topics [1]. The occasion includes known common characteristics and situations of a conversation. For in-car conversation, the occasion corresponds to the situation in the car and the situation of the location and/or area the car is in. This means that the topic of in-car conversation will change in accordance with the situation of the location. The situation includes the season, time, weather and/or background knowledge of the participants in the conversation. For example, in winter, the conversation might include an observation that "this road is really slippery" where the road is icy in a cold area. Situations also affect the transition of topics in a conversation. Sacks argued that co-selection played an important role when the conversation transits to the next topic [11]. He also argued that the co-selection structure consisted of common sense and/or a common subject among participants of the conversation. That is, for in-car conversation, the location is a common subject and the transition pattern of the conversation depends on passengers' common observations. For example, chemists might easily identify a sign board about chemical items from the scenery and the topic of conversation may transit to a chemical subject.

We thus hypothesize that car passengers talk about many location-specific objects and these conversations will be of interest to others. In this study, in developing the proposed system, we address the following two research questions:

RQ1 What are car occupants talking about while driving?

RQ2 Are location-specific conversations of interest to others?

Through responding to the above questions, we investigate in-car conversations to realize our in-car conversation sharing system.

The major contribution of this work includes the following aspects:

[1] `http://wikipedia.org`

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Figure 1. Overview of our conversation sharing system. In-car conversations are embedded in a location and the system shares them with cars that pass that location.

- We proposed a location based in-car conversation sharing system that shares valuable in-car conversations with the occupants of other cars.
- We collected 120 in-car conversation over a 10 month period in real situations and analyzed them.
- We established how often car occupants talk about specific locations and also how interested other people are in these conversations.

RELATED STUDY

Urban informatics, the use of information technology to understand urban needs and opportunities, explores these emerging digital layers of a city at the intersection of people, places and technologies [5, 13]. Zheng et al. revealed flawed urban planning using the trajectories generated by 30,000 taxis traveling in urban areas in Beijing [16]. We not only use quantitative data such as GPS trajectories but also employ conversation recordings generated in cars. Because in-car conversation handles timely information, such as information about a new shop, and road information relating to the season (e.g. an icy road), it is possible to qualitatively handle different information making it worthwhile focusing on in-car conversation sharing.

According to a survey [2], news, cartoons, weather and location-based information are the most popular types of content for car entertainment/infotainment. Tester et al. proposed, "CommuterNews", an in-car entertainment/infotainment system [14]. The system provided daily news stories in the form of multiple-choice questions and short relevant sound clips; however, it cannot provide location-based information. These types of car entertainment/infotainment systems can cause problems arising from distractions and inattention [4, 6]. This has increased the demand for push style (e.g. such as a car radio) in-car infotainment. Because our proposed system collects and shares *'fresh'* conversation associated with its location, our proposed system makes it possible to provide users with up-to-date location-based information without it being operated as a car radio.

IN-CAR CONVERSATION SHARING

In car conversations, people often talk about the locations that they have just passed. Because we believe that the conversations contain information useful to other drivers, the aim of our study is to share these conversations.

We propose a system to share in-car conversations. Figure 1 shows an overview of our conversation sharing system. When people converse in a car, the system embeds the conversation into the location near the car and shares it as *"car radio"* with other cars passing the location. The system is able to provide valuable and up-to-date, information about the location to other cars, because in-car conversations reflect both the knowledge of the occupants and up-to-date information about the location, the season (the date) and the time of day.

In the following three parts we describe the requirements for realizing the conversation sharing system.

Associate Conversations with Locations

To associate an in-car conversation with a location, the system needs to record both audio data and location data simultaneously.

There are some commercial products which have a similar function. Recent digital still cameras have a feature that records both still images and location data using GPS. Google Street View[2] provides panoramic street views from positions along many streets in the world using omnidirectional cameras and GPS. Recently, smartphones have started to include many sensors such as microphones, inertial sensors, and GPS, and are used as data loggers.

Kawaguchi et al. provide a tool, HASC Logger[3], which can record audio, location, acceleration, rotation, etc. for both Apple iOS and Android Smartphones [7].

Clip & Annotate a Conversation

Recorded in-car conversations must be clipped appropriately because recorded conversations are too long to listen to and

[2] `http://www.google.com/streetview/`
[3] `http://hasc.jp/`

the issue of privacy needs to be catered for. It is also necessary to annotate (classify) clipped conversations with respect to the characteristics of each conversation. We assume that the detection of finger pointing and a common focus of attention (shared focus of the eyes) will be key techniques required to clip/annotate a conversation because they both seem to be indicators of objects mentioned in conversations [8]. Finger pointing will happen when the speaker talks about a location near the car, as in "*this* (with finger pointing) building is... ".

Annotating by finger pointing will be possible using a depth camera. Raheja et al. proposed a method to detect finger pointing using Microsoft Kinect [9]. In addition, Intel provides a feature to detect the direction of finger pointing in Perceptual Computing SDK, a programming framework for a depth camera[4]. Using a depth camera, Rümelin investigated the use of a pointing gesture for identifying a distant object from inside a car [10].

Shared Conversations

To share in-car conversations, it is necessary to address issues concerning the current location of the car receiving conversation clips from the system, and the selection of conversations.

For the location of the car, GPS technology is very appropriate. For the selection of conversations, a user interface to control the volume of in-car conversation flow is needed. Each conversation not only contains location data but also metadata including the date, time of day, number of occupants and ages/genders of occupants. It is possible to control the volume of the conversation using this metadata, for example, the user can adjust the date range, the range of the time of day and/or the range of occupants to control the number of conversations being played.

We compared our in-car conversation sharing system to a car radio, so that the user can tune the flow of playing in-car conversation similar to controlling a radio. One difference between the system and a car radio is the playing style. A car radio broadcasts one radio program at a time; however the system simultaneously plays several conversations embedded in the location. Because humans can distinguish a preferred conversation from simultaneously played conversations [3], the system will work as a novel in-car infotainment system.

METHOD

In this study, as an exploratory investigation into in-car conversation sharing, we analyzed in-car conversation according to how the locality was perceived. This will contribute not only to advancing our in-car conversation sharing system but also future human-computer interaction (HCI) research in the context of car use. The details of our analysis are as follows.

Step1: Data Collection

We collected a number of in-car conversations associated with a location over a 10 month period from late May, 2012 to early April, 2013. We asked participants to install a data logging tool, HASC Logger [7], on their smartphones and to record their in-car conversations using the tool. The HASC Logger was able to record audio, location, acceleration and rotation with time stamps. The audio data were recorded as 16 bit/44.1 kHz frequency audio files. The locations were recorded using GPS with a 1 Hz sampling rate. The accelerations and rotations (gyro) were recorded using a 100 Hz sampling rate but we omitted them from our analysis.

[4] `http://software.intel.com/en-us/vcsouce/tools/perceptual-computing-sdk/`

Step2: Screening

Because of poor or speech-free recording, the collected data may need screening. We developed in-house screening software for this purpose. The software consists of a simple audio player and presents a text field for annotations. We asked the subjects to listen to in-car conversations and to classify them into two groups, valid or invalid, using the software.

Step3: Clipping each in-car conversation

We clipped each in-car conversation manually. To clip in-car conversations, we first made a brief transcription of each screened in-car conversation. This was a basic procedure in conversation analysis [12]. In addition to the transcriptions, we noted the metadata of the conversations, including the number of occupants, their names, and a brief description of the trip. We then made clips of each in-car conversation manually according to its content.

Step4: Classifying Conversations According to their Localities

We analyzed the in-car conversations according to perceptions of the localities because locality seems to be a key feature of in-car conversations. In our experience, occupants often talk about a place or an object that can be seen through the car window. In addition, the scenery from the car window recalls an occupant's experience in the past and often prompts a new topic of conversation. That is, the localities in in-car conversations can trigger a chain of conversations.

We classified in-car conversation into the following six topics of localities (Figure 2). The definitions of each topic are as follows:

P1 When the conversation is about a specific location (e.g. a restaurant, shop, etc.) and the location is near the car, we define its topic as P1. Specifically, we classify the conversation as P1 if the conversation has a demonstrative pronoun, "... *this/that* building ..." and "... *here/there* ...". We also classify the conversation as P1 if the conversation has a location-specific noun and the distance between the location of the specific place and the location of the car is less than 50 m.

P2 When the conversation is about a specific location which is in the same region (e.g. the same prefecture or the same state) as the car, we define its topic as P2. Specifically, we classify the conversation as P2 if the conversation has a location-specific noun, and the distance between the location of the specific place and the location of the car is more than 50 m but in the same region.

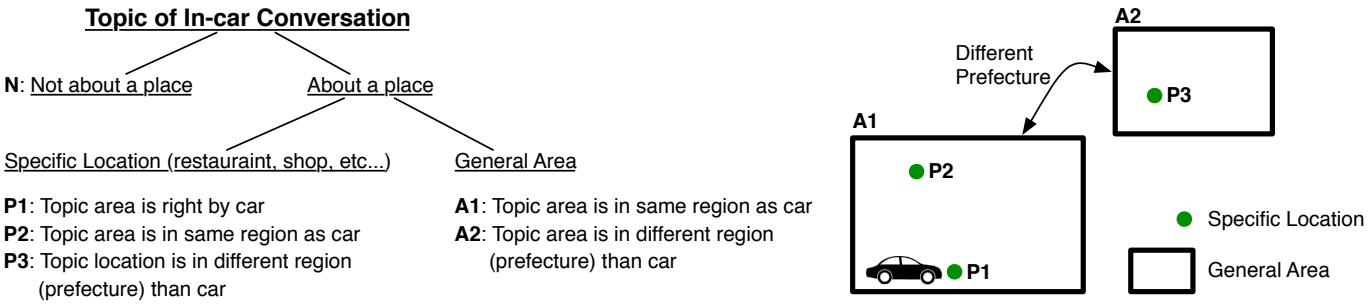

Figure 2. Classification of topics of in-car conversation. Conversation classified with respect to its localities.

P3 When the conversation is about a specific location and the location is in a different region than the car, we define its topic as P3.

A1 When the conversation is about a general area and the area is in the same region as the car, we define its topic as A1. Specifically, we classify the conversation as A1 if it has a demonstrative pronoun, "... *this* area ..." and "*here/there* is ..." and the pronoun indicates an area that is in the same region as the car. We also classify the conversation as A1 if the conversation has a city name or a state/prefecture name such as "New York", "Tokyo", "Paris", "Oregon", "Massachusetts" or "Hokkaido" and the specific area is in the same region as the car.

A2 When the conversation is about a general area and the area is in a different region to the car, we define its topic as A2. Specifically, we classify the conversation as A2 if the conversation has a demonstrative pronoun, "... *this* area ..." and "*here/there* is ..." and the pronoun indicates the area is in a different region than the car. We also classify the conversation as A2 if the conversation has a city name or a state/prefecture name and the specific area is in a different region than the car.

N When the conversation is not about a place, we define its topic as N.

We classify each clipped in-car conversation manually and compare the differences among the conditions (described below) of the in-car conversations. In-car conversation is classified into four conditions according to the situations of the car trip which are as follows:

With Colleagues When the occupants taking part in the in-car conversation are colleagues such as classmates or labmates, we classify the conversation as the "With colleagues" condition.

With Family When the occupants taking part in the in-car conversation are family, we classify the conversation as the "With Family" condition.

In a Taxi When the driver of the car is a taxi driver, we classify the conversation as the "In a Taxi" condition.

With a Guest When the occupants taking part in the in-car conversation include a guest, we classify the conversation as the "With Guest" condition.

Step5: Interest Annotation

We asked each subject to listen to about 10 in-car conversations and to annotate his/her points of interest on them (Figure 3). We developed in-house audio annotation software for the session (Figure 4). A subject could easily annotate his/her point of interest in an in-car conversation just by pushing a button and making a comment. We then associated the interesting point with the clipped in-car conversations.

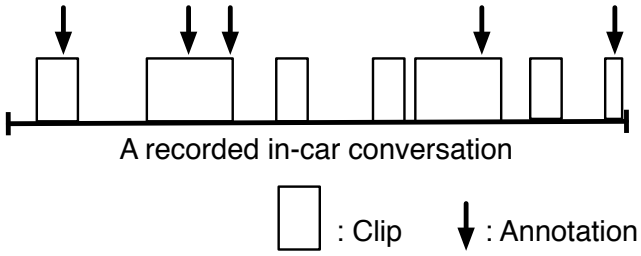

Figure 3. Each subject annotates an interesting part of the in-car conversations.

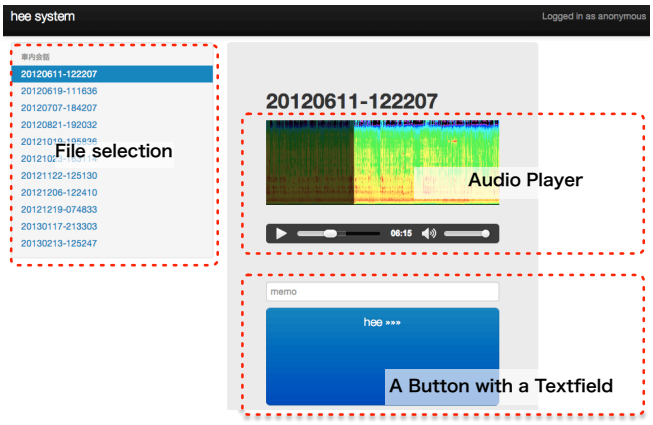

Figure 4. Software for interest annotation of the in-car conversation.

RESULTS

We collected 120 in-car conversations (over 28 hours) over a 10 month period. Using the GPS enabled in-car conversation recording system meant that the recorded data included audio and location information. The results indicate that people show greatest interest in in-car conversations when the subject of conversation is a specific location or area. The details of the results are as follows. Each step corresponds to the step in the previous section, *Methodology*.

Step1: Collected Data

We mainly collected in-car conversation in Hakodate, Japan. Five subjects (4 males, 1 female) who lives in Hakodate and aged 21 to 45 participated in data collection over a 10-month period from late May, 2012 to early April, 2013. Each subject recorded his/her in-car conversations with other occupants using a data logging tool. We collected 120 in-car conversations in total. The total length of the recorded conversations was 28.16 hours and the average recording time was 14.08 minutes.

Step2: Screening

Twelve subjects (11 males, one female) aged 21 to 45 participated in the screening session. The aim of the session was to screen out conversations that were difficult to hear because of noise. We asked each participant to listen to 10 in-car conversations (except one participant who listened to 20 conversations) and to annotate each one as audible or inaudible (i.e., noisy).

Through the session, 80 conversations were screened from the dataset leaving 40 for analysis. The number of files was reduced by two thirds; however, the sum of recording time was reduced only by about 40% (28.16 hours $\rightarrow$ 17.12 hours).

Step3: Clipping each in-car conversation

We made a brief transcription of the 40 in-car conversations and clipped each conversation according to its content. In total, 830 conversation clips were made from 40 in-car conversations.

Step4: Classifying Conversations According to Localities

We then classified each conversation clip into one of the six topics we defined in the above section. Table 1 shows the number of conversation clips by topic indicating that about 60% of the in-car conversations were about a place.

Topics (830 in total)					
P1	P2	P3	A1	A2	N
310	111	7	55	11	336
37.3%	13.3%	$<1\%$	6.6%	1.3%	40.5%

Table 1. The number of conversation clips by topic.

Step5: Interest Annotation

Thirteen (12 males, 1 female) subjects aged 21 to 45 participated in the annotation session. Since they live in Hakodate, they are familiar with the city where we mainly collected in-car conversations.

As we described above, the participants were asked to listen to the conversations and to annotate them with their points of interest using in-house audio annotation software (Figure 4).

It would have been preferable for all participants to listen to all 40 conversations, but it was not realistic to expect them to listen to over 17 hours of conversation. Therefore, we asked the participants to form groups of three or four, and each group listened to 10 conversations.

Table 2 shows the numbers of points of interest for each subject. This result shows that a point of interest was added about every 133 seconds. This implies that in-car conversation has the potential for entertainment and the conversation provides enjoyable content for the users.

Group	Subject ID	Num. of Conv. w/Interest
1	A	52
	E	55
	I	26
	M	10
2	B	7
	F	15
	J	12
3	C	15
	G	15
	K	52
4	D	32
	H	164
	L	9

Table 2. The number of conversations with interest for each subject.

ANALYSIS

What Are Car Occupants Talking About While Driving

As shown in Table 1, about 60% of the in-car conversations were about a place (categorized into P1, P2, P3, A1 or A2) and the other 40% were not (categorized into N). About 50 % of the in-car conversations were about a specific location (P1, P2 and P3) and about 8 % about a general area (A1 and A2), as the answer to **RQ1: "What are car occupants talking about with each other while driving?"**.

Table 3 shows the appearance of location specific words by topic. We define the location specific words as follows:

DP1 The word is a demonstrative pronoun that indicates a specific place, "kore/koko/kono *(here, this)*, is defined as DP1.

DP2 The word is a demonstrative pronoun that indicates a specific place further than DP1, "sore/soko/sono *(that/there)*, is defined as DP3.

DP3 The word is a demonstrative pronoun that indicates a specific place further than DP2, "are/asoko/ano *(that/over there)*, is defined as DP3.

P The word is a proper noun that indicates a specific place such as the name of a station or the name of shop and is defined as P.

A The word is a proper noun that indicates a specific area such as the name of a city, prefecture, district or state and is defined as A.

As described above, we defined topics of conversation according to context and we manually classified them; but, in this table, we ignored conversation contexts. That is, we counted location specific words in an automatic manner.

The table showed that the location specific words should be included in the topics related to locations/areas. It also showed that each topic has a unique frequency of appearance of the location related word. This implies that it will be able to automatically classify conversation topics in the future.

Topics	Location related word				
	DP1	DP2	DP3	P	A
P1	329/320	35/320	62/320	177/320	28/320
	1.03	0.11	0.19	**0.55**	0.09
P2	32/114	29/114	24/114	134/114	34/114
	0.28	0.25	0.21	**1.18**	0.30
P3	0/7	3/7	0/7	11/7	4/7
	-	0.43	-	**1.57**	**0.57**
A1	36/57	5/57	6/57	39/57	41/57
	0.63	0.09	0.11	**0.68**	**0.72**
A2	3/12	1/12	4/12	2/12	17/12
	0.25	0.08	0.33	0.17	**1.42**
N	129/360	29/360	49/360	37/360	13/360
	0.36	0.08	0.14	0.10	0.04

Table 3. The number of location related words and their frequency of appearance per conversation by topic. Emphasized parts shows that the frequency of appearance is larger than 0.5.

People Show Their Interest in the Conversations Related to a Location/Area

Table 4 shows the ratios of points of interest to conversation clips by conditions. From this table, you can see that the two main topics of conversation are P1 and N. If we have a point of view on the number of conversations of interest, the main topic is P1 and interestingly, topic N has only 52 out of 336 (about 15%) points of interest, while other topics have at least 40% points of interest (41%, 55%, 43% 51%, and 55% for P1, P2, P3, A1 and A2 respectively).

This result shows that many types of conversation occur in a car, including small talk (topic N); however, people show greatest interest in in-car conversations when the subject of conversation is a specific location or area as the answer to **RQ2: "Are location-specific conversations interesting to others?"**.

This implies that location is a key feature of in-car conversation, and our in-car conversation sharing system will work well. This also raises the possibility of using finger pointing and focus of attention for automatic annotation. This is because, in our experience, finger pointing and/or focus of attention happen when the speaker talks about the location. We will work on an in-car automatic annotation system in the future.

Cond.	Topics					
	P1	P2	P3	A1	A2	N
All	126/310	61/111	3/7	28/55	6/11	52/336
	41%	55%	43%	51%	55%	15%
Colleagues	87/244	35/76	2/6	19/39	3/7	38/255
	36%	46%	33%	49%	43%	15%
Family	30/54	8/14	-	-	2/3	11/66
	56%	57%	-	-	67%	17%
Taxi	7/8	18/21	1/1	6/6	1/1	2/7
	88%	86%	100%	100%	100%	29%

Table 4. The ratios of points of interest to conversation clips by conditions.

Transition Patterns of In-car Conversations

Figure 5 shows an overview of probabilities of transition and the proportion of interesting conversations. The figure shows typical transition patterns of in-car conversations. You can easily find four transition patterns in the figure. These four transitions are N to N, P1 to P1, N to P1 and P1 to N. Specifically, Table 5 shows the probabilities of transition. Because N means the conversation was not related to the location, these conversations seem to have no relationship to each other. However, the transition, N to P1, seems to be a typical transition when car occupants used the specific location in generating conversation topics as Adato observed [1].

The fifth typical transition, P1 to P2, shows the relationship between the conversations. For instance, the transcription of the conversations is as follows:

P1 A: *This is the sushi restaurant Kantaro.* B: *Yeah... The sign board of that restaurant is old-fashioned.*

P2 A: *Yoshisen and Kantaro chain restaurants are good.* A: *There is an Italian restaurant, one of the Kantaro chain restaurants...* C: *Oh, you said that you want to go there, right?*

This is a typical conversation chain. The specific location (i.e. a restaurant) prompts a person to share knowledge with others. This type of conversation chain occurred in transition A1 to A2:

A1 A: *There are a lot of different convenience stores around here.* B: *I agree.*

A2 A: *There are only 'Lawson' chain stores in the Kansai region.*

A1 B: *But in Hakodate, its rare to see a 'Seven Eleven' chain store, isn't it?* A: *No, they exist. By the way, my favorite store is 'Seiko mart'.*

These examples showed that specific locations or an area will trigger occupants to pass on knowledge.

FROM \ TO	P1	P2	P3	A1	A2	N
P1	125	43	3	15	3	121
	15%	5%	-	2%	-	15%
P2	39	27	2	12	2	29
	3%	3%	-	1%	-	3%
P3	1	2	-	-	1	3
	-	-	-	-	-	-
A1	25	4	1	9	2	14
	3%	1%	-	1%	-	2%
A2	3	1	-	3	2	2
	-	-	-	-	-	-
N	122	35	1	18	2	158
	15%	4%	-	2%	-	19%

Table 5. The probability of transition between two topics. The upper cells show the number of conversations of interest and the lower cells show the ratio of the probability of transition to all transitions.

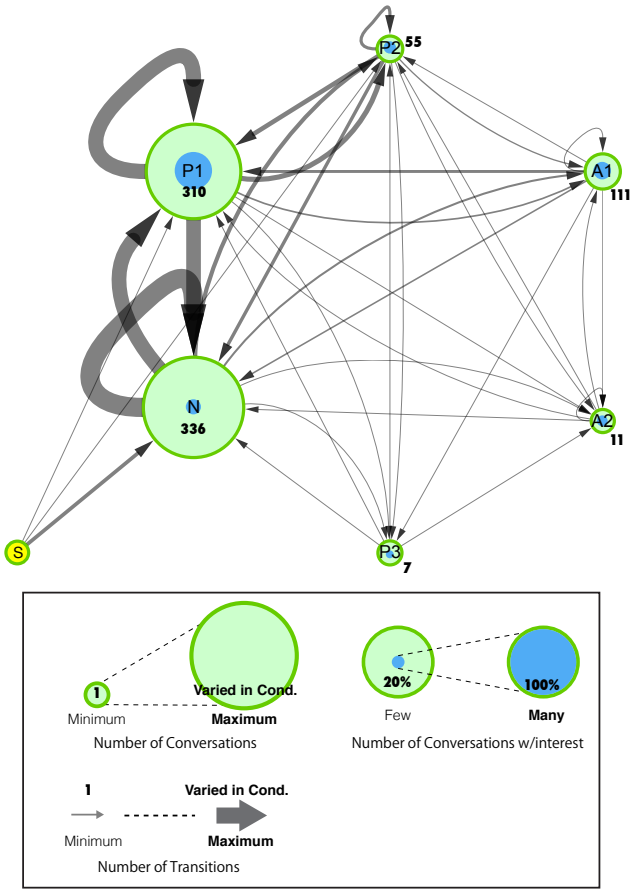

Figure 5. Overview of the probabilities of transition and proportions of interesting conversations. The size of the green circles indicates the number of conversations, the size of the blue circle indicates the ratios of interesting conversations.

Cond.		Topics P1	P2	P3	A1	A2	N
P1	All	15.1%	5.2%	0.4%	1.8%	0.4%	14.6%
	C	16.3%	5.7%	0.5%	1.9%	0.5%	14.0%
	F	13.6%	2.7%	-	0.7%	0.7%	19.0%
	T	4.5%	4.5%	-	2.3%		4.5%
P2	All	4.7%	3.3%	0.2%	1.8%	0.2%	3.5%
	C	5.3%	1.4%	0.3%	1.3%	-	3.8%
	F	2.7%	2.7%	-	-	-	4.1%
	T	6.8%	31.8%	-	2.3%	2.3%	4.5%
P3	All	0.1%	0.2%	-	-	0.1%	0.4%
	C	0.2%	0.3%	-	-	1.3%	3.8%
	F	-	-	-	-	-	-
	T	-	-	-	2.3%	-	-
A1	All	3.0%	0.5%	0.1%	1.1%	0.2%	1.7%
	C	3.7%	0.5%	-	0.6%	-	1.4%
	F	2.0%	-	-	2.0%	0.7%	2.0%
	T	-	9.1%	-	4.5%	-	2.3%
A2	All	0.4%	0.1%	-	0.2%	0.2%	0.2%
	C	0.3%	-	-	0.3%	0.3%	0.2%
	F	-	0.7%	-	0.7%	-	0.7%
	T	-	2.3%	-	2.3%	-	-
N	All	14.7%	0.2%	0.1%	2.2%	0.2%	19.0%
	C	14.2%	4.3%	0.2%	2.2%	0.2%	19.6%
	F	18.4%	3.4%	-	3.4%	0.7%	19.0%
	T	6.8%		2.3%	-	-	4.5%

Table 6. The probabilities of transition between two topics by conditions. The abbreviation C means with colleague condition, F and T means with Family and in Taxi conditions respectively.

Conversations in a Taxi will be a Seed for an In-car Entertainment Program

Table 6 shows the probabilities of transition in four conditions. This table shows differences between the conditions in the transitions of in-car conversation. In particular, the taxi condition differs from others. In the taxi condition, the most common transition pattern is P2 to P2. The transition pattern represents nearly a third of all transition patterns (about 31.8%). The taxi condition also has a unique feature in the ratio of points of interest to conversation clips. As shown in the table, people showed high interest in the conversation in the taxi. Specifically, people showed interest in 35 out of 44 (about 80%) conversations in the taxi condition and 276 out of 830 (about 33%) of all conversations. This implies we can collect high interest in-car conversations in a taxi, which will be a *seed* for the in-car entertainment program of our in-car conversation sharing system.

LIMITATIONS

There are considerable limitations to this study. One relates to the season. We collected in-car conversations over a 10 month period from late May to early April. However, the subjects made their annotations (i.e., points of interest) 3 months after we finished data collection. That is, the season in which the in-car conversations were collected differed from the season in which the participants made annotations to the conversations. This may have affected the subjects interest in the in-car conversations.

Furthermore, there may be cultural differences between regions. The in-car conversations were collected in Japan. The difference between regions may affect the results because the points of interest may vary with different cultures.

CONCLUSIONS

In this study, we proposed an in-car conversation sharing system that engages with the location, and fully involves all car occupants, including the driver. To realize our proposed system, we needed more data about human activities in the car, especially in-car conversations. We thus collected in-car conversations from 120 short car journeys (14.8 minutes on average) over a 10 month period from late May 2012 to early April 2013.

We conducted analysis by hiring 10 people to make annotations to the in-car conversations. Each participant made annotations indicating when he/she was interested in the conversation. We clipped each in-car conversation from the transcriptions of all the conversations. As a result of the clipping process, 830 conversation clips were extracted from the series of in-car conversations. We also classified each conversation clip into one of six topics according to its locality.

Through the analysis, we answered two research questions:

RQ1: What are car occupants talking about while driving?

Our findings revealed that about 50 % of the in-car conversations were about a specific location and about 8 % about a general area.

RQ2: Are location-specific conversations of interest to others?

Our findings revealed that there were many types of conversation in the car, including small talk; however, people showed greatest interest (about 80%) in the in-car conversations when the subject of conversation was a specific location or area.

We also found a typical transition pattern of in-car conversation and discovered that specific locations or an area will act as triggers prompting occupants to pass on their knowledge. The location is a key feature of in-car conversation. This also raised the possibility of using finger pointing and focus of attention for automatic annotation. We will work on an in-car automatic annotation system in the future. These findings will not only advance our study of in-car conversation sharing but will also contribute to future HCI studies on in-car entertainment.

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