

Behavioural observation of interactions between VRU and autonomous shuttles

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On behalf of Vias institute

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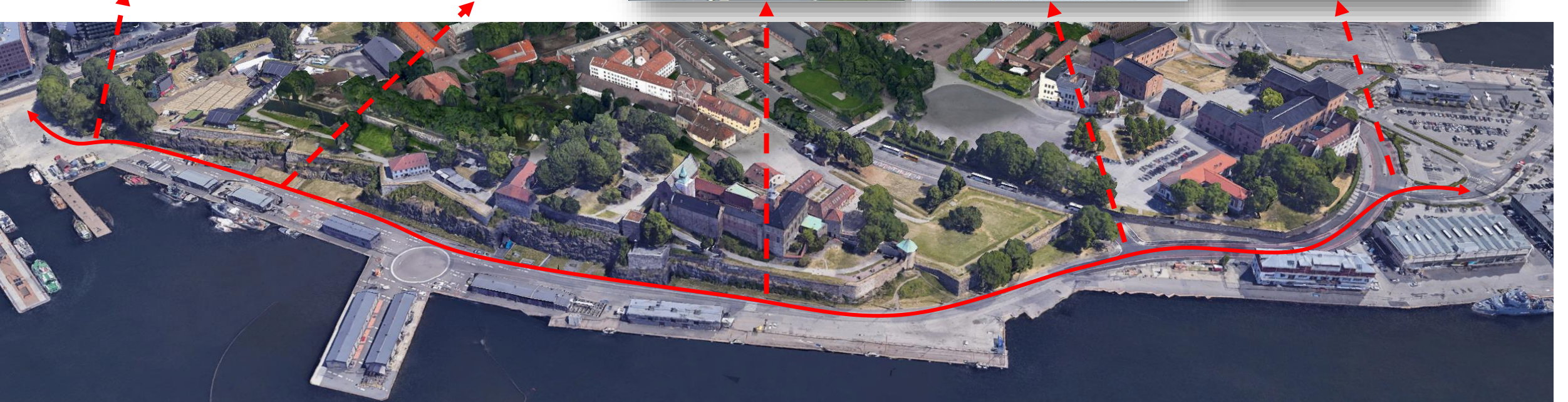
How would you react?



Research questions

- ▶ **What kind of interactions are observed at different locations?**
- ▶ **How does yielding between VRU and AV shuttles take place?**
- ▶ **How frequently is ignorant/aggressive behaviour by VRU towards AV shuttles observed?**
- ▶ **Are there changes over time?**

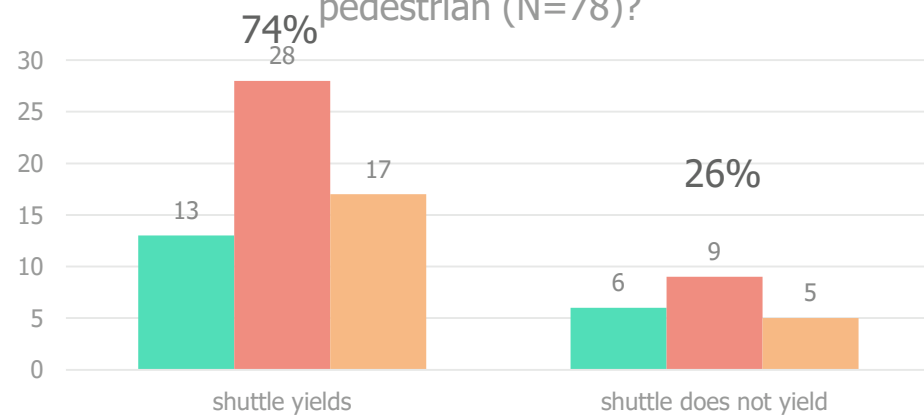
Research setting & design



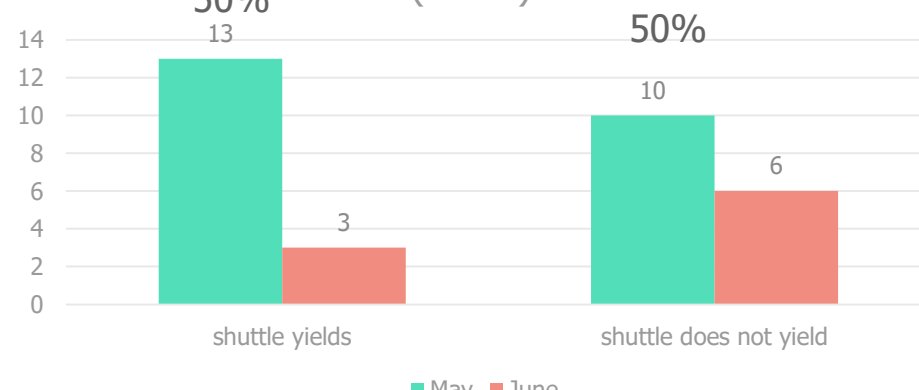
Results – interactions with pedestrians



Does the shuttle yield to a crossing pedestrian (N=78)?



Does the shuttle yield to a crossing pedestrian (pedestrian crossing site 3) (N=32)?



Results – interactions with pedestrians

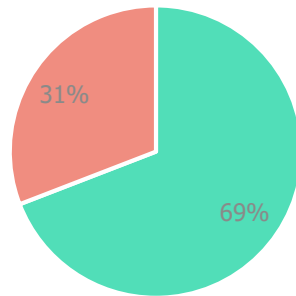


Results – interactions with pedestrians

- ▶ **How does the yielding of the AV shuttle compare to the yielding of regular drivers?**
 - ▶ Analysis of 8h of interactions between crossing pedestrians and regular MV

▶ (AV shuttle: 74-26)

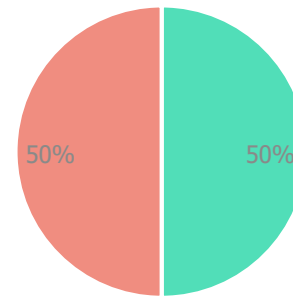
Does a driver yield to a crossing pedestrian
(pedestrian crossing site 1)



■ driver yields ■ driver does not yield

(AV shuttle: 50-50)

Does a driver yield to a crossing pedestrian
(pedestrian crossing site 3)



■ driver yields ■ driver does not yield

Results – interactions with cyclists

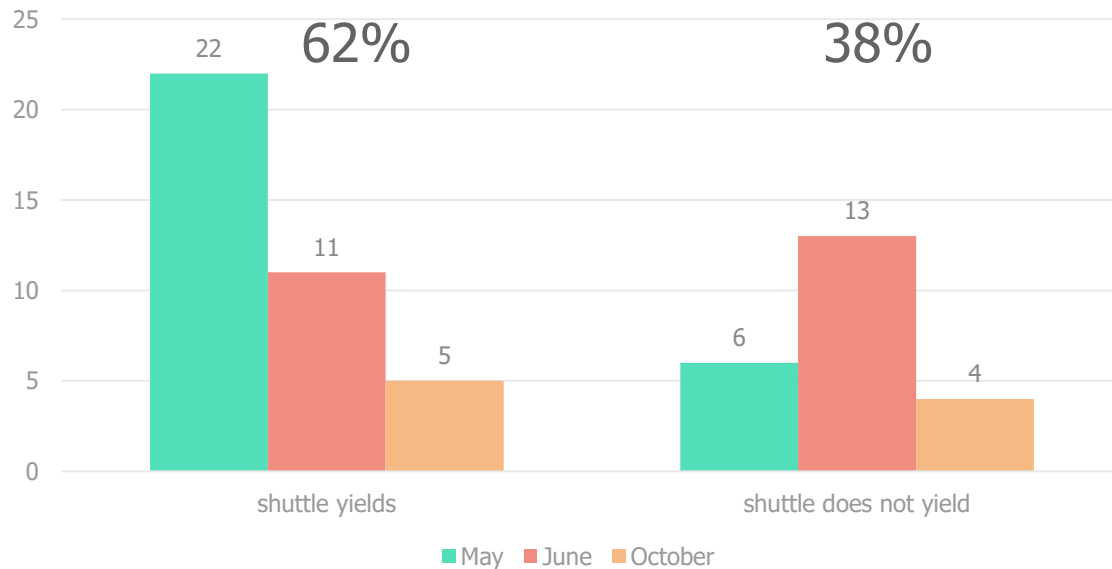
- ▶ Does the right-turning AV shuttle yield correctly to a cyclist going straight through?



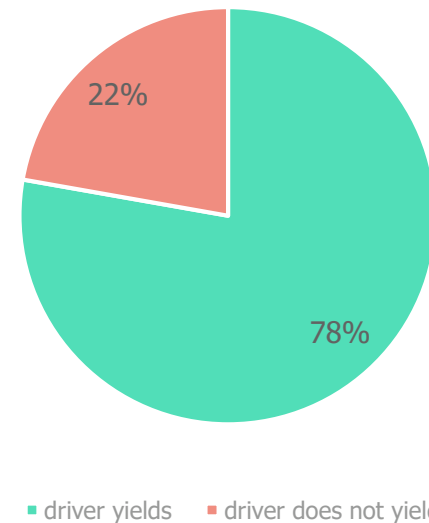
Results – interactions with cyclists

- ▶ Does the right-turning AV shuttle yield correctly to a cyclist going straight through?
- ▶ How does the yielding of the AV shuttle compare to the yielding of regular drivers?

Does the right-turning AV shuttle yield correctly to a cyclist going straight through? (N=61)



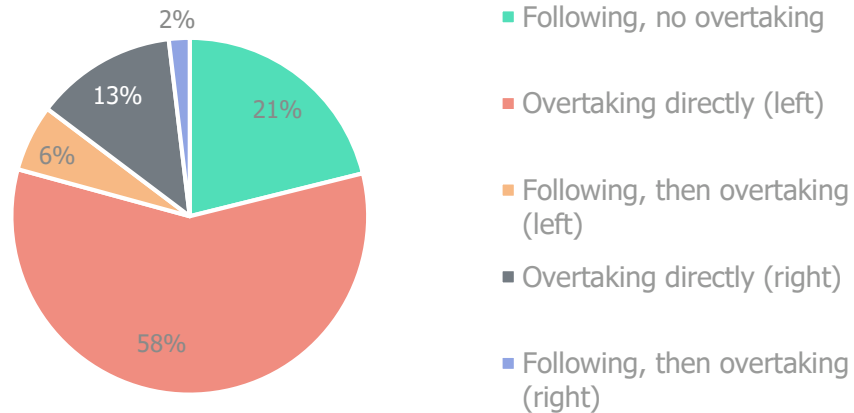
Does a right-turning driver yield to a cyclist going straight through (N=9)?



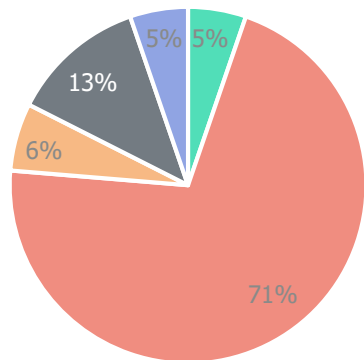
Results – interactions with cyclists

► What happens when a cyclist is behind an AV shuttle?

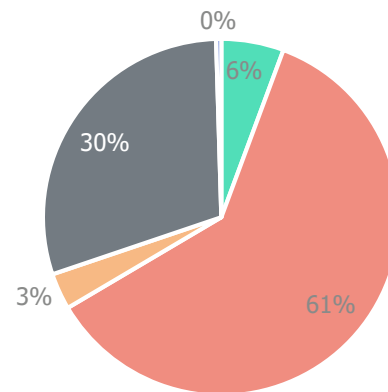
Same direction interactions shuttle - cyclists at site 2
(part with no cycling infrastructure (N=265))



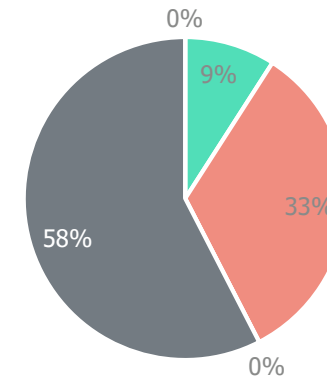
Same direction interactions shuttle - cyclists at site 3 (N=114)



Same direction interactions shuttle - cyclist (site 4 docks) (N=212)



Same direction interactions shuttle - cyclist (site 5 Kontraskjæret) (N=30)



Results – interactions with cyclists



Results – aggressive/ignorant behaviour

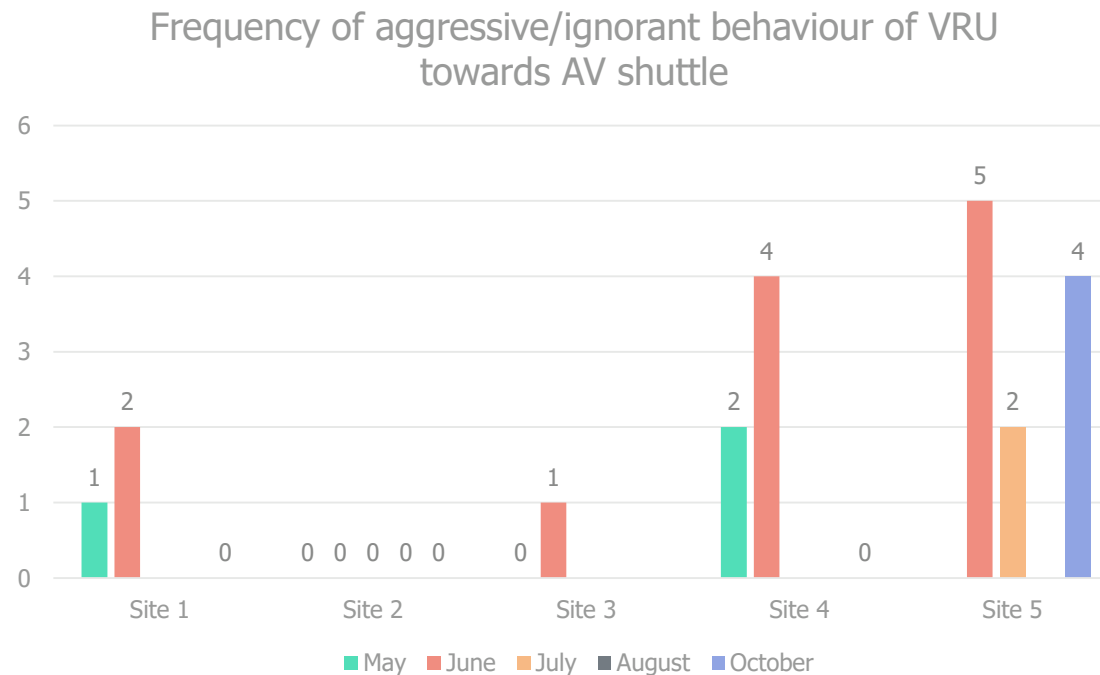


Results – aggressive/ignorant behaviour



Results – aggressive/ignorant behaviour

- ▶ Aggressive/ignorant behaviour is uncommon
- ▶ No temporal effect can be detected



Conclusions

- ▶ **AV shuttle does not yield appropriately in a relatively high number of interactions, which could lead to dangerous situations**
- ▶ **However, AV shuttles do not seem to yield worse than regular drivers**
- ▶ **Due to the low speed, many cyclists overtake the AV shuttles. This could lead to dangerous situations, and also leads to frequent stops for the AV shuttle**
- ▶ **No clear temporal effects could be identified**
- ▶ **Aggressive/ignorant behaviour of other road users was not a major issue.**