Transportation Studies Considering the Aspect of Transportation Users

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OVERVIEW

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2. Transportation User Perception
3. Driver perception & Driver Behavior
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5. Measurement of Driver Perception
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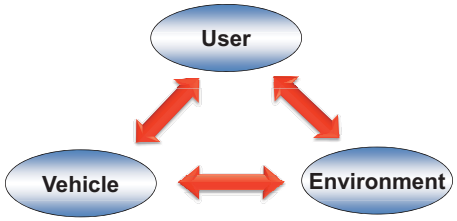
Introduction

Transportation system exists to provide high quality service to **users, which** is a critical component within the transportation systems.



Introduction

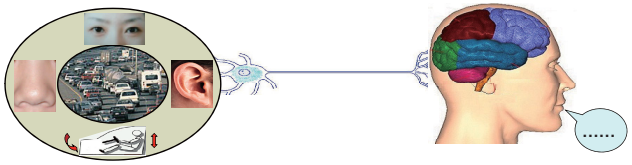
However,

- Deficient **consideration** of "user" in transportation MOEs
- **Limitation of conventional methods** to evaluate user perception
- **Subjective and complicated** human thought process
- **A linguistic approach** for human perception, not a numerical approach

A need to develop a new method to analyze appropriately **subjective and complicated human perception**

Transportation User Perception

A process that begins with human sensory organs and ends in the brain



Examples

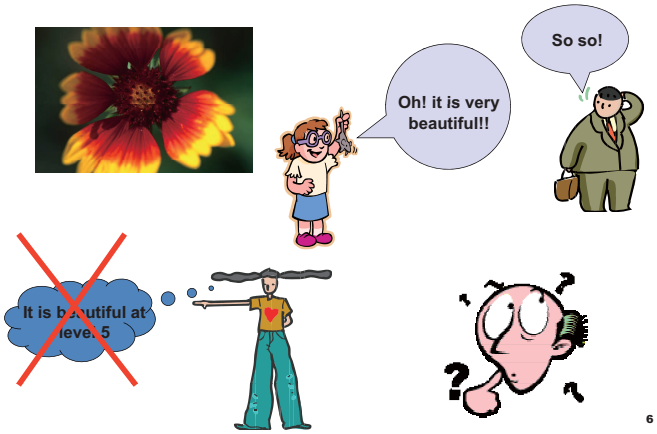
- Detect and recognize hazards
- Acquire and interpret certain information
- Perceive and evaluate service quality

} Make decisions as a response

To express the perception

- Use natural language rather than a numerical value
- Use subjective way rather than objective way

What do you think the flower?



Transportation User Perception

10 minute delay!!

"It's O.K. A 10 minute delay is not a problem."

"It may be a problem. I may be late."

"Oh, my gosh, another 10 minute delay. My boss will kill me"

Transportation User Perception

Example
(Survey of Service Quality of Signalized Intersections)

Question (Part 5)

Q1. What is your perception of the service quality at this intersection? (Please circle one of the linguistic values given below.)

Poor Acceptable Good

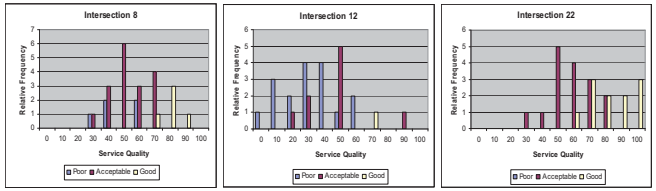
Q2. What percentage of satisfaction do you get from this signalized intersection?
(Please write your perception of this intersection's service quality with numerical values ranging from 0 to 100. "0" means least satisfactory, and "100" means most satisfactory.)

Transportation User Perception

Results using the HCM method

	Intersection 8	Intersection 12	Intersection 22
Measured Delay (sec.)	15	106	28
LOS	B	F	C

Results of the Survey



Driver Perception & Driver Behavior

Highway Facilities and Transportation Service

Transportation Users

Perceptions → Behaviors

Changing Traffic Flow Conditions

Driver Perception & Driver Behavior

< Example >

Perception	.....	Recognize ahead deficient geometric conditions
Behaviors	.....	Speed down and drive carefully
Changing Traffic Flow Conditions	.....	• Traffic flow speed down • Congestion may occurs

Analysis of Driver Perception & Behavior

Limitation of Conventional Methods to Evaluate Transportation User Perception

⇒ A Need of Using Alternative Methods

1. **A Fuzzy Set Theory**
2. A Rough Set
3. A Subjective Probability

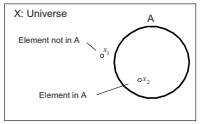
Analysis of Driver Perception & Behavior

A fuzzy set

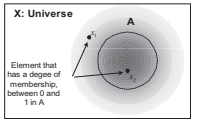
A classic set: a collection of elements in a given domain with a sharp boundary

A fuzzy set : a set with "un-sharp" and vague boundary

a classic set



a fuzzy set



※ In a classic set, there is always a sharp boundary unlike real problems

⇒ Fuzzy sets can analyze real problems with an "un-sharp boundary like user perception

Analysis of Driver Perception & Behavior

Example
(Sets for Service Quality of Signalized Intersections)

LOS	A	B	C	D	E	F
Control Delay (s/veh)	≤ 10	> 10-20	> 20-35	> 35-55	> 55-80	≥ 80

(Source : 2000 HCM)

Intersection A (Control Delay : 45s/veh)

Intersection B (Control Delay : 36s/veh)

A : LOS D
B : LOS D

A : LOS D with 1.0
B : LOS D with 0.4 & C with 0.6

Analysis of Driver Perception & Behavior

■ Studies using Fuzzy Sets to Analysis Transportation User Perception.

- Nodh & Ashford (1995)
  : Analysis of Airport Terminal Service Quality
- Hamad & Kikuchi (2002)
  : Development of Congestion Index
- Lee et al.(2005)
  : Analysis of VMS Service Quality
- Lee et al. (2006)
  : Analysis of Freeway Median Safety Level
- Lee et al. (2007)
  : Analysis of Intersections Quality
- Lee & Donnell (2007)
  : Analysis of Driver Behavior on Pavement Markings

Measurement of Driver Perception

1. **Survey or Interview**
2. **Video-based simulation**
3. **In-vehicle field method**

Methods	Strength	Weakness
Survey or interview	• Representative of the wider driving population or overall driving environments • Possible to collect a relatively large sample size • Cost effective method regarding sample size.	• Removed from the immediate driving environments of the roadway • Difficult to collect drivers' perceptions regarding specific roadway conditions • Difficult to investigate the insight into drivers' thought, perceptions, and evaluations of roadway conditions

Measurement of Driver Perception

Methods	Strength	Weakness
Video-based simulation	Possible to present repeatedly to participants Possible to conduct the experiments with controlled condition to investiga te the effect of given conditions	Removed from the immediate driving environments of the roadway Difficult to collect large size of data Not cost effective method regarding sample size.
In-vehicle field method	Possible to investigate the insight into drivers' thought, perceptions, and e valuations of roadway conditions Possible to obtain the issues that matter to drivers in a actual driving experience No removed from immediate driving environments of the roadway	Difficult to collect large size of data Not cost effective method regarding sample size. Difficult to collect the perception from various driver characteristics Difficult to collect data with real driving situation(e.g. time pressure)

Measurement of Driver Perception

Video-based simulation

- **Use Real Video Data**
- **Use Virtual Reality Video Data**

Video-based simulation Using Virtual Reality Video Data

Use 『UC-win/Road Program』

Measurement of Driver Perception

Simulation Using Virtual Reality Video Data

Some Examples

Korean 2+1 Roads

An Expressway in Korea

Conclusion

- **Many influencing factors** for analyzing transportation user perception.
- A need of a new method to analyze appropriately **subjective and complicated human perception**

- **Considering an aspect of transportation** users is very important, but difficult.
- **A virtual reality technique** is one of great alternative methods to analyzing transportation user perception and behaviors.

"If the only tool you know is a hammer, everything looks like a nail. However, sometimes, it is much more effective to use a screw driver instead of a hammer for certain jobs."

THANKS !

QUESTIONS & COMMENTS