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Webinar: Integrating Explicit and Implicit Methods in Travel Behavior Research: A Study of Driver Attitudes and Bias

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Integrating explicit and implicit methods in travel behavior research: A study of driver attitudes and bias

Tara Goddard
Portland State University

National Institute for Transportation and Communities

February 21, 2017
Structure of the webinar

- Safety statistics
- Social psychology
- Bias in transportation behavior
- Survey instrument
- Survey results – explicit and implicit attitudes
- Focus: drivers who bicycle or not
- Focus: attitudes about overtaking bicyclists
- Conclusion: implications and next steps
- Questions

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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

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

Automobile and Bicyclist or Pedestrian

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

Crashes by time of day

US Bicyclist Fatalities, 2013

- Nighttime (9pm-6am)
- Evening (6pm-9pm)
- Daytime (6am-6pm)

Source: NHTSA

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Crash Causation

Day time, unimpaired driver

- Looked but failed to see: 48%
- Misjudged, inattention, distracted: 52%

Crash cause:
- Inattention: 28%
- Misjudged speed or path: 21%
- Looked but failed to see: 17%
- All others: 34%

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

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

View the video at https://youtu.be/vJG698U2Mvo
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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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
“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 in directing attention?
An important type of idea: An 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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## Explicit vs implicit attitudes

<table>
<thead>
<tr>
<th>Explicit Attitudes</th>
<th>Implicit Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Deliberate, conscious</td>
<td>• Automatic, below conscious awareness</td>
</tr>
<tr>
<td>• Voluntarily accessible, can be acknowledged</td>
<td>• Involuntarily activated</td>
</tr>
</tbody>
</table>

Goddard 2017
Implicit and explicit attitudes are distinct, but related.

Better predictor of behavior than explicit attitudes when:
- Conditions with time pressure and/or high cognitive load
- Sensitive topics like prejudice
- Nonverbal or subtle behaviors
Previous studies have shown that drivers do not respond equally to all pedestrians.

- Drivers in highest status cars less likely to yield to a pedestrian (aka “The BMW Study”) (Piff et al. 2012)
- Drivers display 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

- Drivers pass more closely to men and helmeted or Lycra-wearing bicyclists than women or helmet-less riders (Walker 2007; Florida DOT 2011)

- Drivers pass further away from bicyclists wearing a “Police: Video Recording in Progress” vest than bicyclists in other outfits (Walker and Garrard 2014)
Our mode affects how we see the world

- 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 (Gatersleben 2013)

- Implicit bias toward “car pride” and against bus use improved prediction of mode choice (Moody et al 2016)
Survey instrument
Study design

- Study: two parts, online only
  - Survey: explicit attitudes, self-report behaviors, demographics
  - Implicit Association Test (IAT): implicit attitudes
  - Survey hosted and IAT built by Project Implicit

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Implicit Association Test (IAT)

Concepts:

“Driver”

“Bicyclist”

Attributes:

Positive evaluations: Joyful, Lovely, Wonderful, Beautiful, Pleasant, Happy

Negative evaluations: Painful, Terrible, Horrible, Cruel, Awful, Agony

Goddard 2017
Welcome to the Implicit Association Test. You will use the "e" and "i" computer keys to categorize items into groups as fast as you can. These are the four groups and the items that belong to each:

<table>
<thead>
<tr>
<th>Category</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>Joyful, Lovely, Wonderful, Beautiful, Pleasant, Happy</td>
</tr>
<tr>
<td>Negative</td>
<td>Painful, Terrible, Horrible, Cruel, Awful, Agony</td>
</tr>
<tr>
<td>Driver</td>
<td>![Driver Image]</td>
</tr>
<tr>
<td>Bicyclist</td>
<td>![Bicyclist Image]</td>
</tr>
</tbody>
</table>

There are seven parts. The instructions change for each part. Pay attention!
If you make a mistake, a red X will appear. Press the other key to continue.
Survey respondents (n=676)

Women, n=449, mean age: 40.9 years
Men, n=227, mean age: 42.6 years
Distribution of responses

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Experienced, frequent drivers

Number of years driving

- One year or less: 1%
- 2: 3%
- 3: 4%
- 4: 3%
- 5: 3%
- 6: 2%
- 7: 3%
- 8: 4%
- 9: 4%
- 10 years or more: 9%

75% of respondents have driven for 10 years or more.

Days per week driving

- Zero: 4%
- 1-3 days/week: 9%
- 4-5 days/week: 14%
- 6 days/week: 16%
- 7 days per week: 57%

87% of respondents drive 4-7 days/week.

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Most people encounter bicyclists while driving

How often do you encounter bicyclists when you are driving to work, running errands, or otherwise driving around town?

- **All or nearly all trips**: 11%
- **Frequently**: 31%
- **Occasionally**: 42%
- **Rarely**: 15%
- **Never**: 1%

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Many people have bicycled in the last year, but do not bicycle in the typical week.

**Have you bicycled outside in the last year?**

- Yes: 54%
- No: 46%

- N = 668

**In a typical week with nice weather, how many days do you bicycle?**

- 0: 3%
- 1: 15%
- 2: 24%
- 3 to 5: 46%
- 6 to 7: 12%

- n = 361

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Results
**Explicit attitudes – Exploratory Factor Analysis**

<table>
<thead>
<tr>
<th>Factor name*</th>
<th>Statement</th>
<th>Loading**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driver identity</strong></td>
<td>I am a skilled driver</td>
<td>0.769</td>
</tr>
<tr>
<td></td>
<td>Being a driver is important part of who I am</td>
<td>0.722</td>
</tr>
<tr>
<td></td>
<td>I care if my family and friends think of me as a good driver</td>
<td>0.710</td>
</tr>
<tr>
<td><strong>System justification</strong></td>
<td>Building infrastructure for bicyclists is not a good investment of public funds</td>
<td>0.759</td>
</tr>
<tr>
<td></td>
<td>I do not see bicyclist similar to me on city streets</td>
<td>0.595</td>
</tr>
<tr>
<td></td>
<td>Bicyclists should not be allowed to filter forward through lanes of slow or stopped car traffic</td>
<td>0.529</td>
</tr>
<tr>
<td></td>
<td>If a driver and a bicyclist collide, it is usually not the fault of the driver</td>
<td>0.406</td>
</tr>
<tr>
<td><strong>Social dominance</strong></td>
<td>It makes me angry if I see bicyclists breaking the rules of the road</td>
<td>0.689</td>
</tr>
<tr>
<td></td>
<td>Bicyclists shouldn't hold up traffic</td>
<td>0.669</td>
</tr>
<tr>
<td></td>
<td>It makes me angry if I see other drivers breaking the rules of the road</td>
<td>0.628</td>
</tr>
<tr>
<td><strong>Legitimacy</strong></td>
<td>Bicyclists should have to pass a license test just like drivers do</td>
<td>0.823</td>
</tr>
<tr>
<td></td>
<td>Bicyclists should have to register and pay taxes</td>
<td>0.795</td>
</tr>
</tbody>
</table>

*name given to factor based on social-psychological theory

**Represents measure of association (i.e. correlation) of each statement with its factor

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Explicit attitudes – driver identity

I am a skilled driver

Being a driver is important part of who I am

I care if my family and friends think of me as a good driver

Strongly agree

Strongly disagree

Goddard 2017
Building infrastructure for bicyclists is not a good investment of public funds
I do not see bicyclists similar to me on city streets
Bicyclists should not be allowed to filter forward through lanes of slow or stopped car traffic
If a driver and a bicyclist collide, it is usually not the fault of the driver
Explicit attitudes – social dominance

- It makes me angry if I see bicyclists breaking the rules of the road: Strongly agree
- Bicyclists shouldn't hold up traffic: Strongly agree
- It makes me angry if I see other drivers breaking the rules of the road: Strongly agree

Goddard 2017
Explicit attitudes – road user legitimacy

Bicyclists should have to pass a license test just like drivers do

Bicyclists should have to register and pay taxes

Goddard 2017
Implicit attitude results

- Moderate to strong preference for bicyclist: 19%
- Weak or no preference: 59%
- Moderate to strong preference for driver: 23%

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## Association of implicit and explicit attitudes

<table>
<thead>
<tr>
<th></th>
<th>IAT score</th>
<th>Driver Identity</th>
<th>System Justification</th>
<th>Social Dominance</th>
<th>Legitimacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAT score</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver identity</td>
<td>.098*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Justification</td>
<td>.191**</td>
<td>-0.032</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Dominance</td>
<td>.103**</td>
<td></td>
<td>.143**</td>
<td>.147**</td>
<td></td>
</tr>
<tr>
<td>Legitimacy</td>
<td>.104**</td>
<td>-0.022</td>
<td>.181**</td>
<td>.267**</td>
<td>-</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).
Driver identity and implicit preference for drivers or bicyclists

*the more positive the score, the greater preference for drivers over bicyclists, and vice versa

"Being a driver is an important part of who I am"
The case of drivers who bicycle (or not)
Comparing drivers who have and have not bicycled outside in last year

<table>
<thead>
<tr>
<th></th>
<th>Driver has not bicycled (mean)</th>
<th>Driver has bicycled in previous year* (mean)</th>
<th>Sig.</th>
<th>Effect size**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver identity</td>
<td>4.40</td>
<td>4.43</td>
<td>0.723</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>System Justification</strong></td>
<td>3.20</td>
<td>3.57</td>
<td>0.000</td>
<td>0.5</td>
</tr>
<tr>
<td>Social Dominance</td>
<td>4.37</td>
<td>4.31</td>
<td>0.386</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Road user legitimacy</strong></td>
<td><strong>2.91</strong></td>
<td><strong>2.70</strong></td>
<td><strong>0.011</strong></td>
<td><strong>0.2</strong></td>
</tr>
</tbody>
</table>

*Driver has bicycled outside in the last year, but may or may not bicycle in “a typical week with nice weather.”

**Effect size is calculated as the absolute value of mean difference between driver-bicyclists and driver-non-bicyclists divided by the pooled standard deviation. Conventional small, medium, and large effect sizes are 0.2, 0.5, and 0.8, respectively.
Effect is due to drivers who bicycle regularly

<table>
<thead>
<tr>
<th></th>
<th>Driver Bicyclist* (mean)</th>
<th>Driver Non Bicyclist* (mean)</th>
<th>Sig.</th>
<th>Effect size**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver identity</td>
<td>4.48</td>
<td>4.39</td>
<td>0.234</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>System Justification</strong></td>
<td><strong>3.06</strong></td>
<td><strong>3.49</strong></td>
<td><strong>0.000</strong></td>
<td><strong>0.5</strong></td>
</tr>
<tr>
<td>Social Dominance</td>
<td>4.27</td>
<td>4.36</td>
<td>0.177</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Road user legitimacy</strong></td>
<td><strong>2.51</strong></td>
<td><strong>2.92</strong></td>
<td><strong>0.000</strong></td>
<td><strong>0.4</strong></td>
</tr>
</tbody>
</table>

*Driver-Bicyclists bicycle at least once/week in a "typical week with nice weather", while Driver-Non-Bicyclists may or may not have bicycled outside in the last year, but bicycle zero days in the typical week with nice weather.

**Effect size is calculated as the absolute value of mean difference between driver-bicyclists and driver-non-bicyclists divided by the pooled standard deviation. Conventional small, medium, and large effect sizes are 0.2, 0.5, and 0.8, respectively.

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Bicycling frequency and implicit bias

- Yes: Moderate to strong preference for bicyclist
- No: Moderate to strong preference for driver

Bicycled outside in the last year

Goddard 2017
Bicycling frequency and implicit bias

<table>
<thead>
<tr>
<th>Percentage of respondents</th>
<th>Bicycled outside in the last year</th>
<th>Bike one day or more in typical week</th>
<th>Bike zero days in typical week</th>
<th>Days per week bicycling in typical week with nice weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>50%</td>
<td>60%</td>
<td>50%</td>
<td>60%</td>
</tr>
<tr>
<td>No</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Moderate to strong preference for bicyclist

Moderate to strong preference for driver

Goddard 2017
Half the people who have bicycled in the last year have ridden only for recreation.

When you have ridden a bicycle, has it been for fun or exercise, commuting, errands (like shopping)? Please select all that apply.

- [1] Purely for fun and/or exercise
- [3] Utility trips
- [4] To accompany a child

49.4% bicycled for recreation only

Goddard 2017
Bicycling is healthy and good for the environment – people get that!

*word cloud generated from open-ended question “what are five words or phrases that come to mind when you think of a bicyclist”*
I do not see bicyclists similar to me on city streets

<table>
<thead>
<tr>
<th></th>
<th>Driver Bicyclist* (mean)</th>
<th>Driver Non Bicyclist* (mean)</th>
<th>Sig.</th>
<th>Effect size**</th>
</tr>
</thead>
<tbody>
<tr>
<td>I do not see bicyclists similar to me on city streets</td>
<td>3.02</td>
<td>3.91</td>
<td>0.000</td>
<td>0.6</td>
</tr>
</tbody>
</table>

*Driver-Bicyclists bicycle at least once/week in a "typical week with nice weather", while Driver-Non-Bicyclists may or may not have bicycled outside in the last year, but bicycle zero days in the typical week with nice weather.

**Effect size is calculated as the absolute value of mean difference between driver-bicyclists and driver-non-bicyclists divided by the pooled standard deviation. Conventional small, medium, and large effect sizes are 0.2, 0.5, and 0.8, respectively.
Safety-related behaviors – The case of overtaking
Almost all drivers view themselves as skilled.
... but many admit they do not feel skilled when maneuvering around bicyclists

- **I am a skilled driver**: 93% Disagree, 0% Agree
- **I am not comfortable deciding how fast or close to pass a bicyclist going the same way as me on a street with no bike lane**: 40% Disagree, 46% Agree
- **When my car is moving, it is difficult to judge how far a bicyclist is from my passenger side**: 46% Disagree, 0% Agree

Goddard 2017
And even more people report feeling fearful/nervous

- **I am a skilled driver:** 93%
- **It makes me nervous when I have to drive close to someone on a bicycle:** 77%
- **It startles me when a bicyclist comes up on the driver's side:** 60%

Goddard 2017
Understanding improved and fear decreased for drivers who bicycle, especially weekly bicyclists.

I am comfortable deciding how close or fast to pass a bicyclist going the same way as me on a street with no bike lane.

Chi-square=10.386, p=.006
Most drivers (83%) feel pressure from other drivers to pass bicyclists.

If I don't pass a bicyclist, other drivers get angry

- **Strongly disagree**: 0%
- **Disagree**: 5%
- **Disagree somewhat**: 10%
- **Agree somewhat**: 23%
- **Agree**: 37%
- **Strongly agree**: 20%

Goddard 2017
When controlling for gender, age, bicycling frequency, and attitudes, implicit bias did not predict the previous self-evaluation of driving around bicyclists, BUT

- Implicit bias improved prediction of whether drivers reported checking for bicyclists before making a turn
- Implicit bias improved prediction of whether drivers believe that drivers are usually at fault in a collision between a driver and a bicyclist

Goddard 2017
Conclusions
Attitudes are 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)equity

**Individual**
- Demographics
- Social Identity
- Experience as out-group mode user

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

**Roadway Interaction**
- Public investment in facilities
- Vehicle design
- Cognitive load
- Experience with specific infrastructure and/or other out-group users

Questions examined, raised, and remaining

- Can design “overrule” implicit biases in an interaction?
- How does design help shift both explicit and implicit attitudes?
- Can education or enforcement be better informed by theory?
- How do we normalize and legitimize all roadway users?
Implications for practice

- Much remains to be learned about cognitive processes, particularly social cognitions, of drivers toward vulnerable road users, and their implications for road safety.

- Social cognitions may help explain some of why “build it and they will come” assumptions fail and why different vulnerable road users may experience the same street design differently.

- Implicit methods may add value to traditional travel survey methods, particularly related to sensitive issues and/or issues in high speed, high stress environments.

- Evidence is growing that getting people on bikes frequently (not just an occasional, off-street event) can help improve both explicit and implicit attitudes (bike share? frequent open streets events? weekly shopping trips?)
Acknowledgments

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THANK YOU

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