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CZECH REPUBLIC

On-site observation of driver- pedestrian interaction at zebra crossings

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- 2. Study design and sites**
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1. Aims

The aim of this work was to describe pedestrian-driver encounters, communication, and decision strategies at marked crossings.

Including:

- Pedestrians' behavior before and while crossing the road at marked crossings (and when a car is approaching).
- Drivers' behavior while approaching a marked crossing when a pedestrian is on the sidewalk or about to cross the street.
- Pedestrian-driver communication (such as eye contact, gestures, verbal expressions, and signals, such as the flashing of lights) in situations before and while crossing at marked crossings.

2. Study design

Mixed-methods study design

- 1. Exploration** of pedestrians' and drivers' needs and conflict situations that may arise from their interaction (identification of problems): focus groups with pedestrians and drivers.
- 2. Pilot study:** sites, questionnaire, observation sheet, camera recordings.
- 3. Data collection/Field study:** observation (data from cameras, on-site observations, speed and density measurements), interviews (short on-site interviews with pedestrians).
- 4. Exploration and generalization:** expert workshop.

2. Study design

Field study design and data

1. Four observation sites – zebra crossings in the urban area of the city of Olomouc (approx. 100,000 inhabitants)
2. 3 activities at the same time: to observe drivers' behavior, to observe pedestrians' behavior, and to administer interviews to pedestrians (all data connected)
3. Observation situation: a car is approaching a crossing **where** a pedestrian is present (waiting), approaching, or crossing the road.
4. Focus of observation:
 1. Pedestrians – their behavior before and while crossing, awareness, crossing strategies (e.g., making the driver stop), communication with drivers
 2. Drivers – their strategies while approaching a crossing (when pedestrians are present – giving priority or not), communication with pedestrians
 3. Interviews with pedestrians – their needs, perceived safety and comfort, and habits and strategies while crossing the road

2. Study design

Field study design and data

1. Date and time: data collected during December 2013-March 2014, observation times: 7.00-9.00, 12.00-13.00, 16.00-17.00. No snow, ice or wet conditions.
2. Camera recordings – of selected sites; 24 hours; car and pedestrian densities were counted.
3. Speed measurement at selected sites during observation times.
4. Altogether **1584 observations** (situations observed at 4 sites).

2. Sites

Site 1: Billa supermarket

Single crossing, narrow street with turning vehicles, no traffic lights. Average speed: 28.2 km/h. Densities (cars/pedestrians: 3358/1903, ratio 1.76)



2. Sites

Site 2: Student cafeteria

*Single crossing, narrow street, no traffic lights. Average speed: 29.9 km/h.
Densities (cars/pedestrians: 3477/791, ratio 4.4)*



2. Site

Site 3: Santovka shopping gallery

*Crossing including a tram line and bicycle lane, narrow street, no traffic lights.
Average speed: 29.9 km/h. Densities (cars/pedestrians: 4672/546, ratio 8.56)*

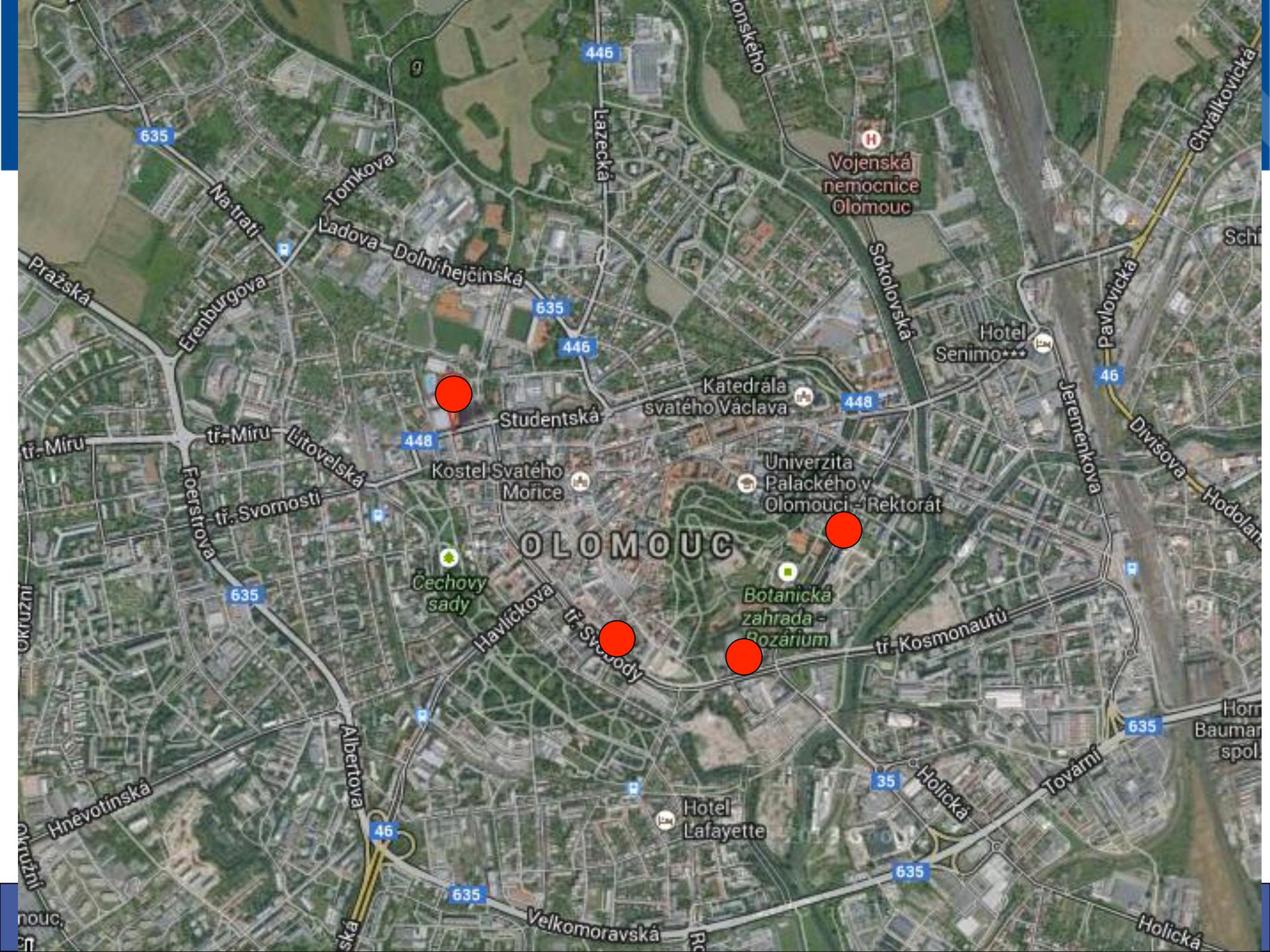


2. Sites

Site 4: Faculty of Natural Science

Crossing including a tram line and bicycle lane, narrow street, turning vehicles, no traffic lights. Average speed: 31.2 km/h. Densities (cars/pedestrians: 4609/930, ratio 4.96)





3. Accident data for Olomouc – 01/2010-09/2013

- No. of accidents involving pedestrians: 174
- Time: mostly before 9.00 and between 15.00 and 19.00
- Injuries and deaths: 90% with injuries, 15% involving serious injuries (27 people), 3 accidents with pedestrian fatalities (2%)
- Pedestrians: women 44%, men 26%, 20% children
- Culpability: 75% drivers; reason: failure to give priority to a pedestrian on the crossing, distraction from driving, inappropriate turning
- Type of vehicle involved: 10% trucks, 5% trams, 5% buses
- Pedestrian behavior: correct 55%, suddenly stepping into the roadway 14%
- Site: 26% on a crossing, 23% off a crossing (more than 20 m away), 9% on a light-controlled crossing with the green light on (*see next slide)
- Conditions: 70% daylight – good visibility, 25% nighttime

3. Accident data for Olomouc – 01/2010-09/2013

Accident site situation	Frequency	%
01 pedestrian entering the road at a GO signal	11	9.00%
02 pedestrian entering the road at a STOP signal	1	1.00%
03 pedestrian entering the road near a crossing (max. ca. 20 m away)	5	4.00%
04 crossing the road at a marked crossing	33	26.00%
05 crossing the road immediately before or after a vehicle pulled up at a stop	3	2.00%
06 crossing the road immediately in front of or behind a parked vehicle	4	3.00%
07 walking, standing on the sidewalk	5	4.00%
08 walking on the correct side	4	2.00%
09 walking on the wrong side	1	1.00%
10 crossing the road away from a crossing (20 or more metres away from the crossing)	30	23.00%
00 situation other than the above	32	25.00%
	Total = 129	100%

4. Results

a. Speed and densities (video and radar measurement)

Site	Max. speed	Average speed	No. of CARS*	No. of pedestrians*	Ratio (cars/pedestrians)
1. Billa	66.0	28.18	3358	1903	1.76
2. Cafeteria	53.0	29.88	3477	791	4.40
3. Santovka	89.0	29.93	4672	546	8.56
4. NS Faculty	68.0	31.18	4609	930	4.96

* No. of cars/pedestrians during 4 hours when observations took place (all directions)



4. Results

b. Pedestrian interviews – purpose of the trip and frequencies

Where are you going? (N= 490)

The most frequent reason for using the crossings at the given sites was **going to or from school** (149 respondents, i.e., 30%), followed by **going to or from work** (94 respondents, i.e., 19%). Other reasons given by the pedestrians included **going home or to the halls of residence**, **going for a walk** or walking for no particular purpose, and **going out to engage in leisure activities**.

Do you walk here regularly? (more frequently than once per week)? (N= 490)

Most of the pedestrians, specifically 384 respondents (78%), who were addressed at the given locations used the crossing **regularly** (more than once per week). 106 respondents (22%) used it less than weekly.

4. Results

b. Pedestrian interviews – perceived safety

Do you find it safe to cross the road here? (N= 473)

The majority of the pedestrians (287, i.e., 60%) who were interviewed found it **rather safe** to use the given crossings to traverse the road, while 186 respondents (40%) did not find it safe to cross the road at the crossing under study.

Perceived safety of crossings as reported by the pedestrians:

- Student cafeteria (78%)
- Billa supermarket (61%)
- Faculty of Natural Science (51%)
- Santovka shopping gallery (41%)

The most common reasons for the pedestrians finding it unsafe to cross included a **poor view, heavy traffic, the speed of the passing cars, the absence of traffic lights, the absence of a traffic island on a long crossing, and experience of drivers not stopping before the crossing**. A few pedestrians who responded did not find the crossing safe because there were **no elements that made drivers stop or slow down**, such as speed bumps.

4. Results, c. On-site observations

1. What influences **drivers'** yield/go behavior? What is the role of explicit communication between drivers and pedestrians in wait/go behavior?

Independent variable	B	Wald	Sig	Exp(B)
Car speed	-0,30	17,82	0,00	0,74
Road traffic density	-0,15	4,52	0,03	0,86
Pedestrian traffic density	0,12	2,13	0,14	1,12
The car was less than 10 metres away	-0,71	25,45	0,00	0,49
A line of cars was approaching (driving in platoon)	0,50	16,37	0,00	1,65
Child (0-12)	0,35	0,68	0,41	1,42
Male (13-25)	0,11	0,24	0,62	1,12
Female (13-25)	0,22	1,28	0,26	1,24
Female (13-25)	-0,04	0,03	0,85	0,96
Senior citizen (65+)	0,98	2,26	0,13	2,67
Group of pedestrians	1,04	24,49	0,00	2,82
The pedestrian stood waiting more than 0.5 m away from the curb	-1,06	6,64	0,01	0,35
The pedestrian used at least eye contact to give the driver a sign.	0,87	2,04	0,15	2,39
The pedestrian waited less than 5 seconds.	0,73	3,60	0,06	2,08
The pedestrian waited more than 5 seconds.	-1,04	55,33	0,00	0,35
The driver engaged in other activities while driving.	0,59	0,95	0,33	1,81
The pedestrian engaged in other activities while crossing the road.	-0,39	5,24	0,02	0,68
Invariable	0,00	0,00	0,99	1,00

4. Results, c. On-site observations

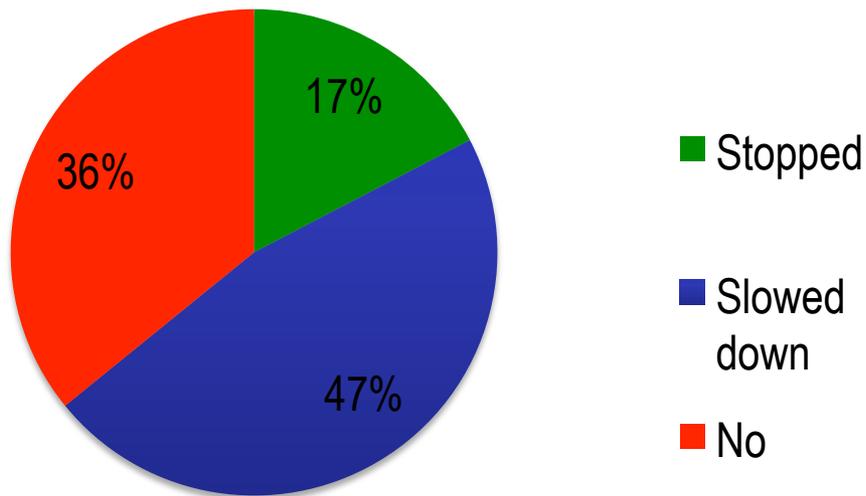
1. What influences **drivers'** yield/go behavior? What is the role of explicit communication between drivers and pedestrians in wait/go behavior?

- *The probability of a driver yielding to a pedestrian declines as the speed increases*
- *The probability of a driver yielding to a pedestrian declines as the traffic density increases*
- *A driver is more likely to yield to a pedestrian when there is a platoon of cars*
- *A driver is more likely to yield when a group of pedestrians is waiting/crossing*
- *A driver is less likely to yield if a pedestrian stands waiting more than half a meter away from the curb*
- *A driver is less likely to yield to a pedestrian if the latter is engaged in a different activity (such as writing a text message)*

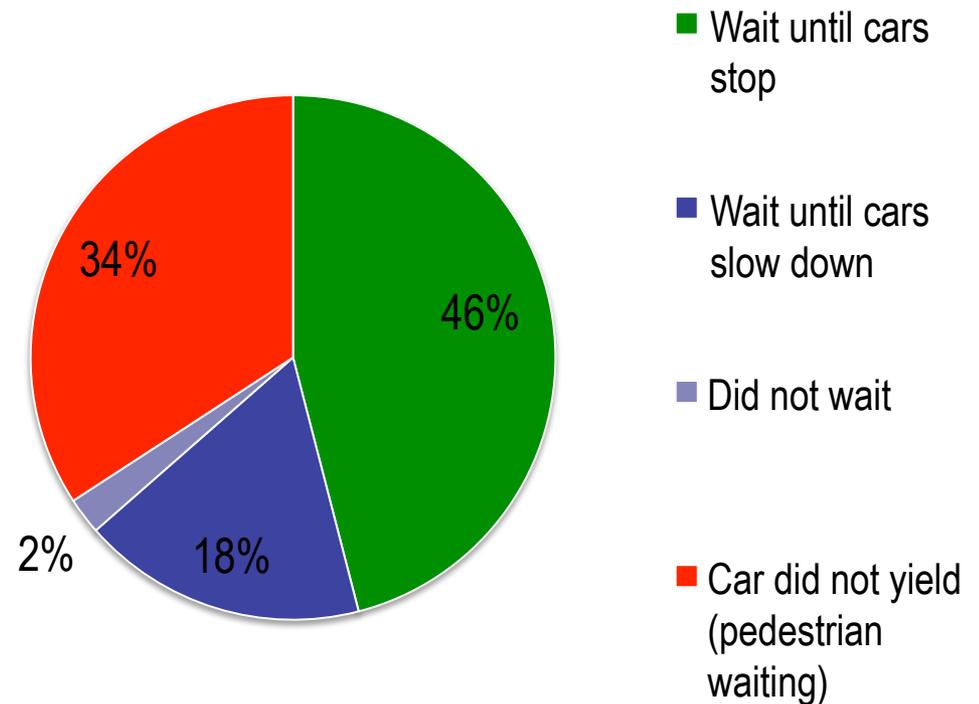
**significant*

4. Results, c. On-site observations

Did the driver yield to the pedestrian?



Did the pedestrian wait before crossing the road?



4. Results, c. On-site observations/pedestrian interviews

2. What influences **pedestrians'** wait/go behavior? What is the role of explicit communication between drivers and pedestrians in wait/go behavior?

Observations:

- *Pedestrians waited until the car came to a complete standstill (rather than slowed down) when the traffic density rates were low*
- *Pedestrians waited for more than 5 seconds to cross when the traffic density rate was high*
- *Pedestrians find it safer to cross the road when the traffic density is low (not confirmed for speed)*
- *Women feel less safe*

**significant*

4. Results, c. On-site observations/pedestrian interviews

2. What influences **pedestrians**' wait/go behavior? What is the role of explicit communication between drivers and pedestrians in wait/go behavior?

Interviews:

What options do you consider when crossing a road? (whether to wait and “yield to the car” or step onto the road/crossing?) (N= 290)

The most common circumstances that the pedestrians consider when crossing a road on a marked crossing (whether to wait or step onto the road) include:

- **speed of the approaching car** (197 answers)
- **distance of the car from the crossing** (164 answers)
- **traffic density** (101 answers)
- **whether there are cars approaching from both directions** (90 answers)
- **various signs given by the drivers** (waving a hand, flashing their lights, etc.) (67 answers)
- **presence of other pedestrians** (58 answers)

4. Results, c. On-site observations/pedestrian interviews

2. What influences **pedestrians'** wait/go behavior? What is the role of explicit communication between drivers and pedestrians in wait/go behavior?

Interview:

What do you think is a sign that the driver of the oncoming vehicle will stop and let you cross? (N= 476)

The majority of the pedestrians conclude that the driver of the oncoming vehicle is about to yield to the pedestrian on the crossing on the basis of a **combination of multiple signals from the driver**. The most common single sign which the pedestrians find to be an indication of the driver giving them priority is their **slowing down** the car or bringing it to a **complete standstill**. Other indicators include **the driver's non-verbal gestures** or making **eye contact with the driver**. Some pedestrians reported that they find the **flashing of lights** a sufficient signal from the driver. Statements referring to the pedestrians **not being able to recognise** whether the driver is giving way to them were also recorded.

4. Results, c. On-site observations/pedestrian interviews

2. What influences **pedestrians'** wait/go behavior? What is the role of explicit communication between drivers and pedestrians in wait/go behavior?

Interviews:

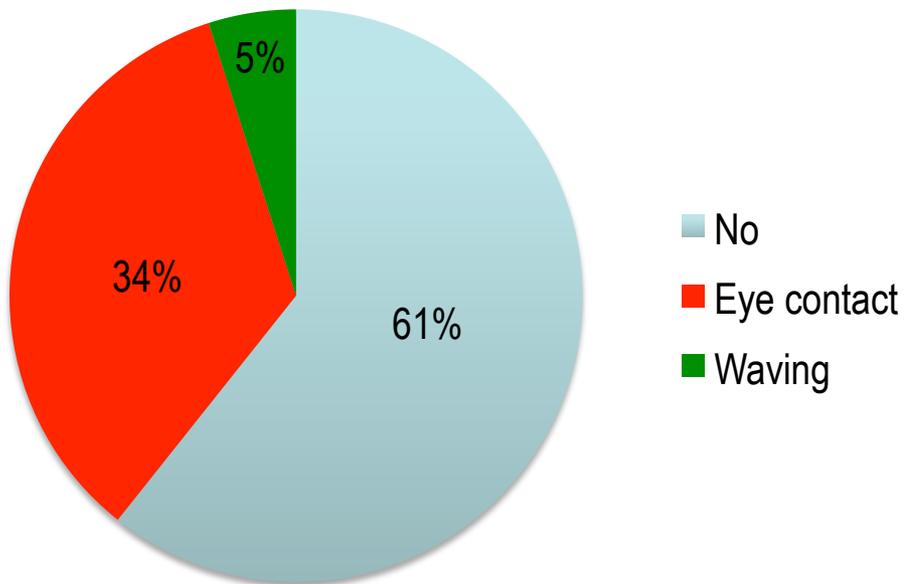
How do you indicate your intention to cross a road?

The majority of the pedestrians indicate their intention to use a crossing by the way **they stand by the road waiting**: a pedestrian stands at the crossing or roadside waiting until it is safe to cross.

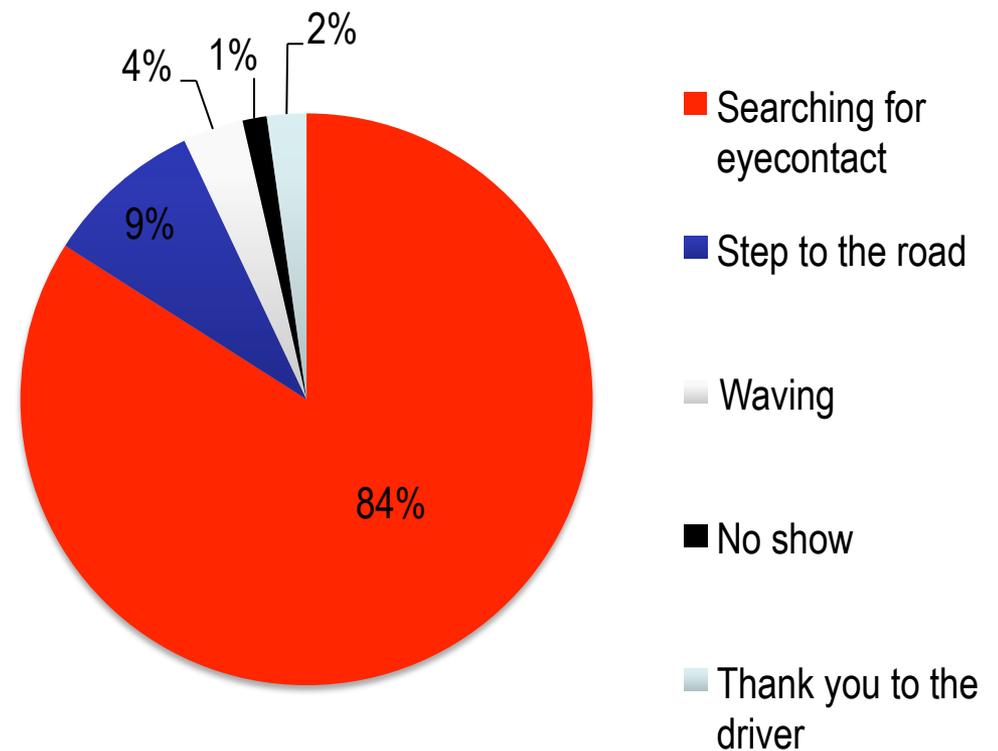
Another common indication for the driver is a person's **moving slightly forward or even stepping into the roadway**. Pedestrians also try to inform the driver about their intention to cross by **giving non-verbal signals**, such as waving a hand and beckoning, or **making eye contact** with the driver. Another way of letting the driver know that a pedestrian is about to cross the road is **looking around**.

4. Results, c. On-site observations/pedestrian interviews

Did the driver explicitly communicate with the pedestrian?



Did the pedestrian show his/her intention to cross (and how)?



4. Results, c. On-site observations

3. Conflict situations

A conflict situation is more likely to arise if:

- *cars travel at a higher speed,*
- *the traffic density is higher, or*
- *a pedestrian is distracted by a different activity when crossing.*

**significant*

5. Summary

1. Generally, the most relevant predictors of pedestrians' and drivers' behavior are:

- densities of car traffic and pedestrian flows
- car speed

2. Pedestrians – wait/go behavior and perceived safety and comfort

The majority of the pedestrians who were interviewed found it rather safe to use the marked crossings under study (60%), while 40% of the respondents do not find it safe to traverse the road at the given crossings.

46% of the pedestrians require drivers to stop before the crossing (not only slow down) for them to feel safe to cross. On the other hand, only 17% of the drivers did so (and 47% slowed down). 36% of the drivers did not yield.

5. Summary

2. Pedestrians – wait/go behavior and perceived safety and comfort

Women feel less safe.

Factors influencing pedestrians' wait/go behavior:

- car speed
- distance of the car from the crossing
- traffic density
- whether cars are approaching from both directions
- various signals from the driver (eye contact, waving, flashing of lights)
- presence of other pedestrians

5. Summary

2. Pedestrians – wait/go behavior and perceived safety and comfort

Pedestrians indicate their intention to cross a road by:

- the way they stand at the roadside waiting
- indicating forward movement or actually stepping into the roadway
- non-verbal signals
- making eye contact
- looking around

The majority of the pedestrians (84%) were searching for eye contact with drivers, while only 34% of the drivers did so.

5. Summary

3. Drivers' yield/go behavior

Factors influencing drivers' yield/go behavior:

- speed (higher speed = lower willingness to yield)
- traffic density (higher density = lower willingness to yield)
- driving in a platoon = greater willingness to yield
- driver's willingness to yield increases where there is a group of pedestrians
- pedestrian being distracted = lower willingness to yield

4. Conflict situations

The probability of conflict situations increases with:

- cars travelling at higher speeds
- higher traffic density
- pedestrians being distracted by a different activity while crossing.

Thank you for
listening!



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