The Cell Phone Paradox: How do we Explain the Differences Between Simulator and Naturalistic Driving Research?

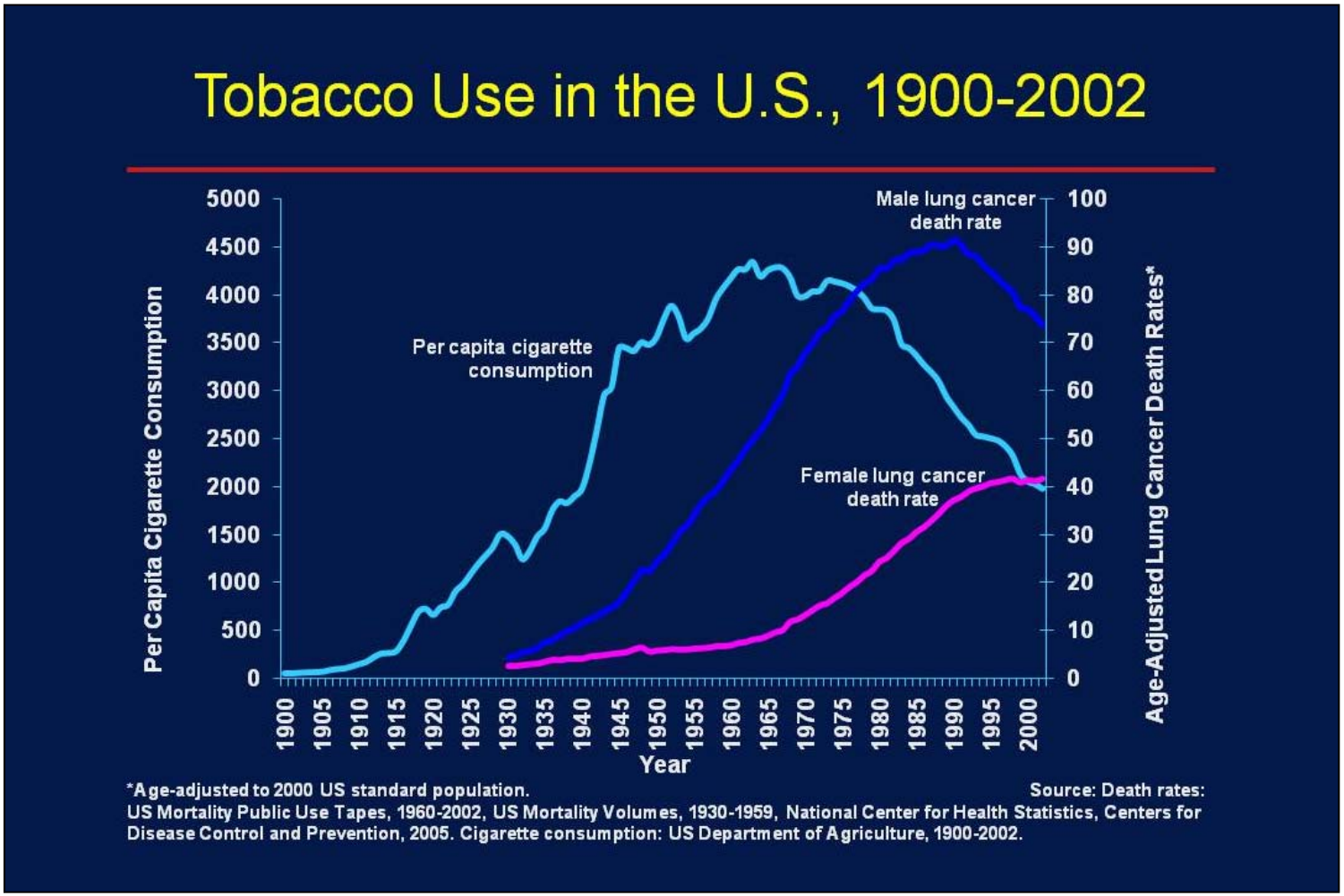
Jeffrey Hickman, Ph.D.
Center for Truck and Bus Safety

Virginia Tech Transportation Institute

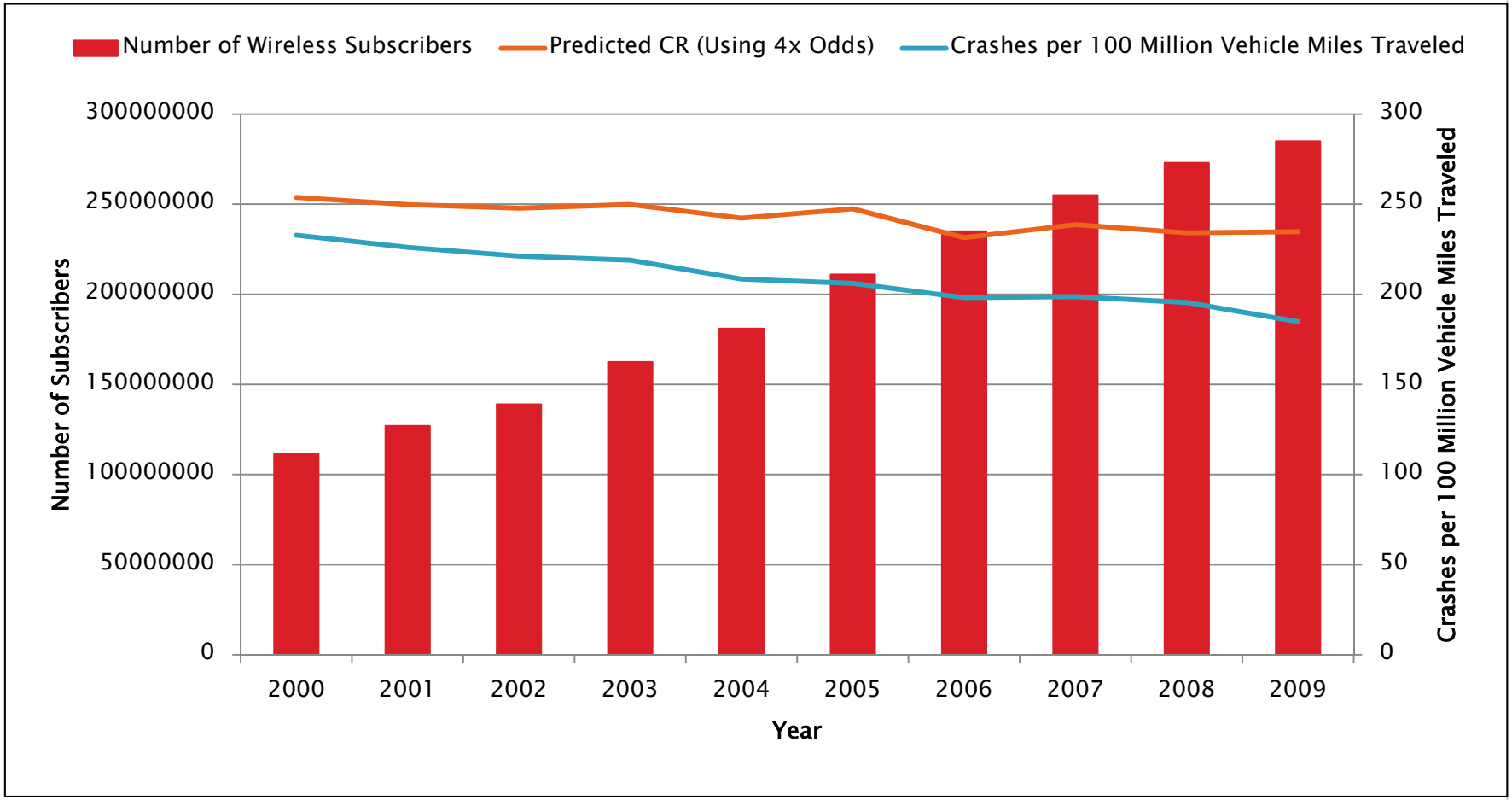
Summary of Simulator Findings (NSC, 2010)

- Talking on a cell phone
  - Longer brake response times
  - Delay in processing
  - Reduced recognition of hazards, signs, etc.
  - Increase in speed variability
  - Increase in crashes

Tobacco Use and Cancer Deaths



Paradox of Cell Phones and Crashes



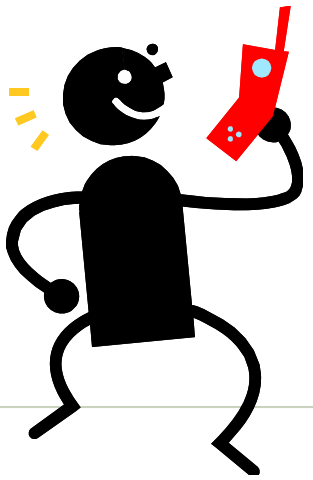
Adapted from Hanowski (2011)

Explanations for the “Cell Phone Paradox”

- Methodological
- Do effects exist in real world?
  - If so, do they impact safety?
- Why?

Cell Phone Use as a Task

- Is cell phone use risky?
  - Yes, if viewed as a dichotomous variable
- Cell phone use must be divided into subtasks
- Each subtask associated with different risk



Experimental Demands (1 of 2)

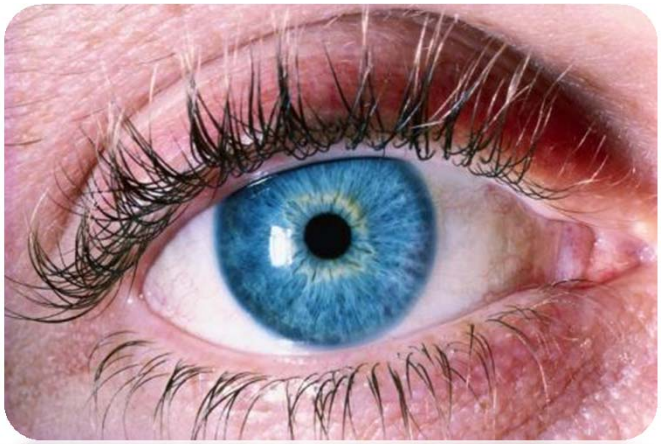
- Experimental demands, in themselves, may be viewed as a stressor
  - No choice on when to engage in conversation in simulator experiment
  - Average conversation is short and mundane (~2.3 min)
    - Research on emotional conversation is mixed
    - Not discussing rocket science or counting backwards from 1,000
- Maintain following distance and speed

Experimental Demands (2 of 2)

- Tendency for drivers to drive slower and increase headway
- Funkhouser & Sayer (2012) found that drivers use cell phone when:
  - Stopped or at low speeds (self-regulation)
- Fitch & Hanowski (2011)
  - Truck drivers used cell phone the least during high-task demands

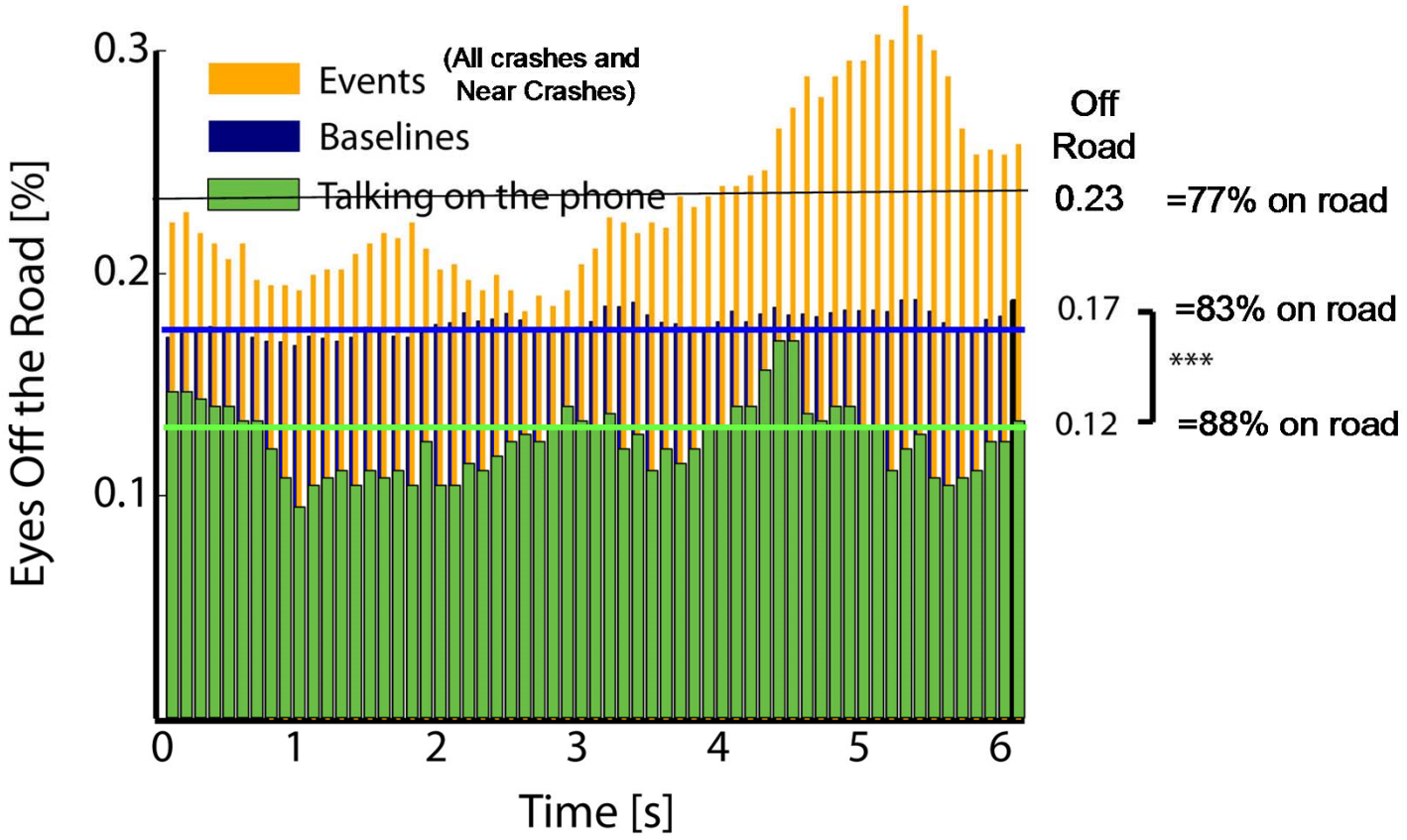
Gaze Concentration (1 of 2)

- Do not scan mirrors as much
- Do not scan the periphery as much
- Termed "gaze concentration"
  - Fixate on forward roadway
  - Thought of as a dis-benefit
  - Could be a safety benefit



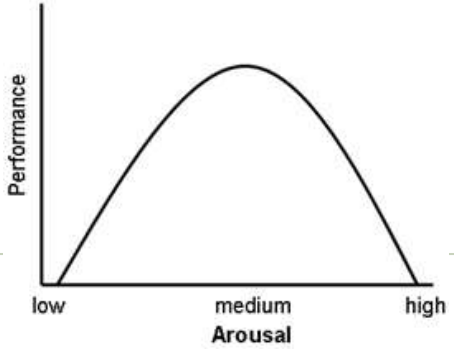
Gaze Concentration (2 of 2)

- Trent Victor (personal communication)



Arousal (1 of 2)

- Driving is primarily a visual task
- Driving is a habitual behavior
- Can be monotonous and boring
  - Truck drivers can drive up to 11 hours in the U.S.
  - Associated with periods of low arousal
- Task monotony has been shown to decrease vigilance
- Yerkes-Dodson law (1908)



Arousal (2 of 2)

- Cell phone conversation/secondary verbal task effective in reducing fatigue, increasing arousal
  - Geshon et al. (2009)
  - Atchley & Chan (2011)
  - Drory (1985)
  - Hanowski et al. (1998)
    - Focus groups

Model to Explain Cell Phone Paradox

- What we know
  1. Primary task performance is relatively stable under stress/high demands
  2. Effective performance under these conditions is accompanied by physiological activation
  3. Overt decrements, where found, are small
     - More common in laboratory than in real world
     - May be related to high level of motivation
     - More effective control, higher commitment to goals

Cognitive Compensatory Control (1 of 3)

- Hockey (1997)
- Regulate attention/effort to preserve primary task
- Regulate effort based on goals
  - Primary vs. secondary
- Performance protected under stress by recruitment of additional resources
- Allocate resources to primary task
  - Increase effort, maintain acceptable limits
  - Ignore secondary task

Cognitive Compensatory Control (2 of 3)

- Remember, longer brake response, delays in processing, etc.
- Those same simulator studies also report
  - Longer following distance
  - Less speed
- At some level, drivers are aware of this deficit
  - Compensate for these effects

Cognitive Compensatory Control (3 of 3)

(Adapted from Hockey, 1997)