

# Results and Empirical Analysis of Activity Planning from the UTRACS Prompted-Recall Survey

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Presentation at the 3rd Conference on Innovations in  
Travel Modeling, May 10-12, 2010

# Outline

- ▣ Background
- ▣ Survey methodology
- ▣ Survey implementation
- ▣ Activity Planning Observations
- ▣ Conclusions

# Background:

- ▣ Calibration and validation of activity-based travel demand models require extensive quantity of detailed and accurate data
- ▣ New methods of travel surveying are being developed to keep up with more demanding data requirements
  - Especially for advanced Activity-Based travel demand modeling
- ▣ GPS technology has been applied to travel survey techniques since the late 1990's (*Battele, 1997; Asakura et al., 1999; Draijer et al. 2000*)

# Background:

## Advantages of using GPS

- ▣ Travel surveys using GPS provide more accurate data regarding travel time, distance, route, activity location, and trip and activity rates (*Batelle, 1997; Murakami et al., 2003; NuStats, 2004*)
- ▣ Travel diary data is collected passively, freeing up time for respondents to:
  - take the survey for longer periods, or
  - answer questions not usually made in travel survey, such as questions about their decision making process regarding activity-travel behavior

# Background:

## Longer duration surveys

- ▣ Most travel surveys have short duration: 1 or 2 days
- ▣ A longer participation period for each respondent may provide greater value than large-sample one-day surveys (*Murakami et al., 2003*)
- ▣ Capability of capturing the development of individual's schedule and observed outcome

# Survey Methodology

# Survey Methodology

- ▣ Automated GPS-based prompted recall survey
  - No manual data processing
  - Auto-suggested answers for travel mode and recurring activity and travel attributes
  
- ▣ Internet-based
  - Better media for prompted recall travel surveys (*Stopher and Collins, 2005*)
  - Instant data retrieval makes data cleaning and processing expedited
  
- ▣ Collection of traditional activity-travel diary and also decision making process data
  - Planning horizons
  - Flexibilities
  - Motivations behind final choices

# Methodology:

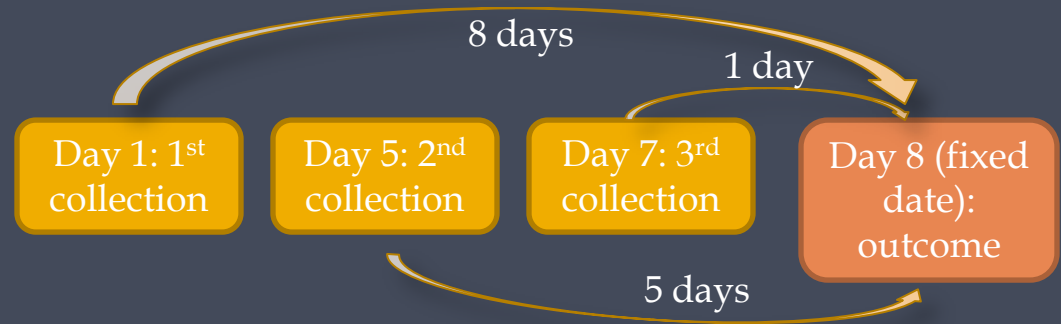
## Part 1: Upfront surveys

- ▣ User registration
  - ▣ Socio-demographic survey
  - ▣ Routine activities survey
  - ▣ Frequently visited locations survey
- Allows identification of activity and travel attributes, thus avoiding repetitive queries



# Methodology:

## Part 2: Periodical activity planning survey



- Collection of planning data for a fixed date at three moments:
  - 8 , 3 and 1 day before fixed date
- Collection of activity type, location, start and end time, travel mode and persons involved

ACTIVITY PREPLANNING SURVEY

Enter details about all activities which you are CURRENTLY planning for **THURSDAY, JULY 23, 2009**

ONLY fill out the attributes for each activity (Location, Time, Mode, etc.) which you have already thought about and leave anything you have not thought about BLANK. Activities do not have to be added in any order, and can be removed by pressing the "RESET" button.

Once you have entered all of the information which you have CURRENTLY planned for the day, scroll to the end of the page and press the "SUBMIT" button.

Activity Type	Location	Start Time	End Time	Travel Mode	Who With	
Social	park		12:00 PM	Bicycle		Reset
Primary Work	office	1:00 PM	6:00 PM	Auto-Drive		Reset
Meal		7:00 PM			Friends	Reset
						Reset

# Methodology:

## Part 3: GPS data collection and questionnaires

- ▣ Carry the GPS logger for 14 days
- ▣ Upload GPS data on survey website daily
- ▣ Correct activity-travel pattern if needed. Errors can be due to:
  - Signal acquisition delay
  - Bad Satellite fixes
  - Occasional failures of the location finding algorithm
- ▣ Answer questionnaire for every trip and activity

# Part 3: example of webpages

This is where you answer questions regarding the activities you completed.  
You will have to fill out this form for each activity in the log you have completed.

Page 1 of 5.

Activity questionnaire

## Log correction

This is where you answer questions regarding the activities you completed.  
You will have to fill out this form for each activity in the log you have completed.

Page 2 of 17.

Trip questionnaire

# Survey Implementation

# Survey equipment

- ▣ GPS logger: AMOD AGL3080 Photo Tracker
  - Storage capacity: 128 MB (360 hours of tracking)
  - 3 AAA rechargeable batteries
  - 15 hours of continuous operation
  - Cold start time: few minutes to 15 or more minutes, depending on meteorologic conditions and urban density



- ▣ Computer
  - internet connection
  - USB port
  - Java Runtime Environment (JRE)

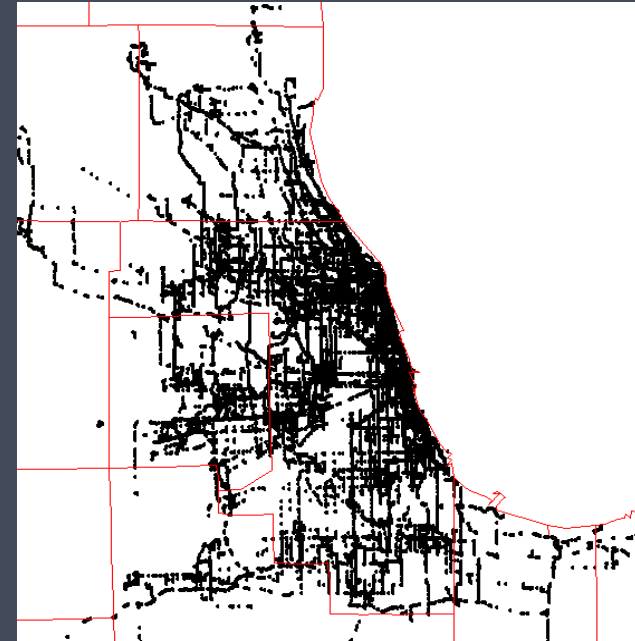


# Sample

- ▣ Random stratified sample of the Chicago area population
  - Half of the sample: ages 65 and over
  - Counties of Cook, DuPage, Lake and Will, State of Illinois
  - Stratas by :
    - ▣ County - following population distribution of Census 2000
    - ▣ Income (4 stratas) – low income households were oversampled due to past experience of lower response rates (*Kurth et al., 2001*)

# Results

	Elderly	Non-elderly	Total
Respondents (persons)	51	59	110
Respondents (households)	48	54	102
Activities	2,774	3,194	5,968
Trips	2,610	3,020	5,630



RESPONSE RATES			
	Elderly	Non-elderly	Total
Response rate <sup>(a)</sup>	9.65%	14.67%	11.95%
Cooperation rate <sup>(b)</sup>	12.50%	26.97%	17.36%

(a) Calculated with AAPOR formula RR3A

(b) Ratio of respondents to eligible persons contacted

# Results By Demographic Type

## Total Average Daily Duration (in hours)

	All	Employed	Student	< 65	Female	Teleworker	ICT users
Work/School	2.8	2.9	3.5	4.8	3.0	4.1	2.5
Personal/Service	0.6	0.6	0.4	0.3	0.6	0.4	0.5
Household-related	0.2	0.1	0.1	0.2	0.2	0.2	0.2
Discretionary	1.8	1.7	1.8	1.7	1.6	1.7	1.8
Shopping	0.5	0.5	0.3	0.4	0.6	0.3	0.4
Other	0.3	0.4	0.7	0.4	0.4	0.1	0.3
<b>Total</b>	6.2	6.3	6.7	7.8	6.4	6.8	5.7

## Average Daily Frequency

	All	Employed	Student	< 65	Female	Teleworker	ICT users
Work/School	0.6	0.7	0.6	1.0	0.7	1.0	0.6
Personal/Service	0.5	0.5	0.6	0.4	0.6	0.3	0.4
Household-related	0.3	0.3	0.4	0.3	0.3	0.3	0.3
Discretionary	0.9	0.9	1.0	0.7	0.9	0.7	0.9
Shopping	0.9	0.9	0.4	0.7	0.9	0.7	0.9
Other	0.4	0.4	0.3	0.3	0.3	0.3	0.4
<b>Total</b>	3.6	3.6	3.3	3.3	3.7	3.4	3.5

## Average Activity Duration

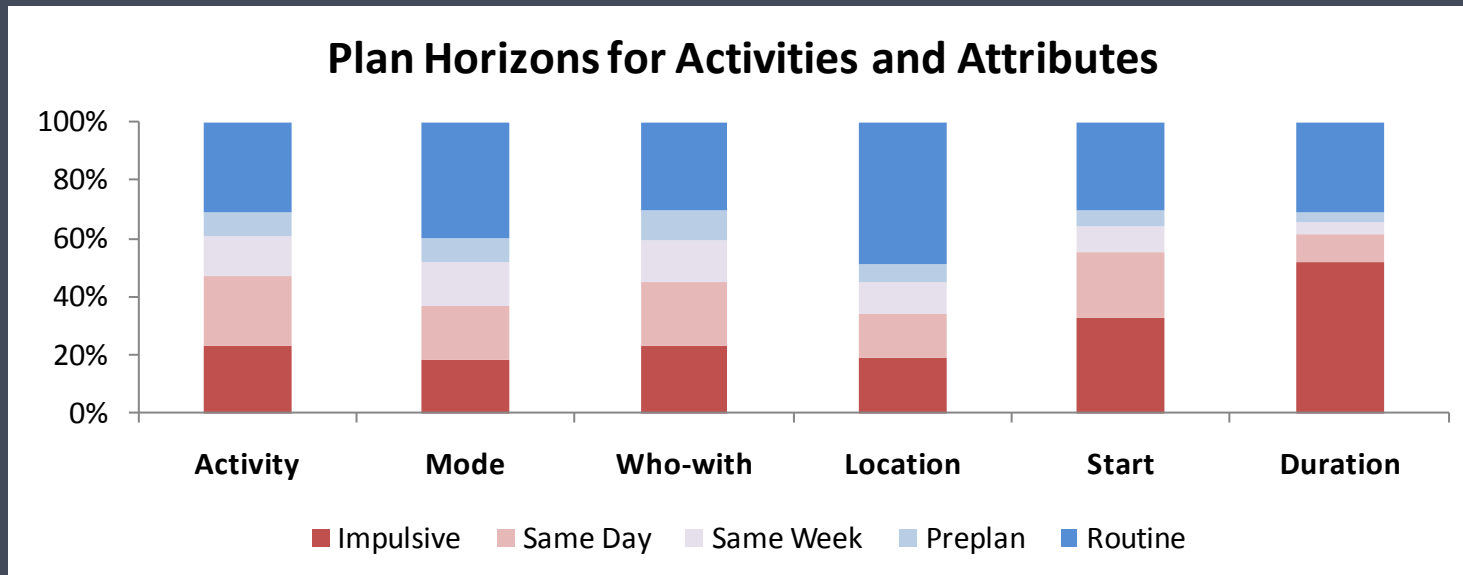
	All	Employed	Student	< 65	Female	Teleworker	ICT users
Work/School	4.5	4.5	6.0	5.1	4.3	3.9	4.1
Personal/Service	1.2	1.2	0.7	1.0	1.2	1.1	1.1
Household-related	0.7	0.6	0.2	0.8	0.7	0.7	0.8
Discretionary	1.9	1.9	1.9	2.3	1.8	2.3	1.9
Shopping	0.6	0.5	0.6	0.5	0.6	0.4	0.5
Other	0.9	1.0	2.2	1.5	1.3	0.2	0.9



# Activity Planning Observations

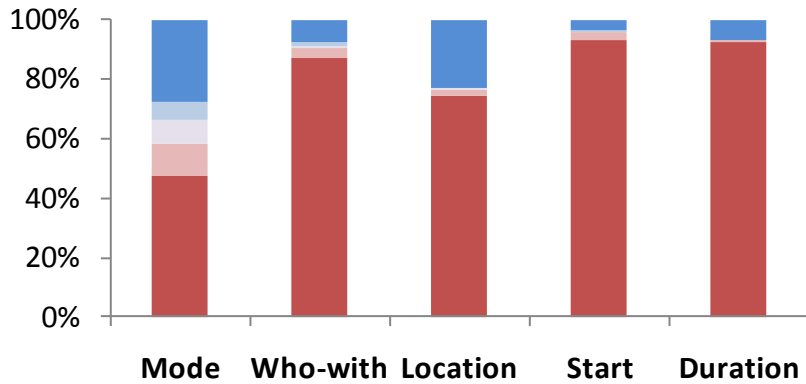
# Activity Planning Horizons

- ▣ Key behavioral component of activity planning
- ▣ “When was this decision made”
- ▣ Extends CHASE plan horizon:
  - Includes Activity plan horizon
  - Also includes horizons for five key attributes

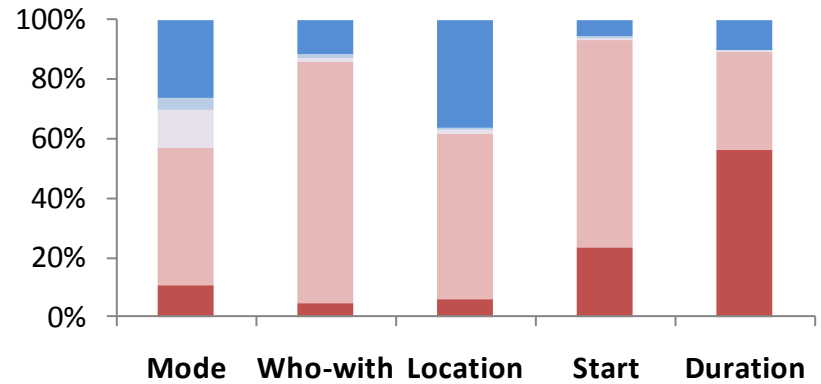


# Attribute vs Activity Planning

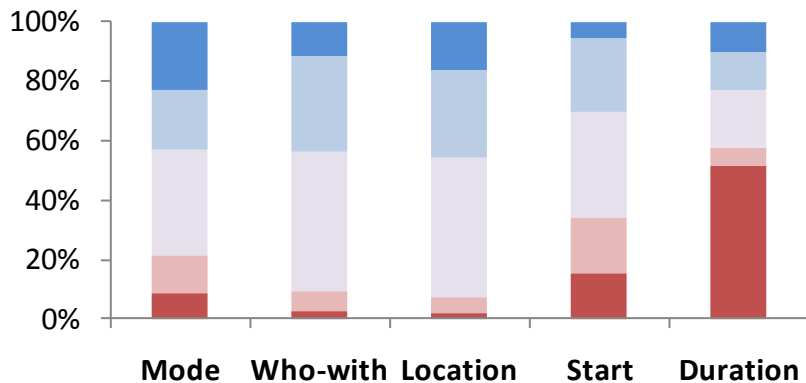
## Impulsive Activities



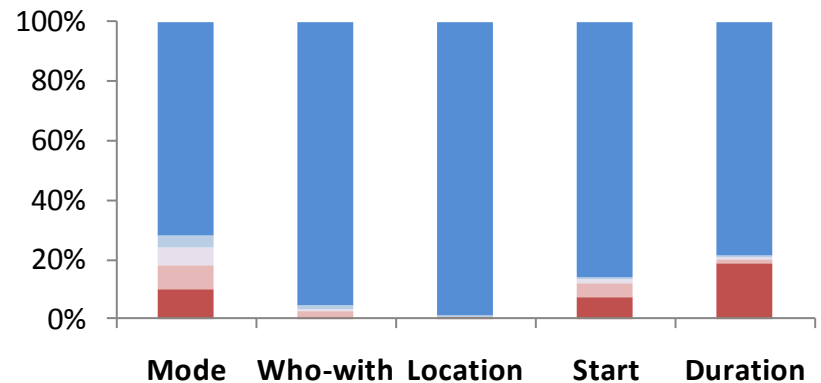
## Same Day Activities



## Preplanned Activities



## Routine Activities

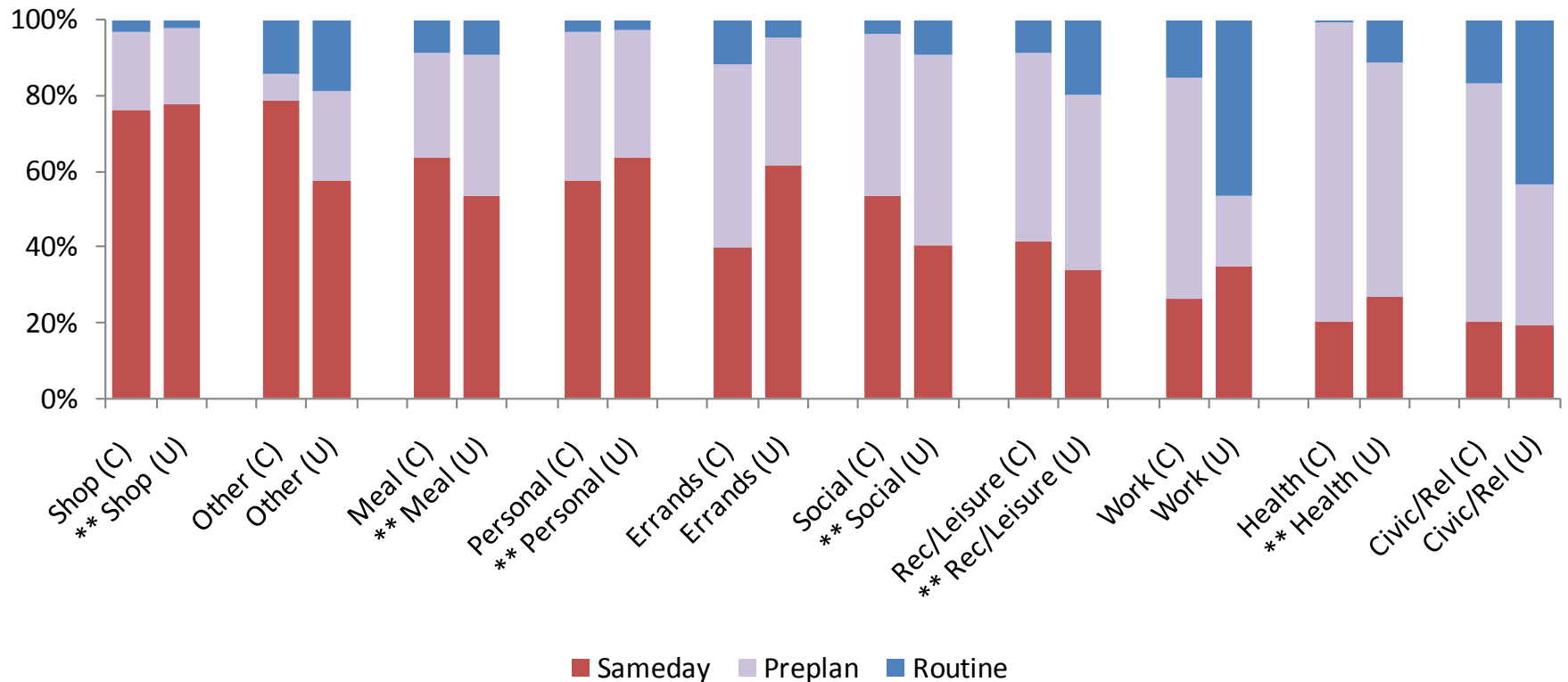


Impulsive Same Day Same Week Preplan Routine

Impulsive Same Day Same Week Preplan Routine

# Comparison to Other Plan Horizon Observations

- ▣ CHASE: other major source of planning data
- ▣ Very similar activity plan horizon distributions



# Activity Flexibility

- ▣ Another key aspect of planning behavior
- ▣ Perceived constraints on decision making
- ▣ For attributes: inflexible, somewhat or highly flexible

## Flexibility Distributions

	<i>MODE</i>	<i>PER</i>	<i>LOC</i>	<i>STR</i>	<i>DUR</i>
Inflexible	58%	64%	74%	25%	47%
Flexible	42%	36%	26%	75%	53%

## Flexibility Correlations

	<i>MODE</i>	<i>PER</i>	<i>LOC</i>	<i>STR</i>	<i>DUR</i>
MODE	1.00				
PER	0.10	1.00			
LOC	0.06	0.11	1.00		
STR	0.11	0.19	0.04	1.00	
DUR	0.06	0.04	0.03	-0.02	1.00

# Conclusions

# Conclusions

- ▣ Reinforcement of previous findings that:
  - GPS surveys have improved ability of capturing more short distance/duration trips
  - Self-reported surveys overestimate travel time
  
- ▣ Good quality data collected over long time period
  - two weeks of activity-travel data
  - Detailed planning behavior data
  - Little evidence of fatigue/conditioning
  
- ▣ Detailed planning data regarding each activity collected
  - Plan horizons and flexibilities for important activity attributes
  - Further understand activity planning processes
  
- ▣ Data used in multivariate analysis of planning to further understand factors influencing planning behavior

**THANK YOU!**





# Assessment of Data Quality

# Sample bias

- ▣ Measured by the percent root mean squared error (RMSE) in relation to:
  - Household size
  - Household income
  - Gender
  - Vehicle availability
  - Race
  - Age
- ▣ Reference values from American Community Survey (ACS)
- ▣ Non-elderly RMSE = 38.53%
  - Age is most critical characteristic: lower participation of individuals younger than 45 years-old
- ▣ Elderly RMSE = 49.15%
  - Income is most critical: over representation of incomes between \$75,000 - \$99,999 per year

# Respondent burden

- ▣ Feedback from respondents: Likert-type questions regarding experience with the survey
  - 53% of elderly and 63% of non-elderly say the survey is not difficult to complete
  - 60% believe the participation period of 2 weeks is not excessive
  - Major issue: 64% considered daily time commitment too long
- ▣ Time consumption:

Stage	Mean time on page	Standard deviation	Average time spent per day: lower limit	Average time spent per day: upper limit
Activities	01:54	00:52	04:44	12:33
Trips	01:19	00:40	02:41	08:21
Log correction	12:46	07:58	04:47	20:44
Total time	15:59	09:30	<b>12:12</b>	<b>41:38</b>

# Fatigue and conditioning

- ▣ Fatigue: saturation with the burden of survey
    - Decline in trip rate
    - Inconsistent answers
    - Increase in item non-response
  
  - ▣ Conditioning: influence of survey on behavior
    - Schedule optimization
    - Route optimization
  
  - ▣ Constant activity and trip rate over duration of survey
  - ▣ Decline of time spent answering questionnaires about trips and activities
  - ▣ Decline of missing value index
  - ▣ Fairly consistent answers
- Minimal effects of fatigue and conditioning