



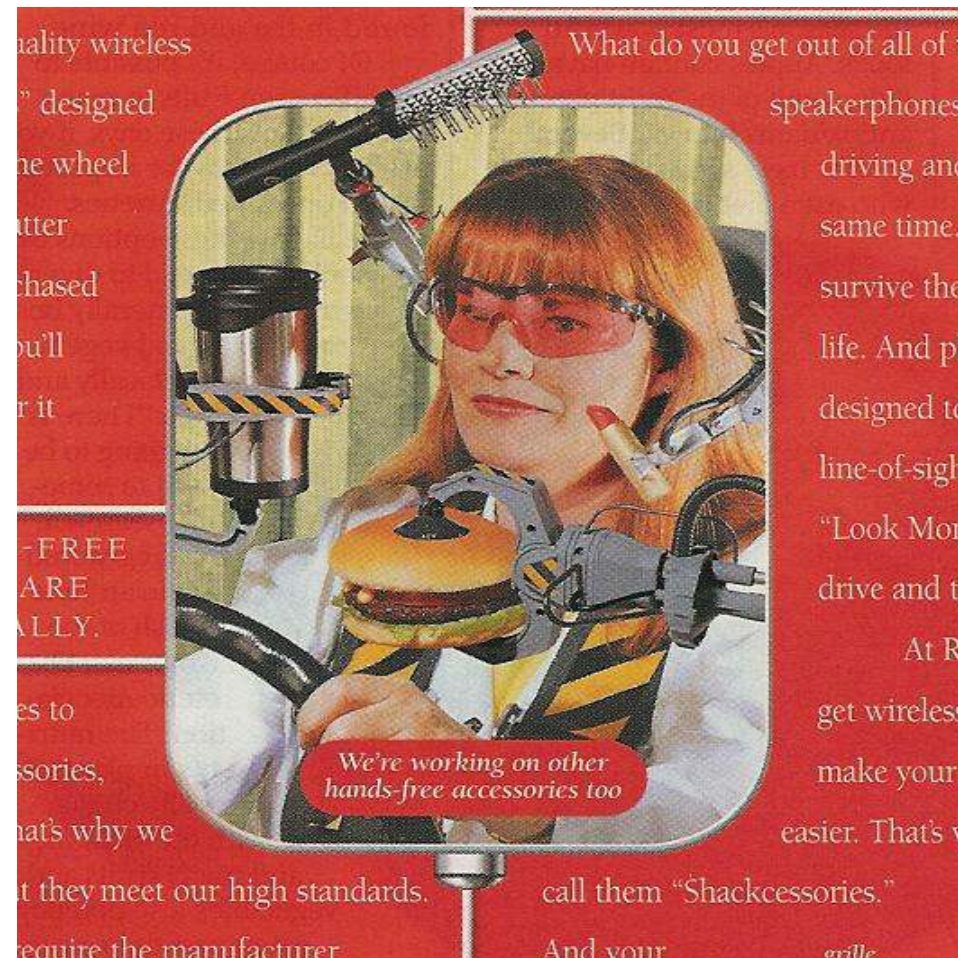
Driver Distraction: A view from the simulator



Frank Drews & David Strayer



Distracted Driving and Multi-tasking...



Research Questions



- Does conversing on a cell phone interfere with driving?
- What are the sources of the interference?
 - Peripheral interference (dialing, holding the phone)
 - Attentional interference (cell phone conversation)
- Who is affected?
 - Are there age / expertise effects?
- How much are drivers affected?
 - How significant is the interference?
 - How do other cell phone activities compare?
 - How do other types of conversation compare?

Simulator-Based Studies

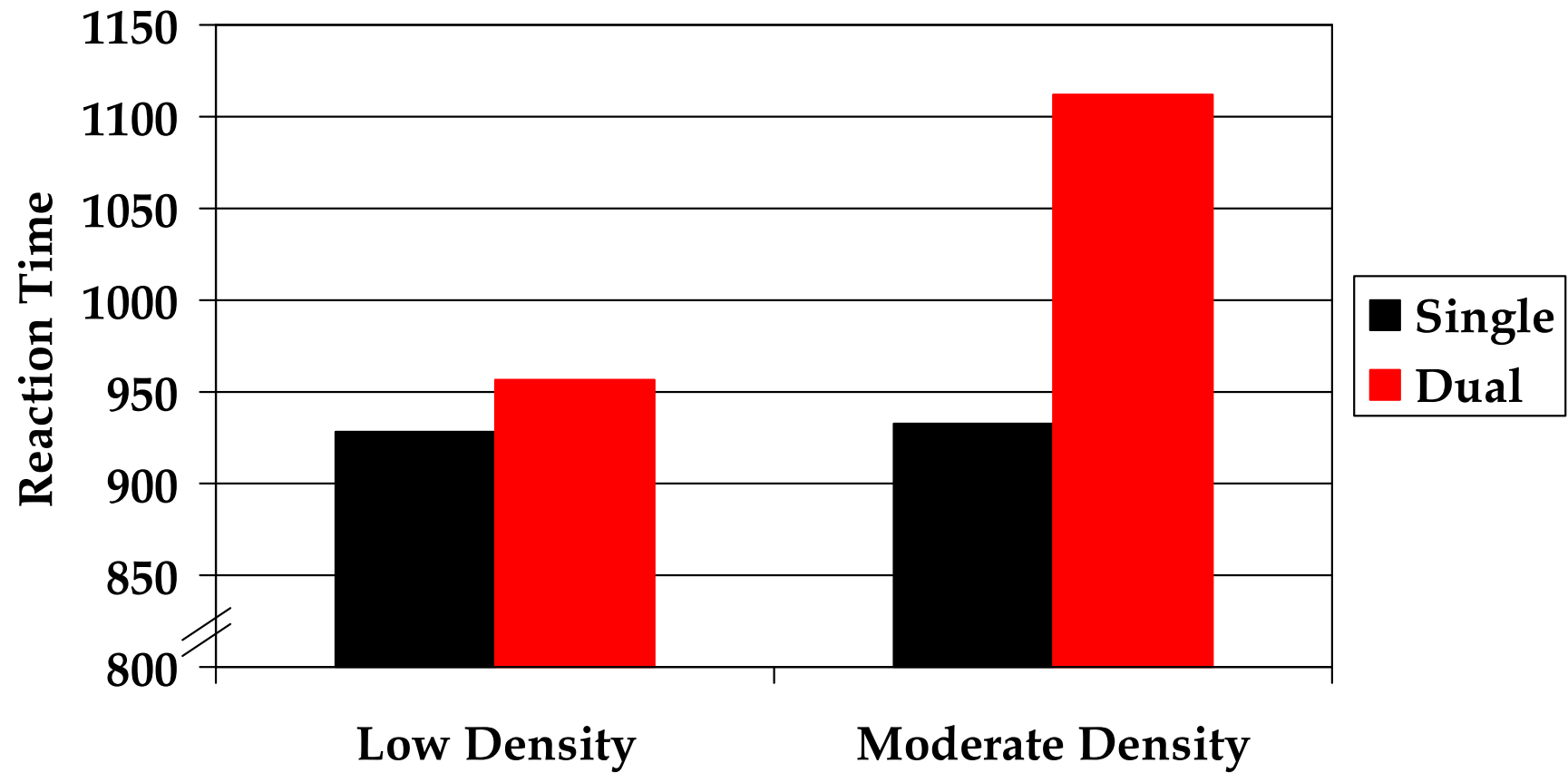


Does conversing on a cell phone interfere with driving (Experiment 1)

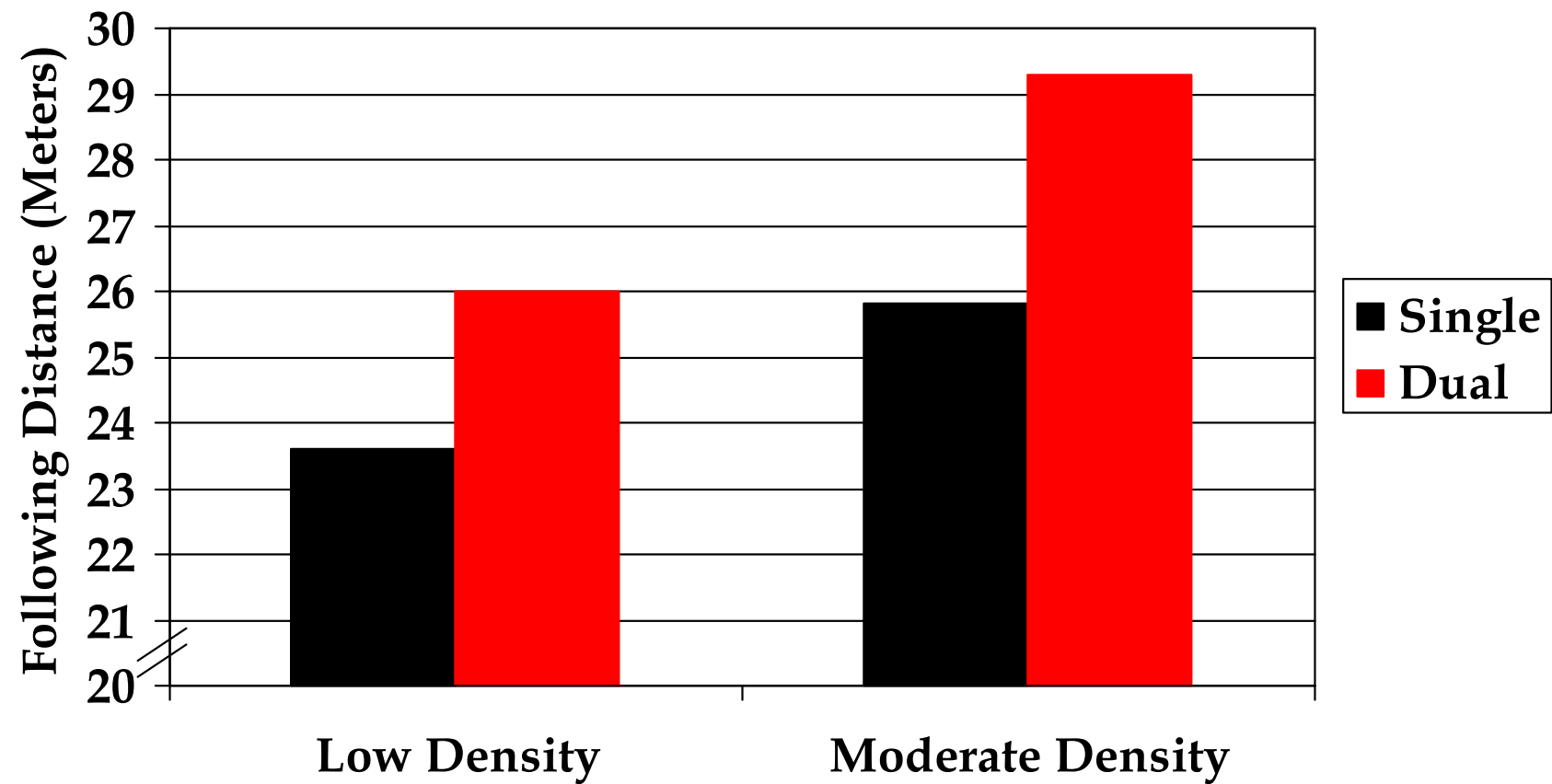
- Car-following paradigm
 - Follow periodically braking pace car
 - Required timely and appropriate reactions
 - Hands-free cell phone (positioned in advance)
 - Naturalistic conversations
- Conditions
 - Single vs. dual-task
 - Low vs. moderate density *
- Measures
 - Reaction time
 - Following distance
 - Rear-end collisions

	Single	Dual
Low		
Mod.		

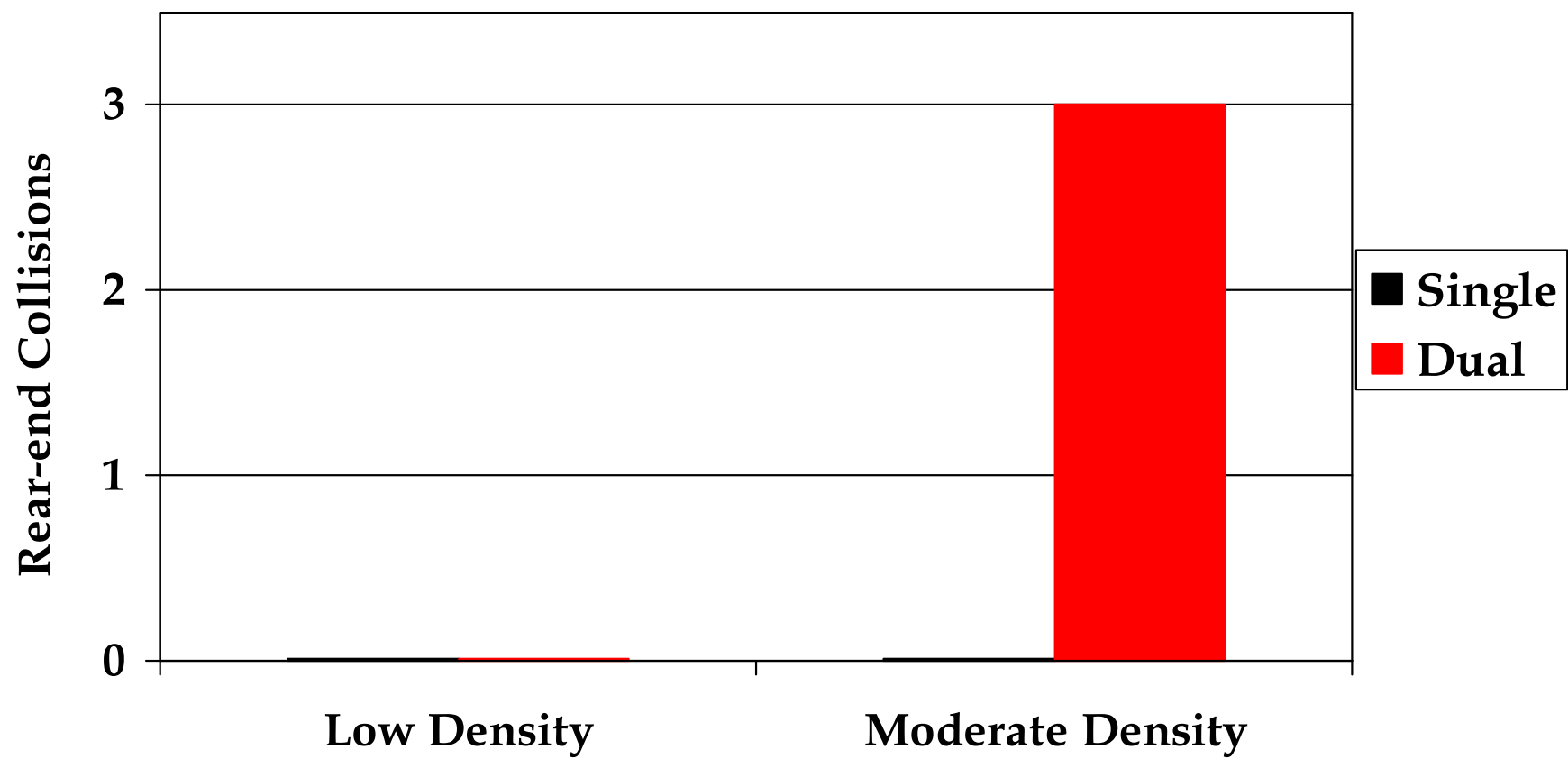
Reaction Time



Following Distance



Rear-end Collisions





Summary (Experiment 1)

- Cell-phone driver's
 - Slower reaction times
 - Drivers compensate by increasing following distance
 - Increase in rear-end accidents
- Cell-phone interference
 - Naturalistic conversations

Why Do Cell Phones Cause Interference?

- From earlier studies, no interference from:
 - Radio broadcasts (audio input)
 - Books on tape & recorded conversations (audio/verbal input)
 - Simple shadowing (audio/verbal input, verbal output)
- Implies active engagement in conversation necessary
- Impairments from both hand-held and hands-free units
 - Implies central / cognitive locus
 - Inattention-blindness (Neisser, Simons)

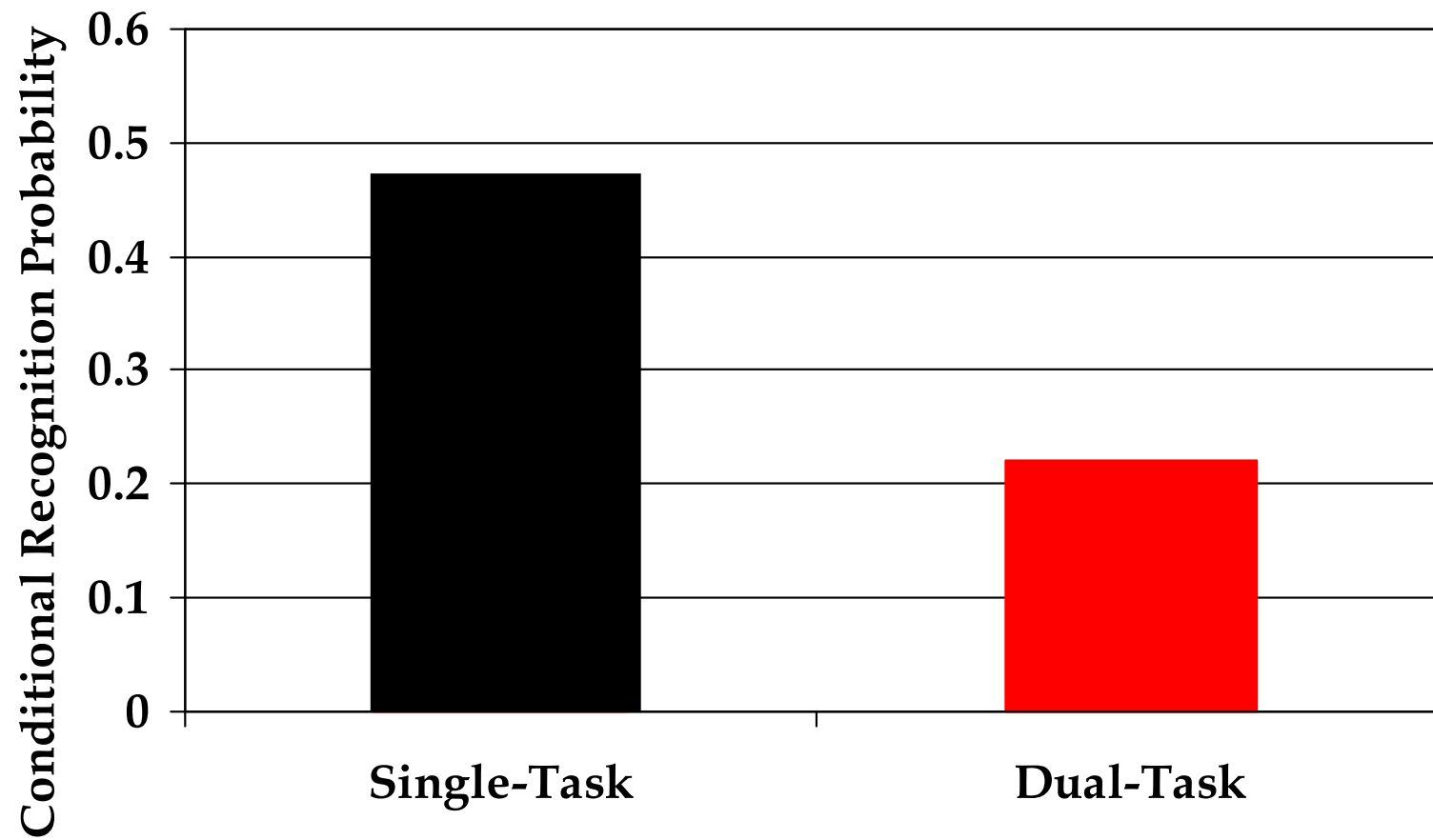


Inattention-Blindness (Experiment 2)

- Is there cell-phone induced inattention blindness?
 - Hands-free cell phone
 - Naturalistic conversation with confederate
 - Eye tracker
- Two phases to the study:
 - Phase 1: Single & dual-task driving
 - Phase 2: Recognition memory tests for objects encountered while driving



Recognition Memory Given Fixation





Summary (Experiment 2)

- Cell phone conversations create inattention blindness for traffic related events/scenes
- Cell phone drivers look but fail to see up to half of the information in the driving environment
- No evidence that cell phone drivers protect more traffic relevant information



Are there age / experience effects? (Experiment 3)

- Car-following paradigm
 - Follow periodically braking pace car
 - Required timely and appropriate reactions
 - Hands-free cell phone (**positioned in advance**)
 - Naturalistic conversations

- Performance Measures

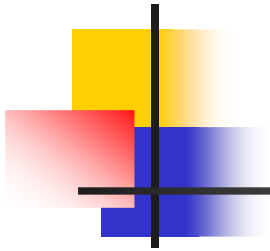
- Reaction time
- Recovery time
- Driving speed
- Following distance

Younger Adults

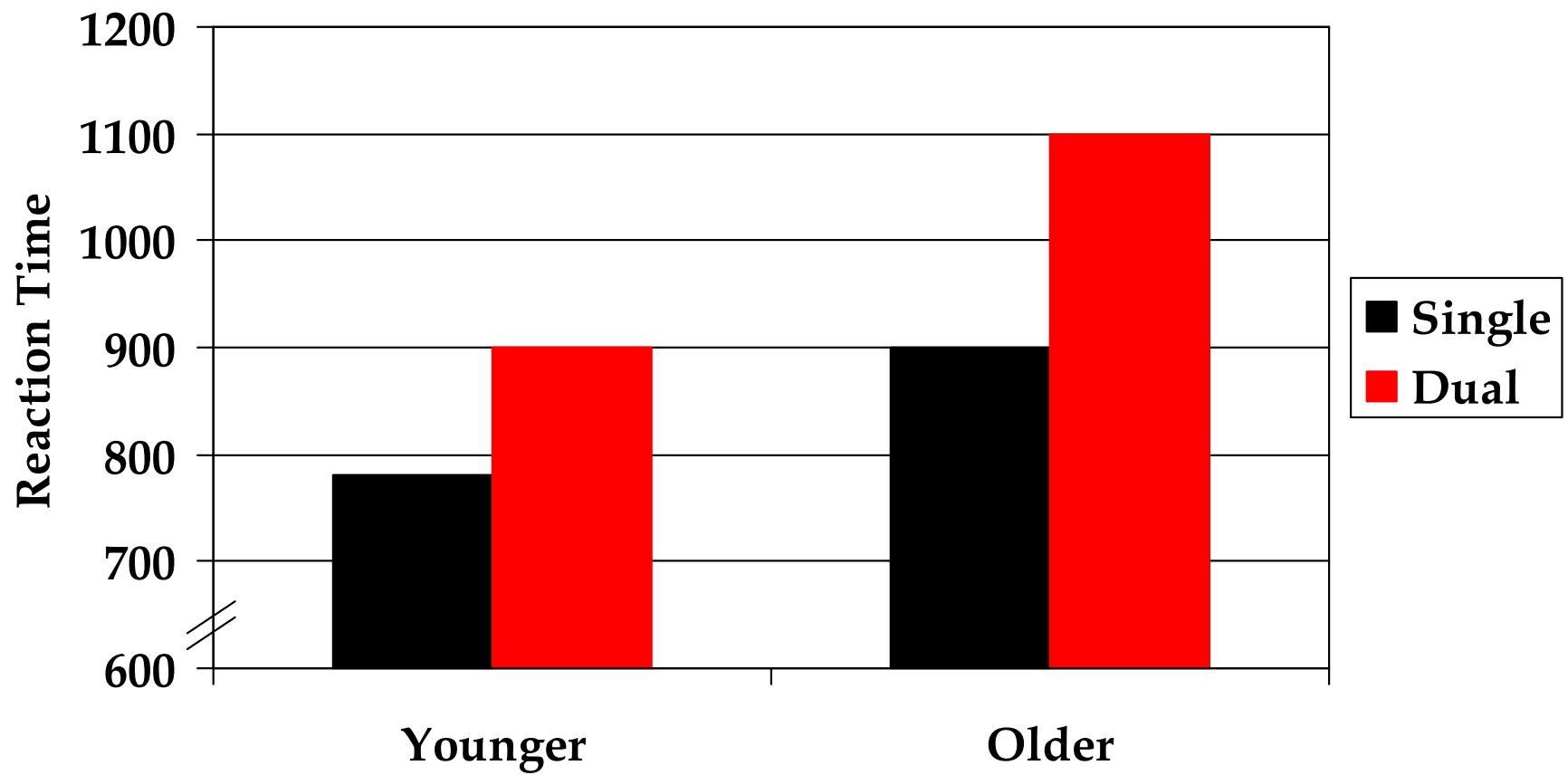
Older Adults

Single Dual

Single		Dual	
Younger Adults			
Older Adults			

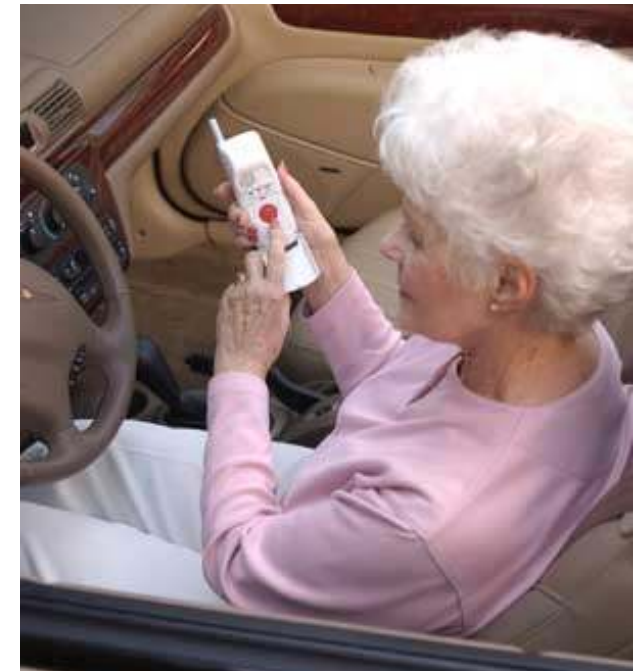


Brake Reaction Time



Summary (Experiment 3)

- Main effect of single vs. dual-task:
 - Reaction time
 - Following distance
- Main effect of age:
 - Slower reactions
 - Slower driving speed
 - Greater following distance
- No Age x Task interaction



How Significant is the Interference?

The drunk driver (Experiment 4)

- Cell-phone vs. drunk-driver
 - Redelmeier and Tibshirani (1997) suggested that “the relative risk [of being in a traffic accident while using a cell-phone] is similar to the hazard associated with driving with a blood alcohol level at the legal limit” (p. 465).

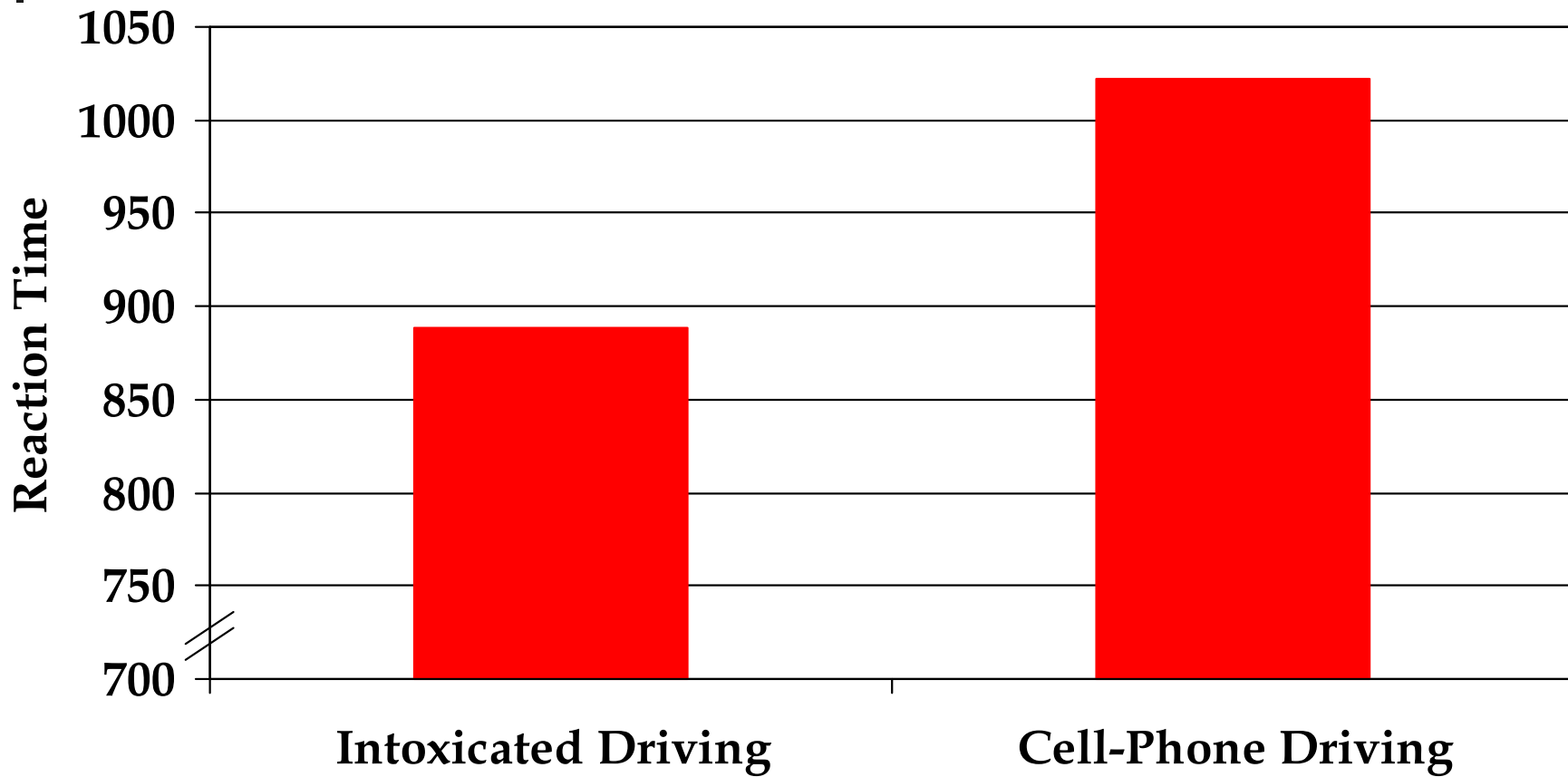




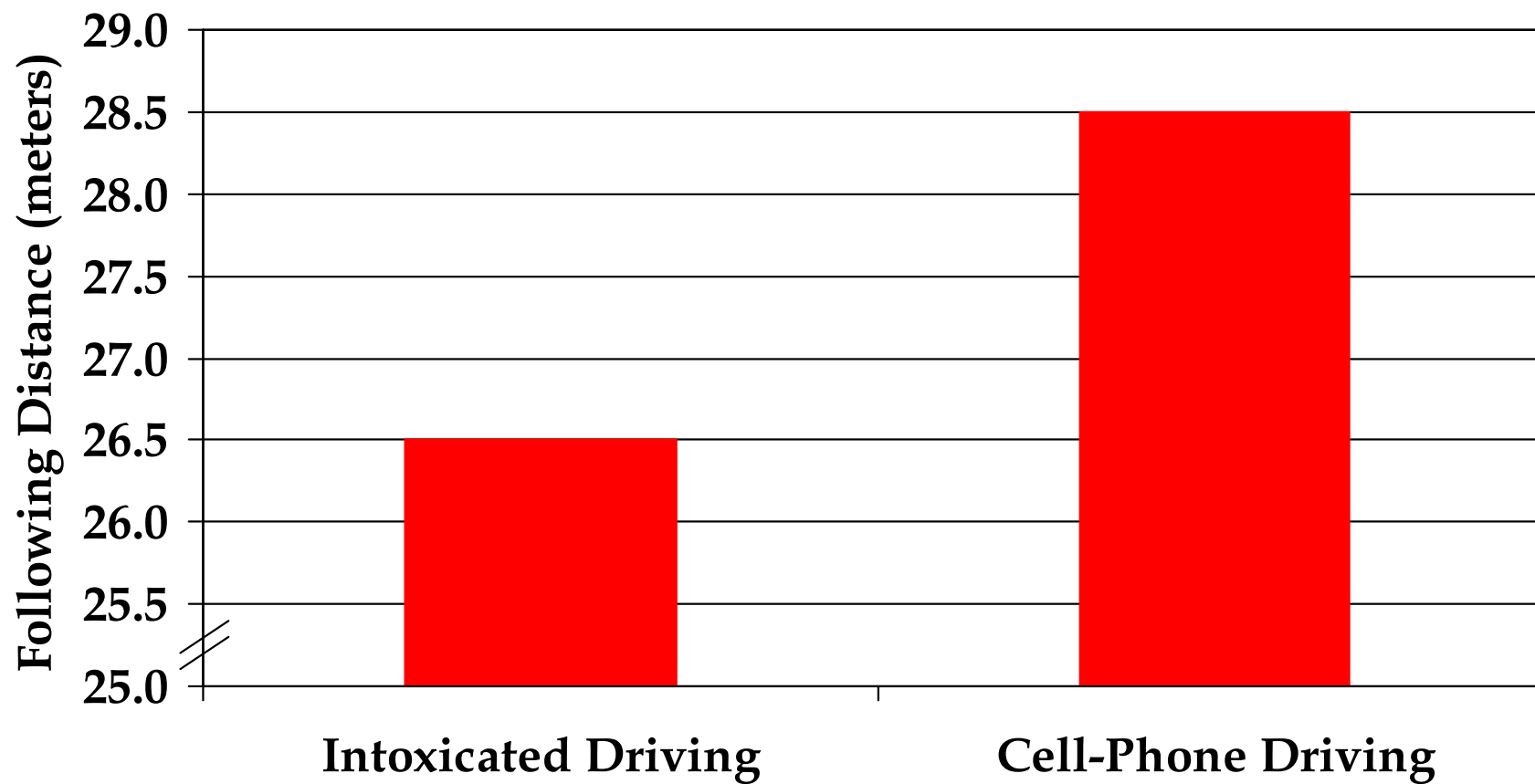
Cell-phone Driver vs. Drunk Driver

- Car-following paradigm
 - Follow periodically braking pace car
 - Required timely and appropriate reactions
- Conditions
 - Single-task driving
 - Cell-phone driving *
 - Intoxicated driving (BAC= 0.08 wt/vol)
 - * Hands-free = Hand-held

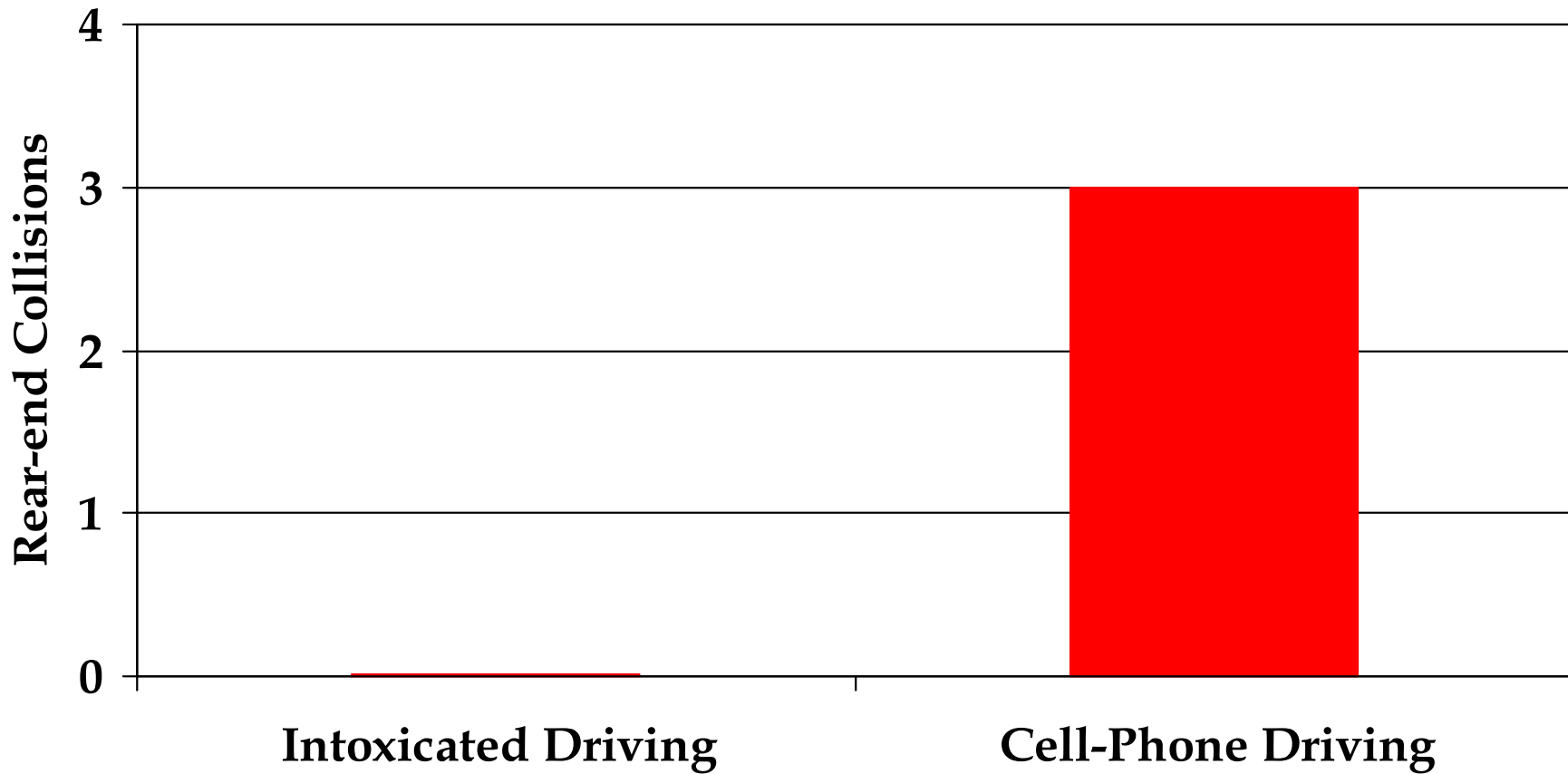
Reaction Time



Following Distance



Rear-end Collisions



Summary (Experiment 4)

- Compared to drunk drivers, cell-phone drivers
 - React slower
 - Increase following distance
 - Compensate by increasing following distance
 - But: Still more rear-end accidents
- When controlling for time on task and driving conditions, cell-phone drivers' performance is worse than that of the drunk driver



**I'M NOT DRUNK
I'M ON THE PHONE**



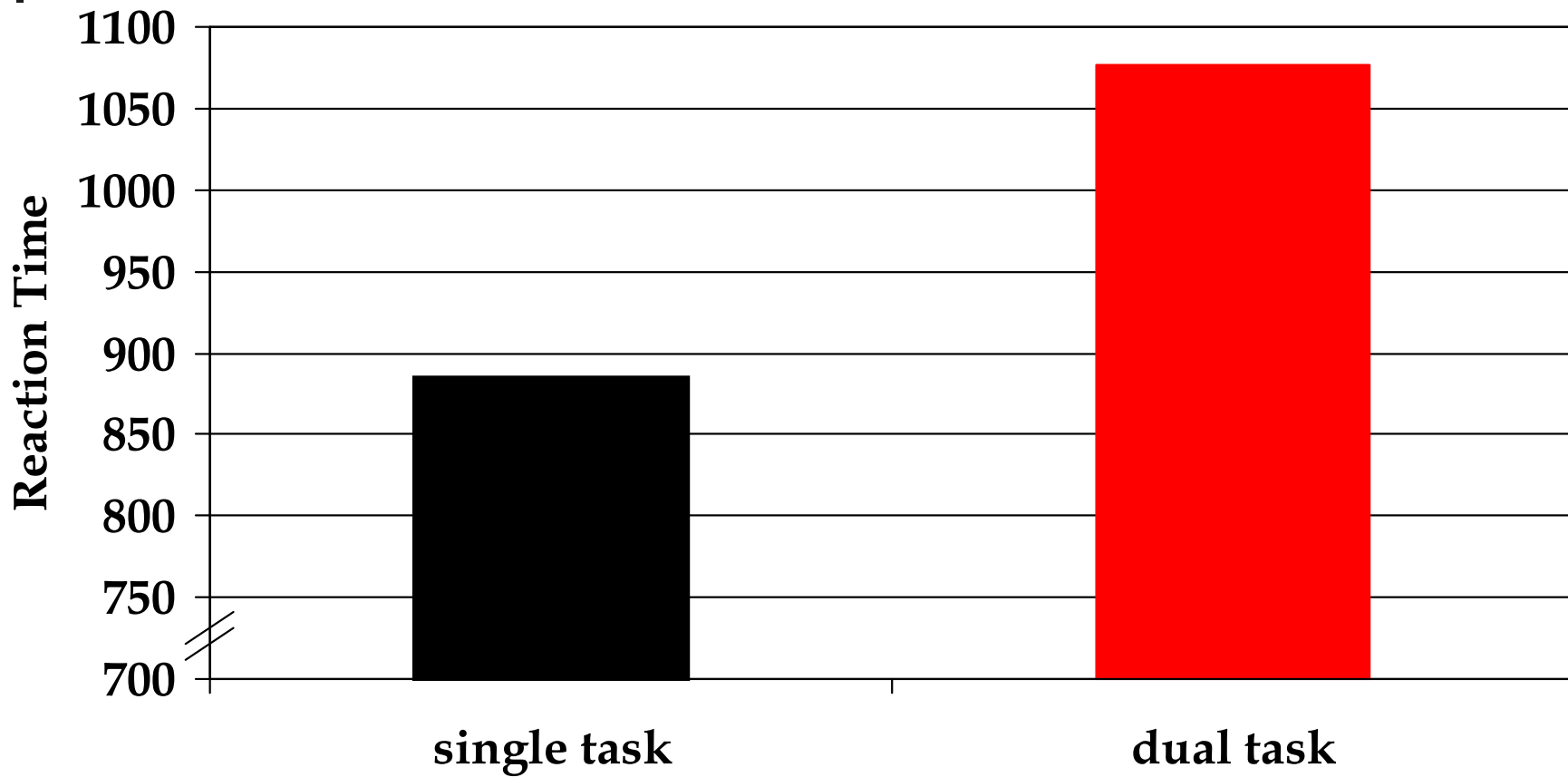
Other cell phone related activities: Text messaging (Experiment 5)

- Car-following paradigm
 - Follow periodically braking pace car
 - Required timely and appropriate reactions
 - 20 friend dyads
- Conditions
 - Single vs. dual-task
- Measures
 - Reaction time
 - Following distance
 - Minimum following distance
 - Rear-end collisions

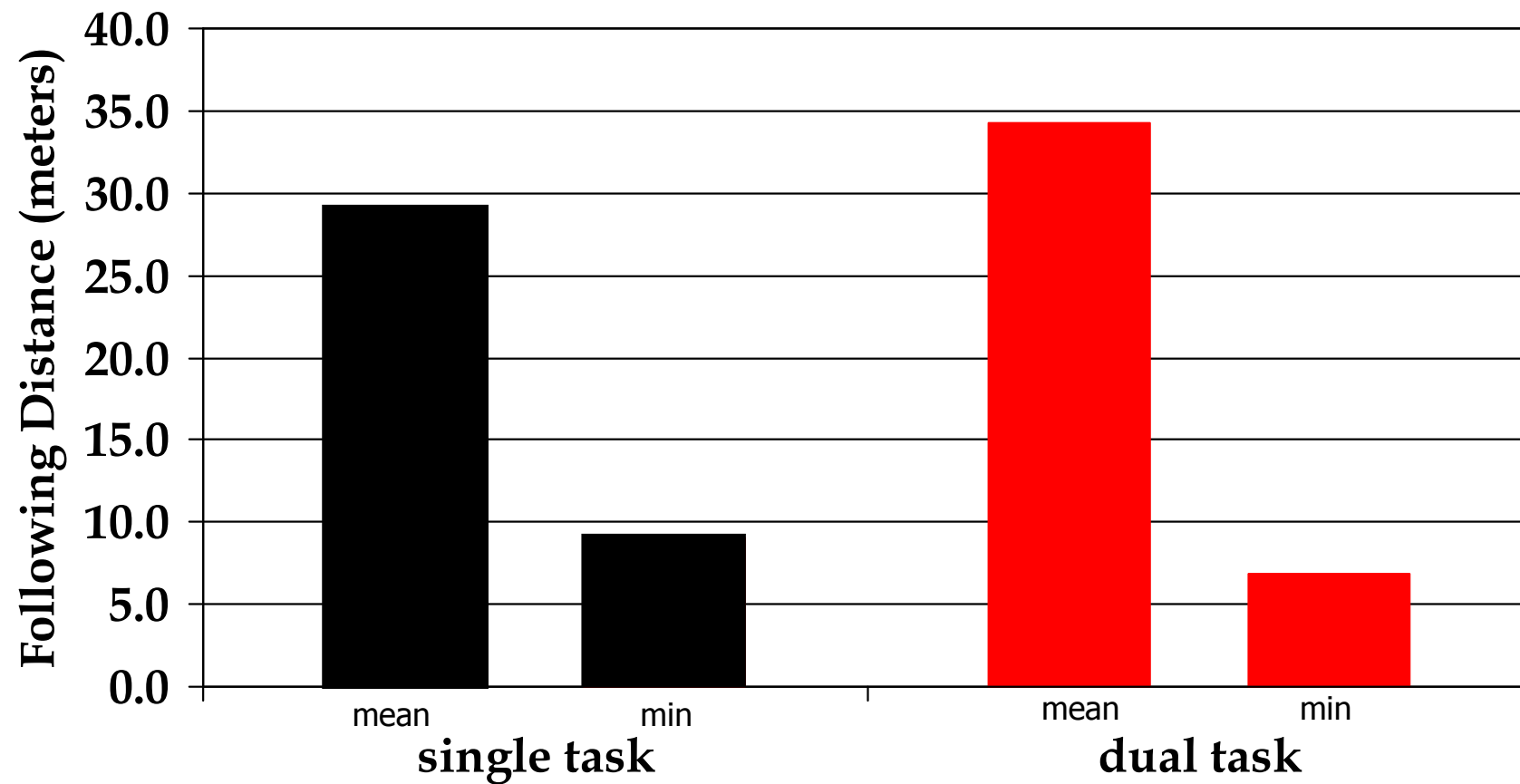
Single **Dual**



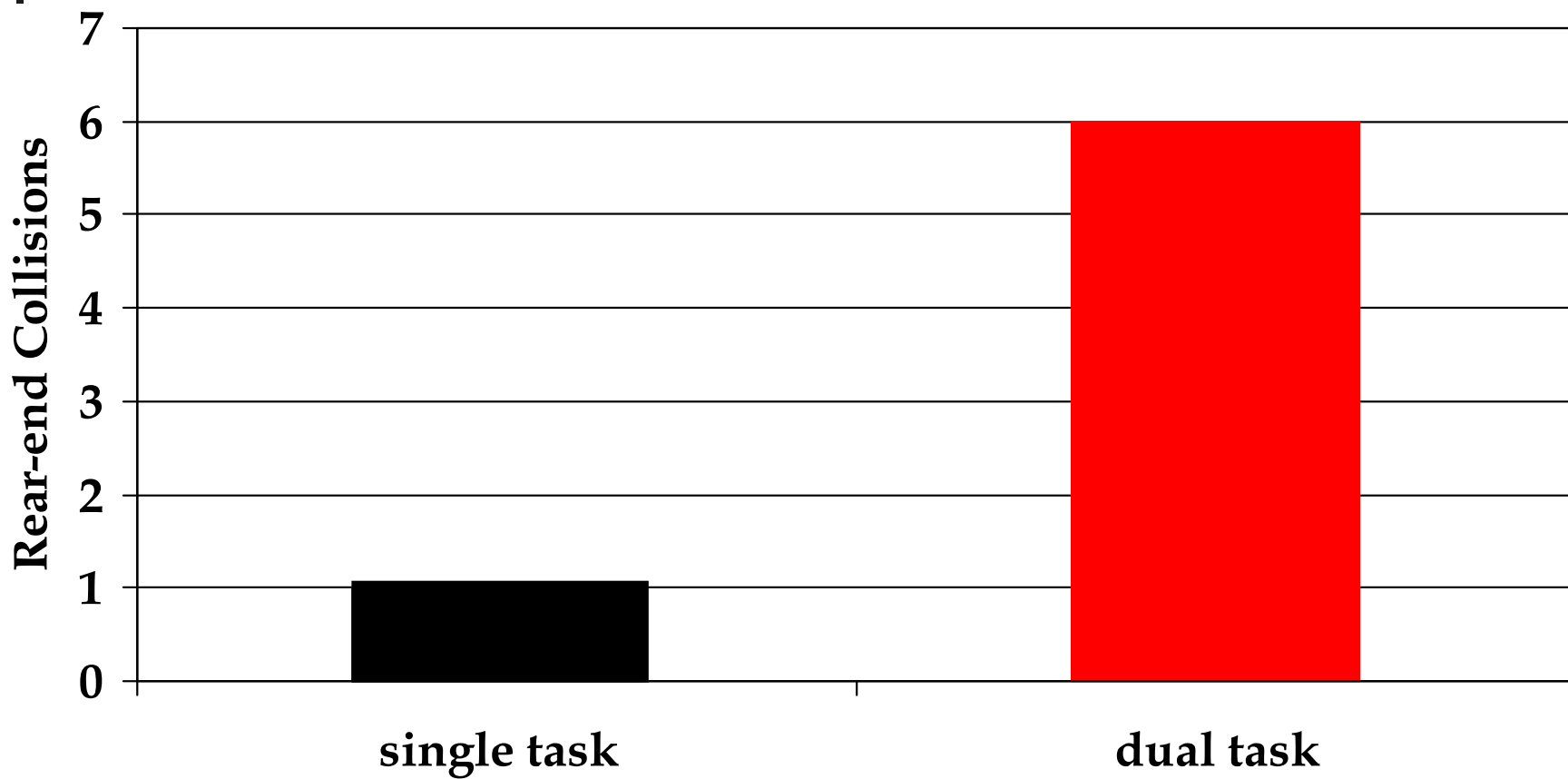
Reaction Time



Following Distance



Rear-end Collisions





Summary (Experiment 5)

- Test messaging drivers
 - Slower reaction times
 - Increased following distance
 - But: smaller minimum distance
 - Increase in rear-end accidents
- Things can be worse: Text messaging exceeds cell phone conversations in accident risk

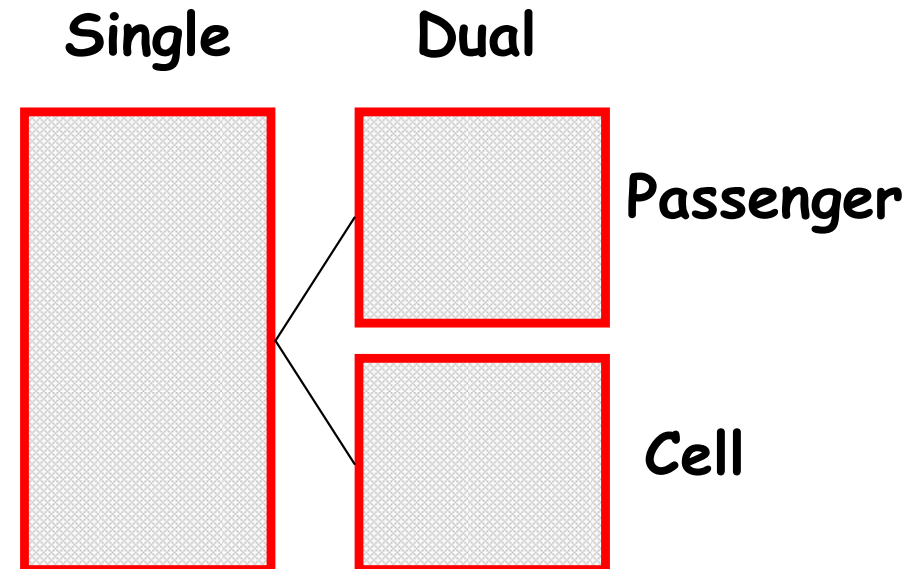
DID YOU HEAR
ABOUT THAT NEW STUDY
THAT SAID EVEN HANDS-FREE
CELL PHONES ARE
DANGEROUS?

I'M PROBABLY
NOT EVEN SUPPOSED
TO BE TALKING
TO YOU RIGHT NOW...

2004
GARY WOODWARD
KIRBY

Other types of conversations: Cell Phone vs. Passenger Conversations (Experiment 6)

- Conditions
 - Single task / dual task
 - Conversing on cell phone
 - Conversing with passenger
- Design
 - Task (2) x Condition (2)

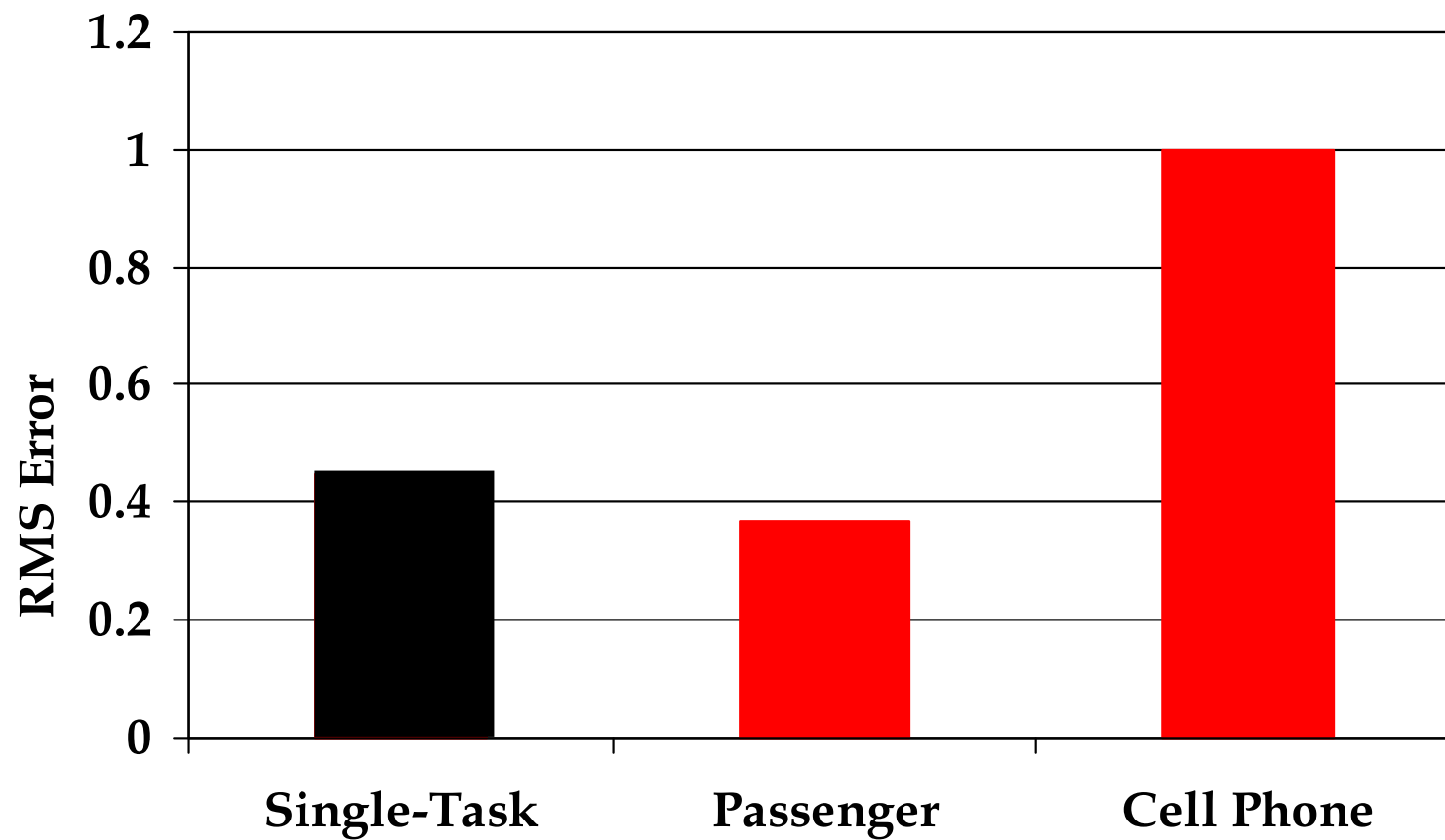




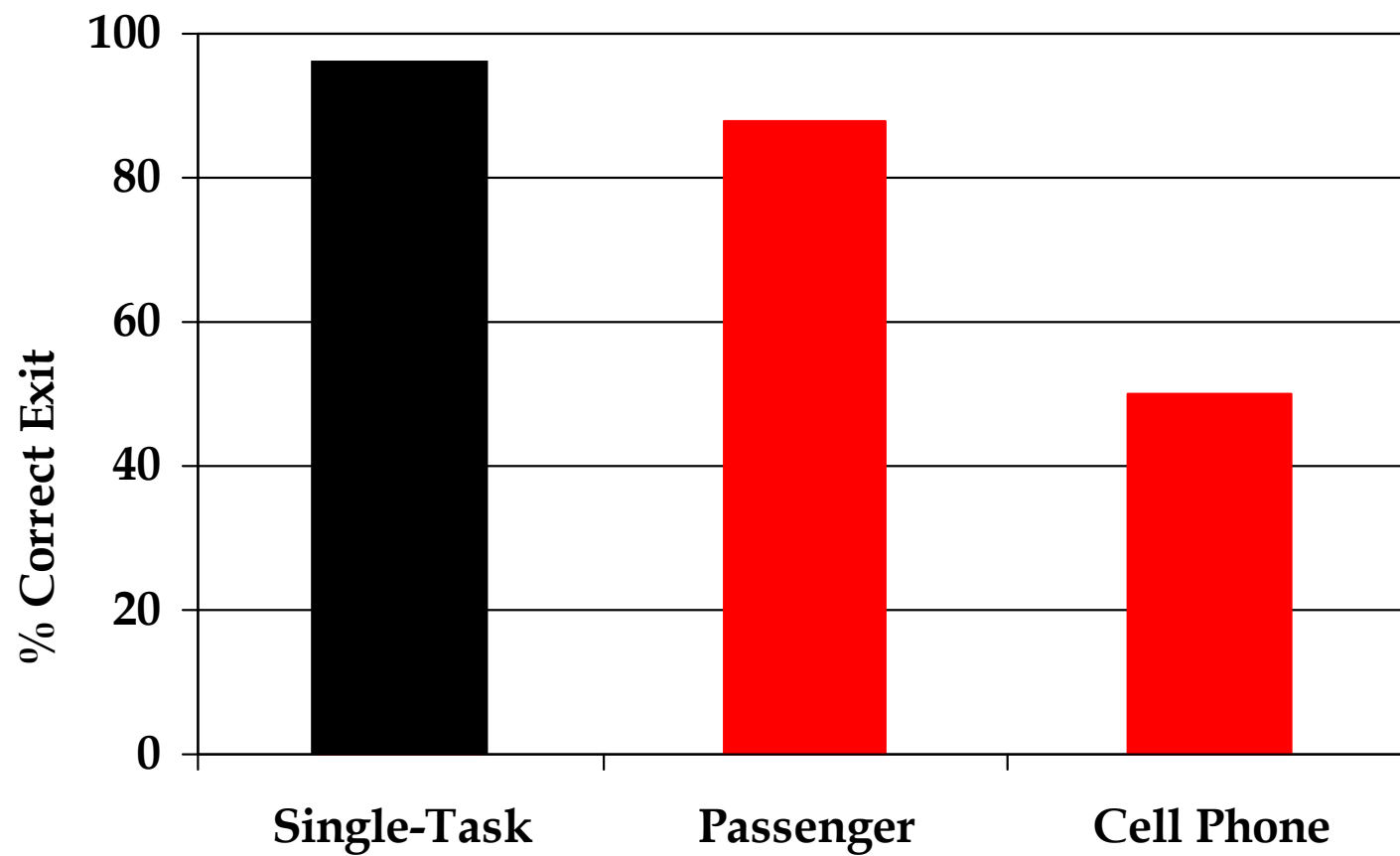
Cell Phone vs. Passenger Conversations

- Free driving paradigm
 - 8 miles of highway
 - Exit highway at rest area
 - Hands-free cell phone
 - Close call stories / friends
- Performance Measures
 - Lane keeping
 - Navigation task
 - Traffic references

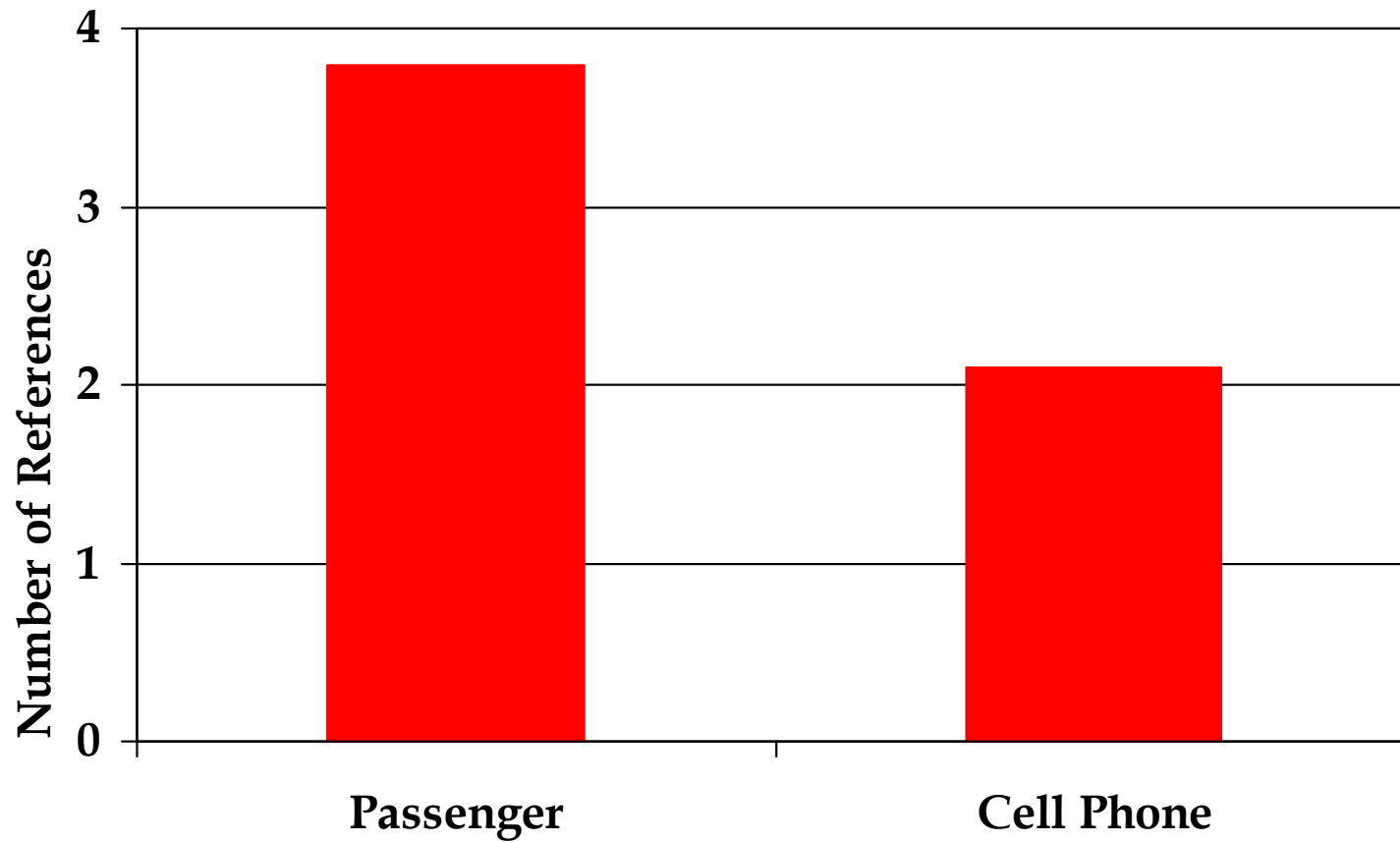
Lane Keeping Errors



Successful Navigation



Traffic References





Summary (Experiment 6)

- Cell-phone conversations
 - More lane keeping errors
 - More navigation errors
 - Fewer references to traffic
- Passenger conversations
 - Collaborative problem solving
 - Shared situation awareness
 - Passenger actively supports the driver



The answers

- Does conversing on a cell phone interfere with driving?
 - Yes
- What are the sources of the interference?
 - Peripheral interference (dialing)
 - Attentional interference (inattention blindness)
- Who is affected?
 - Younger and older drivers equally affected
- How significant is the interference?
 - Worse than listening to radio/books on tape
 - Worse than in-vehicle conversations
 - Worse than driving while legally intoxicated
 - BUT: Less significant than text messaging

