

Can “mobile” devices work for mobility?

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- In 2009, 5,474 people were killed in U.S. roadways and 448,000 were injured in motor vehicle crashes that involved distracted driving. (FARS and GES)
- 20 percent of injury crashes in 2009 involved reports of distracted driving. (NHTSA).
- 18% of fatalities in distraction-related crashes was a cell phone use. (NHTSA)

HMI guidelines for in-vehicle device

Display: Size of display, size of character, visibility, auditory intensity, audibility

Location of display: Gaze direction

Amount of information: Not too complex to read within a limited time, the speech length should be within a few words

Task complexity: Task should be completed within 20 seconds (AAM), Total glance time should be within 8 second (JAMA).

People loves “always connected”



“Sense of reassurance”?

How integrate “connectivity” with car driving?

Overview

- Why it is difficult to go connectivity and car driving together?
 - The driver has to perform two different tasks
 - Task switch make the performance worse
 - Performance decrease even the task is auditory task
- Does the solution exist?
 - Learn from human verbal communication in car
 - Timing of talk and contents

Features of Car Driving

- **Situation is dynamically changing**
 - **Task demand is not constant**

Task demand



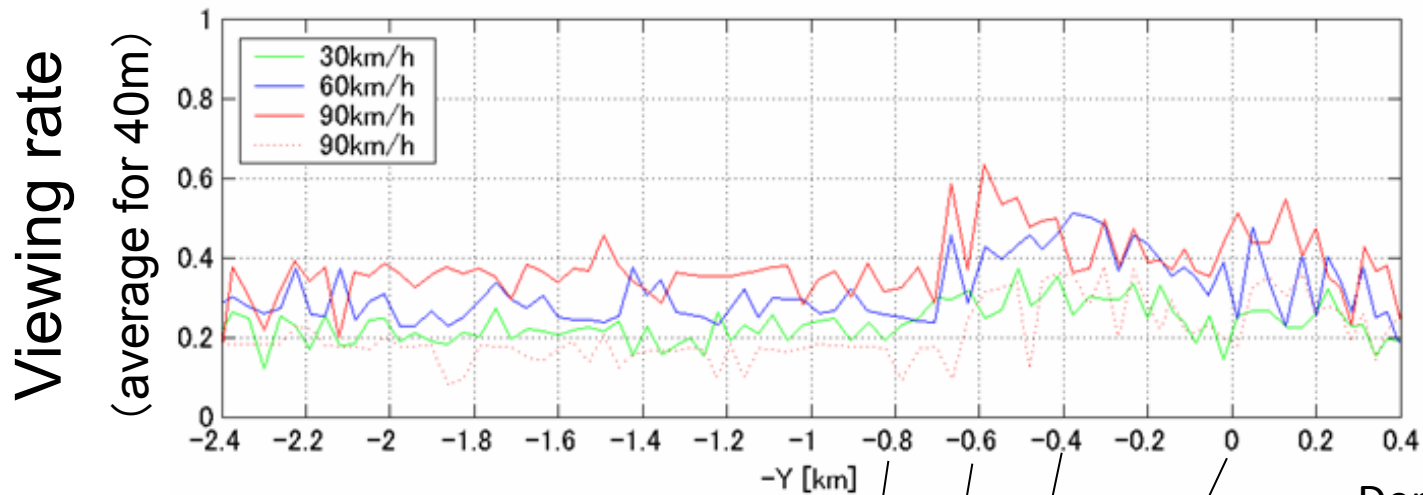
Measurement of visual demand



Senders
(Univ. Toronto)
1966



Get view for 0.6 second after the button press. Wait until one's patience

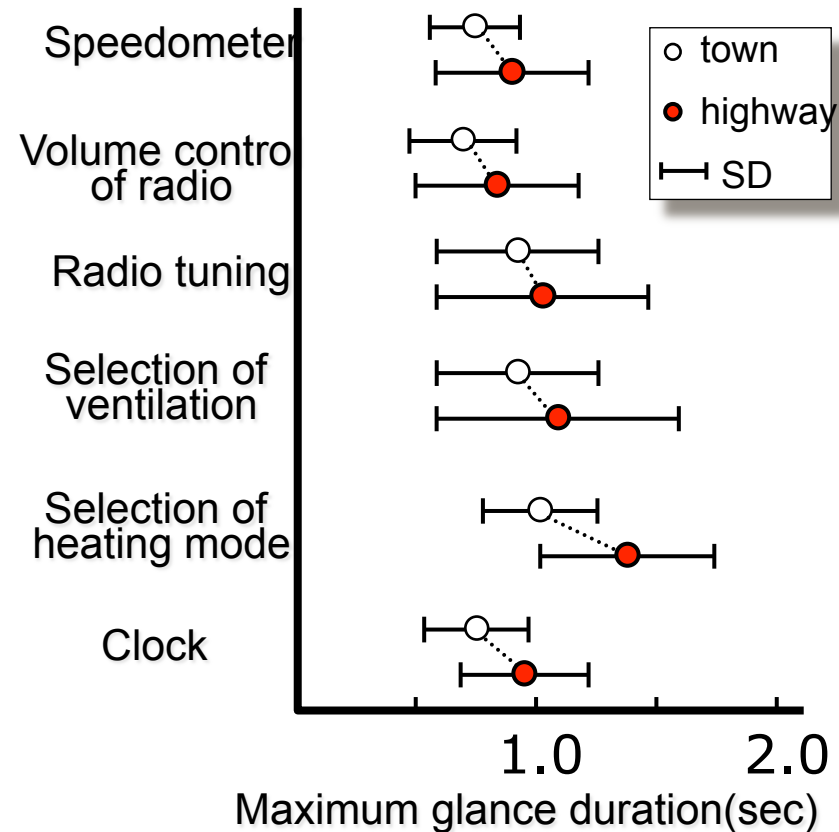


Demand depends on road condition and vehicle condition



Amount of information presentation can not be fixed

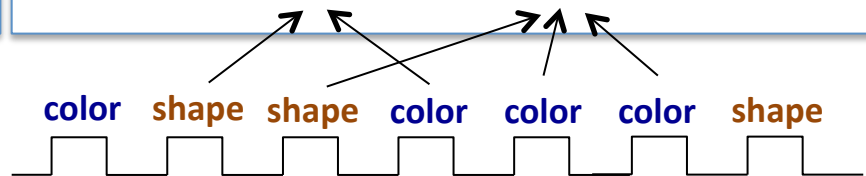
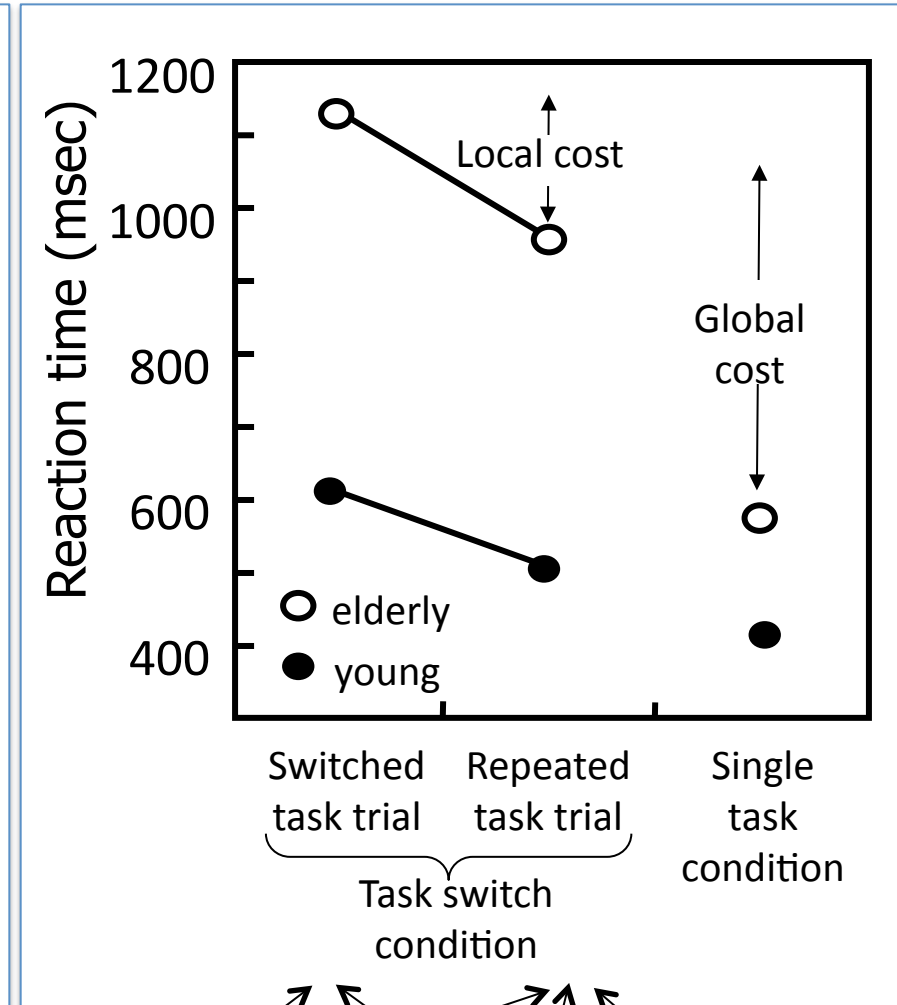
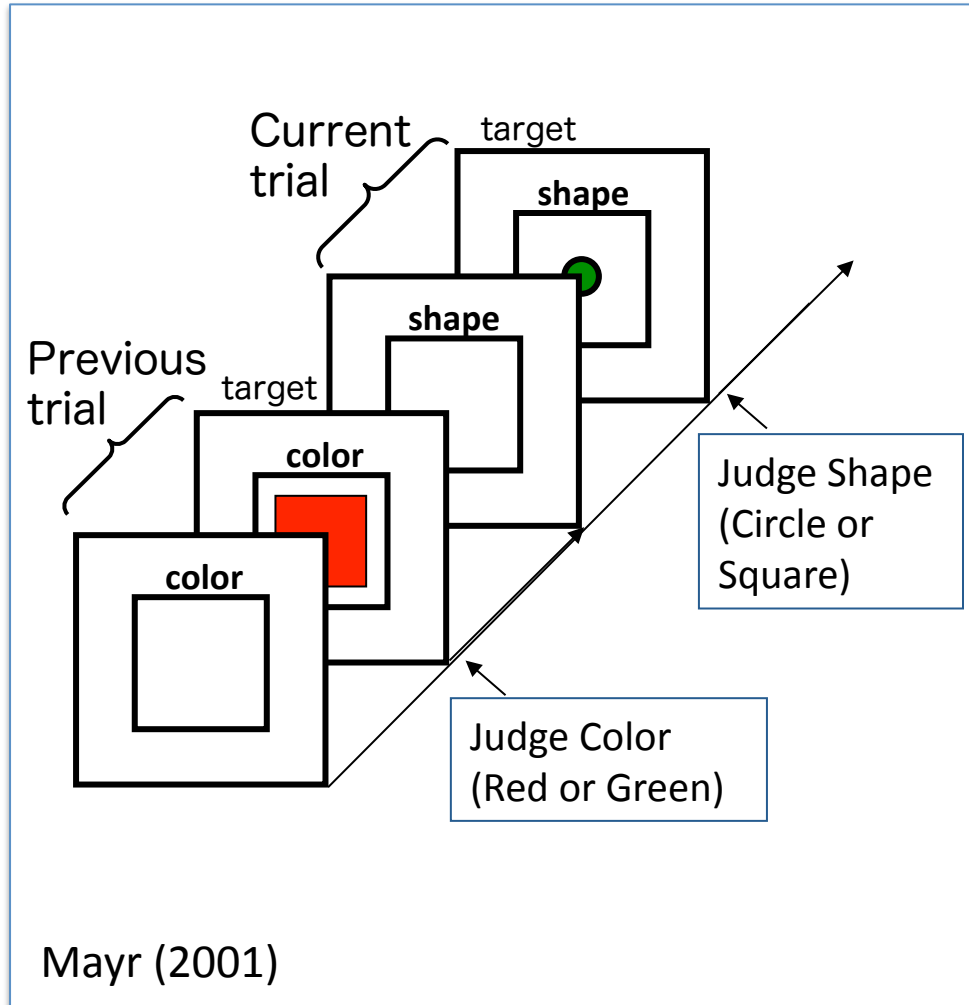
We perform dual tasks by time sharing while driving



Distraction is induced by task switching

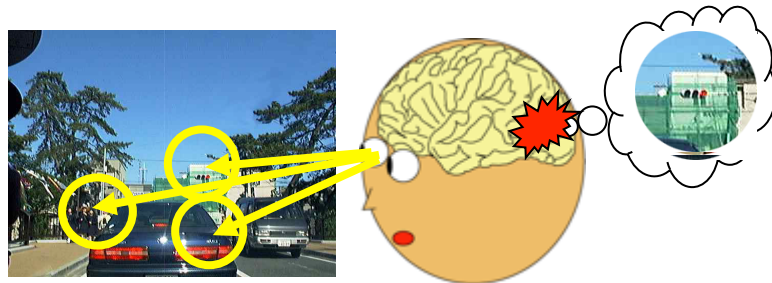
Between 0.5 sec and 1.8 sec

Task switch is difficult

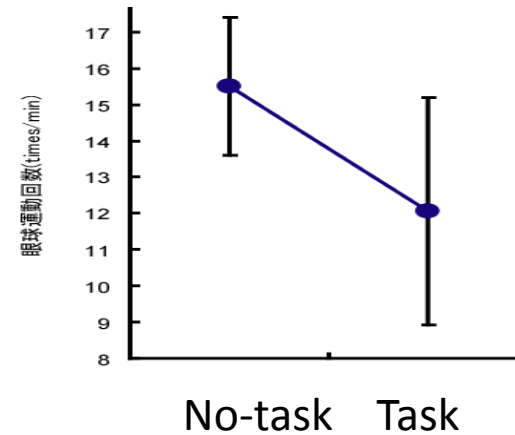


No visual task reduces the visual performance

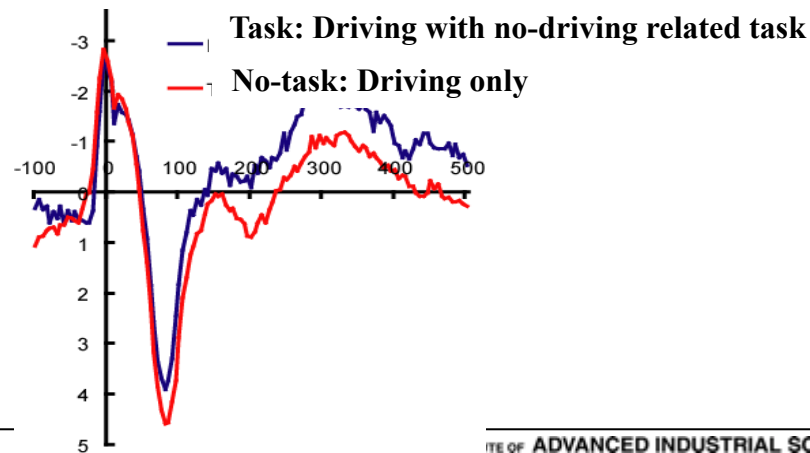
Experimental Vehicle



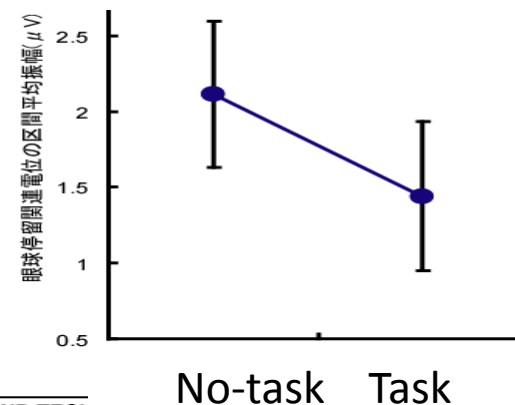
Num of saccadic eye movement



Eye Fixation Related Potential



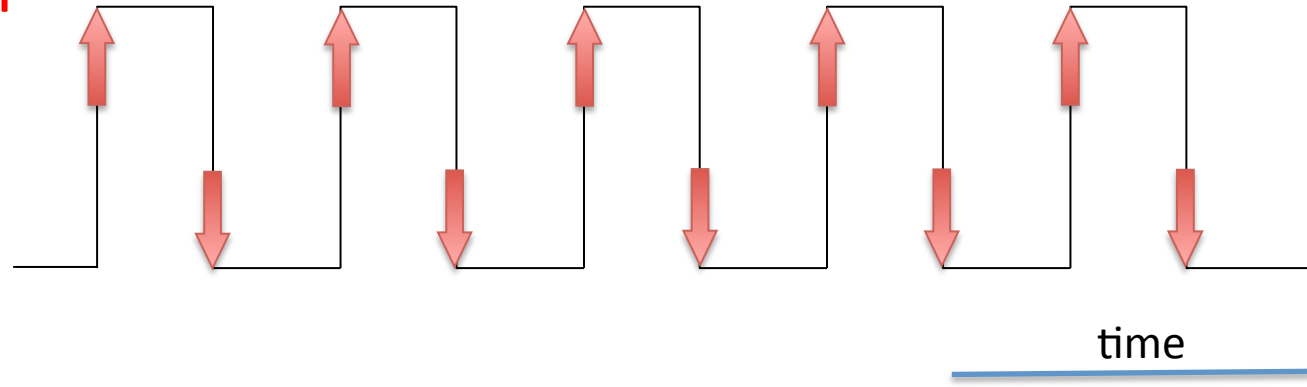
Amplitude of eye fixation related potential



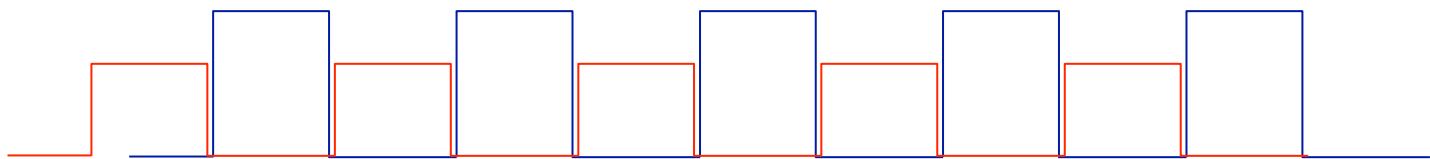
Task switch workload

Information task

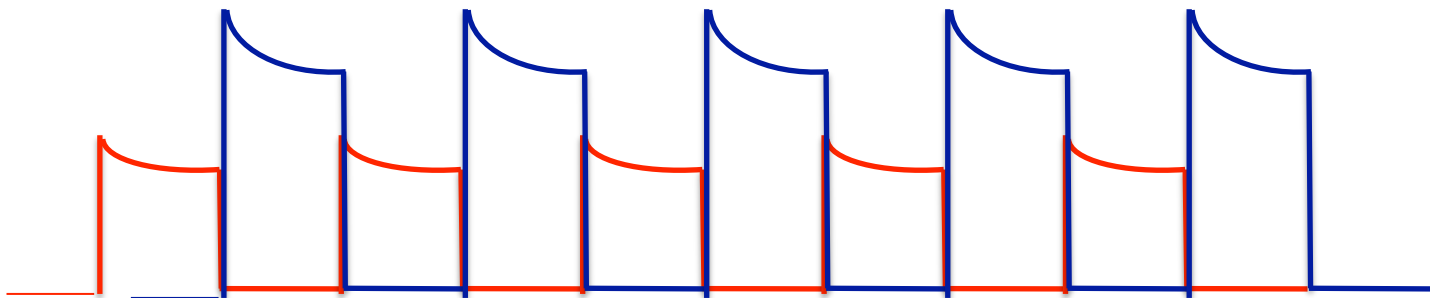
driving



Information task + driving task



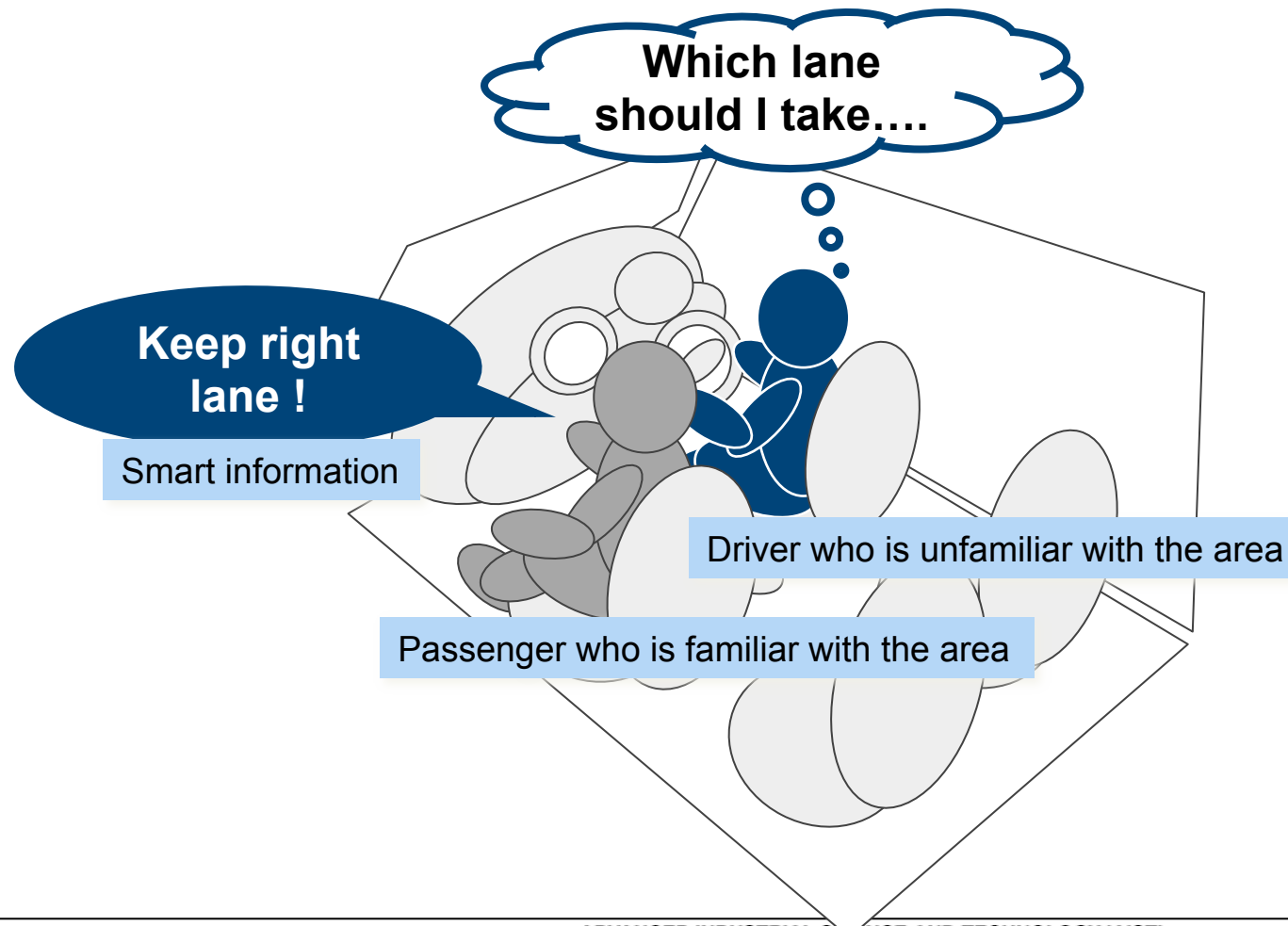
Actual Workload



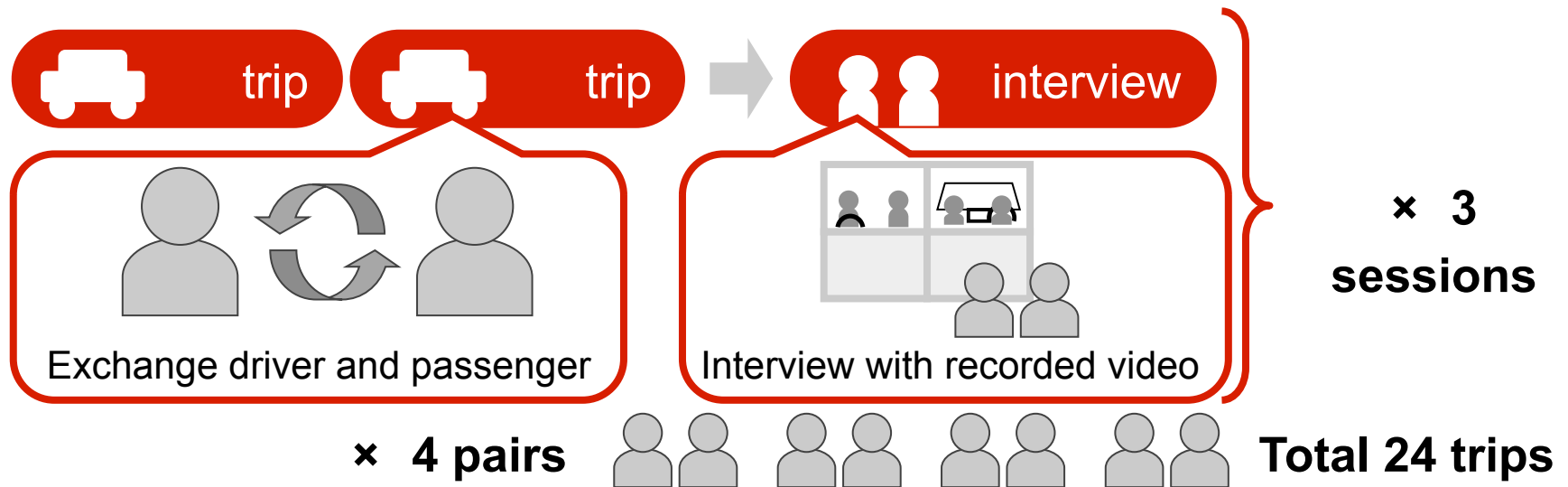
Does the solution exist?

“blink hood”
is required ?

How we manage complex dual tasks with a passenger while driving



Create the smart passenger



1. Assist as they usually do
2. Assist after what the driver like to know
⇒Based on findings by the interview session
3. Assist after learn how to do
⇒Advices obtained from other pairs

Collaborate work with Nissan Motor

Inensitive assistance

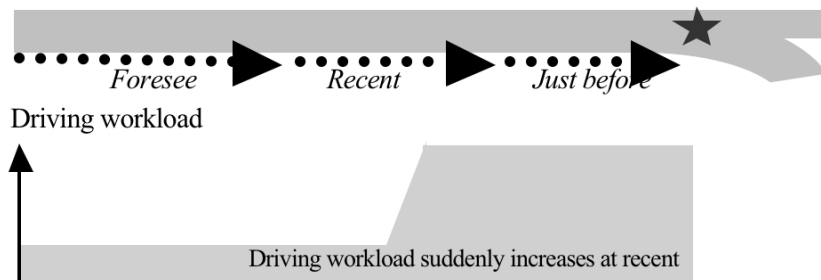
- Timing of information -

- ✓ Don't tell during deceleration:
 - If we are going to stop, tell after stopped.
- ✓ Don't tell when the signal is going to change to red
 - Tell after it became red.
 - Tell after completing turn at an intersection.
- ✓ Foresee other traffic

Timing should be managed to be compatible with driver workload

Examples of “Smart information”

	Driving Scene	Timing	Content of information
1	Approaching to ETC gate	Foresee Near	Lane direction to ETC gate Confirming the current lane was correct
2	Approaching a bidirectional branch of the metropolitan expressway	Foresee Near	Lane direction to the branch Confirming the current lane was correct
3	Merging to enter the expressway	Near	Timing of acceleration or slowdown



Foresee: Target is not yet seen
 Near: Target is seen but no necessary to take action
 Just before: Timing of taking action, otherwise fail it

Smart assistance

- **Information is structured, not just splitting**
 - Pre-cueing: “I’ll tell afterward”
 - Future task: “Situation will be ** after the exit”
- **Select a good cue in the environment**
 - “Follow that red car”
 - “The restaurant is behind that back building”

Conclusion

- Connectivity via mobile devices and car driving must go together for people nowadays.
- We must realize it is essentially difficult. No dreamland of technology.
- We must find the solution, more than just information transmission.
 - Structuralize information.
 - Convey information based on the structure at the good timing of situation.