Psychology of Roadway Interactions: Implications for Road Safety

Tara Goddard
Portland State University
Traffic Crashes: The Numbers

In 2014:

Pedestrians:
- 4,884 killed (more than 12 per day)
- 65,000 injured* (one injury every 8 minutes)

Bicyclists:
- 726 people killed (~2 per day)
- 50,000 injured* (one injury every 10.5 minutes)

Economics:
- Cost of pedestrian injury for kids 14 and under: $5.2 billion
- Cost of bicyclist injury: $4 billion

*Known to be underreported in police data


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Crashes: Injury Severity

Automobile only

- Property Damage Only: 40%
- Injury or Fatality: 60%

Automobile and Bicyclist or Pedestrian

- Property Damage Only: 7%
- Injury or Fatality: 93%


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Crash Causation

Day time, unimpaired driver

- Looked but failed to see: 48%
- Misjudged, inattention, distracted: 52%
- All others: 34%
- Looked but failed to see: 17%
- Misjudged speed or path: 21%
- Inattention: 28%

Source: Brown, I. D. (2005). Review of the “looked but failed to see” accident causation factor. UK Department for Transport

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What causes “Looked but failed to see” (LBFTS) errors?

- Multiple hazard perceptions tests in laboratories demonstrate that drivers do not recall or react to everything in their visual environment, even critical events, despite opportunity to see hazards.

- “It is plausible to suggest that the looked-but-failed-to-see error does not arise due to the physical environment but as a result of the drivers’ visual search strategy and/or mental processing.” – Herslund & Jorgensen, 2003

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Controlled Processes

- Are intentional
- Involve awareness
- Require effort
  - Typically slow
- Executed serially
- Tend to be linguistic
  - Reportable in words

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Automatic Processes

- Do not require intention
- Do not require awareness
- Do not require effort
  - Typically fast
  - Executed simultaneously
- Tend to be perceptual
  - Hard to capture in words

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A test of attention (count the passes by the team in white shirts)
A test of attention (count the passes by the team in white shirts)

Image credit: Daniel Simons, personal website
Inattentional Blindness (IB)

Cause:
A *psychological* lack of attention

Outcome:
Failing to perceive an unexpected stimulus in plain sight


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The psychology of (in)attention

“Attention creates no idea” – William James, 1890

“It is possible to conceive of [attention] as an effect and not a cause, a product and not an agent . . . Attention creates no idea; an idea must already be there before we can attend to it”

-(William James, The Principles of Psychology (1890) p. 450)

Are certain types of ideas more important than others?

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An important type of idea: Attitude

- Evaluation of a person, object, group, concept, etc.
- “Psychological tendency to evaluate an entity with favor or disfavor” (Eagly & Chaiken, 1998)
  - Has multiple components
  - Has conscious and unconscious aspects
  - Can affect mental models and processing
  - Can direct attention

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The ABCs of attitudes

Affective
- Moods, emotions

Behavioral
- Intended and enacted behaviors

Cognitive
- Thoughts, beliefs

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### Attitude toward bicyclists: Negative attitude example

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective</td>
<td>Moods, emotions&lt;br&gt;Ex: “Bicyclists annoy me”</td>
</tr>
<tr>
<td>Behavioral</td>
<td>Intended and enacted behaviors&lt;br&gt;Ex: “I do not want to bicycle”</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Thoughts, beliefs&lt;br&gt;Ex: “Bicyclists should not block cars”</td>
</tr>
</tbody>
</table>

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Explicit vs implicit attitudes

Explicit Attitudes
- Deliberate, conscious
- Voluntarily accessible, can be acknowledged

Implicit Attitudes
- Automatic, below conscious awareness
- Involuntarily activated

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Inconsistent explicit and implicit attitudes

Explicit Attitudes
- Deliberate, conscious
- Ex: “Bicyclists are doing good things for the environment”

Implicit Attitudes
- Automatic, below conscious awareness
- Ex: “Bicyclists are annoying”

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Implicit vs. Explicit Attitudes

- Implicit and explicit attitudes are distinct, but related.

- Meta-analysis: $r = .27$ for implicit attitudes for prediction of behavioral, judgment, and physiological measures (Greenwald, et al. 2009)

- Better predictor than explicit attitudes when:
  - automatic processing conditions (e.g., time pressure, cognitive load)
  - Sensitive topics like prejudice
  - Nonverbal or subtle behaviors

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Implicit Bias

- Implicit bias affects:
  - Policy preferences
  - Doctors’ behaviors with minority patients
  - Hiring and job interview selection
  - Police behavior with minorities

- Might implicit bias affect issues in the transportation domain?

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Previous studies have shown that drivers do not respond equally to all pedestrians

- Drivers yielded more frequently to visibly disabled pedestrians (Harrell 1992)
- Drivers more likely to yield to pedestrians in same age group (Rosenbloom et al 2006)
- Drivers in highest status cars less likely to yield to a pedestrian (aka “The BMW Study” ) (Piff et al 2012)
- Drivers displayed racially-biased yielding behaviors to pedestrians at crosswalks (Goddard et al (2015), Coughenour et al (2017))
Similarly, drivers do not respond equally to all bicyclists

- Walker (2007) and Florida DOT (2011) determined that drivers passed more closely to male, Lycra-wearing “cyclists”
- Walker and Garrard (2014) found that drivers only gave more passing distance to “Police: Video Recording in Progress” vest
Bias in the Transportation Context

Point-of-view via mode may affect evaluation of other people’s intent or motivation, and future mode choice

- Gatersleben et al (2013) found that when viewed from a car, people rated a simulated playground interaction as “threatening”, while viewed as a passerby on foot, rated the interaction as playful

- Moody et al (2016) found that implicit bias toward “car pride” and against bus use improved prediction of mode choice
Attitudes just one piece of a complex puzzle, but understudied in context of bike/ped safety


The Conceptual Model of Roadway Interactions

- **Sociocultural**
  - Social norms
  - Roadway culture
  - Structural (in)equality
  - Stereotypes
  - Social dominance
  - System justification
  - Public investment in facilities
  - Vehicle design

- **Physical**
  - Facility design
  - Speeds and volumes
  - Level of separation

- **Individual**
  - Demographics
  - Social Identity
  - Experience as out-group mode user
  - Cognitive load
  - Experience with specific infrastructure and/or other out-group users

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Implications

- Can design “overrule” these implicit biases?
- Can education or enforcement be better informed by theory?
- How do we normalize or legitimize all roadway users?

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THANK YOU

Questions on these slides or research cited: Tara Goddard
goddard@pdx.edu