Summary
Our long term goal is to promote mutual trust based on the expectations of both a pedestrian and an autonomous vehicle (AV). Our first step to accomplishing this is to propose a user study that leverages virtual reality (VR) to examine the effects of an autonomous vehicle’s driving behavior and situational characteristics on a pedestrian’s trust.

Introduction
AVs have the potential to improve road safety, expand access to transport and help to promote a more sustainable future. Public fears regarding safety remains a major barrier to widespread adoption. Therefore, trust is vital to promoting the acceptance of AVs.

Problem with Trust in AVs
- Explicit intent communication improves driver’s trust in AVs
- Devices for explicit communications include:
  - LED displays, speakers, etc.
However,
- Not clear which or if any devices will be available for explicit communication to pedestrians.
- Effective explicit communications depends on the prior expectations of both the pedestrian and the AV.

Proposed work
- Identify important factors that promote a pedestrian’s trust in AVs.
- Design a user study to empirically verify the impact of these factors.

User Study
- Study the impact of the AV’s driving behavior and type of road crossing on a pedestrian’s trust in an AV.

Hypothesis
- Pedestrians will trust an AV more:
  - When the crossing is signalized vs. unsignalized.
  - When the AV exhibits defensive vs. normal or aggressive driving.

Method
- Participants will cross a midblock road crossing in a VR environment in the following six treatment conditions:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Defensive driving</th>
<th>Normal driving</th>
<th>Aggressive driving</th>
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</thead>
<tbody>
<tr>
<td>Signalized crossing</td>
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<tr>
<td>Unsignalized crossing</td>
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Experimental Setup
- Participants will wear a VR headset and interact with an AV while walking on an omnidirectional treadmill and employing touch controllers.

Measurements
- **Attitudinal** – trust, propensity to trust, task load and simulation sickness measured through surveys
- **Behavioral** – waiting time, crossing time, time to collision measured in simulation and gaze vector measured through eye tracker
- **Physiological** – pupil size, blink rate and heart rate variability

Expected Results
- Demonstrate that an AV’s driving behavior and situational characteristics impact a pedestrian’s trust in the AV.
- In particular, pedestrians exhibit high trusting behavior under defensive driving and signalized crosswalk conditions.

Future Work
- Study how the effects vary by the pedestrian’s traits (age and disabilities etc.) and the number of pedestrians (e.g. herding behavior).
- Examine the impact of an AV’s driving behavior and situational characteristics on the effectiveness of explicit communication.
- To extend the model to include other factors relevant for other road users such as cyclists, other drivers, etc.

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