The Road Less Traveled: The Kitamura Route Choice Legacy

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The Joy of the Journey: Celebrating the Life and Work of Ryuichi Kitamura

Motivation for Research

"ATIS Impact on Travel Demand"

- Route choice with traffic information from ITS
- Likelihood of route switching
- Frequency of switching
- Effect of traffic information, background knowledge, experience with system

The ***REAL*** Motivation

- Challenge conventional wisdom concerning route choice behavior
- Explore other motivations than minimizing travel time, distance and cost

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- Challenge conventional wisdom concerning route choice behavior
- Explore other motivations than minimizing travel time, distance and cost
- ***Ryuichi as rebel***

Many Collaborators:

Gwen Owens	**Dr. Raghavan Srinivasan**
Dr. Mohammed Abdel-Aty	**Dr. Karthik Srinivasan**
Dr. Kenneth Vaughn	**Lou Dantas**
Dr. Prasunna Reddy	**Dr. Wan-Hui Chen**
Raghu Kowshik	**Dr. Jack Yang**
Dr. Fred Mannering	***Thomas Golob***

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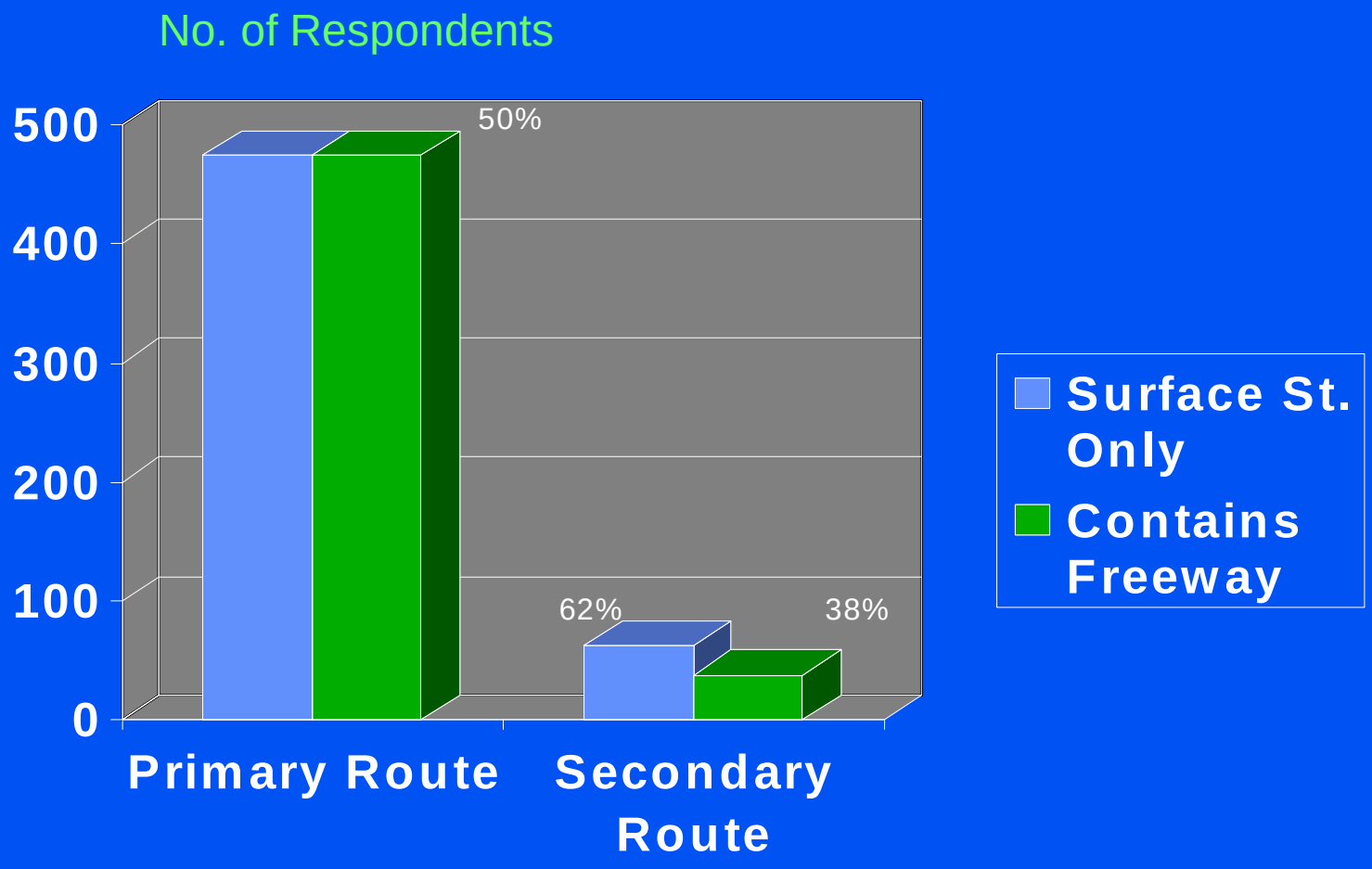
Los Angeles-Area Survey

- 1992 random sample of 944 LA-area commuters
- Tom Golob, UCI of particular help
- Obtained detailed route by route, street by street information on typical travel to work/school
- Reported behavior concerning route switching frequency and acquisition of traffic information

Summary of Predictor Variables

- **Commute Distance (miles)**
- **Travel Time (min.)**
- **Mode used**
- **Socio-demographic information**
- **Years at home, job**
- **Receipt of pre-trip traffic reports**
- **Receive en-route traffic reports**
- **Flexibility in work schedule**
- **Perceptual ratings**

Commuters' Route Choice



Approach – Bi-variate Probit

$$Y_1^* = \beta X_1 + \epsilon$$

$$Y_1 = \begin{cases} 1 & \text{if } Y_1^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Receipt of traffic information

$$Y_2^* = \alpha X_2 + \Theta Y_1 + \xi$$

$$Y_2 = \begin{cases} 1 & \text{if } Y_2^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Use of more than one route to work

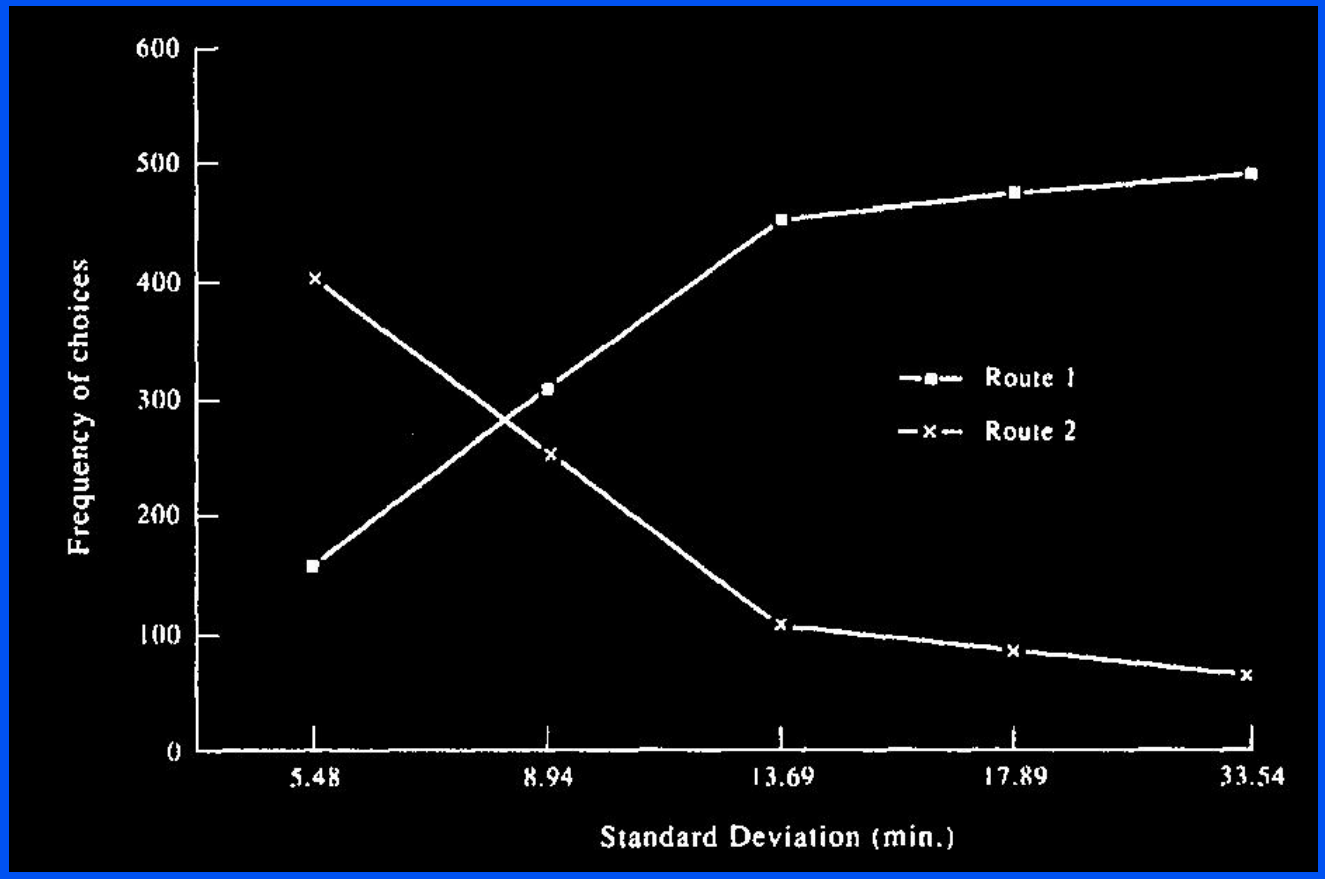
Probit Model: Pre-trip Acquisition

	Coefficient	t-statistic
PRE-TRIP INFORMATION MODEL		
Constant	-0.416	-3.79
X1 No variation in traffic conditions dummy (1 if no variation on perceived, 0 otherwise)	-0.361	-3.68
X2 Female dummy (1 if female, 0 otherwise)	0.110	1.15
X3 Uncertainty of travel time dummy (1 if reported that trip time uncertainty is a major problem, 0 otherwise)	0.436	3.23
X4 Distance from home to work	0.013	3.40
MULTIPLE ROUTE MODEL		
Constant	-2.033	-6.95
X5 Income dummy (1 if income ³ $75,000, 0 otherwise	0.302	2.43
Y1 Receiving pre-trip information dummy (1 if receive pre-trip information, 0 otherwise)	1.002	2.74
X6 No. of driving days in the last 2 weeks	0.032	1.26
X7 Level of education dummy (1 if respondent is a college grad. or completed some college, 0 otherwise)	0.409	2.55
Error-term Correlation	-0.518	-2.38

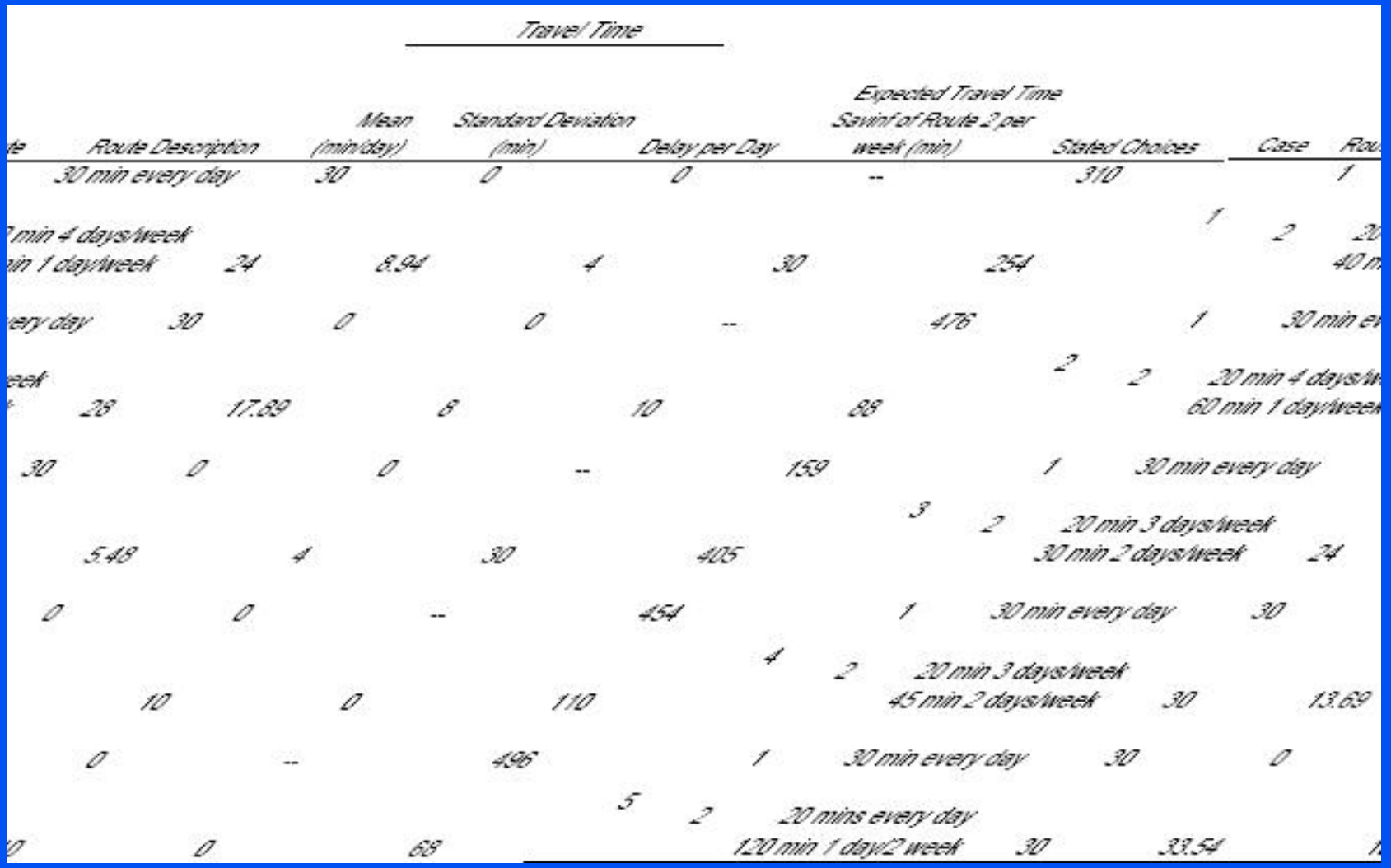
Second Wave Survey

- Conducted one year later, obtained any changes in behavior or location
- Included 5 stated preference questions
  - Choice of 2 routes: slower but no variability; second faster but more variable
- Identify participants for 3rd wave: customized route choice mailback survey

Stated Preferences: Two Hypothetical Routes



Stated Preferences with Uncertainty



		Travel Time							
	Route Description	Mean (min/day)	Standard Deviation (min)	Delay per Day	Expected Travel Time Saving of Route 2 per week (min)	Stated Choices	Case	Rou
	30 min every day	30	0	0	--	310		1
	1	2	20					
	min 4 days/week in 1 day/week	24	8.94	4	30	254		40 m
	ery day	30	0	0	--	476	1	30 min ev
	2	2	20 min 4 days/w					
	28	17.89	8	10	88			60 min 1 day/week
	30	0	0	--	159	1	30 min every day	
	3	2	20 min 3 days/week					
	5.48	4	30	405		30 min 2 days/week	24	
	0	0	--	454	1	30 min every day	30	
	4	2	20 min 3 days/week					
	10	0	110		45 min 2 days/week	30	13.69	
	0	--	496	1	30 min every day	30	0	
	5	2	20 mins every day					
	0	68		120 min 1 day/2 week	30	33.54		

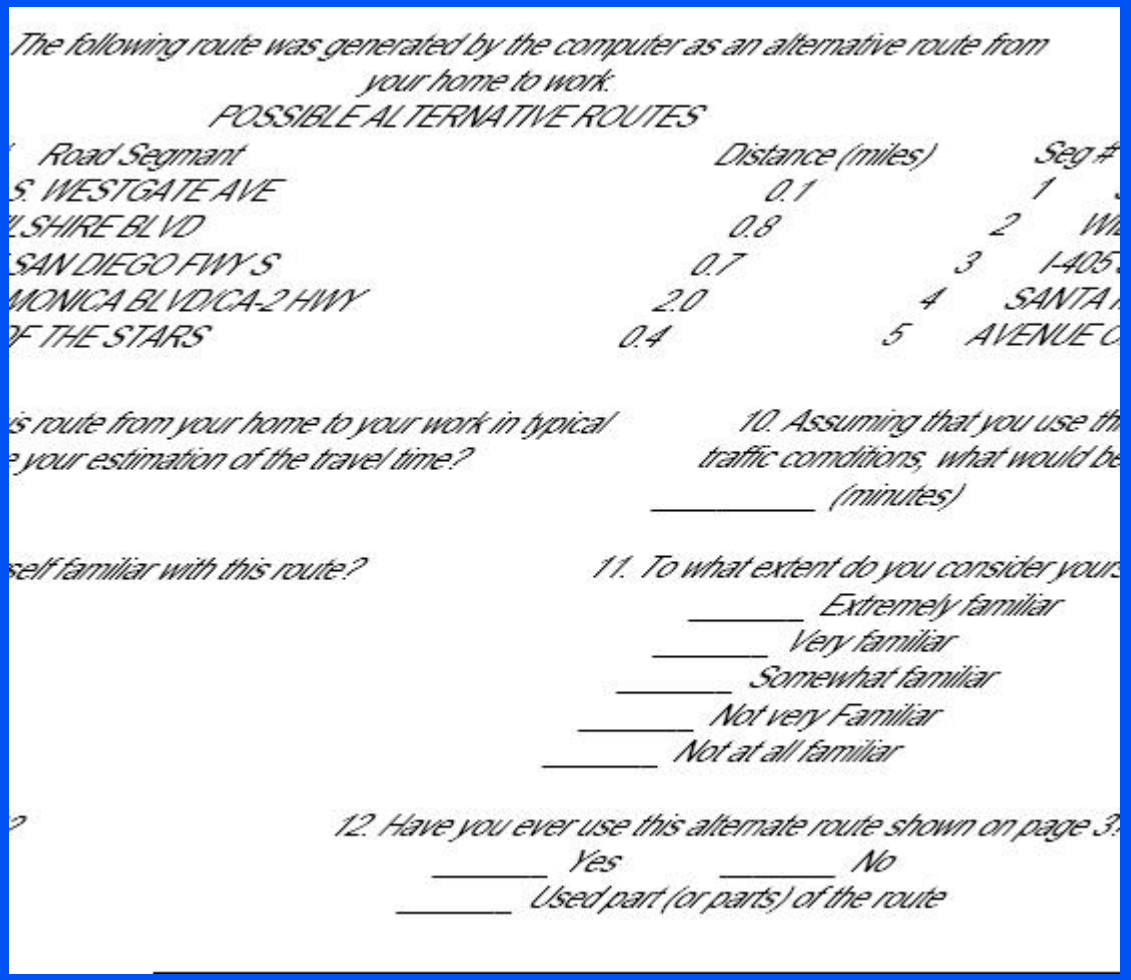
Effect of Travel Time Variability

	Normal mixing distribution	
	Coef.	t-stat
Constant	-2.394	-5.89
X_1 Attitude toward shorter distance dummy (1 if extremely or very important, 0 otherwise)	0.550	3.26
X_2 Standard deviation of travel time on Route 2 (min.)	-0.067	-6.32
X_3 Difference in expected travel time between Route 1 & 2 /week	0.067	10.31
X_4 Receive pre-trip information - instrumented	0.416	2.54
X_5 Male dummy variable	0.548	3.25
α Standard Deviation of ξ_1	1.462	13.51

Third Wave Mail-back Customized SP

- Tried to make SP more realistic by including actual route as one alternative – asked specific questions comparing *these actual routes*
- Developed another SP to include different travel time, travel time variability and provision of traffic information built around actual travel time of chosen reported route

Compare Primary Route to Specific Alternate



The following route was generated by the computer as an alternative route from your home to work:

POSSIBLE ALTERNATIVE ROUTES

	Road Segment	Distance (miles)	Seg #	
	S. WESTGATE AVE	0.1	1	
	L SHIRE BLVD	0.8	2	W
	SAN DIEGO FWY S	0.7	3	I-405
	MONICA BLVD/CA-2 HWY	2.0	4	SANTA
	F THE STARS	0.4	5	AVENUE

s route from your home to your work in typical
your estimation of the travel time?

10. Assuming that you use th
traffic conditions, what would be
_____ (minutes)

self familiar with this route?

11. To what extent do you consider your
_____ Extremely familiar
_____ Very familiar
_____ Somewhat familiar
_____ Not very Familiar
_____ Not at all familiar

?

12. Have you ever use this alternate route shown on page 3
_____ Yes _____ No
_____ Used part (or parts) of the route

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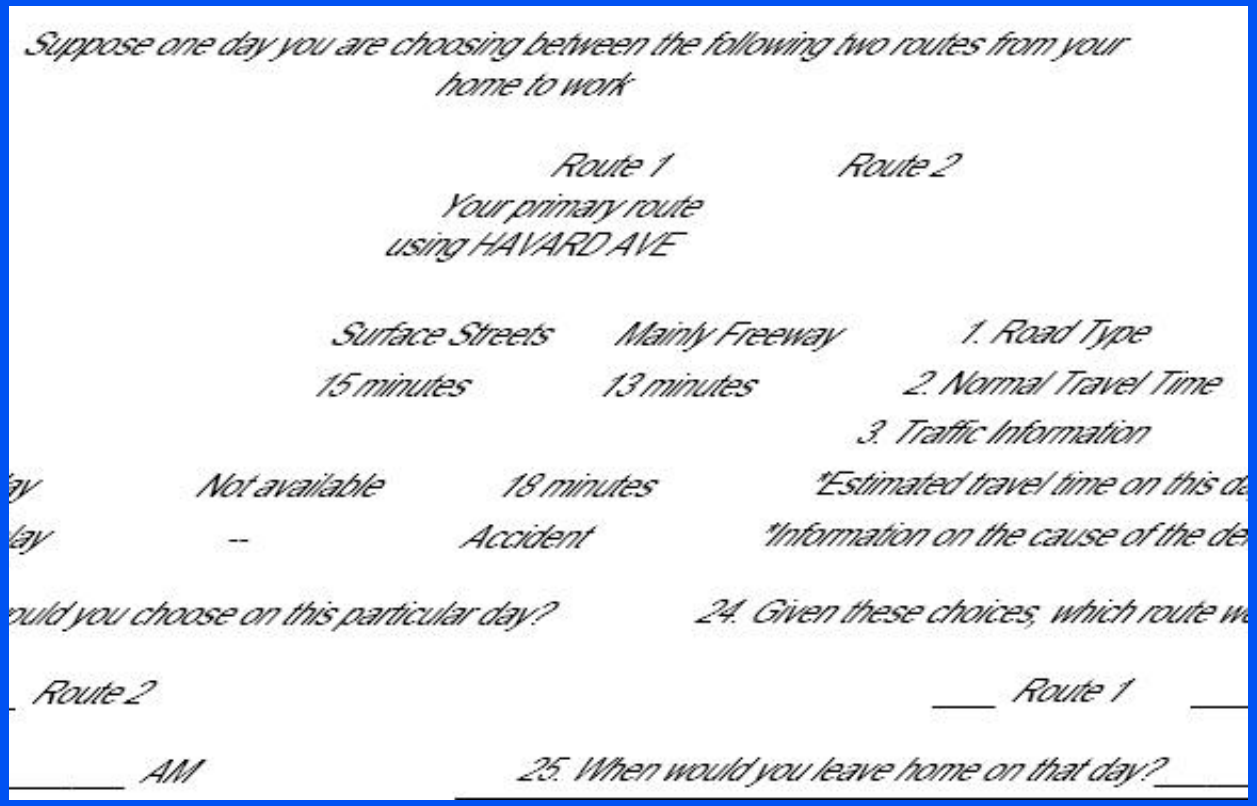
Expanded Through SP



Suppose one day you are choosing between the following two routes from your home to work

	Route 1 Your primary route using HAVARD AVE	Route 2
1. Road Type	Surface Streets	Mainly Freeway
2. Normal Travel Time	15 minutes	13 minutes
3. Traffic Information		
*Estimated travel time on this da	Not available	18 minutes
*Information on the cause of the del	--	Accident

24. Given these choices, which route wo

___ Route 1 ___ Route 2

25. When would you leave home on that day? _____ AM

Research Innovations

- Route choice panel
- Use of perceptual variables
- Used GIS to generate specific alternative routes
- Multiple stated preference “experiments” to extend analyses
- SP applied to transit component as well
- Travel time saving – travel time variability tradeoff
- Methods used

Ryuichi's Concluding Comment

"Aw . . . You don't really believe those results do you????"

Legacy

- Influence on route choice is clear with citations through 2008
- Traffic assignment formulations
- Emergency vehicle routing
- Women Travel – implications for willingness to take risks and address uncertainty
- Methodological reference in crash data analysis