אוניברסיטת בן-גוריון בנגב
Ben-Gurion University of the Negev

Improving Cyclists' Conspicuity with an Alternating Blinking Light System (ABLS)

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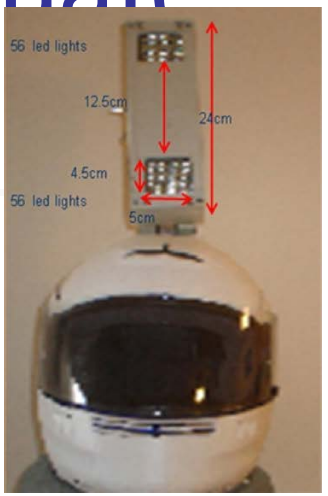
Problem ID: lack of cyclist's visibility causes crashes

- Cyclists have the right-of-way more often than drivers in crashes
- In many crash analyses drivers report they did not see the cyclist before impact
- Being vulnerable, cyclists are the victims
- Scope of problem: unknown (Cyclists' injuries and crashes are the most under-reported crashes in police data)

Previous research on 2-wheelers' visibility (mostly PTWs)

- Increase conspicuity through reflective clothing and lights – with different patterns
- Problem: with all the surrounding visual noise, it is hard to identify a cyclist just on the basis of a reflective or illuminating light source

Objective: Develop and evaluate a unique signature



- Previous studies – 2-B-Safe with PTWs
  - Pinto Cavallo – Triangle, Helmet, Yellow head
  - Shinar – helmet-mounted ABLS
- Improvement for bicyclists (can be applied to PTWs)
  - Two linked alternating light sources
  - Master on helmet and ‘slave’ on rear of seat and/or handle bar.
- Advantage over previous ABLS: cheaper with Bluetooth technology and easier to implement (however, no advantage with side-view)
- Advantage over bio-motion: easier to implement, less likely to be obscured as it is higher than leg lights.

Study method: Phase I

- Cyclist approaches the video camera from a distance >250 meters until reaching camera.
- Camera is mounted on a center island or traffic circle of a divided four lane urban arterial road
- Riding conditions
  - Locations: 3 different road segments (all of same road)
  - Light conditions: 2 - daytime and dusk
  - Lights: 3 - none, single flashing light on handle bar, ABLS.

Study Method: Phase II

- Two experiments with presentations of video clips of traffic with and w/o cyclist
  - Experiment 1: Cognitive Conspicuity – without expectation of bicyclist. Just report vehicles you saw
  - Experiment 2: Sensorial Conspicuity – participants primed to detect a bicyclist. Find if the clip contains a cyclist or not.

Experiment 1 Cognitive Conspicuity (w/o Expectancy)

- Participants: 20 students (13F, 7M), 23-29 yrs old, with 2+ yrs driving experience
- Procedure: 72 randomly ordered video clips of traffic. In half the clips there was a bicyclist and in half there was no bicyclist. Each clip lasted 1.0s. Then viewer indicated vehicles in the clip – by placing icons in relevant position. Once finished, the participant clicked on a "play" button to start the next trial.

Exp 1: Stimuli and Responses

Dusk
No Lights

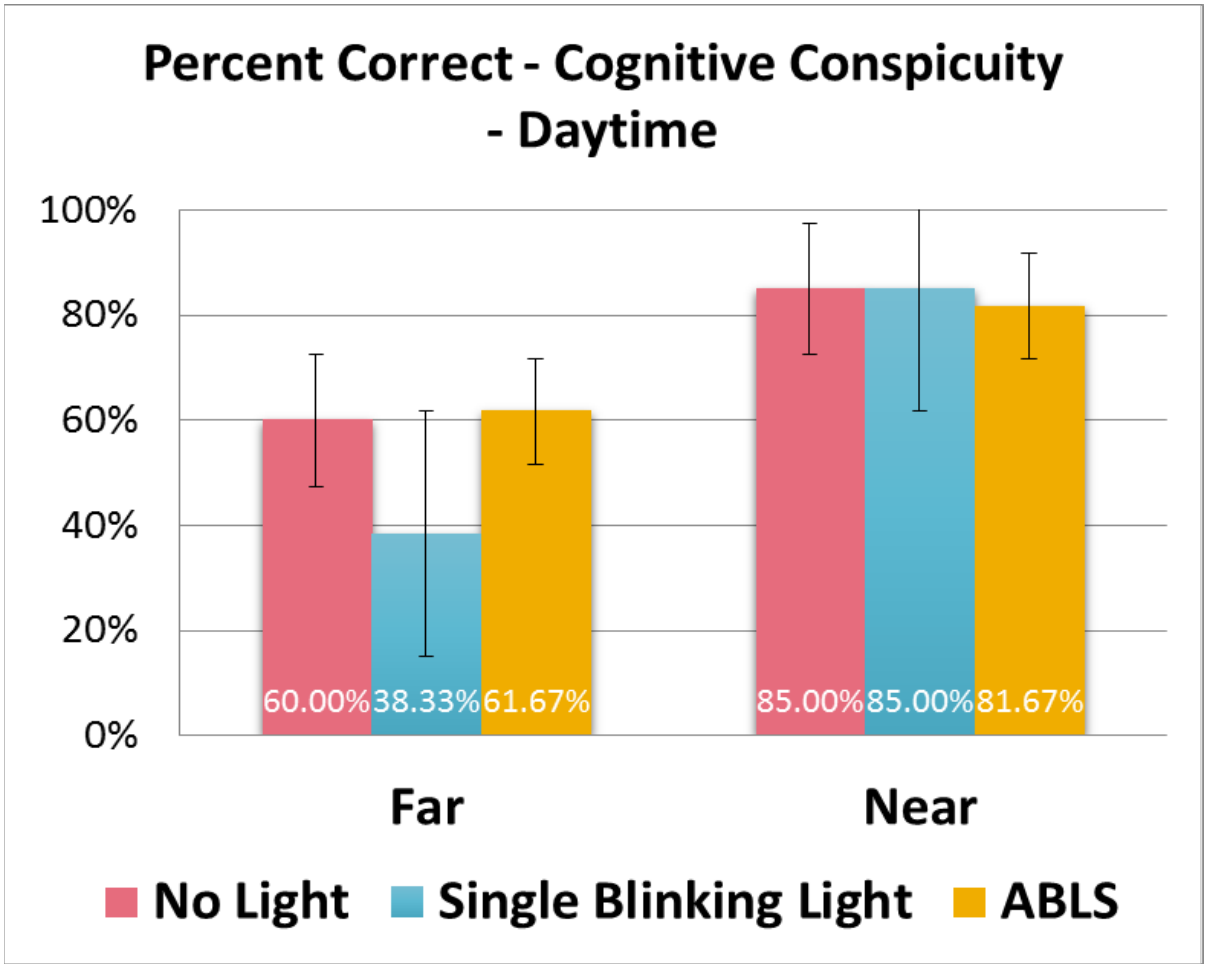
Dusk
Single Light

Dusk
ABLS

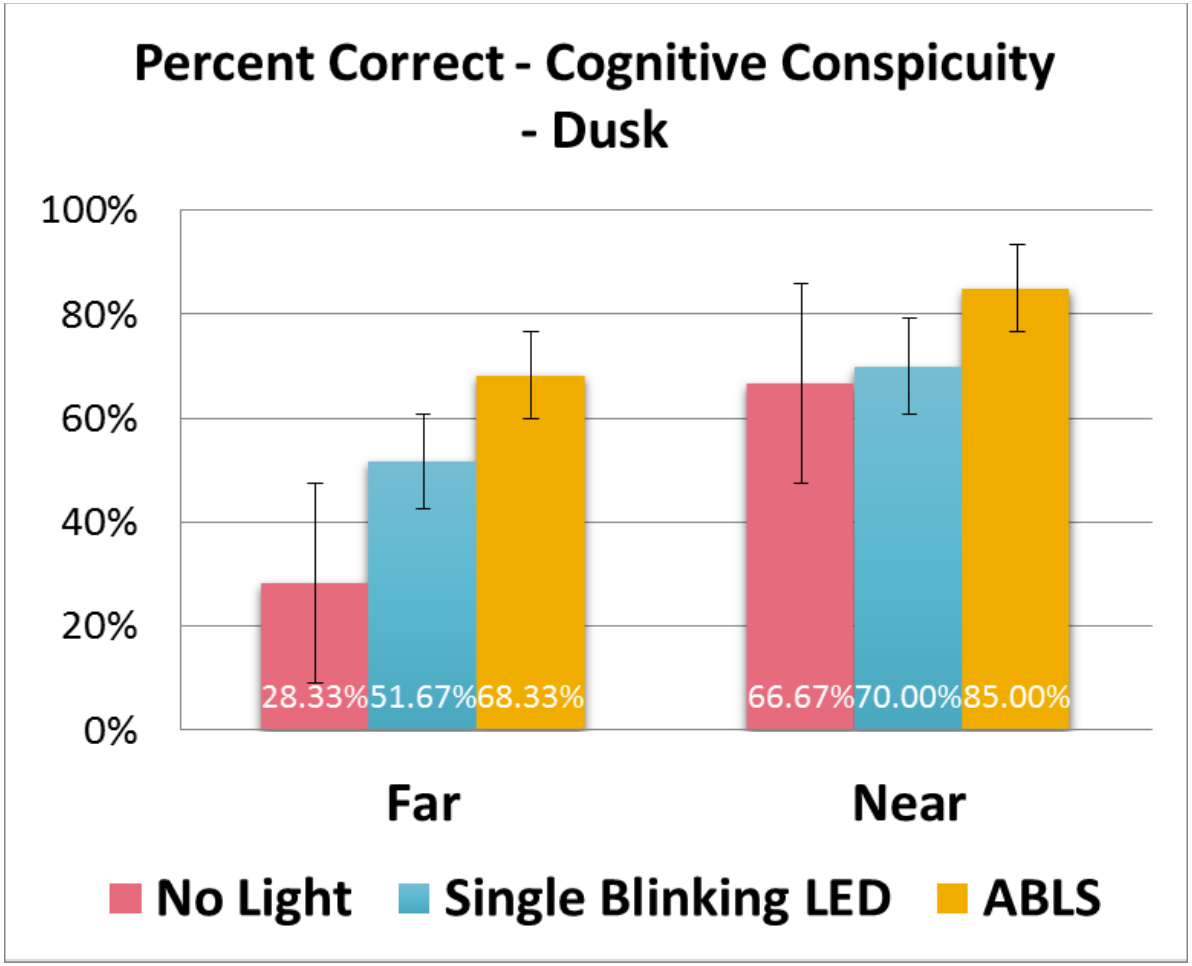
Design and Measures

- Independent measures
  - Time-of-Day (2- Daytime and Dusk)
  - Bicycle lighting (3- none, single light on handle bar, ABLS)
  - Cyclist Distance (2 – Far=140m, Near=60m)
  - Roadway (3)
  - Traffic (2 -with and without bicycle)
- Dependent measures
  - False Alarms - % false detection of bicyclist: 3.48%
  - Correct Detections: main dependent measure.

Results: Daytime Detections (%) (Cognitive Conspicuity)



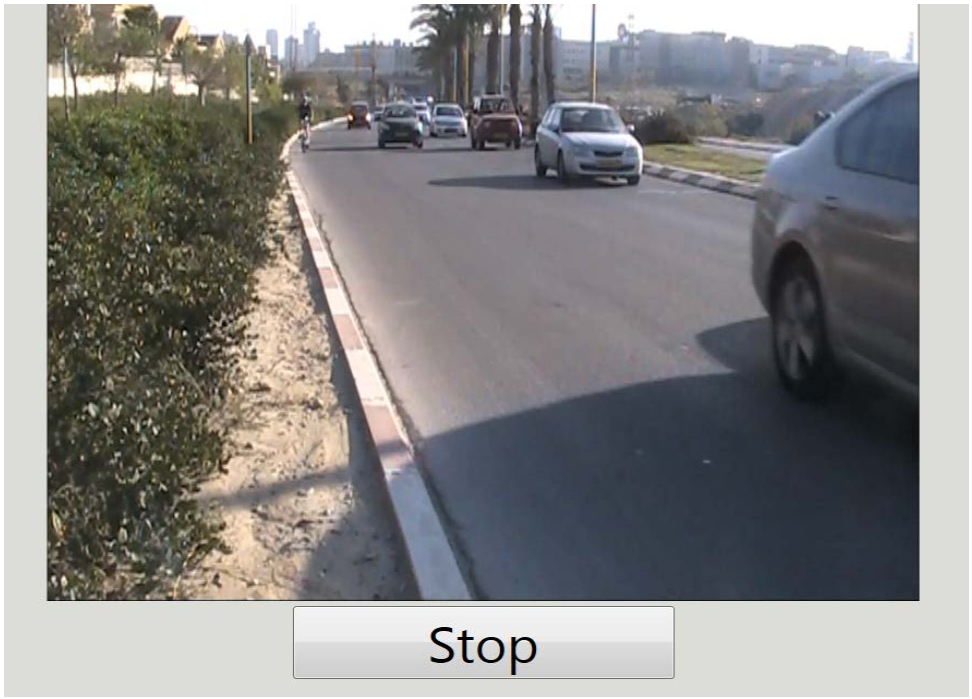
Results: Dusk Detections (%) (Cognitive Conspicuity)

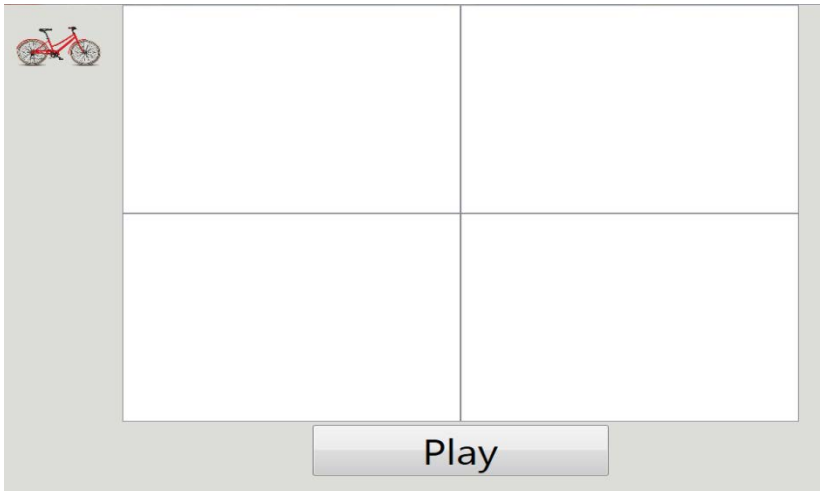


Exp 2: Sensorial Conspicuity – with Expectancy

- Participants: 20 students (11F, 9M), 23-31 yrs old, with 2+ yrs driving experience
- Procedure: 72 randomly ordered video clips of traffic. In half the clips there was a bicyclist and in half there was no bicyclist. Each clip ended when the viewer responded or for 2.5s. Then viewer indicated bicycle location in the clip – by placing icon in relevant position. Once finished, the participant clicked on a "play" button to start the next trial.

Exp 2: Stimuli and Responses

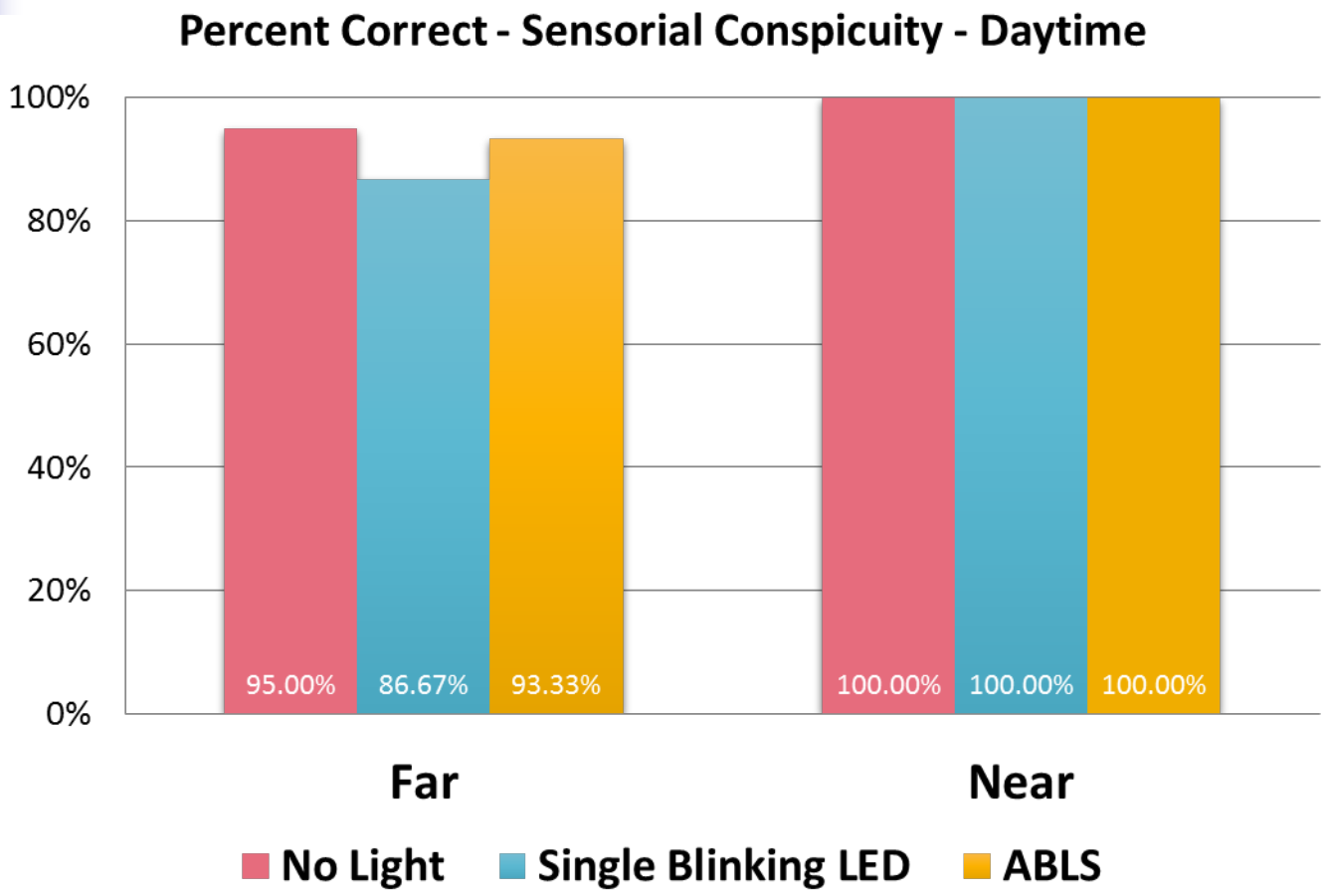




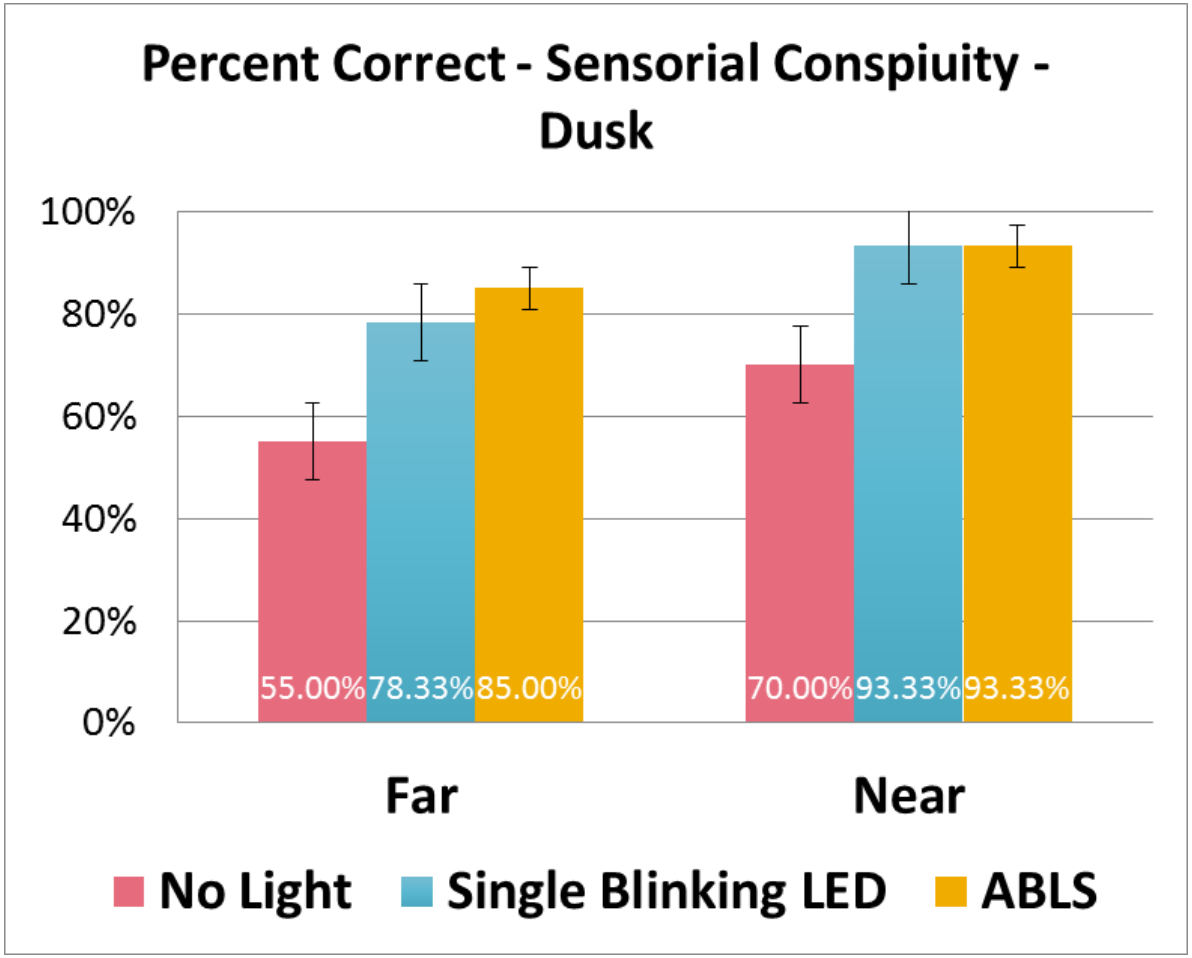
Design and Measures

- Independent measures – same as in Experiment 1.
- Dependent measures
  - False Alarms - % identification of bicycle where there was none: 6.38 %
  - Correct Detections: main dependent measure.
  - Time to Detect Cyclist: Response time from clip onset.

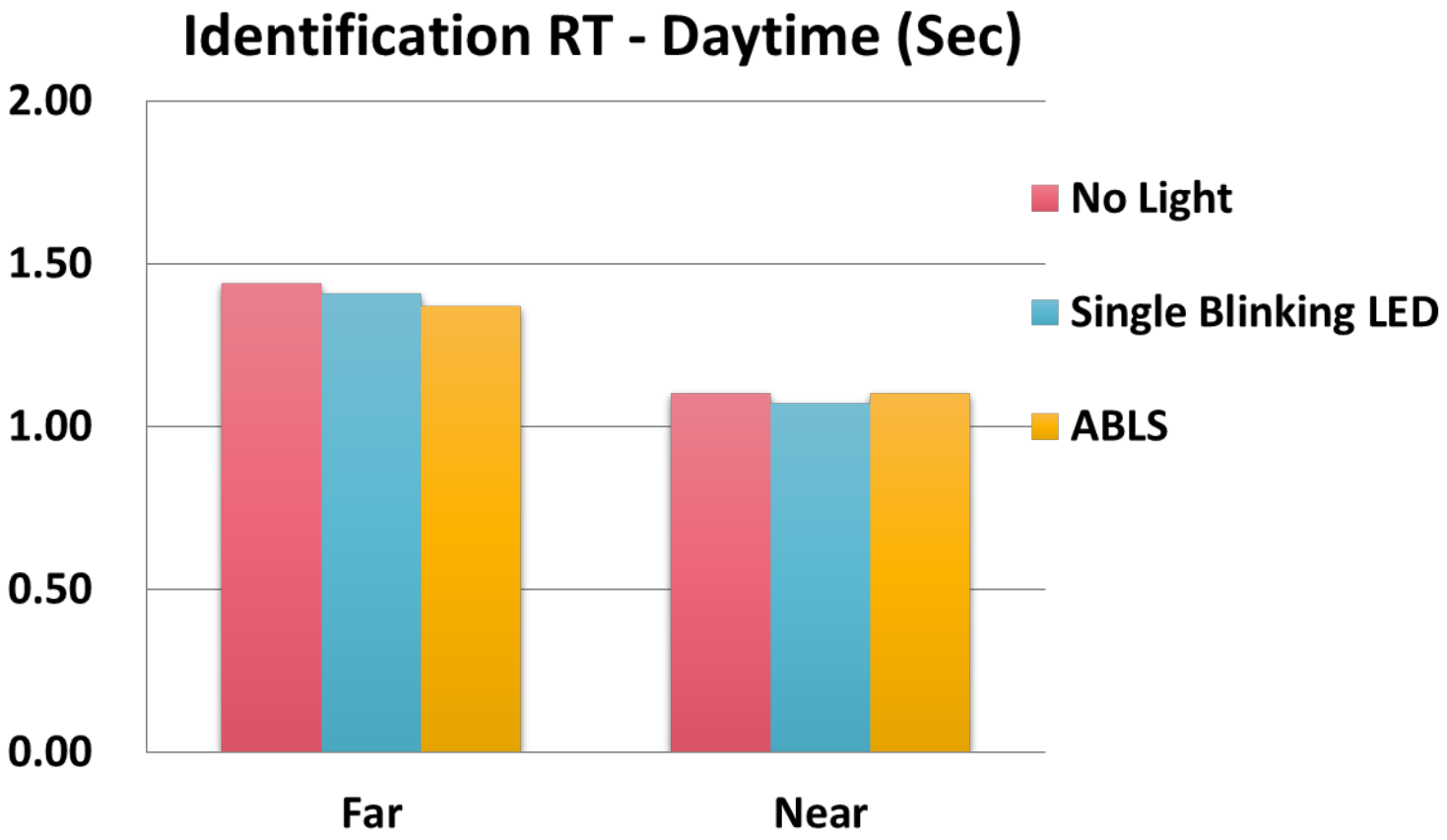
Results: Daytime Detections (Sensorial Conspicuity)



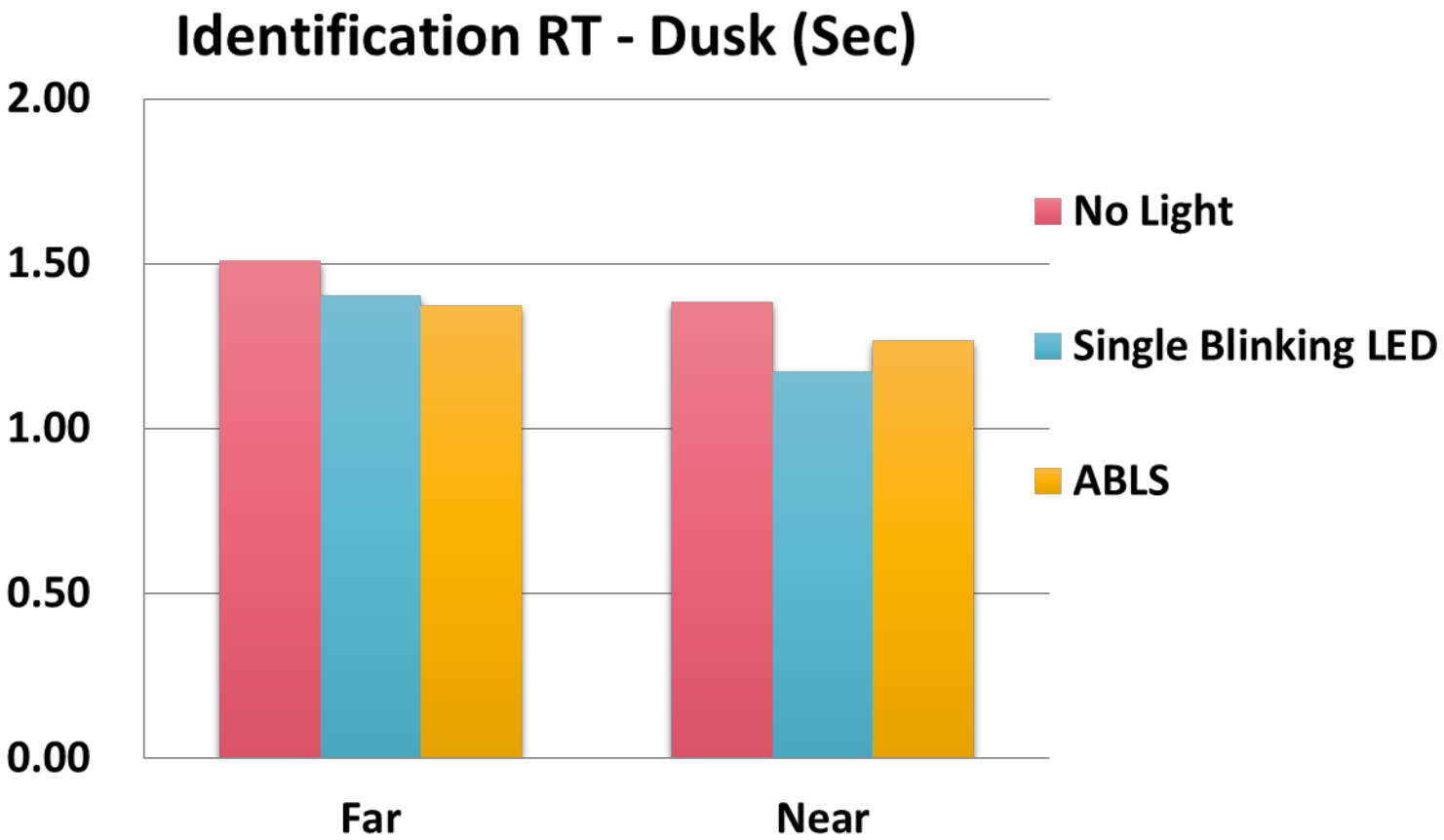
Results: Dusk time Detections (Sensorial Conspicuity)



Results: Identification RT – Daytime (Sensorial Conspicuity)



Results: Identification RT – Dusk (Sensorial Conspicuity)



Conclusions

- Lighting – either single or ABLS does not improve conspicuity during daylight hours.
- ABLS improved both cyclist cognitive and sensorial conspicuity, but only in the more difficult dusk condition.
  - Cognitive conspicuity is better relative to no lights or a single light both when the cyclist is far and near.
  - Sensorial conspicuity is better than no lights or a single light only in the far distance. When the cyclist is close the ABLS is as effective as a single light
  - Identification RT was affected by the time of day and distance, but was not different than with a single blinking light.

Conclusion and Recommendation

- The ABLS creates a unique 'signature' that attracts the viewer's attention to cyclists and improves the likelihood of their identification when the cyclist is not expected by the driver and when the light conditions are not optimal.
- The ABLS should be evaluated in other conditions of poor visibility and from both front and rear.

THANK YOU

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