***Food for Thought*:**

The "Looking But Not Seeing" Phenomenon:

Could It Be Happening To Us?

Are We Looking and Not Seeing?

A Lunchtime Discussion for the

International Symposium on Naturalistic Driving

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Albert Einstein once asked:

Does the moon exist when no one is looking at it?

http://1.bp.blogspot.com/_g98Zj6GaUaE/SRh-MUzxPEI/AAAAAAAACiI/-_jcqL_N0P0/s400/ladder+to+the+moon.bmp

Why That Question?

- Because even in the realm of physics, there was early recognition that beliefs play a role in science
- Scientists are human – and bring their perceptual and cognitive processes with them to the job of science
- That means that we (as researchers) are subject to the same vulnerabilities as everyone else

Why beliefs matter . . .

- They lead us to see things differently from each other
- They lead sometimes to conflict . . .

  Sometimes to deepened understanding . . .

  And sometimes to convergence . . .

  . . . . . .Often in that order
- As scientists, we are obliged to strive hard as a community to be aware of when and how these very-human processes are affecting our work

Two Cognitive/Perceptual Phenomena Important for Distraction

& We May Experience Them Even As We Study Them

1. The Looking-and-Not-Seeing Phenomenon

   [Looking at a 'scene' and not seeing something that is in it]

2. Confirmation-Bias

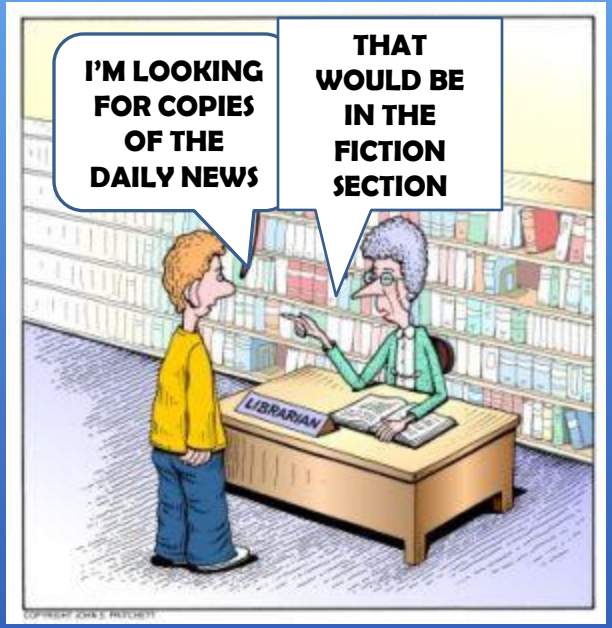
   [Looking at data, and seeing that which confirms what we thought was true]

“Looking and not seeing”

Focusing attention closely on the actions of the “white-shirted team” in a video can lead us to *not* “see” the gorilla in their midst

“Confirmation Bias”

An expectation – e.g., that the middle row is comprised of letters – can lead us to “confirm” that the central configuration is a “B” rather than a “13.”



Why Talk About This?

Because in science,
it is sometimes worth
having a second or third look
at what is in front of us
(the data, the methods)
to see if there is something new there
that we had not noticed before

(working hard to shed the expectations of our paradigms)
(double-checking for any biases in our reasoning)

An Invitation:

Reflect on these issues . . .

Look beyond what you've seen before

http://zenhabits.net/fotos/20071230reflection.jpg

Toward new or deeper understanding

The Picture
That We Have An Opportunity To Re-Examine:

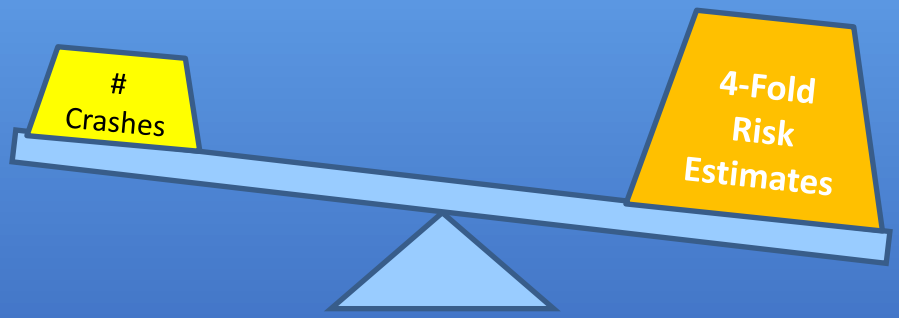
- **Crash Record on Distraction**
- **Task Demands & Their Effects on Driving Performance**
- **Relationship between driving performance decrements and crash risk**
- **Assessment of crash risk**
  - Avoiding the 'gaping middle' – what does it take to build the bridge?

The Crash Record on Distraction

Are Things Adding Up?

Early epidemiological estimates of distraction risk asserted:

- Risk of a crash while calling on a cell phone was **four times as high as "just driving"**
- **"Similar to the risk of driving under the influence of alcohol"**
- And these estimates are among the most often repeated



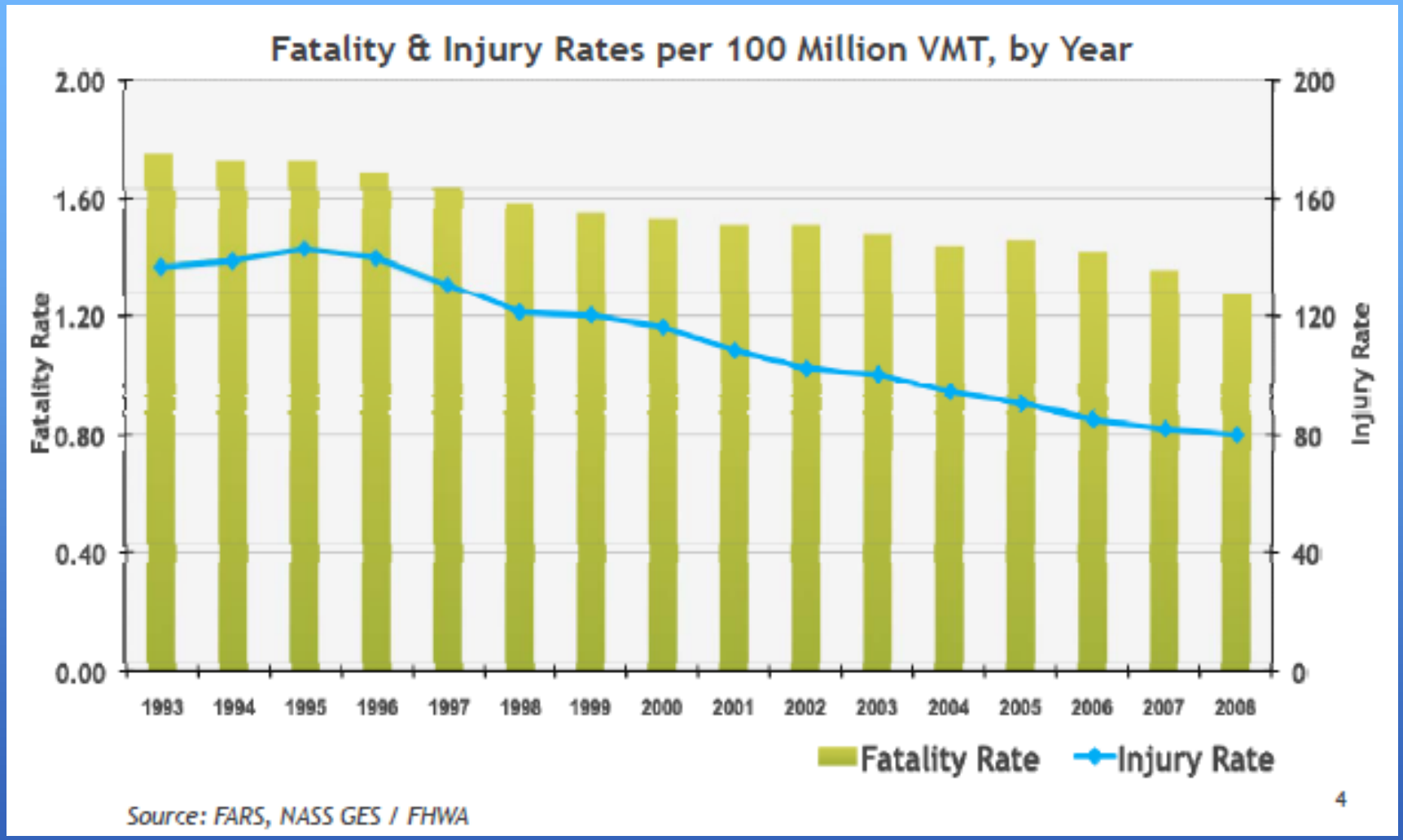
AND YET

- **Neither** the number of **distraction-related crashes nor** the number of fatalities being recorded in the national databases appear to match this level of risk -- **not for cell phones** – and **not for cell phones combined with all other sources** of distraction

Expectations Violated ?

- The number of cell phone subscriptions *increased* to 250 million by 2008. (Number of vehicle registrations =247 million)
- The number of *other* consumer electronic devices used in-vehicle *also increased* from 2000-2008:
- **Yet the total numbers of fatalities and the total number of crashes in the U.S. have remained stable or declined slightly.**

Fatality Rates & Injury Rates Over Years



From: Presentation by Alliance of Automobile Manufacturers, October 2009

So what about just those crashes related to distraction?

- Distraction. In 2008, distraction contributed to 5,870 fatalities in the United States (~16% of the 37,261 fatalities that occurred in motor vehicle crashes that year) (NHTSA 2009).

This compares to:

- Alcohol. In 2008, 11,773 people were killed in alcohol-impaired driving crashes, accounting for nearly one-third (32%) of all traffic-related deaths in the United States.

Do We Need A New Breakdown Like This One??

PERCENTAGE OF CDS CRASHES INVOLVING INATTENTION/DISTRACTION-RELATED CRASH CAUSES. (ADAPTED FROM WANG ET AL., 1996)

Data Element	*% of Drivers*	*% of Crashes*
Attentive or not distracted	46.6	28.4
Looked but did not see	5.6	9.7
Distracted by other occupant (specified)	0.9	1.6
Distracted by moving object in vehicle (specified)	0.3	0.5
Distracted by while dialing, talking, or listening to cellular phone (location and type of phone specified)	0.1	0.1
Distracted while adjusting climate controls	0.2	0.3
Distracted while adjusting radio, cassette, CD (specified)	1.2	2.1
Distracted while using other device/object in vehicle (specified)	0.1	0.2
Distracted by outside person, object, or event (specified)	2.0	3.2
Eating or drinking	0.1	0.2
Smoking related	0.1	0.2
Distracted/inattentive, details unknown	1.5	2.6
Other Distraction (specified)	1.3	2.2
Unknown/No Driver	38.5	46.0

How has this changed since 1995??

So There Are Inconsistencies It Appears

Early Epidemiological Estimates

(Redelmeier & Tibshirani, 1997; McEvoy, 2004)

Conflict With

Later Epidemiological Estimates

Hahn & Prieger; Young & Schreiner

The Crash Record

But Perhaps There Are Also Emerging Consistencies??

Early Epidemiological Estimates

(Redelmeier & Tibshirani, 2004; McEvoy, 2004)

Conflict With

Later Epidemiological Estimates

from retrospective studies

Hahn & Prieger; Young & Schreiner

The Crash Record

Odds-Ratios

from prospective naturalistic studies

More consistent with each other??

Clues??

- Perhaps taken together, this picture offers some clues about what to examine as we move forward

What Other Factors Could Be At Play?

- **ISSUES OF HUMAN CHOICE & EXPERIENCE ??**
- Hahn & Prieger point out – along with Young – that *certain* epidemiological methods focus only on "drivers who crash" (overlooking all those who call and don't crash)
  - They note that this method can overestimate risk **if** there is an underlying factor that increases BOTH
    - The risk of calling (or engaging in a secondary task)
      AND
    - The risk of crashing

- Have we paid enough attention to such possibilities?
  - To user types, usage profiles, conditions of use?
  - And whether they affect crash risk?

One *hypothetical* example . . . .

- **Teens** may seek new and novel things, take more risks, push away from authority and rules as they seek to establish their own adulthood
- **Teens** may use electronics with high frequency as an expression of their interest in the new & novel – and because they enable socializing
- **Teens** may crash more often while driving, due to inexperience, risk-taking, and other factors

  - So teens (given their propensities) may both **call more** and **crash more**
  - This type of co-variation (or 'selection bias') – could lead to inflated crash risk estimates for the general population in the case-crossover method.

Users & Usage Profiles:
Hypothetical Example & Questions

Percent Of All Miles Driven	Hypothetical Percent of Drive Time On Phone	Product of These Two: Percent Of All Driven Miles On Phone
• Teens …….7%	18%	1%
• Age 20-34…….36%	12%	4%
• Age 35-49…….49%	6%	3%
• Age 50-60…… 6%	3%	<1%
• Ages >60 ……. 2%	1%	<1%

Surprising?
Puzzling?
Unexpected?

Miles of Exposure to risk

* **Risk from activity**

* **Co-occurrence of events during activity?**

Crashes are a function not only of miles of exposure but also the risk associated with device usage under conditions of use – and perhaps this accumulates over all groups to a total number of crashes lower than that originally expected, and more like what is observed ??

These Complexities Do Not Diminish The Need for Action

‘Distraction’ Deserves Action

- Prevention may be possible for many distraction crashes.
- Mitigation for still others.
- And finding an effective mix of countermeasure strategies – may be facilitated by:
  - developing a better grasp of distraction crash risk
  - a clear picture of the pre-crash factors contributing

Task Demands & Their Effects on Driving Performance

Task Demands & Their Effects

Microscopic View

- Some studies **focus in on a single task**
- Compared to “just driving”
- STRENGTHS: Clarity, Ease
- WEAKNESSES: Loss of context

Example:
Comparing Cell-Phone Conversation to Just Driving

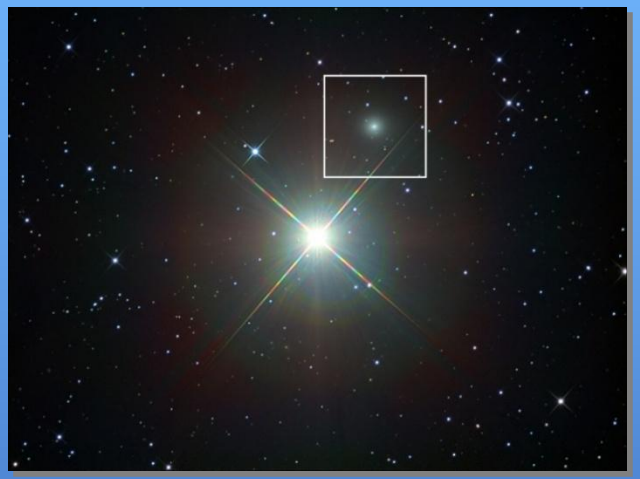
	Vehicle Control Performance		Event Responsiveness	
	Lanekeeping	Speed/Headway	Slowing of RTs	Miss Rates
Cell-Phone Conversation Effects from MetaAnalyses (Caird et al (2004); Horrey & Wickens (2006)	N.S.	N.S.	**160-210 ms**	**2-12%**

A significant difference

Yet interpreting its meaning can be difficult – since we see so little of the picture

Task Demands & Their Effects

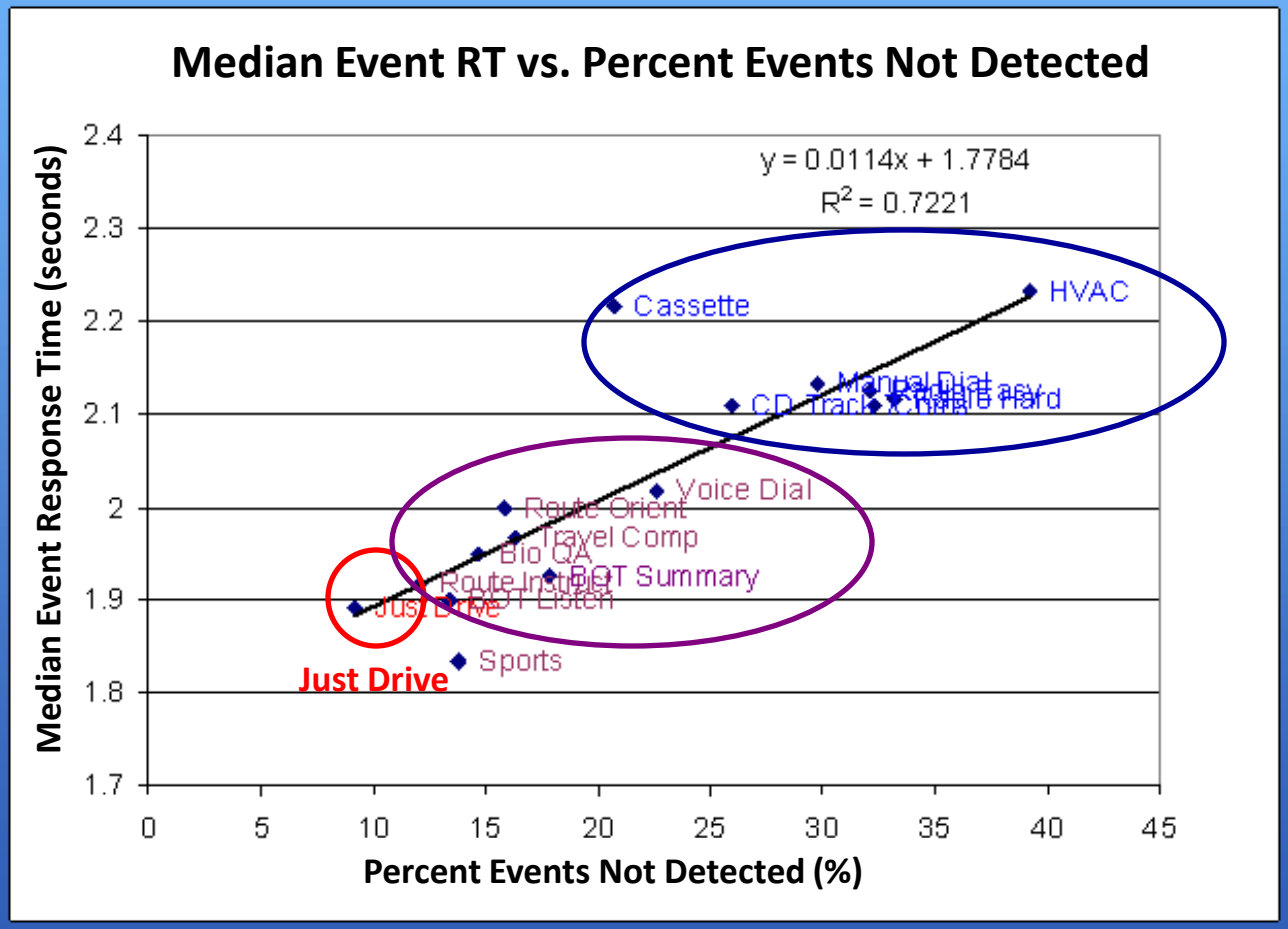
Telescopic View



http://antwrp.gsfc.nasa.gov/apod/image/0810/mirachs_ayiomamitis_label.jpg

- Some studies examine a range of tasks and task types
- Place task effects in larger context
- Including the task of "just driving"
- STRENGTHS: Provides more context
- WEAKNESSES: Can be more difficult to conduct, and to interpret

Example:
'Telescopic' View of Task Effects on Events (occurring in central location)

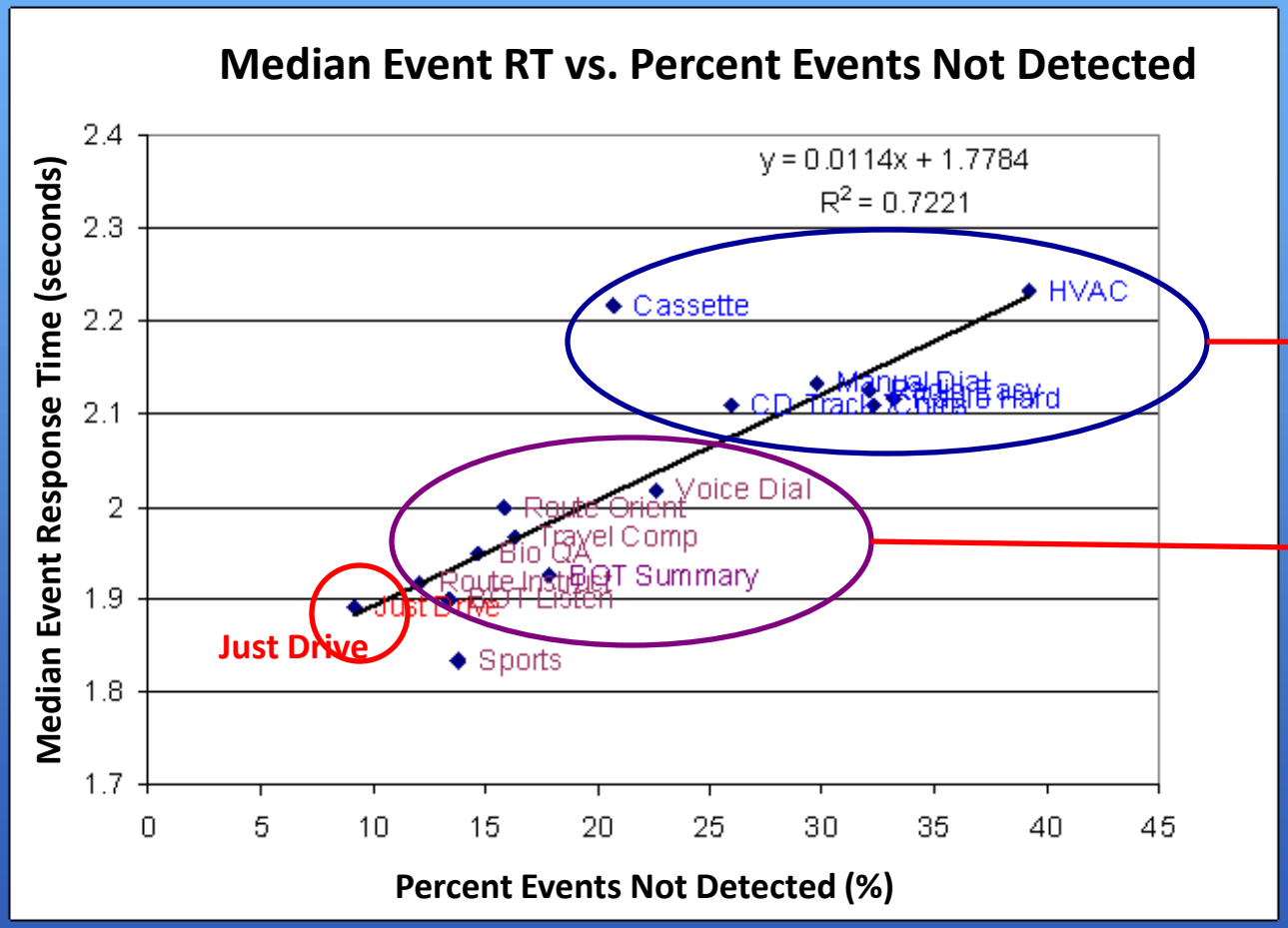


Visual-Manual Tasks

Auditory-Vocal-Cognitive Tasks

Adapted from CAMP Driver Workload Metrics Project, Angell et al, 2006

Example:
'Telescopic' View of Task Effects on Response to Events (occurring in central location)



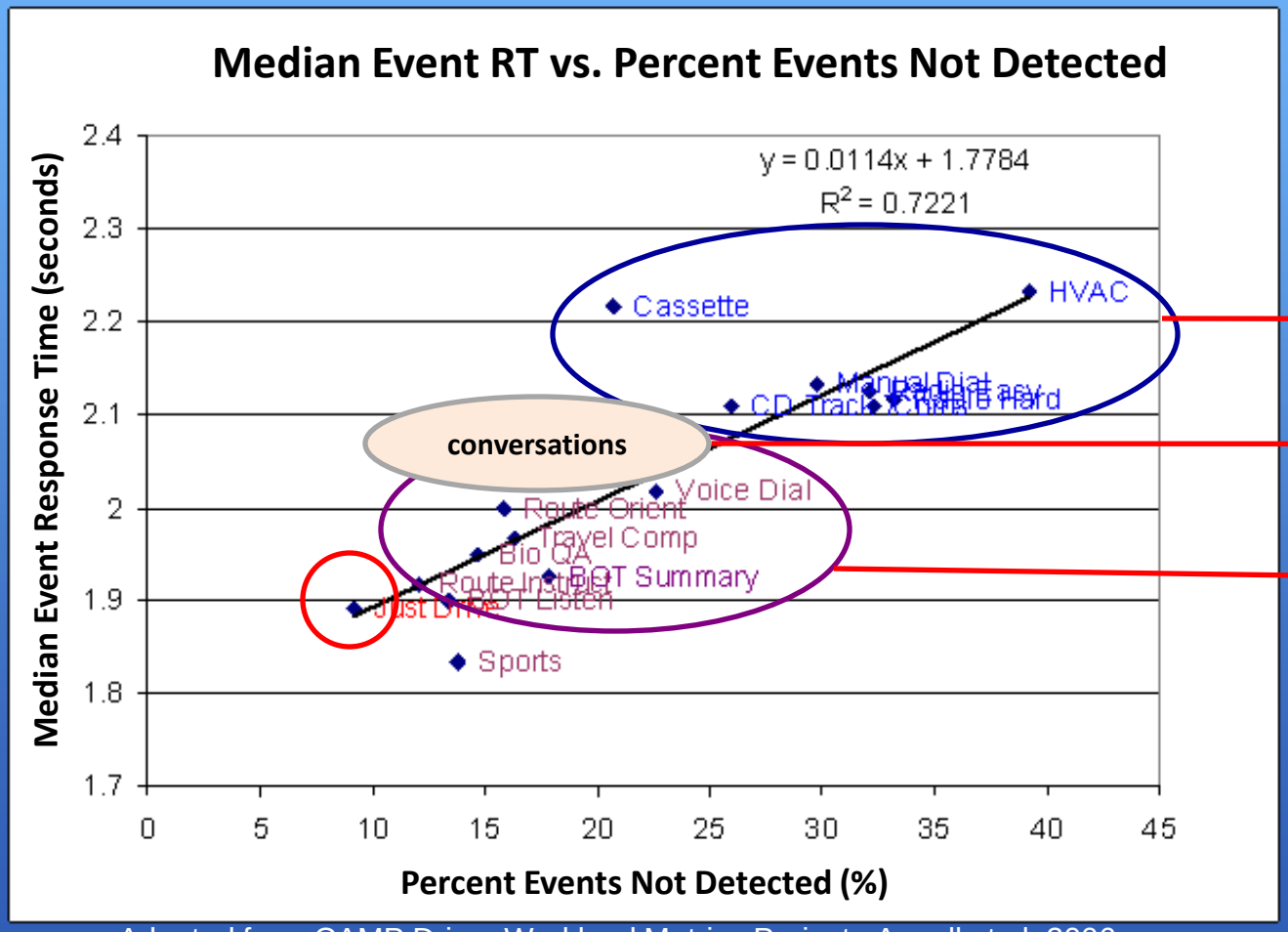
Extent of RT Slowing

Visual-Manual
210-310 ms

Auditory-Vocal Cognitive
0-130 ms

Adapted from CAMP Driver Workload Metrics Project, Angell et al, 2006

Pulling All Task Effects Into One View: An Example



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Conversations
160-210 ms

Auditory-Vocal-Cognitive
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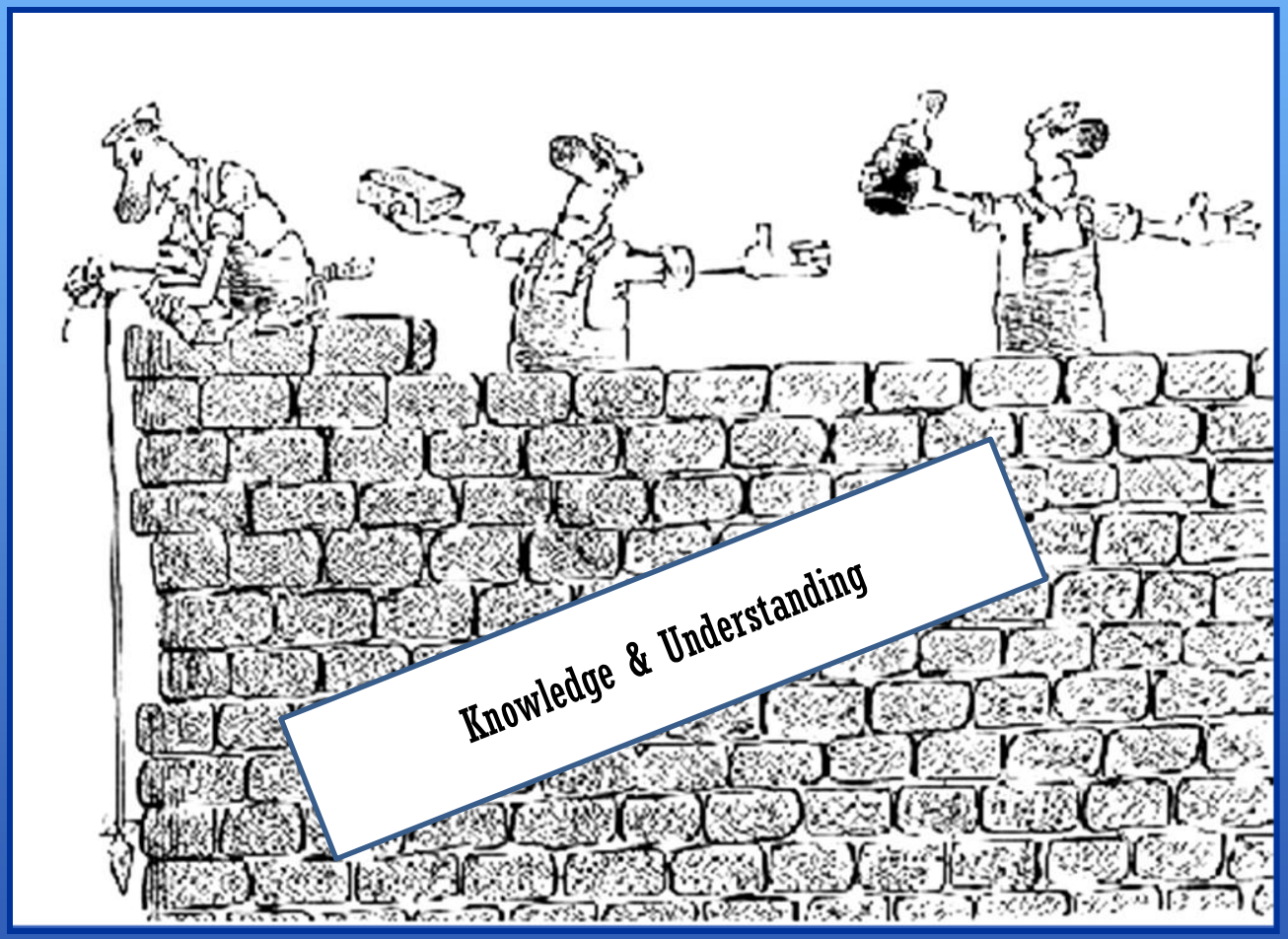
Might the views be complementary?

- Perhaps so!!

- Although different methods have been used:
  - The results appear to converge, not conflict
  - The results appear to be meaningful (from a theoretical point of view)

Brick by brick . . .
is structure starting to emerge??



Performance vs. Behavior

Performance vs. Behavior

“PLEASE DO THIS TASK NOW”

OBSERVING WHEN, HOW, WHETHER, DRIVERS CHOOSE TO DO A TASK

& under what conditions

Do we clearly see?

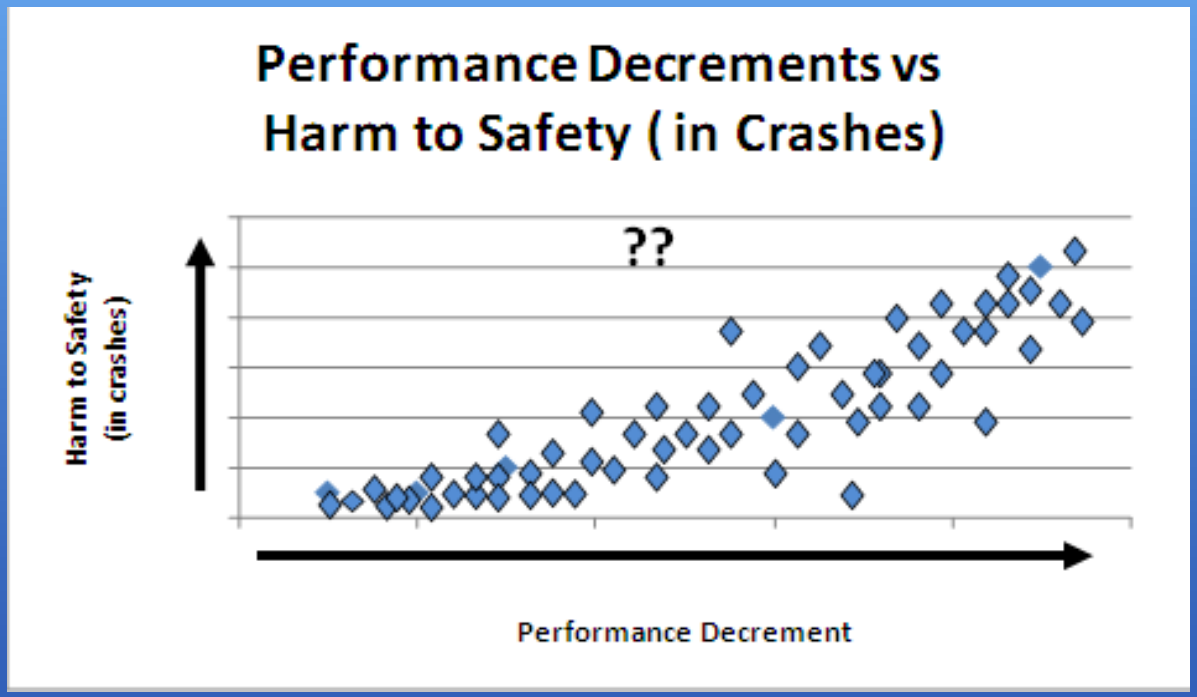
Each of these contributes
essential and valuable information . . .

But
"PERFORMANCE" & "BEHAVIOR" can be DISTINCT
-- and deserve to be carefully distinguished
one from the other.

And used to complement one another in a larger integrative picture.

Performance Decrements Can Create an Expectation of Safety Dis-Benefit

- Yet not all performance decrements lead to measurable safety dis-benefits or harm



Graph depicts an ILLUSTRATIVE relationship – FUZZY & IMPERFECT.

ACTUAL Relationships are largely unknown.

Issues Related to Assessment of Crash Risk

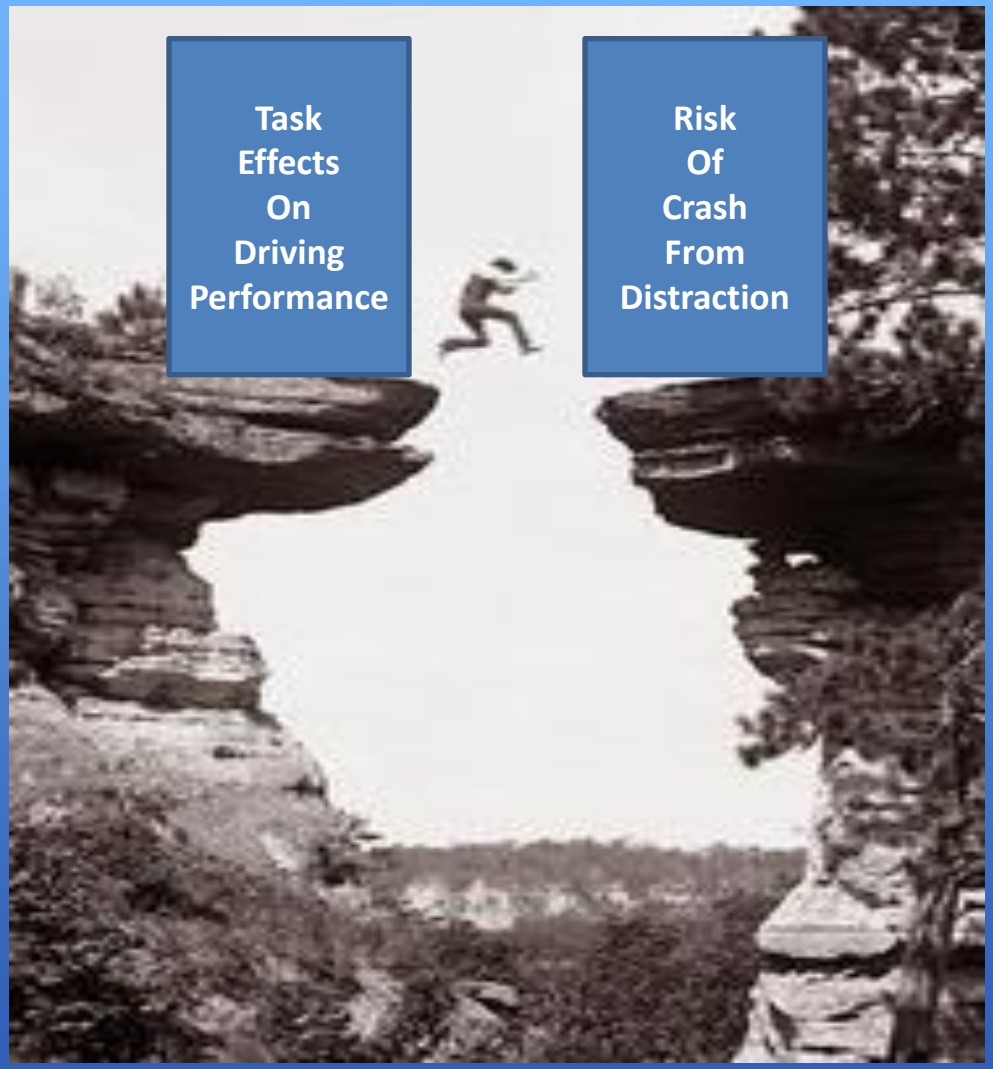
Gaping Middle Syndrome

http://www.examiner.com/x-7251-Milwaukee-History-Examiner~y2010m1d15-Photographer-made-Wisconsin-Dells-famous

The Choices

1. Take a **great leap** & hope for the best
2. Carefully build a strong **bridge** from one point to the other
3. **Stay put** (abandon attempts at progress)

Gaping Middle Syndrome



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Assessment of Crash Risk

- Benefits from an understanding of task intrusion on driving (including task type, length of task, and intensity of task & its intrusion)

- BUT it requires more than that

It may require understanding . . . .

Frequency of Task Engagement,

Conditions of Engagement,

Probability of Co-Occurring Hazards During Task,

The Type of Driver Doing the Task and the Driving,

Amount of Driving,

and . . . ???

Possible Factors Contributing To Crash Risk Beyond Task Demand

Illustrative Only

Types of Drivers

Amount of Driving

7% 36% 39% 16% 2%

Types of Devices They Choose To Purchase/Bring Into Vehicle

Portable – Portable – Portable – Both – Embedded - Neither

Frequency , Length, & Intensity of Use While Driving

High High Moderate High Moderate Low

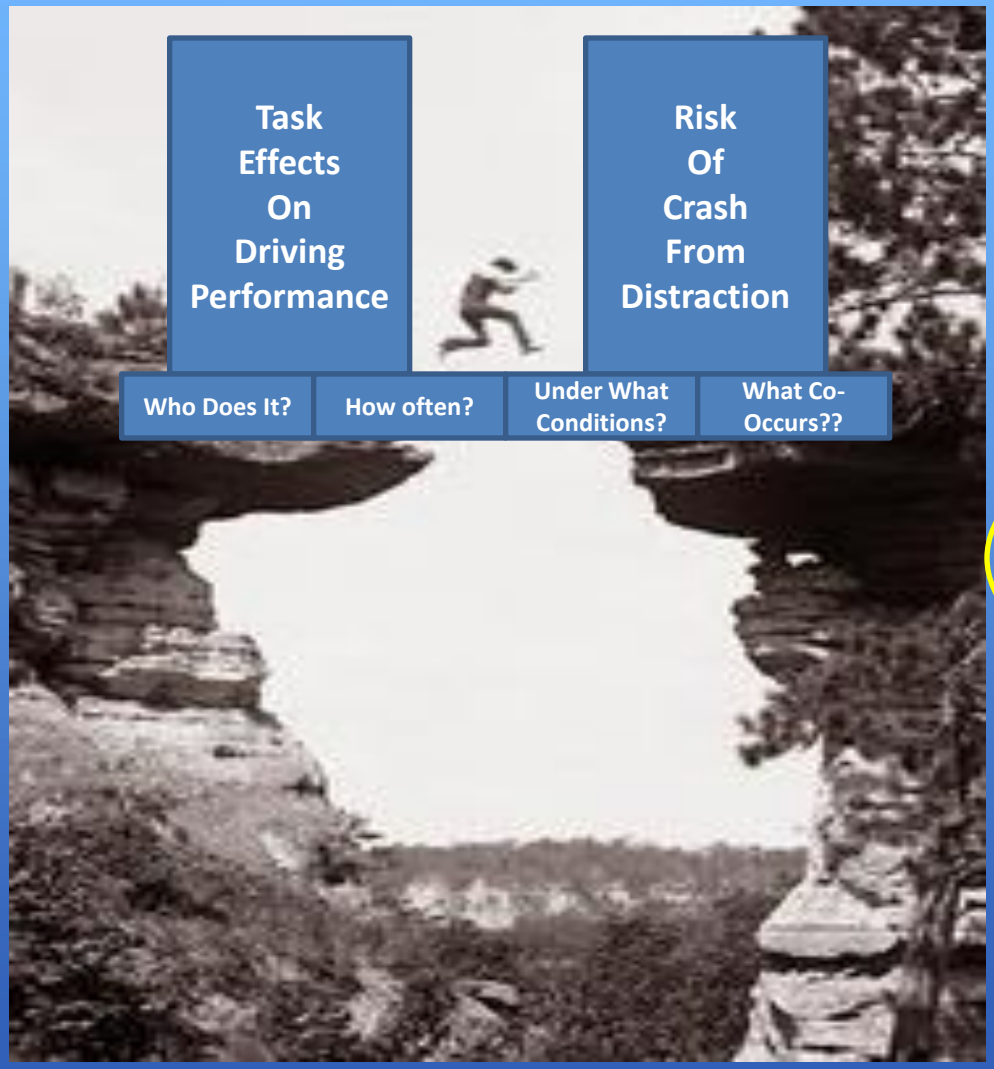
Conditions of Use

Wide – Somewhat – Careful – Selective – Selective –Highly Selective

Co-Occurrence of use with other factors & events on roadway

Unknown or still emerging

Bridging Gaping Middle Syndrome



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Closing Thoughts & Questions

- Distraction *is* contributing to significant harm (even though crash risk is perhaps not as high as initially estimated).
  - 5,870 fatalities per year, a serious number
  - Plus additional injury and suffering
- To address it even more completely than we are now, can we:
  - "Look and see" the phenomena as fully as possible, with less bias of prior expectation?
  - Attend to surprises in the findings – exploring and understanding them?
  - Where possible, work toward "connecting" findings together?
- Can such efforts facilitate distraction prevention and mitigation?
- Or at least give us something to talk about at lunch ?. . . .

Our Opportunity Today/Tomorrow:
Look beyond what we've seen before

http://zenhabits.net/fotos/20071230reflection.jpg

Toward new or deeper understanding