Pedestrian behavior analysis in shared space

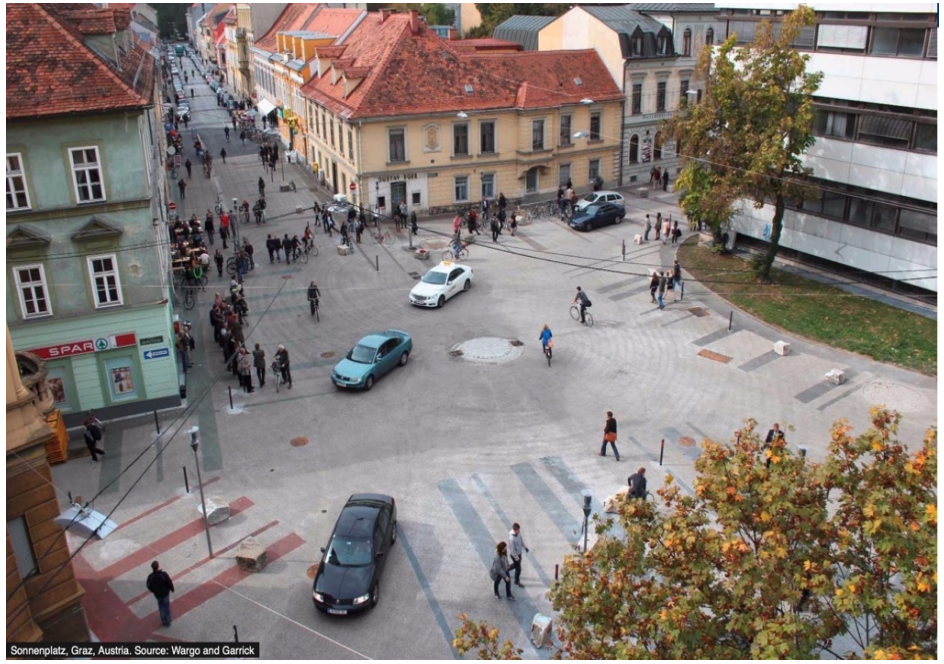
ADVISED BY MAKOTO ITOH

CHEN ZHANGYIJING

Background

- **Shared space**(Hans Monderman, 1999)

- Shared space is an urban design approach that minimises the segregation between modes of road user.
- This is done by removing features such as kerbs, road surface markings, traffic signs, and traffic lights.



Sonnenplatz, Graz, Austria. Source: Wargo and Garrick

Background

- **Goal of shared space**
- By creating a greater sense of uncertainty and making it unclear who has priority, drivers will reduce their speed.
- In turn reducing the dominance of vehicles, reducing road casualty rates, and improving safety for other road users.

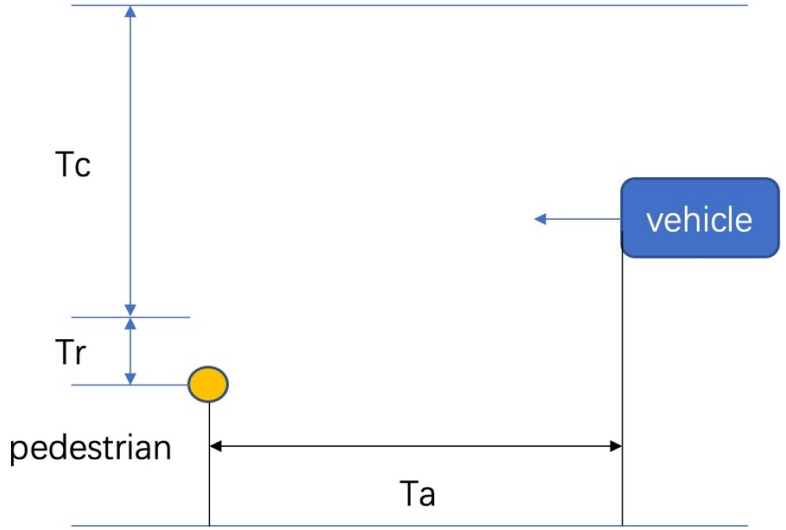
Evaluation methods

- **Safety index (Naumann Sebastian, 2015)**

$$\mathrm{SI} = P \times \frac{Tc \times Ta}{Tr}$$

- Safety index (SI) is a new method applied in this study, it shows how pedestrian react to an incoming vehicle by considering factors which affect pedestrian behavior during the road crossing in shared space.

- Tr: time of reaction,
- Ta: time of approaching of vehicle,
- Tc: time of crossing and
- P: parameter of road crossing



Experiment

- **Facility**

- Large space

1) one of the world's largest virtual reality (VR) systems

2) massive cuboid space(25m wide, 15m deep, and 7.8m high).

3) use 12 projectors to project synchronized 3D images on the entire surfaces of its walls and floor.

4)use 20 motion capture cameras to take 3D measurements of the locations of people and things.

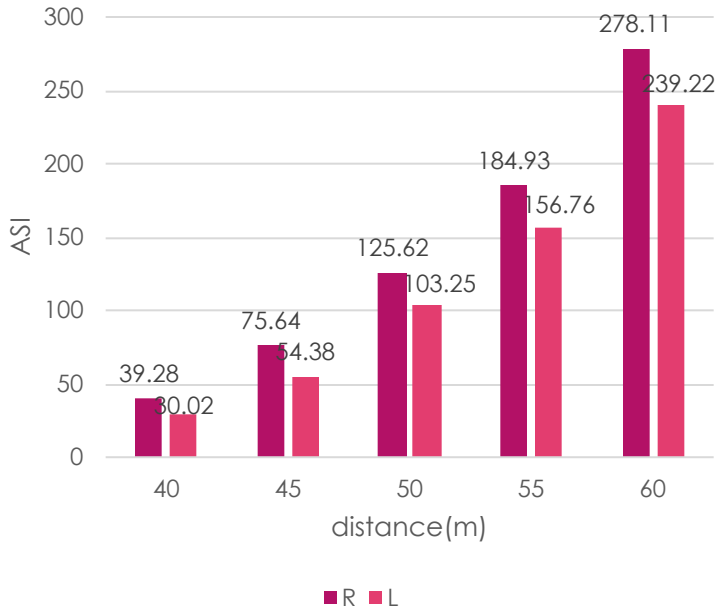
Experiment design

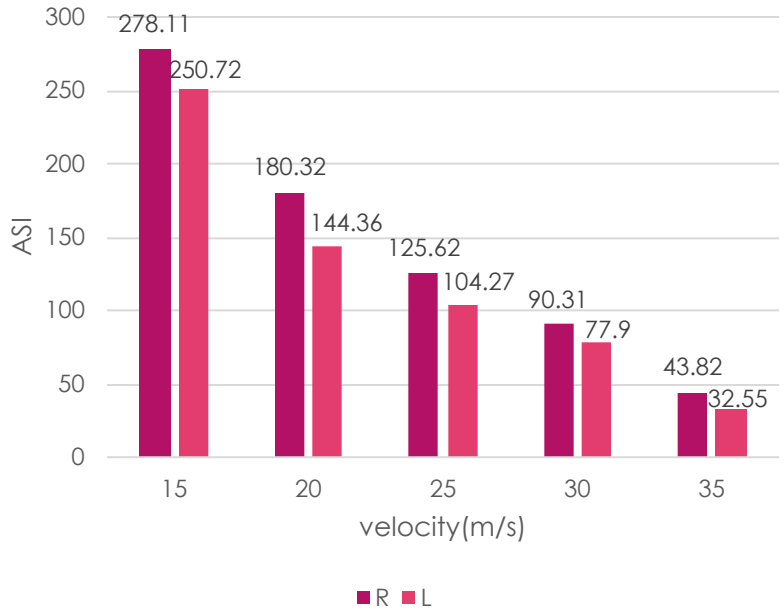
- **Scenario**

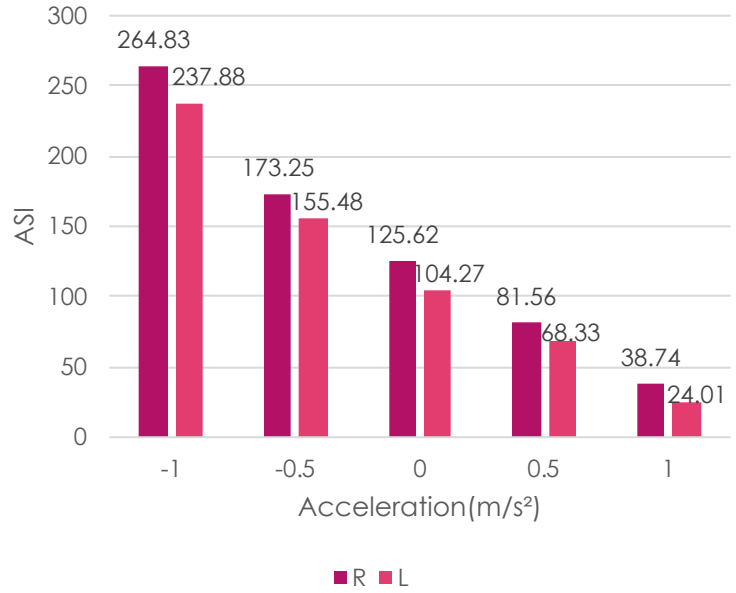
- Vehicle approaches a participant from different directions (left or right) with different motion factors (distance, velocity and acceleration/deceleration).

scenario	Acceleration(m/s^2)	Distance(m)	Speed (km/h)	Direction
1	-1	50	25	L/R
2	-0.5	50	25	L/R
3	0	50	25	L/R
4	0.5	50	25	L/R
5	1	50	25	L/R
6	0	40	25	L/R
7	0	45	25	L/R
8	0	55	25	L/R
9	0	60	25	L/R
10	0	50	15	L/R
11	0	50	20	L/R
12	0	50	30	L/R
13	0	50	35	L/R

Result: Safety index







By extracting data from motion capture as shown in Table, we can calculate the SI of each scenario, then obtain the average value of safety index for each representative scenario named Average Safety Index (ASI)

Conclusions

- This study proves an effective method to quantify the behavior of pedestrian when they encounter other road users, it is important for urban planners to improve the total safety of shared space because pedestrian is the weakest part of whole traffic system.

- With the help of preliminary analysis and SI, the relationship between the behavior of pedestrian and motion factors is obvious, pedestrian easily yield to vehicle with high-profile motion factors (high velocity, high acceleration and short distance), some pedestrian with traffic accident records are conservative to all incoming traffic situation which means they chose to yield to vehicle with all types of motion factors, reasons for this type behavior is still unclear in this research.