

# eco-driving dashboard

empowering school bus drivers to conserve fuel



## why school buses?

In light of such issues as climate change and peak oil, our overarching goal in designing for public transportation is to reduce the consumption of petroleum fuel. School buses, we found, have enormous impact:

- In the U.S. there are over 500,000 school buses that travel more than 4 billion miles a year.
- School buses have an average fuel economy of only 5-7 miles per gallon.
- School buses annually consume an estimated 600 million gallons of fuel, costing \$1.5 billion and emitting 6.6 million tons of carbon dioxide.
- Exhaust from diesel fuel contributes to serious health problems, including heart disease, cancer and premature death. The 24 million children who ride school buses daily are especially vulnerable to these effects.

## research

### Exploring the Problem

We interviewed the director of transportation for the Monroe County Community School Corporation and found that:

- Measures to improve fuel economy exist but are primarily technical with little attention to the effects of driver behavior.
- Anti-idling policies are established but compliance is low due to strong counter-habits and lack of feedback

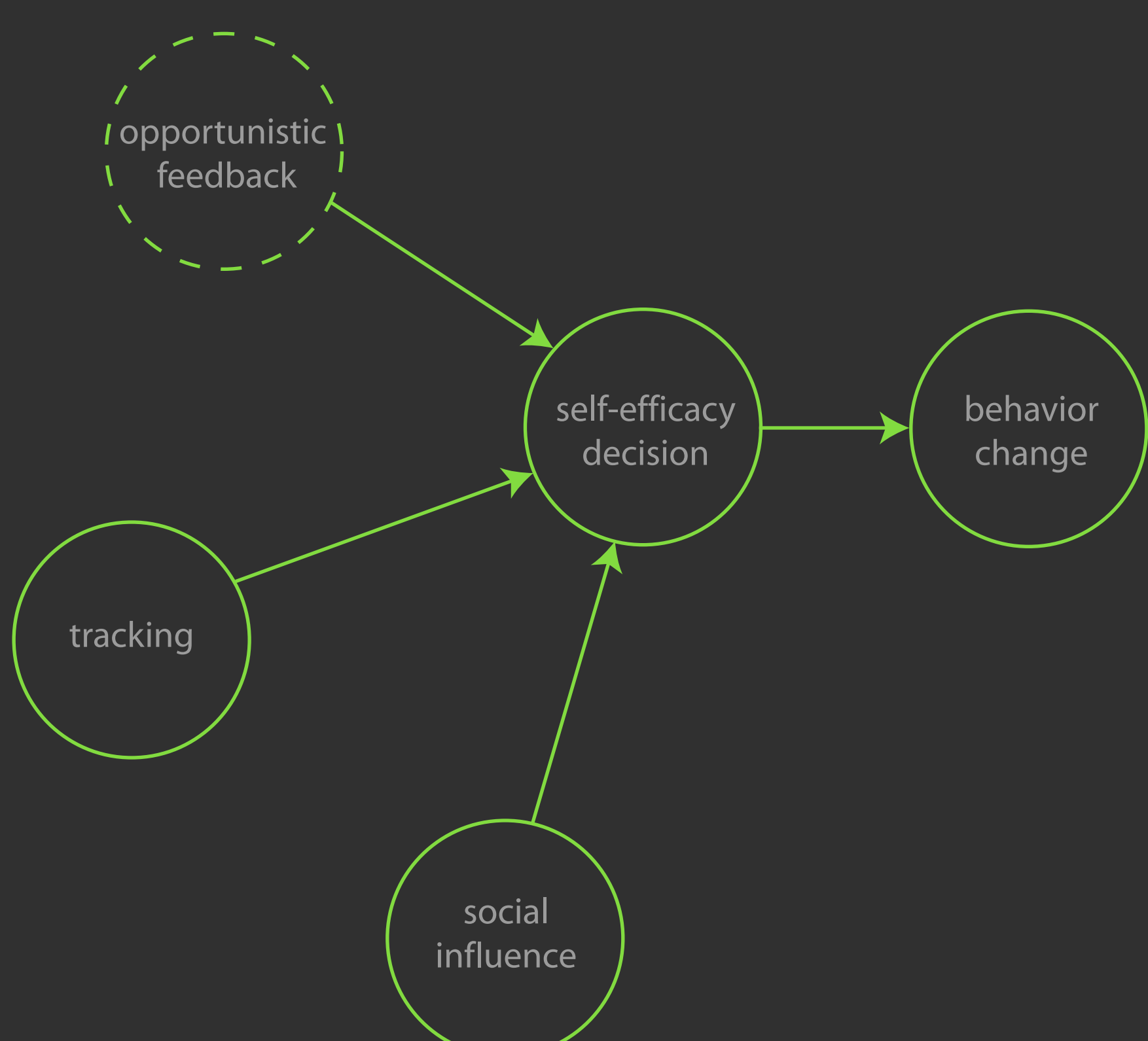
### Aggressive Driving

- The greatest impact on fuel efficiency is dictated by proper acceleration and deceleration patterns.
- Estimates suggest that changing driving style can reduce fuel consumption up to 15-20%.

### Excessive Idling

- Counter to the common myth, it is not better to leave a diesel engine running than to start and stop. This behavior wastes fuel, pollutes and causes greater wear and tear on the engine.
- The EPA estimates that a typical school bus will burn 1/2 gallon of fuel for every hour spent idling.

### Feedback for Behavior Change



## design

### 'Celerometer'



- While driving, the current rate of either acceleration or braking is continuously displayed.
- The spectrum is divided into discrete colored bars in order to draw attention to excessive rates.
- A secondary feedback of estimated fuel efficiency serves to reinforce the costs of celeration habits.

### 'Idling Reminder'



- A timer will appear when the driver has shifted into park with the engine still running.
- As established idling thresholds are exceeded the color changes from green to orange to red.

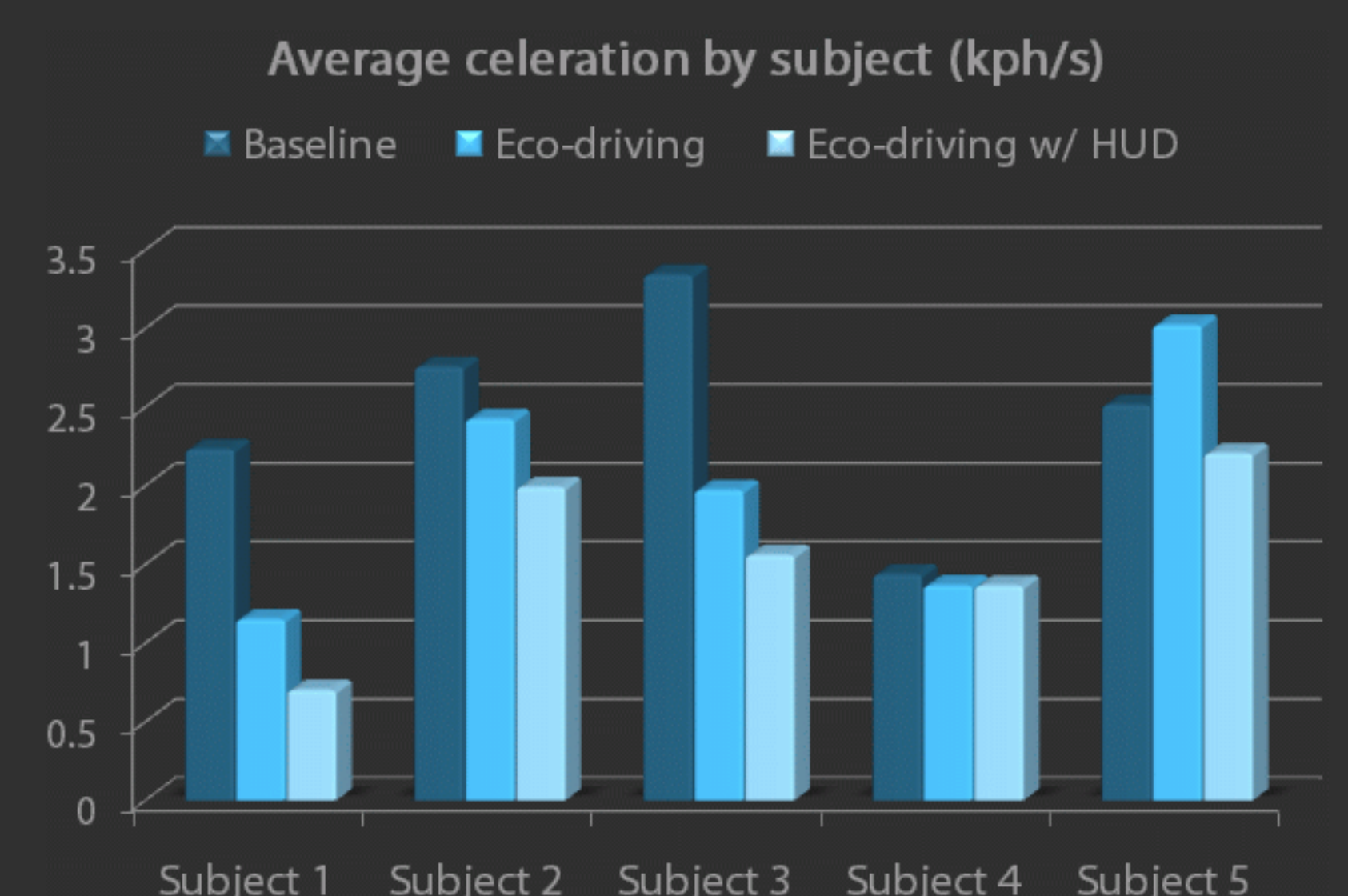
## evaluation

### Test Setup



- To evaluate the persuasive efficacy of the 'celerometer', we conducted a user test with a functional prototype implemented inside a 3D driving simulation.
- After practice, five subjects were given the scenario of a bus driver who needed to drive students to school.
- Each subject was observed performing three trials on a virtual course with realistic driving conditions.

### Results



- Comparing the driving behavior of subjects between the baseline, eco-driving, and eco-driving with celerometer scenarios, the average celeration decreased for all subjects.
- We conclude that the HUD had a significant effect on persuading participants to drive less aggressively.