A Behavioral Approach to Improving Pedestrian Infrastructure at Signalized Intersections

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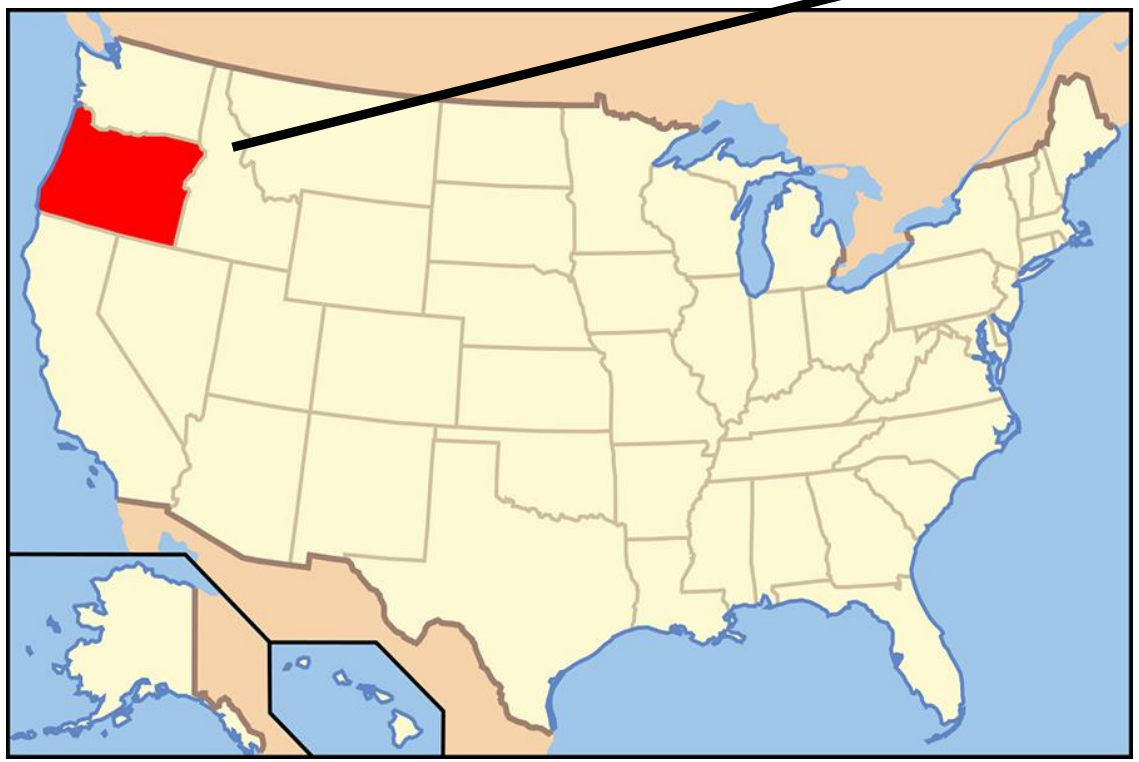
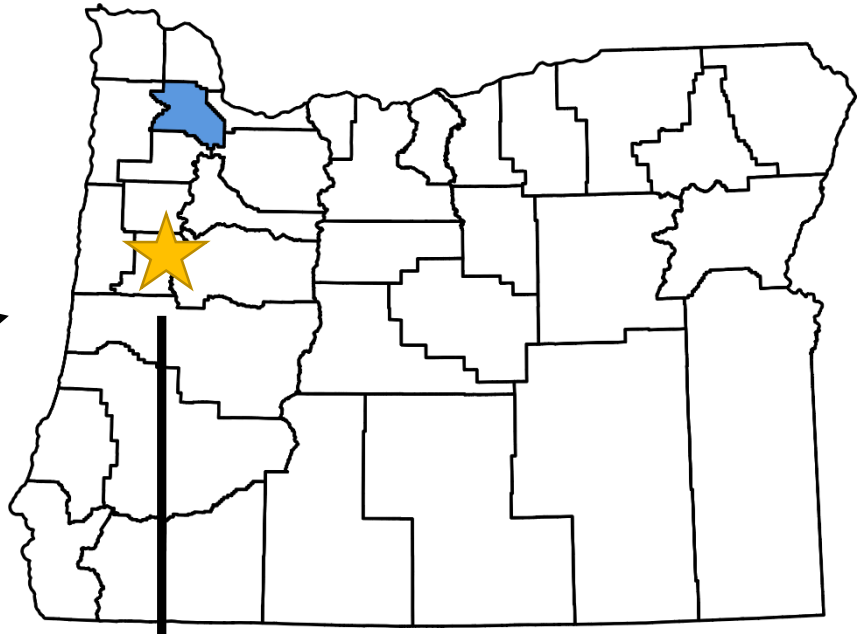
Introductions



Oregon, United States



Washington County, Oregon

Oregon State University

Project Background

- In the US, pedestrians often use pushbuttons to request a WALK signal.
- Many intersection corners in Washington County, Oregon, USA have two pushbuttons located on a single pole.
- Unnecessary button pushes create unnecessary delay for all users, especially…
  - When the pedestrian phase controls the concurrent vehicle phase
  - At intersections with split phasing
  - At coordinated intersections

A typical signal pole in Washington County, Oregon, USA

Project Background

- No previous studies have examined pedestrian search patterns with regard to pedestrian pushbutton use.
- Uncertainty about how a system operates can contribute to non-compliant behavior (Bradbury et al. 2012; Fitzpatrick et al., 2016).
- Providing extra information about a system to that system's user can be important for maintaining trust and the continued use of a system when it is novel or operates counter to expectations (Lee et al., 2004; Fox et al., 1998).
- Some cities have found that more persons use pushbuttons, and they receive fewer service calls, when illuminated feedback was provided on their pushbuttons (Van Houten et al., 2006; Huang et al., 2001).

https://dailyhive.com/vancouver/vancouver-accessible-pedestrian-signals-push-buttons

Project Flow

Stage 1
- Field experiment

Stage 2
- Conceptual alternatives design

Stage 3
- Large-scale conceptual alternatives survey

Research Questions

1. Is there a demonstrated need for modifications to existing pedestrian infrastructure at the study intersection that would help pedestrians correctly associate which pushbutton corresponds to which crosswalk and which crosswalk will be served next?

2. Where do pedestrians look for information when choosing between two acceptable crossings?

3. When do pedestrians look for information from specific roadway elements on their approach to the pushbutton pole?

Field Experiment: Location

Conducted at SW Scholls Ferry Rd and SW Nimbus Ave, Washington County, OR:

- Pushbuttons located on a single pole
- Split-phase operation
- WALK phase must be activated prior to onset of concurrent vehicular phase
- High vehicular volume
- High prevalence of undesirable pushbutton behaviors

SW Scholls Ferry Rd & SW Nimbus Ave, Washington County, OR

Field Experiment: Design

- 6 -12 participants were recruited from Washington County.
- Participants arrived at the intersection at a scheduled time and were outfitted with eye tracking glasses.
- The participant completed two “there-back” tours of the intersection: diagonal and adjacent tours.
- The participant completed pre- and post-task surveys.

Example Experimental Set-Up

Field Experiment: Design

- **“Choice” scenarios**: When the participant could choose between crosswalks to get to their destination.
- **“Reasonably efficient”** choice: Assumed the crosswalk next to be served is the one associated with the vehicular phase which is *not* currently active.
- **“Inefficient”** choice: When the participant selected a crosswalk for which the concurrent vehicular phase appeared to already be active.

Field Experiment: Analysis

- **Areas of Interest (AOIs)** for north-south and east-west approaches:
  - Pedestrian Signal Heads
  - Pushbutton Signage
  - Pushbuttons
  - Vehicle Traffic Signals
  - Vehicle Traffic

- AOI Performance Measures:
  - Fixation count
  - Fixation duration
  - Fixation start time
  - Fixation sequence

Field Experiment: Crossing Task Results

7/9	Participants with usable eye tracking.
2/7	Participants who pushed both pushbuttons.
15/19	Reasonably efficient choice scenarios.
14%	% fixation time on traffic and traffic signal AOIs, for inefficient choices.
56%	% fixation time on traffic and traffic signal AOIs, for efficient choices.

TAKEAWAY: Results suggest participants used traffic and traffic signals to choose reasonably efficient crosswalks.

Field Experiment: Crossing Task Results

	East-West Button Push		North-South Button Push	
AOI	Fixation Duration (s)	% of Total Fixation Time on AOIs	Fixation Duration (s)	% of Total Fixation Time on AOIs
East-West Pushbutton	2.47	27%	0.13	1%
East-West Pedestrian Signal	0.33	4%	0.00	0%
East-West Pushbutton Signage	0.67	7%	0.10	1%
East-West Traffic	3.07	34%	1.95	21%
East-West Traffic Signal	0.43	5%	0.13	1%
North-South Pushbutton	0.60	7%	2.82	31%
North-South Pedestrian Signal	0.00	0%	0.46	5%
North-South Pushbutton Signage	0.44	5%	1.94	21%
North-South Traffic	1.02	11%	1.55	17%
North-South Traffic Signal	0.00	0%	0.00	0%

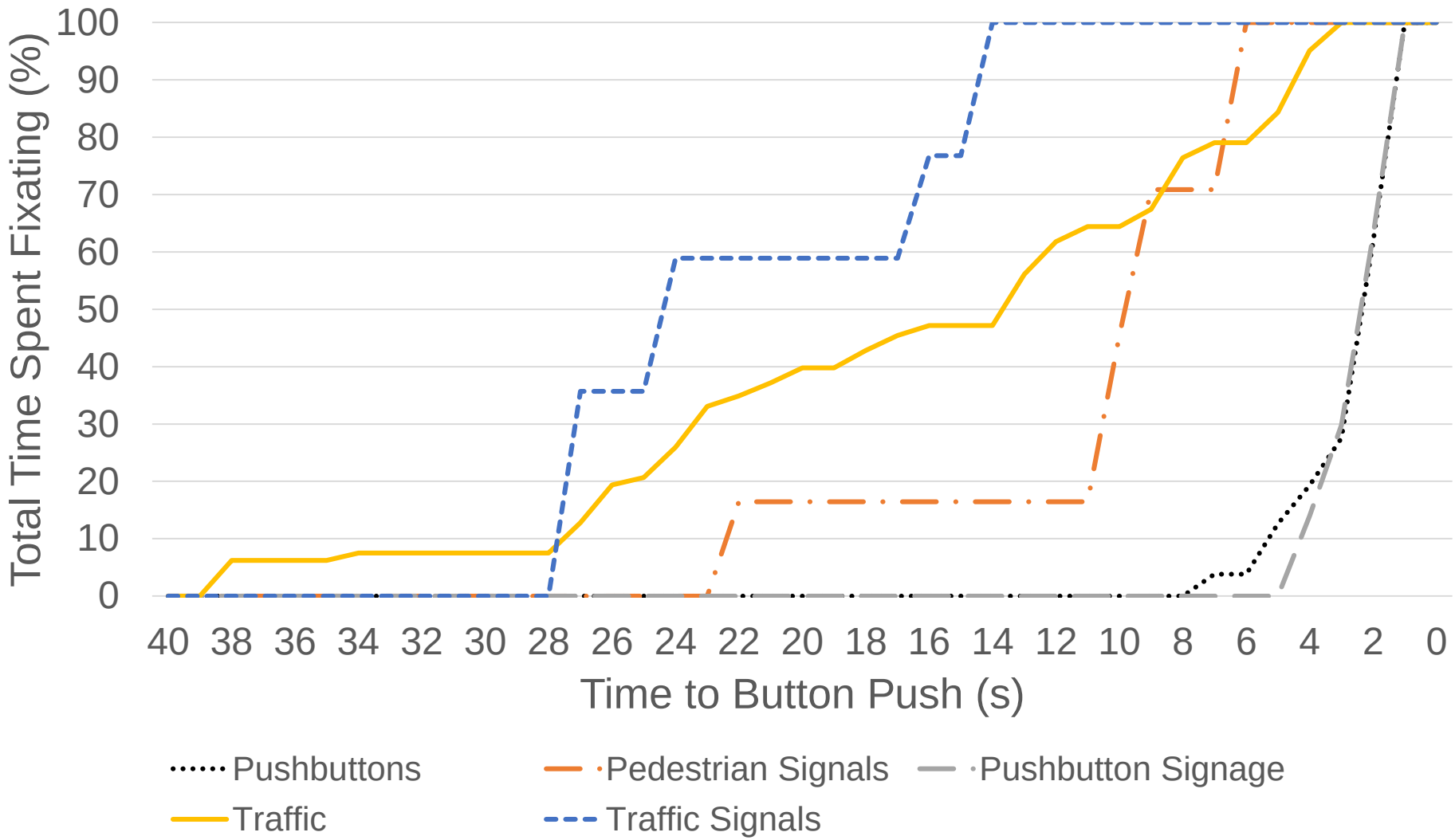
Fixations by First Button Push for Crosswalk Choice Scenarios

Field Experiment: Case Studies

Participants A and B pushed both pushbuttons during a “choice” scenario.

Participant A	Participant B
• Was served first corresponding to their 2nd button push. • Crossed on 2nd button push’s phase. • Made 4 fixations prior to 1st button push. • Made 26 fixations prior to 2nd button push.	• Was served first corresponding to their 1st button push. • Stopped paying attention to ped signal for 1st button push after 2nd button push; crossed on 2nd button push’s phase. • Made 5 fixations prior to 1st button push. • Made 45 fixations prior to 2nd button push.

Field Experiment Crossing Task Results



Time fixating on AOIs prior to first button push

Field Experiment: Takeaways

TAKEAWAY #1	**Participants observed vehicle traffic signals and traffic to choose which pushbutton to push.**
TAKEAWAY #2	**Participants observed vehicle traffic signals and traffic earliest on their pushbutton approach.**
TAKEAWAY #3	**Participants seemed to use pushbuttons and pushbutton signage.**
TAKEAWAY #4	**Some participants demonstrated confusion as to which crosswalk would be served next.**

OVERALL TAKEAWAY

Additional information could help participants identify which crosswalks are next to be served.

THANK YOU! Questions?

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