



The effect of experience on injury risk across various modes of transport

George Yannis, Professor
Christos Katrakazas, Research Associate
Apostolos Ziakopoulos, Research Assistant

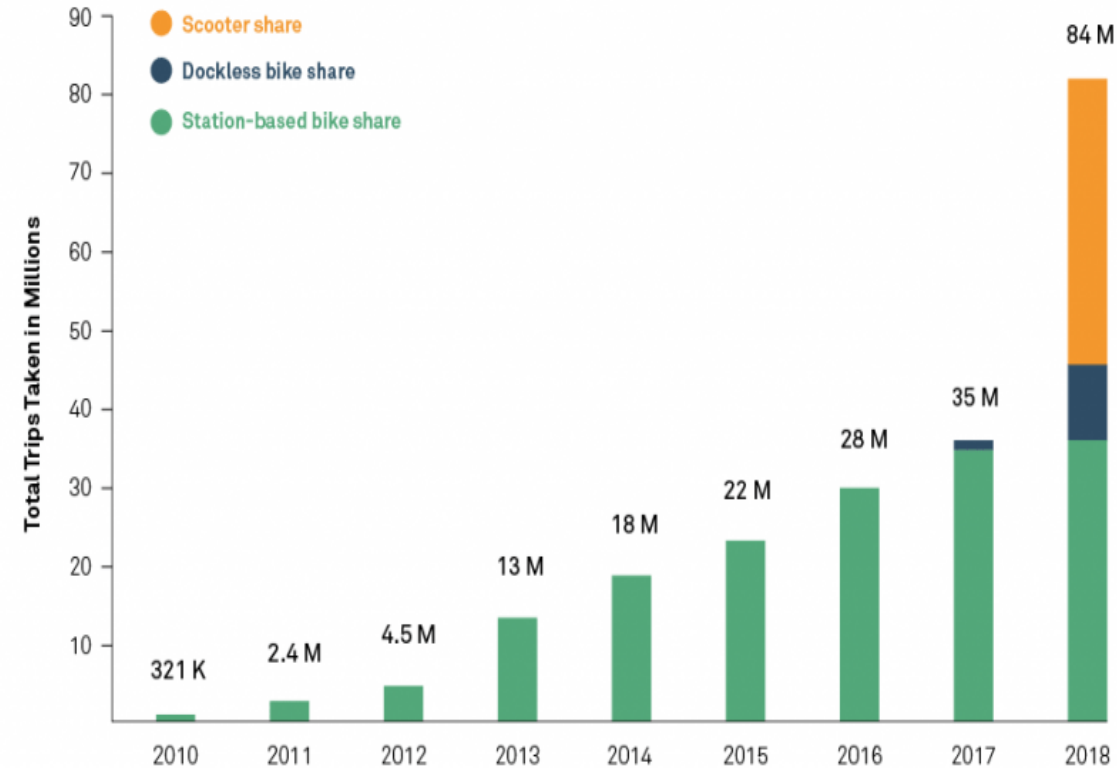


Department of Transportation Planning and Engineering,
National Technical University of Athens, Greece

The Objective

- The explosion of micro-mobility on city streets brought in **important safety implications** mainly for the vulnerable road users (pedestrians and riders of cycles, e-scooters, PTWs).
- **E-scooter rider behaviour** is certainly a key aspect for traffic safety.
- A key role for safer micromobility is going to play the growing **experience of e-scooter riders** but also of the other road users.
- Scientific evidence on **the effect of experience** on injury risk across various modes of transport might shed light on e-scooter traffic safety.

84 Million Trips on Shared Micromobility in 2018



Source: NACTO



Presentation outline

- Novice Drivers (3)
- The role of “Driver experience” (3)
- The role of “Rider experience” (2)
- Experience across modes & vehicle familiarity (2)
- The role of training (3)
- Safety-in-numbers (2)
- Conclusion (1)



Novice Drivers (1)

- In every crash and fatality statistics, **16-24 year old drivers** are greatly over-represented, with **2 to 3 times higher risks** than those of more experienced drivers.
- Young driver crashes **differ from those involving more experienced drivers**, in fact they typically occur at night, are single vehicle crashes (with no other vehicles involved), and occur as a result of 'loss of control' and high speeds.
- Young drivers' high crash rates primarily result from **immaturity, lack of experience, impairment, and lifestyles** associated with their age and their gender.



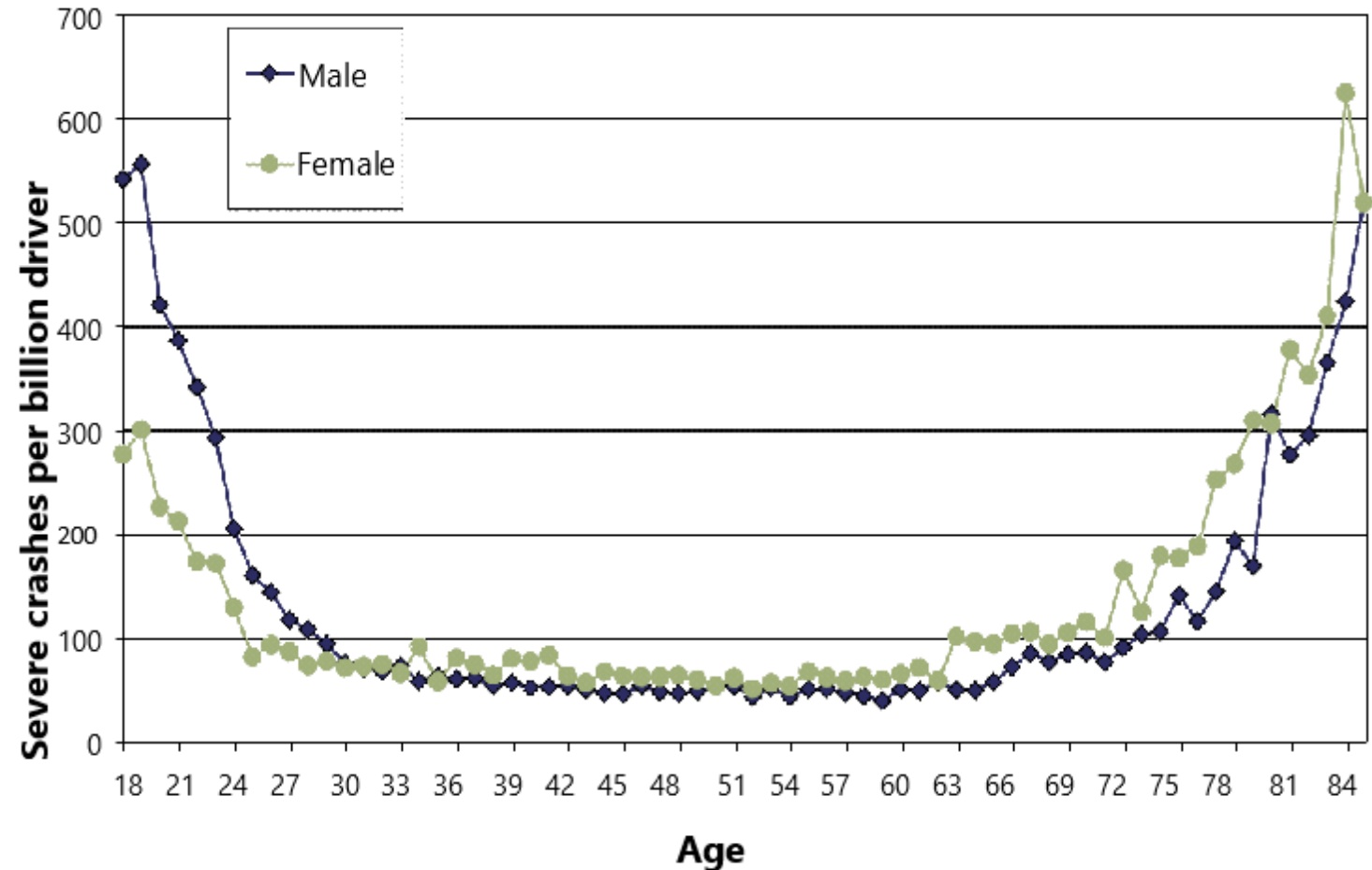
Novice Drivers (2)

- In addition, young drivers drive more frequently during **high-risk hours and in high-risk situations** e.g. night-time driving, speeding, less frequent use of seat belts and driving older cars with fewer safety features: This results also to **higher risk exposure**.
- Lack of experience interacts with age (Konstantopoulos et al., 2010):
Younger novices experience steeper crash reductions over the years.
Initial overall crash rates are lower for older novice drivers compared to younger ones.



Novice Drivers (3)

- A very **steep safety increase** (per billion driver-kms) is observed during the seven first years of driving, as a combined effect of driver age and experience.
- **Young male drivers** are over-represented in severe crashes compared to young female drivers, when also controlling for exposure (annual mileage).

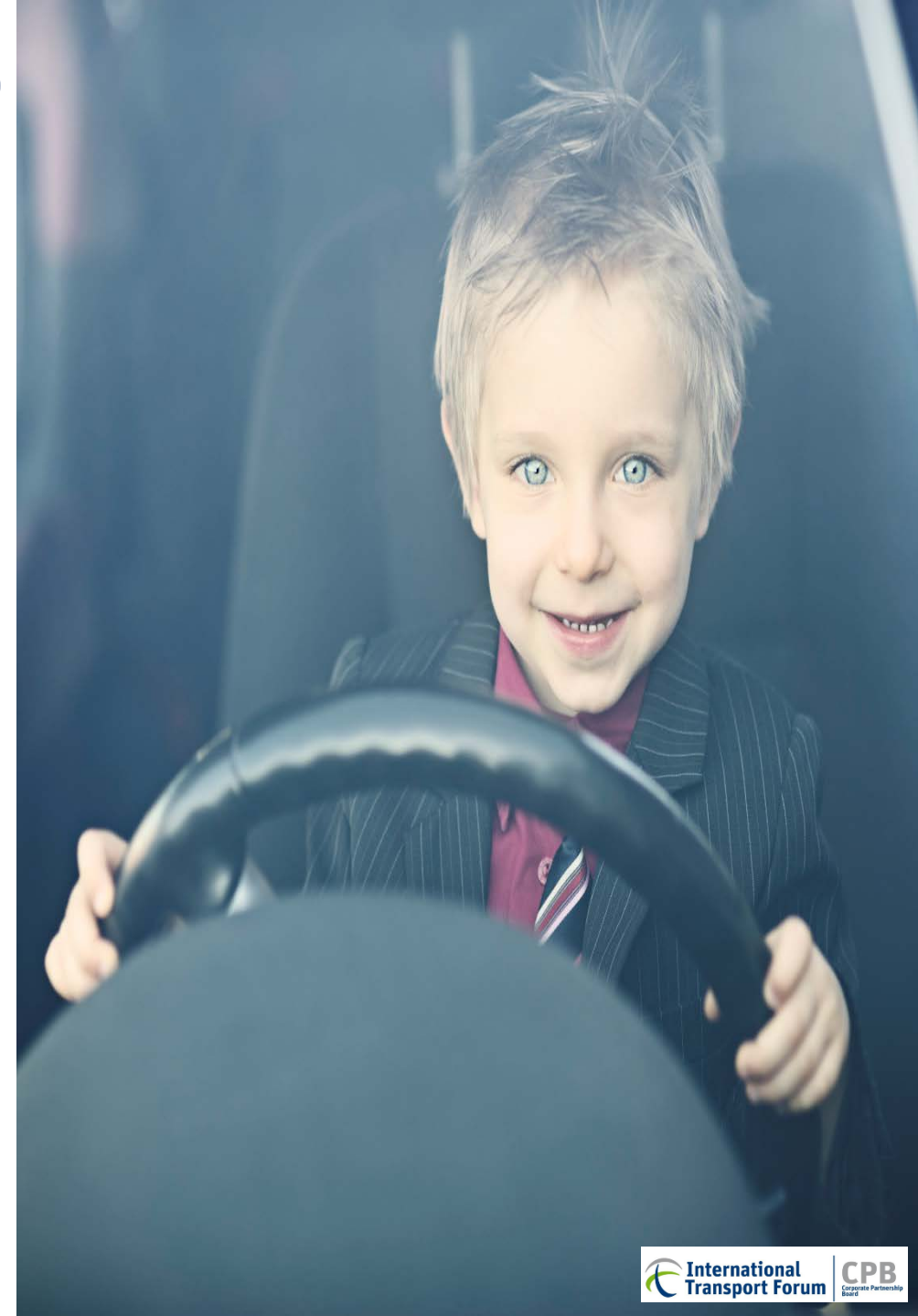


Source: Dutch Ministry of Infrastructure and Environment, Statistics (2004-2009)



The role of “Driver experience” (1)

- Driving experience affects both **vehicle control skills** and more complex **cognitive skills**, such as information processing skills, self-calibration, hazard and risk perception and safety related motivation or attitudes (Harrison, 1999).
- Lack of driving experience, in terms of kilometers driven, affects **vehicle maneuvering** such as steering competence and increases the tendency to **commit operative errors** and the probability to be involved in near miss crashes.
- Experience **affects visual search strategies** and increases cognitive skills, which are more influential than the lack of vehicle control (Underwood, 2007).



The role of “Driver experience” (3)

- Experience has been found to reduce crash and near-crash risk **in naturalistic driving experiments**.
- Driver instructors have been found to significantly differ in **eye movements** compared to learner drivers. Instructors collected more information through fixations in different visibility conditions (day, rain, night) and needed **less processing time**.
- Experienced drivers have a **broader range of horizontal search** sweeps.
- Experienced drivers have **higher accuracy** and **decreased cognitive processing time** when assessing hazardous scenarios (Jackson et al., 2009).



The role of “Rider experience” (1)

- Novice PTW riders are overconfident about their abilities and they **perceive hazards in a less appropriate manner** than experienced ones.
- Conversely, riding experience **governs personal perception** of danger.
- Research has shown that experienced PTW riders **respond faster** to hazards than inexperienced ones (Hosking et al., 2010).



The role of “Rider experience” (2)

- Cognitive abilities in both (i) hazard detection and (ii) situational criticality assessment depend on and **are improved with riding experience**.
- **Probability of getting involved in a crash is higher** in inexperienced PTW riders.
- However, **advanced training** has proved beneficial over mere experience.
 - Experienced riders may exploit openings while underestimating hazards (Crundall et al., 2014).



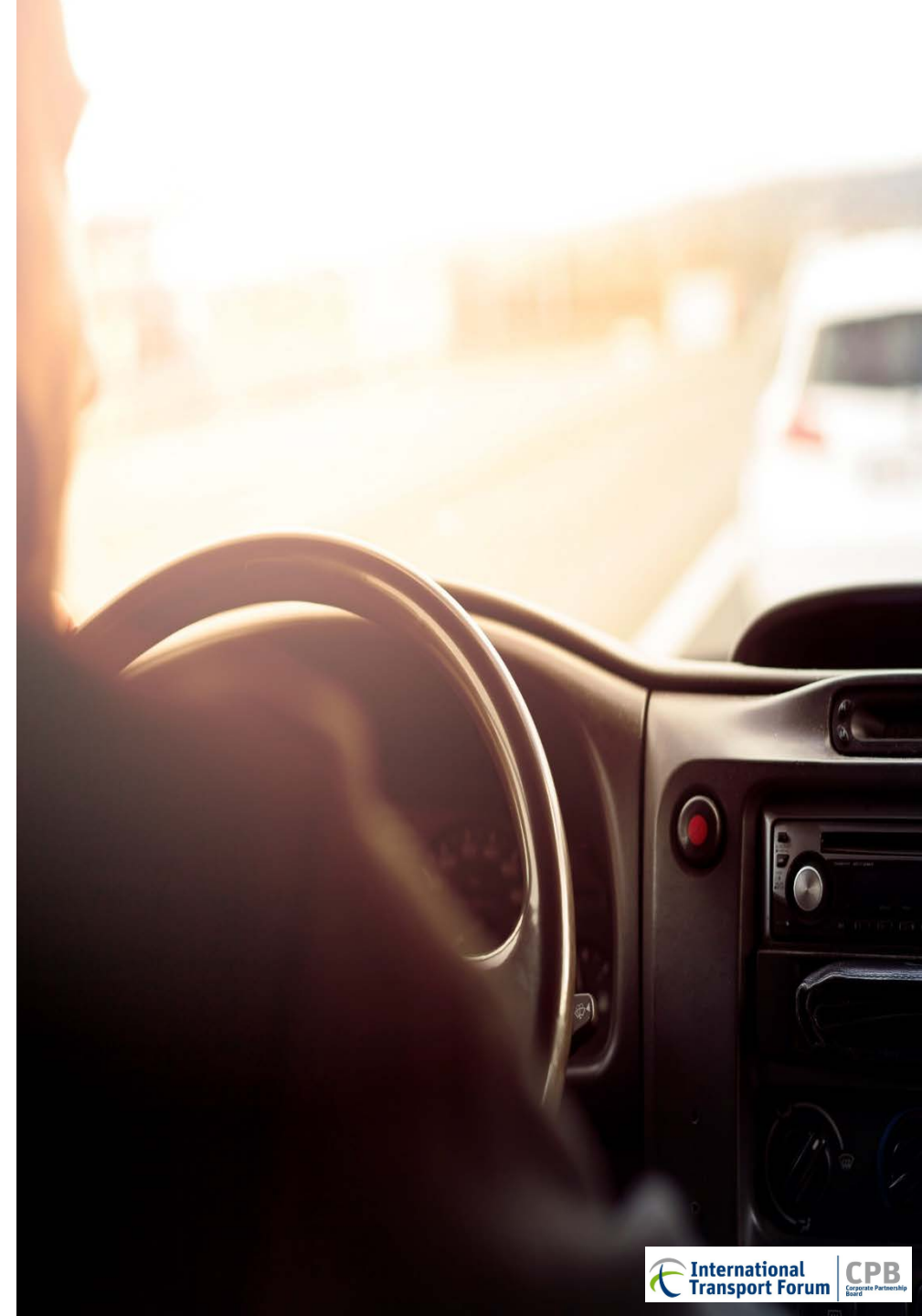
Experience across modes

- Car driving experience has contributed positively to the safety of **powered-two-wheelers** (Lardelli-Claret et al., 2005).
- **E-bike riders** with car driving experience were statistically less likely to be involved in at-fault crashes (Yao & Wu, 2012).
- Unexpected simulator scenario: less experienced **truck drivers** reacted later, and were involved in more collisions. Novice drivers exhibited longer steering reaction times (Markkula et al., 2013).



Vehicle Familiarity

- It is found that **driving safety is highly related to vehicle familiarity** as well.
- Historically, a relatively **high number of crashes** involve inexperienced drivers & drivers who appeared to be unfamiliar with their specific vehicle (Perel, 1983).
- Kilometers driven with the **same motorcycle** led to decreases in fatal/severe crashes, more than other aspects of rider experience (Mullin et al., 2000).
- Studies have shown **confusion and distraction** can also result from inadvertent operation of unfamiliar controls (Liu et al., 2018).



The role of training (1)

- **Training** focuses on the enhancement of skills needed for safe driving **across modes**.
- Regarding motorized mobility scooters (MMS), training has been found to **increase safe manoeuvring** among pedestrians and scooter users (Toosizadeh, 2014).
- Studies suggest that training should be an essential step in ensuring that MMS users are **safely integrated in transportation systems** and aware of the associated risks (Nitz, 2008).
- However, an **established procedure** for assessment of training needs and risks of scooter users is lacking (Nitz, 2008).



The role of training (2)

Paradigms from novice driver training of cars and trucks

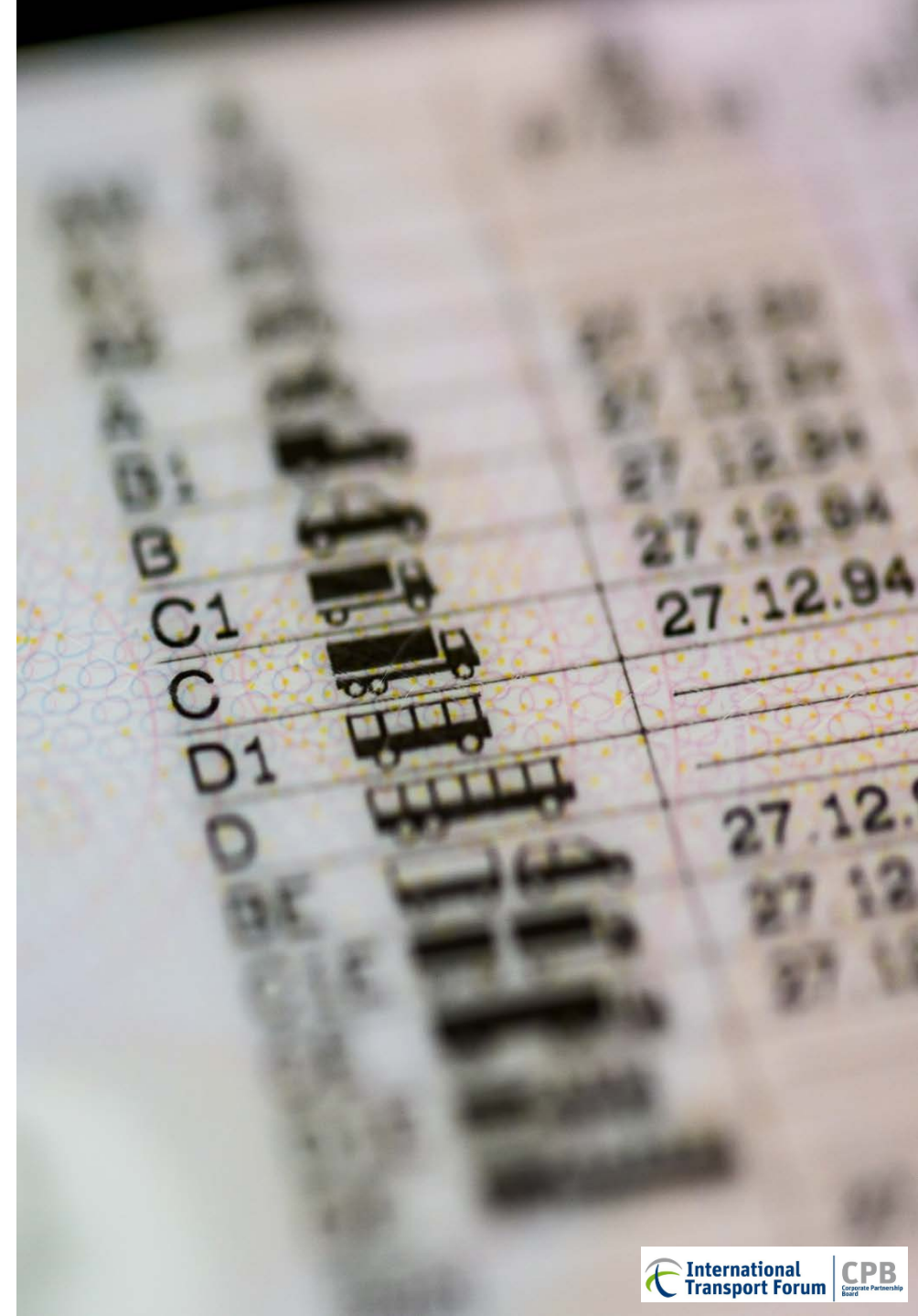
- Implementation of graduate driving licensing (GDL) training has resulted in **22% crash reduction** among 16-year old and 6% in 17-18 year old drivers (SafetyCube, 2017).
- Training results in **7-11% less crashes** for novice drivers compared to untrained ones (SafetyCube, 2017).
- Pre- and post-licence driver training is profitable for safe driving skills development and can address risk factors such as **overconfidence, ignorance & poor hazard perception**.



The role of training (3)

Paradigms from novice driver training of cars and trucks

- Among truck drivers, formal training has been found to **reduce crash rate** by ~20% (Laiou, 2017).
- A recent study (Freydier, 2016) shows that early trained drivers have better speed **adaptation skills** and enhanced lateral and longitudinal **vehicle control**, than traditionally trained ones.
- Although there is an inconsistency in the success of different training forms and the enhancement of road safety, scooter-specific training should **lead in safer urban mobility**.



Safety-in-numbers (1)

- Pedestrians and cyclists are vulnerable road users; if their exposure increases, one may expect the number of traffic injuries to increase.
- A counter-argument is that the injury rate for pedestrians and cyclists is not constant, but subject to a “safety-in-numbers” effect, which means that the larger the number of pedestrians or cyclists, the lower the injury rate for each pedestrian or cyclist.
- In essence, safety-in-numbers implies that a doubling of the number of road users will be associated with less than a doubling of the number of related crashes.



Safety-in-numbers (2)

- A systematic review and meta-analysis on crashes involving motor vehicles and cyclists or pedestrians:
A safety-in-numbers effect exists
(Elvik and Bjørnskau, 2017).
- In a recent survey study (Fyhri et al., 2017), results suggest that bicyclists experienced a short term safety-in-numbers effect through the years 2013-2014.
 - Cyclists experienced fewer occasions of being overlooked by cars and **fewer safety critical situations (near-misses)**.
- Hypothesis: If more people use micro-mobility modes of transport, one may expect **the larger the number of e-scooters** in the streets, **the lower the injury rate for these users**.



Conclusion

- E-scooters are becoming rapidly popular amongst inexperienced drivers, and already constitute an additional **Vulnerable Road Users' group**.
- Driving and riding **experience** together with vehicle **familiarity** undoubtedly result in a better driving performance across all transport modes.
- The **safety-in-numbers** effect implies that as long as the number of e-scooters increases, there will be fewer safety-critical events for micromobility users.
- **Training** as a means for experience gaining can lead to safer maneuvering and less risk taking in urban environments and thus to the e-scooters safe integration in a multifaceted transport system.





The effect of experience on injury risk across various modes of transport

George Yannis, Professor
Christos Katrakazas, Research Associate
Apostolos Ziakopoulos, Research Assistant



Department of Transportation Planning and Engineering,
National Technical University of Athens, Greece