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ADVANCING ROAD SAFETY THROUGH TWINNING

PhD SEMINAR SESSIONS

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Analysis of Influential Factors on the Share of Bicycle Traffic in Urban Areas

Leonid Ljubotina mag.ing.traff.

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「クロアチア人の三つ*の顔」*

- **「人には三つの顔がある」**

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*Generated by ChatGPT

CYCLING HOLIDAYS IN CROATIA

Croatia has risen to become one of the most popular holiday destinations in the world in less than two decades - and quite rightly so. Croatia offers perfect holiday conditions all year round. Hot bathing temperatures in summer and mild pleasant days in autumn and winter. Optimal for a cycle tour with Eurobike!

ALL CYCLE TOURS IN CROATIA >

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Second Croatian face – What do we show to our friends?

Interreg
Danube Transnational Programme

REPUBLIKA HRVATSKA
Ministarstvo mora, prometa
i infrastrukture

The National Plan on the Development of Cycling Transport for the period from 2023 to 2027

Nacionalni plan razvoja biciklističkog prometa za razdoblje od 2023. do 2027. godine predstavlja srednjoročni akt strateškoga planiranja kojim Republika Hrvatska po prvi put postavlja temelj sustavnom planiranju, učinkovitom upravljanju i praćenju biciklističkoga prometa na svom području. Dugoročno praćenje i planiranje razvoja biciklističkih prometnih potreba te njihovo sustavno zadovoljavanje predstavlja način uspješnoga rješavanja prometnih problema te unaprjeđenja postojeće ili izgradnje nove biciklističke infrastrukture koja će uspješno djelovati u okviru cjelokupnoga prometnoga sustava.

For the first time!

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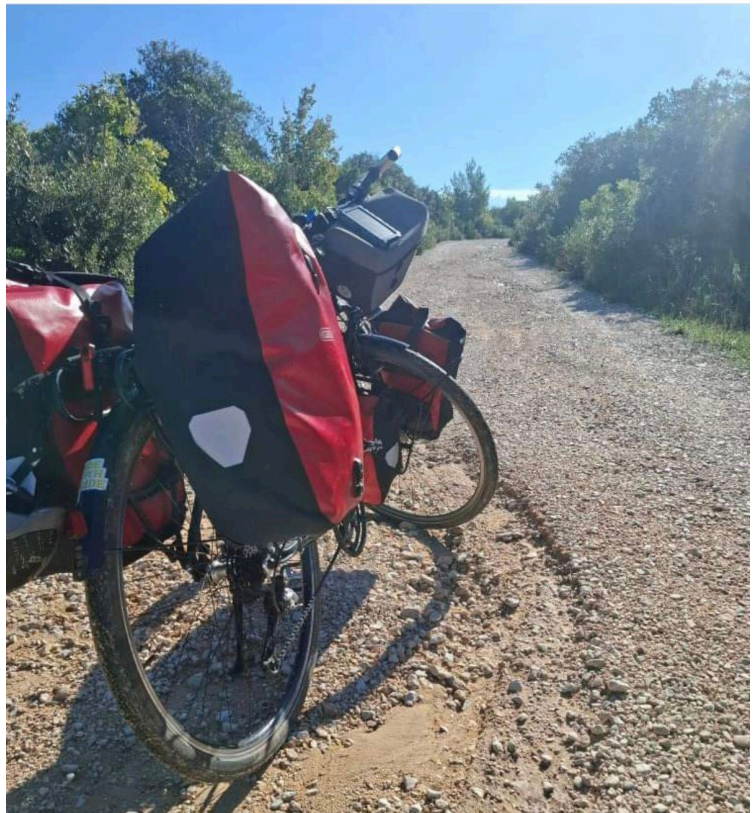
Third face of Croatia – what we do not show?

EuroVelo Discussion Group
Thomas Wel · 7 h ·

Ev8.
They call this a bikeroute 🙄
There's no bikeroute really in Croatia. At least on the coast. But they put beautifuls plates "Eurovelo 8" on 19th century old paths.



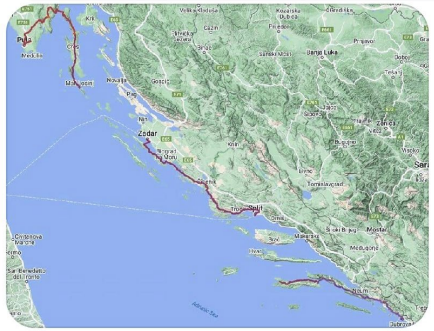
EuroVelo Discussion Group
Simon Wreford-Bush · 26. ruj 2023. ·

I'm sure this has been said before but the EV8 through Croatia is terrible. Beautiful scenery, but the drivers have no care for cyclists and the route has nothing to keep them safe 👎

10 Komentara: 14 Podijeljeno 1 puta

Sviđa mi se Komentiraj Pošalji Podijeli

David Reece
The main coast road is very busy and would totally avoid. Apparently one of the top 10 most dangerous roads in Europe. Head for the islands. I did this route this year for a week. It's quite hilly though but great scenery.



1 g. Sviđa mi se Odgovor

Review cycling trip Croatia 2023

Therefore, we rode a combination of EuroVelo 8 and our own planned route. The beginning of our route coincided with the EuroVelo. We started with a transformed railway track that began along the Slovenian coast, the Parenzana trail. In terms of location, views, and tranquility, this route was absolutely fantastic. The railway winds through a hilly landscape with occasional sea views via moderate climbs and tunnels through Istria. However, a missed opportunity for this route is its deplorable condition, making it only feasible with a mountain bike. There are very large stones on the path, often sections with loose gravel which are not manageable with heavy touring bikes, and certainly not with racing bikes. Additionally, the earthen sections are often overgrown and very rough. The further south the route progressed, the worse it became, so we decided in Motovun to deviate from the Parenzana.

After this, we devised our own route to reach the island of Cres through the Istrian interior. There were few small roads here, so we were forced to follow a main road.

After taking a ferry, we cycled across Cres from north to south to Mali Lošinj. Cres was a beautiful island, and the initial section was relatively quiet. Despite there being only one road, we encountered traffic only every two hours when a ferry arrived. Here, it sufficed to wait for the caravan to pass. Once past Cres, there was a lot of (continuous) traffic; unfortunately, there was only one road, which was also lined with concrete blocks, preventing us from avoiding the heavy truck traffic.

From Mali Lošinj, we took the ferry to Zadar, from where we mostly followed the EuroVelo route again. Unfortunately, EuroVelo here followed a very busy road for a large stretch. After following this road for a while, we decided to take small unofficial agricultural roads inland. This also allowed us to visit the waterfalls at Krka. It would be beneficial if the EuroVelo route passed through here as well. Additionally, it is much quieter here.

Beyond Krka, we gradually made our way back to the coast (and thus to EuroVelo). Once at the coast, we were forced to cycle along a very busy coastal road towards Split. Just before Split, we were led up a hill to an archaeological site, but nothing was provided for cyclists. Once in Split, it was not at all clear where we could ride safely.

Upon arriving in Split, our cycling adventure came to an end. Croatia is a beautiful country, also for cycling, but unfortunately, the infrastructure is still too inadequate. It is currently only recommended for very experienced cycle tourists. Previous experiences in other European countries (Belgium, the Netherlands, Germany, Luxembourg, France, Italy, Slovenia, Austria, Switzerland, etc.) show that cycling routes can be organized much better and safer with relatively few resources. This can be

https://www.eurovelo8.hr/karta/etapa/13-pakostane-sibenik

Tema: poginuo biciklist (40 članaka)

TRAGEDIJA U SLAVONIJI

Biciklist poginuo u naletu automobila kod Našica

TRAGEDIJA

Teška nesreća na Krku: Biciklist nakon sudara umro u kolima hitne pomoći

Nesreća se dogodila oko 9 sati u mjestu Kornić, blizu grada Krka

NESREĆA KOD N. GRADIŠKE

Starija vozačica naletjela na biciklista, on na mjestu preminuo

Osobnim automobilom koji je naletio na biciklistu upravljala je vozačica starije dobi.

VELIKA GORICA

Policija objavila detalje: Pijani vozač skrivio nesreću u kojoj je poginuo 18-godišnjak

Vozilo se nekontrolirano kretalo te se vratilo na kolnik i naletjelo na bicikl marke Cube kojim je upravljao 18-godišnjak...

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https://www.vecernji.hr/tag/poginuo-biciklist-36588

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Solution?

Cycling infrastructure?

- Stakeholders, enthusiasts, cyclists

Who will finance it?

- City administration

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04.09.2024 | NEWS

WHO DOES CYCLISTS INSULATE?

Croatian Roads: We are not planning to ban cyclists on the highway, here's why

We are publishing the response of Croatian Roads in full:

Croatian *roads do not plan to ban cyclists on the state road DC8 ("highways"). Namely, based on the Ordinance on functional categories for determining the network of bicycle routes (Official Gazette 91/2013, 114/2017), the basic network of bicycle routes in the Republic of Croatia consists of 10 national main bicycle routes, in which four international ones are integrated, i.e. European cycling routes (EuroVelo 6, EuroVelo 8, EuroVelo 9 and EuroVelo 13).*

The DC8 state road, which runs along the Adriatic coast of the Republic of Croatia, is important not only for motorized traffic but also for bicycle traffic and is part of the EuroVelo 8 cycle route, also known as the "Mediterranean Route", which connects cyclists from all over Europe to attractive destinations along the Mediterranean. The abolition of the possibility of using the DC8 for cyclists would have significant negative consequences for cycle tourism, transport sustainability and mobility. Cycle tourism, or tourism associated with cycling, is becoming an increasingly popular form of active vacation. Cyclists traveling along the EuroVelo 8 route often prefer roads such as the DC8, due to their proximity to the coast, natural beauty and cultural attractions. Such tourists often use local accommodation facilities, restaurants and other services, thereby directly contributing to the economy.

Furthermore, cycling plays a key role in promoting sustainable transport. Cycling reduces traffic congestion, harmful gas emissions and dependence on fossil fuels, thus contributing to environmental protection. Keeping the DC8 state road accessible to cyclists encourages sustainable tourism and mobility development, while reducing the negative impacts that motorized traffic has on the environment, while eliminating cycling on this road could discourage the use of bicycles as a means of transport, thus increasing dependence on cars and other unsustainable forms of transport , "they told the Libero portal.

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https://www.liberoportal.hr/vijesti/kome-smetaju-biciklisti-hrvatske-ceste-ne-planiramo-zabraniti-promet-biciklistima-po-magistrali-evo-zasto

ACTION PLAN FOR THE DEVELOPMENT OF CYCLOTOURISM

- The cost of construction on 6 km of demanding terrain would be around **€1.7 million**, and it is probably a better solution to look for alternatives in a boat line and/or traffic discipline. (Limski Kanal)
- In Funtana, it is "impossible" to widen the road with a bicycle lane due to the proximity of houses. The speed limit is already partially set at 30 km/h, and it might be a better solution to extend it to the entire 400 m of this section. It is possible to consider a detour via secondary roads, but for the main route direction, this would require crossing the main road twice, which poses a greater risk than staying on it with appropriate discipline from motor vehicle drivers.
- Road widening in the settlement is very expensive due to land prices, and this project is estimated at **€1.5 million**. Alternatives Fažana - Valbandon should be reconsidered once more.

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Projekt MedCycleTour; Mediteranska ruta – EuroVelo 8
Plan aktivnosti razvoja rute za Hrvatsku za razdoblje od 2018 do 2030. g.
https://www.htz.hr/sites/default/files/2018-09/Akcijski%20plan%20za%20razvoj%20rute%20EV8%20u%20Hrvatskoj.pdf

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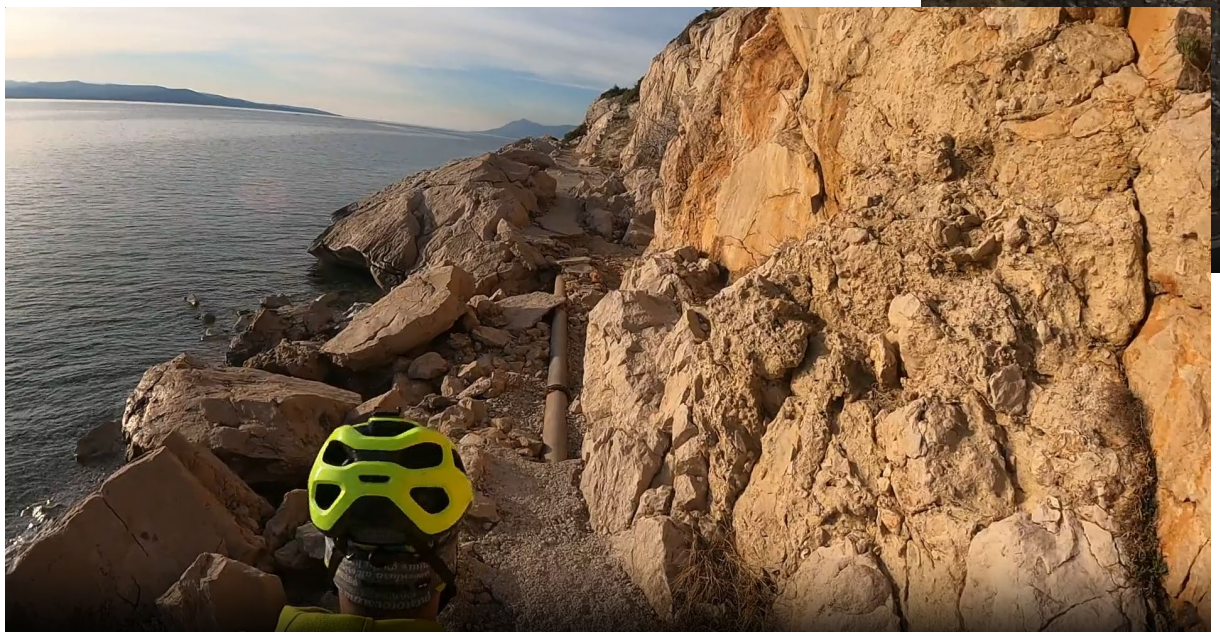
On-site situation



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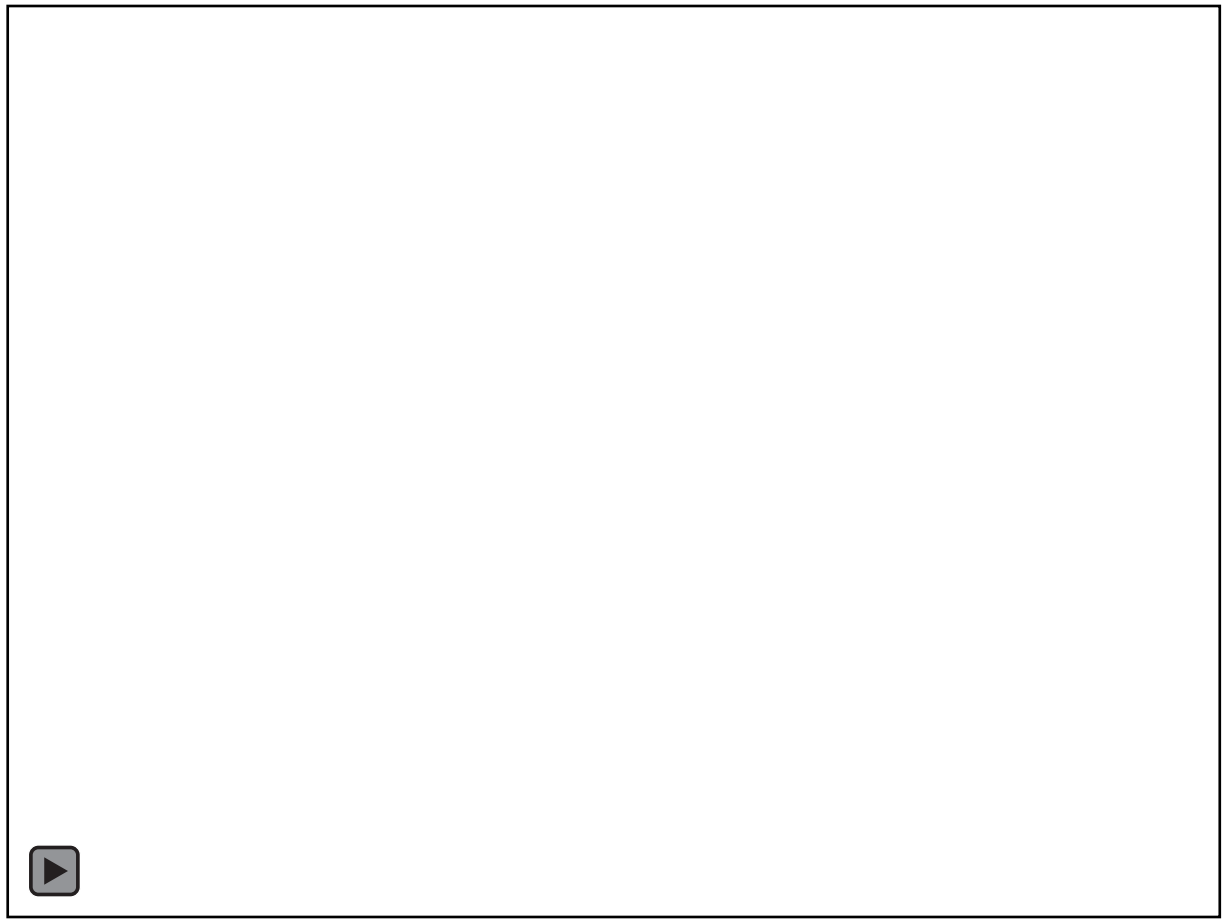
What does the current knowledge base tell us?



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Costs

- The cost of owning (and maintaining) a bicycle is lower compared to a personal car.
- The time "cost" is currently higher, but an e-bike helps reduce the difference.
- Traffic congestion costs can be eliminated or significantly reduced by using a bicycle.

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Transport & Mobility Leuven, A comparative cost-benefit analysis of cycling within the Benelux and North Rhine-Westphalia, October 18, 2022, https://www.benelux.int/wp-content/uploads/2023/03/Report_Cycling_Benelux_NRW.pdf

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Health

- According to the recommendation of the World Health Organization (WHO), adults (**aged 18 to 64**) should engage in at least **150 to 300 minutes** of **moderate aerobic activity per week** or 75 to 150 minutes of vigorous aerobic activity to reduce the risk of cardiovascular diseases, hypertension, type 2 diabetes, and certain types of cancer (such as bladder cancer, breast cancer, etc.).[1]
- Active mobility is an excellent way to encourage the population to engage in physical activity, considering the large number of people who spend 30 minutes in traffic daily but struggle to find an "extra" half hour in their day for exercise.[2]

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1. World Health Organization, "WHO guidelines on physical activity and sedentary behaviour," 2020.
2. T. Götschi, J. Garrard, and B. Giles-Corti, "Cycling as a Part of Daily Life: A Review of Health Perspectives," Transp Rev, vol. 36, no. 1, pp. 45–71, 2016, doi: 10.1080/01441647.2015.1057877.

Characteristics

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Economic effects

- Every bicycle trip brings a net benefit to society.
- If 100,000 people commute to work by bicycle over a distance of 5 km one way, they generate a total benefit of €196 million per year. If they travel by car, they create a cost of €203 million per year. Of this total cost, **€89 million is borne by the car user, but €114 million is covered by the rest of society.**[1]
- According to the ADFC publication for the year 2023.:[2]
  - One-day trip – average €32/person/day
  - Short trip (1-2 nights) – average €130/person/day
  - Trip >3 nights – average €117/person/day

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1. Transport & Mobility Leuven, A comparative cost-benefit analysis of cycling within the Benelux and North Rhine-Westphalia, October 18, 2022, https://www.benelux.int/wp-content/uploads/2023/03/Report_Cycling_Benelux_NRW.pdf
2. https://www.adfc.de/fileadmin/BV/RFS/user_upload/ADFC_Radreiseanalyse_2024_Handout_WEB.pdf

Sustainability

- In December 2020, the European Commission adopted **The Strategy for Sustainable and Smart Mobility** with the aim of steering European transport towards the future, planning to ensure high availability of sustainable alternative transport solutions, including sustainable and healthier intercity and urban mobility, for a greater variety of travel options. This Strategy supports the further development of cycling traffic, the increase in the share of public transport, walking, and cycling in the modal distribution of travel in order to reduce pollution and traffic congestion caused by transportation, **with the goal of achieving climate targets by 2030.**
- The strategy aims to encourage the growth of active transportation by constructing more than 2,300 kilometers of various cycling infrastructure in cities, with plans to double this number to 5,000 kilometers over the next decade.

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Sustainable and Smart Mobility Strategy, European Commission COM(2020), Brussels, 9.12.2020, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12438-Sustainable-and-Smart-Mobility-Strategy_en
NACIONALNI PLAN RAZVOJA BICIKLISTIČKOG PROMETA ZA RAZDOBLJE OD 2023. DO 2027. GODINE, MMPI, SRPANJ 2023., https://mmpi.gov.hr/UserDocsImages/dokumenti/INFRASTRUKTURA/Infrastruktura%207_23/NPRBI%2028-7_23/Nacionalni_plan_razvoja_biciklisti%C4%8Dkog_prometa_2023-2027.pdf

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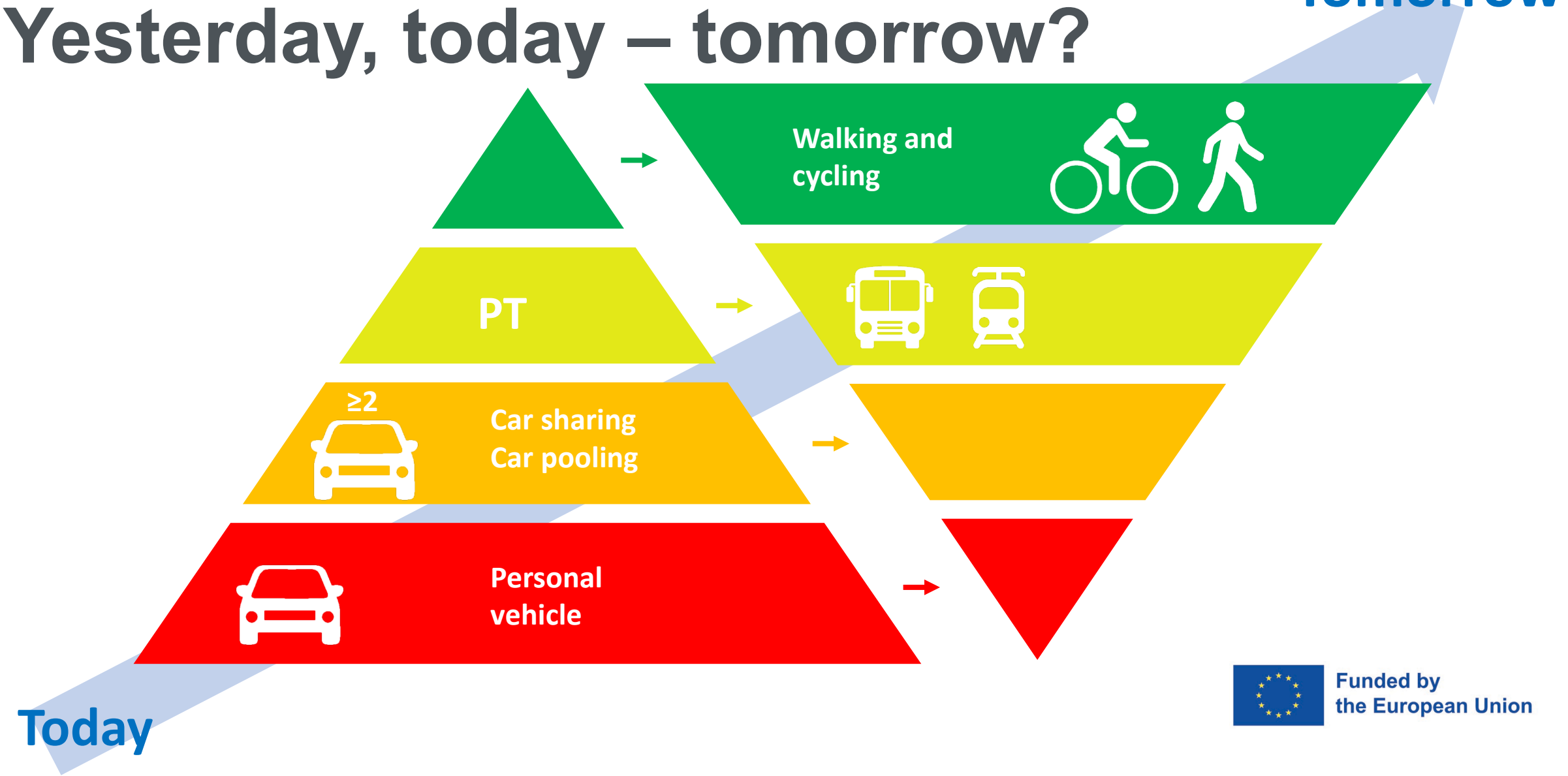
Yesterday, today – tomorrow?



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Social policies:

- Reducing speed limits for motor vehicles.
- Increasing the costs of car ownership.
- Promoting public transport.
- Ensuring access to public transport.

Municipal policies:

- "15-minute city.„
- Car-free city centers.
- Bicycle subsidy programs.

Policies for individuals:

- Informational and educational programs.
- Targeted advertising of environmentally friendly modes of travel.

Infrastructure policies:

- Investment in cycling infrastructure.
- Facilities at destinations (secure parking, shower at the workplace).

eviews of the Literature," Curr Environ Health Rep, vol. 4, no. 3, pp. 278–285, 2017, doi: 10.1007/s40572-017-0148-x.

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Categories of factors (according to J.Hunt)

Infrastructure characteristics:	Mixed traffic characteristics:	Characteristics of the individual or trip:	Environmental characteristics:
• Type of cycling infrastructure, • On-road parking, • Slope, • etc.;	• Traffic culture and speed of motorized traffic, • Interaction with pedestrians, • Intensity of motorized traffic, • etc.;	• Gender, • Age, • Income, • Concern for personal safety, • Trip length, • etc.;	• Weather conditions, • Aesthetics along the route, • Availability of public transport, • etc...

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J. D. Hunt and J. E. Abraham, “Influences on bicycle use,” Transportation (Amst), vol. 34, pp. 453–470, 2007.

Infrastructure characteristics

Type of cycling infrastructure

- According to Antonakos:
  - Marked on-road bicycle lane – 3.9 out of 5 points;
  - Unmarked wide shoulder – 3.6;
  - Off-road bicycle lane – 3.4;
  - Bicycle path – 2.4;
  - Gravel path – 1.8;
  - Sidewalk – 1.5.
- Aultman-Hall (quality of gravel paths):
  - 57.4% of survey participants responded that they use gravel paths for travel if they are of "good quality";
  - 35.4% of respondents stated that they use gravel paths if they are of "medium quality";
  - 7.2% of respondents stated that they use gravel paths if they are of "poor quality."

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Infrastructure characteristics

Type of cycling infrastructure

- According to Taylor and Mahmassani:
  - Wide curb lanes are more popular among experienced cyclists.
  - Marked bicycle lanes are more popular among less experienced cyclists.
- According to the authors, a marked bicycle lane itself has a promotional and attractive effect, making it easier to highlight when drawing attention to cycling infrastructure.

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Infrastructure characteristics

Equipment and features of the infrastructure

- The master plan of the City of Denver, as well as Fajans and Curry, state that cyclists prefer routes with fewer traffic lights and stop signs to maintain their riding momentum. Accelerating on a bicycle is one of the most energy-demanding movements a cyclist has to perform.

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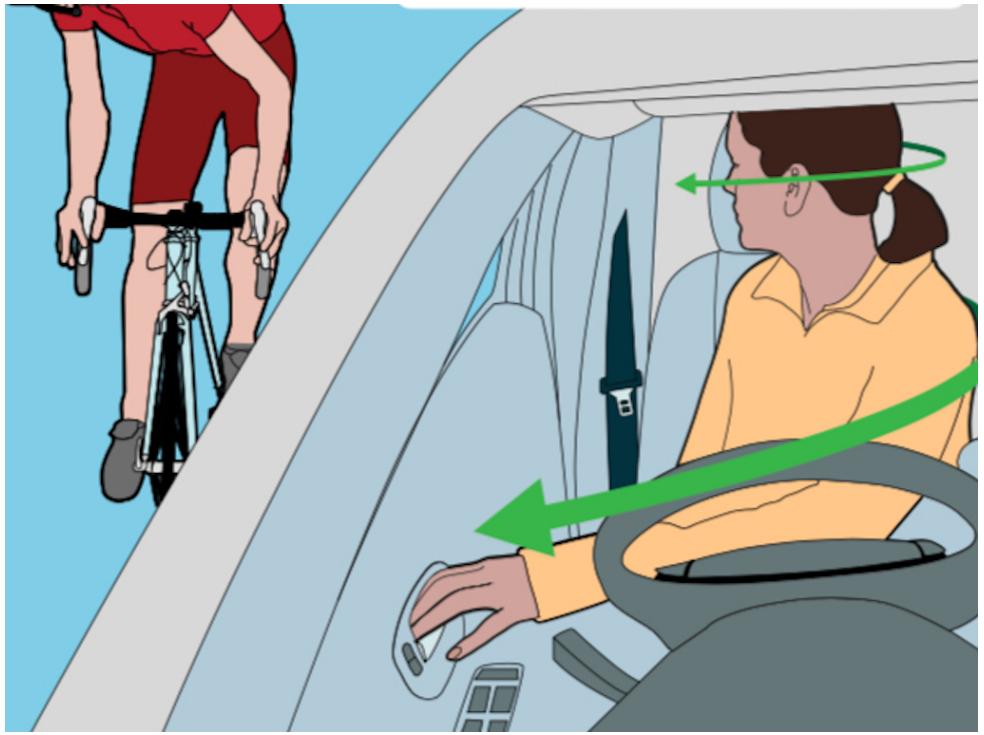
Infrastructure characteristics

Presence of on-street parking



- Stinson and Bhat state that cyclists in rural areas are more sensitive to this issue compared to cyclists in urban areas. The reason for this may lie in the greater availability of parking spaces in urban environments, which desensitizes urban cyclists to the issue.

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Infrastructure characteristics

Longitudinal slope

- Aultman-Hall states that cyclists, on average, choose routes longer than the shortest available—possibly due to slope.
- She also notes that men are less sensitive to slope.
- Parkin reports that the City of Bradford, due to its "hilly terrain," has a low cycling share of just 0.84%. Doncaster, with its "moderately hilly terrain," records a cycling-to-work share of 3.13%, while York, among the selected cities, has the highest cycling share at 13.06%. The terrain in York is described as "very flat.„
- Fyhri suggests that one possible way to overcome the challenge of slopes in cities is the use of electric bicycles (e-bikes).

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Mixed traffic characteristics:

Speed of motorized vehicle flow and driver behavior

- Snelson and Lawson state that motor vehicle drivers have a negative attitude and behavior toward cyclists, which creates discomfort for cyclists when they have to share infrastructure with motorized vehicles.
- Sorton and Walsh mention that the high speed of a vehicle passing too closely to a cyclist can cause loss of control and discomfort, especially when the vehicle's passing is followed by water splashing on wet road conditions.
- Cui reports that along road sections where higher traffic speeds are recorded, a lower number of cyclists have been observed.

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Mixed traffic characteristics:

Motorised traffic volume

- Kang and Fricker, in their study, state that cyclists tend to use separated cycling infrastructure along higher-level roads, especially if there is a higher flow of motorized traffic on those road sections, as confirmed by Cui.
- Aultman-Hall, in her work, notes that less cycling traffic has been recorded on routes that share infrastructure with more than two bus lines.

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Characteristics of the individual or trip:

Gender

- Studies indicate that the ratio favors men, and it generally varies across different ranges depending on the city where the study was conducted, ranging from 60% male cyclists to 90%.
- When considering the total trip distance, studies again identify men as the gender more likely to cycle longer distances.
- On the other hand, studies favor women when it comes to cycling to college during student years, cycling for shopping and daily tasks, and using bicycles for visits to friends and family.

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Characteristics of the individual or trip:

Age

- In her work, Antonakos notes that the older population consciously avoids using unpaved routes or paths, but other indicators are difficult to correlate with the age of cyclists.
- On the other hand, Wardman claims that in his analysis, he was unable to prove a statistically significant impact of age on cycling.

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Characteristics of the individual or trip:

Safety concerns

- Puchster and Dijkstra state that in the United States, pedestrians have a 23 times higher chance of traffic-related death, and cyclists have a 12 times higher chance of death compared to drivers and passengers in vehicles. In comparison to European figures, the risk per kilometer traveled and per trip for American cyclists is twice as high as for cyclists in Germany, and three times higher than for cyclists in the Netherlands.
- PLOCS – Perceived level of cycling safety

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Environmental characteristics:

Weather conditions

- According to Lawson, one of the three reasons why motor vehicle drivers do not cycle is the fear of bad weather conditions.
- Parkin states that an increase in temperature results in a higher percentage of cycling trips.
- Nankervis concludes that cyclists perceive low temperatures (<17°C) as more uncomfortable than high temperatures (>30°C).

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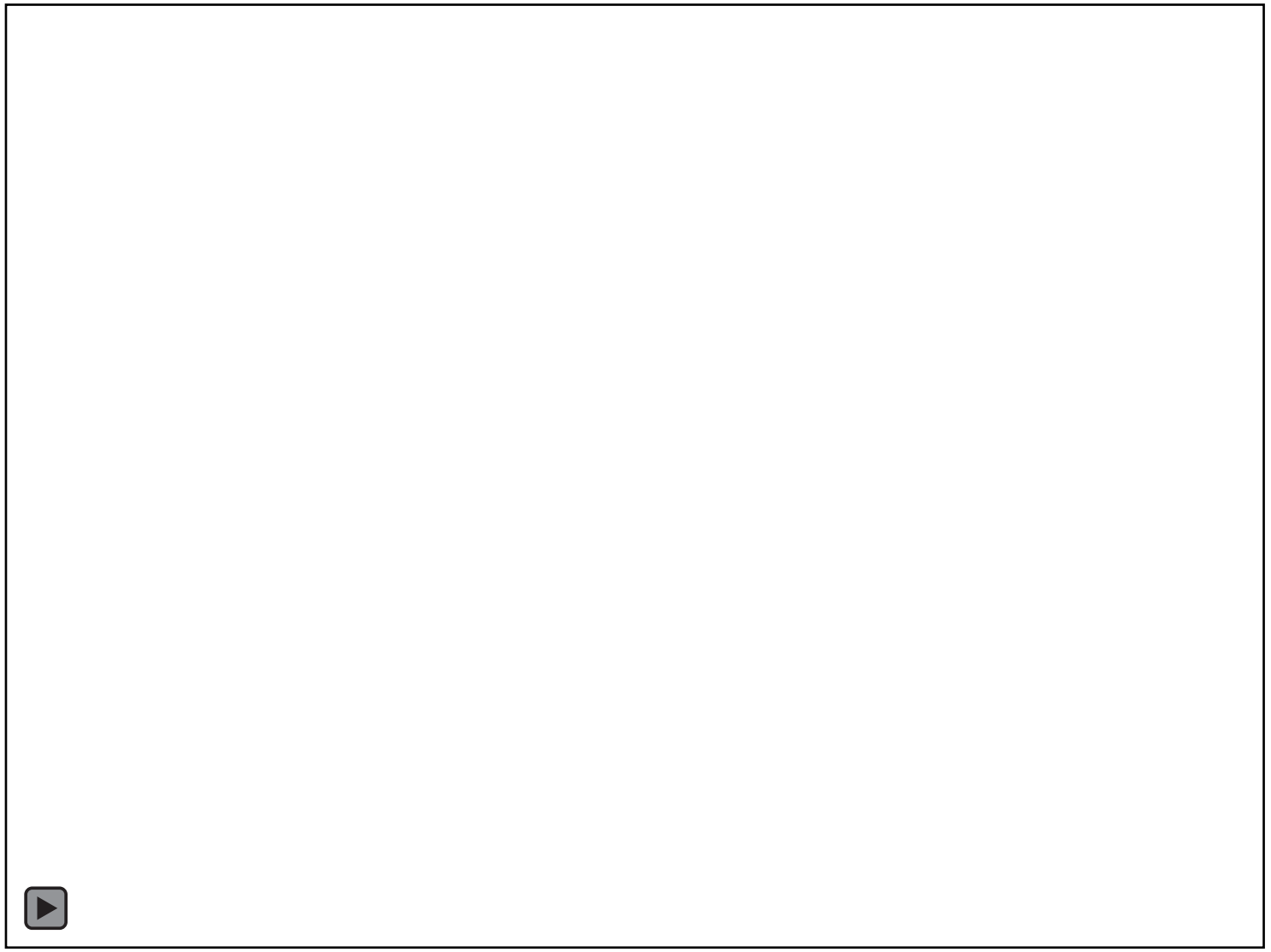
Environmental characteristics:

Level of political and public support for cycling

„Comprate un auto, Perico” – "Iconic" advertisement in Chile

- Ortuzar



https://www.youtube.com/watch?v=flVb5LehWHk&ab_channel=CanalPretoR%C3%A9clame

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Important note

- A large number of authors disclaim the applicability of the results to geographical areas outside the one where the research was conducted!

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Quantification of factors in recent literature

- Subjective indicators such as **PLOCS – Perceived Level of Cycling Safety** and **WTB – Willingness To Bicycle**.
- According to Wu, PLOCS represents the user's perception of safety in the context of cycling and is most commonly measured using a questionnaire based on the **Likert scale**. On the other hand, according to Nazemi, WTB represents an individual's willingness to ride a bicycle in a particular road environment and is also most commonly measured using questionnaires based on the Likert scale.

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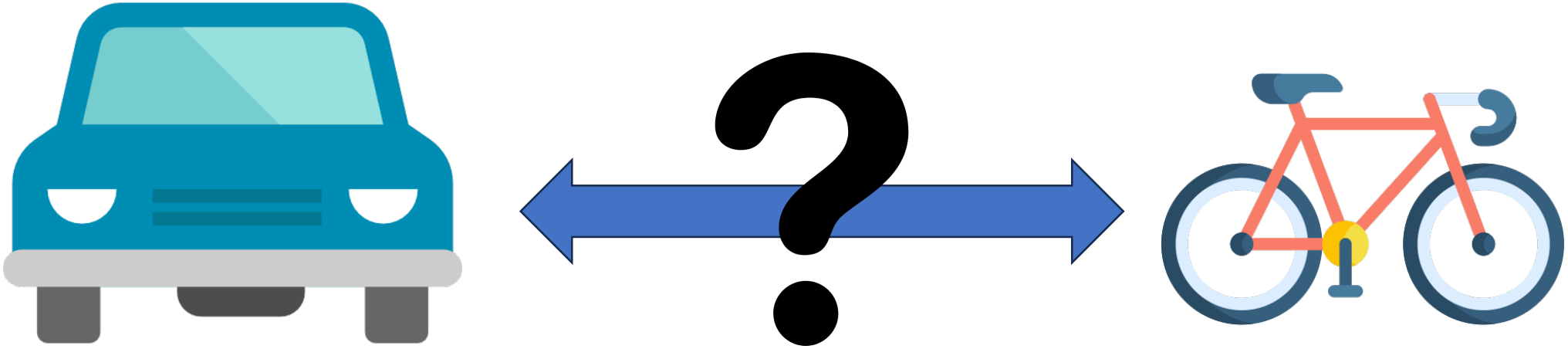
Transport model



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Prediction models

- In the study conducted by Kölbl and Helbing, it is stated that each trip is a function of the energy that will be expended for that trip. This leads to the first model for estimating cycling potential:

$$\mathrm{E} = \sum_{i} p_i t_i$$

- Where t_i epresents the time spent in mode of transport ' i'.
- Ortuzar limited his model to two possible outcomes: "Yes, I would use a bicycle" and "No, I would not use a bicycle.„
  - The "Yes" option includes any of the possible factors, while the "No" option excludes any.

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Existing research in Croatia

- Mainly focused on individual cities,
- A study on cycling tourism in the Republic of Croatia showed a low level of satisfaction regarding the availability of cycling paths/routes and a low percentage of guests (5%) who use bicycles as an activity during their stay.
- There is no model for quantifying the potential share of cyclists.

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Conclusion

- Large variation in results
- Results limited to the location
- Contradictory results
- Source of results often – surveys
- Diversity of identified factors

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Direction of future research

- In the continuation of the research, special attention will be given to the analysis of factors relevant to the geographical area of Croatia.
- Given the extensive range of factors identified in previous studies, the research will focus on **infrastructural elements and their effects on safety perception.**
- Modeling various elements of cross-section, as well as analyzing perception and interaction between potential users and infrastructure using simulation solutions.

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