E-scooter road safety campaign matrix	
Target groups	Users of rental e-scooters: In particular, young adults (average age: 30 years), male (3/4 of users), who use e-scooters almost exclusively for leisure purposes (90 %). At the moment, about 20 % are first-time users. Users in the evening hours tend to be younger than daytime users and more often ride together in groups (Ringhand et al., 2021) Users of private e-scooters: Slightly older than users of rental e-scooters (average age: 38 years) and almost exclusively male (91 %). e-scooters are primarily used for journeys to work/place of education (UDV research report no. 87)
Dos and Don'ts in e-scooter road safety campaigns	✓ Prefer rational/emotionally positive/social messaging and humorous approaches ✓ Show desired behaviors ✓ When depicting hazards, show alternative views (close-ups, bird's-eye view) or other kinds of presentations (known/abstract figures, analogies) ✓ Use accounts from celebrities well-known to the target group (popular skateboarders, influencers, etc.), point out social consequences ✓ Point out similarities to and differences from bicycle use ✓ Test the prevention concept prior to its implementation and evaluate it afterwards ✕ Avoid messaging based on fear or the risk of penalties (e.g., the concrete display of the consequences of an accident) ✕ Do not depict persons who exhibit undesirable behavior, fall or have an accident (this might be seen as a challenge)
General notes on media formats	**Video clips[1]:** ✓ Address the target group via platforms and social media that it uses a lot, e.g., as advertising (5 to 20 seconds) on YouTube or Instagram ✕ Persons shown should be similar to target group or should be role models; use appropriate analogies, e.g. with PC games ✕ Avoid long explanatory videos **Apps:** ✓ Time-specific presentation possible (evening hours/night-time) ✓ Multiple presentations can enhance recollection ✓ Possibility of integrating incentivizing quizzes, also outside of context of e-scooter usage via push messages ✓ Make use of technical capabilities (e.g., warnings while riding) ✕ Avoid long text/image sequences when addressing users during the rental process **Training:** ✓ Encourage participation in rider safety training or self-training via video and app ✓ Use incentives, e.g. free minutes ✓ Improve vehicle control (helpful for almost every aspect) ✕ Prevent the target group from practicing/trying out undesired behaviors ✕ Make sure that the trainer does not "only give lectures"

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[1] To differentiate them from app content, videos refer more particularly to video clips for social media platforms (YouTube, TikTok, Facebook, Instagram)

Topic		Description	Objectives	Format requirements	Target group-specific strategies	More tips
Critical events	Uneven surfaces	Due to the small wheels of e-scooters, even small bumps may become major obstacles. Loss of control of vehicle and risk of falling due to: • Large height differences at curbs • Slipping of the wheels on edges parallel to the direction of travel • Potholes or roots in or at which the small wheels get stuck • Loss of balance on cobblestones • Getting stuck in tram tracks	Acquire confidence in dealing with bumpy surfaces, riding with foresight: • Improve control of vehicle [esp. experienced e-scooter users] • Reduce speed [esp. first-time e-scooter users] • Cope with curbs by riding slowly up or down or dismounting if height difference is too great • Drive with foresight/watch out for potholes/roots, adapt appropriate visual strategy • Drive around potholes/roots, etc. • Cross tram tracks at a 90° angle	Video clips: • Show bumps/jerky riding • Consider different angles (e.g., close-up of wheel and curb; from user's perspective) App: • Show bumps and jerky riding despite lack of depth information Training: • Demonstrate the correct behavior, e.g. angle when crossing tram tracks • Practice, e.g., coping with curbs/potholes	• *Humorous:* e.g., cartoon, mini-game similar to Super Mario with driving around potholes • *Rational:* inform about problems of uneven surfaces, depict unevenness (features) • *Constructive:* convey visual strategies (regular change of gaze between directly in front of the e-scooter and looking ahead), do not show falls • *Social: norm:* depict peers, celebrities	Differences from bicycle use: due to the smaller wheels, uneven surfaces such as cobblestones, curbs and edges are a bigger problem than when riding a bike.
Critical events	Slippery / wet conditions	On wet and slippery roads, the e-scooter can easily slip with the rider on it and braking becomes more difficult, especially in curves. This problem is more critical than when riding a bicycle due to the smaller wheels of the e-scooter, which are mostly made of solid rubber. • Wetness due to rain, dew or wet leaves • Slippery ice or snow	Riding at appropriate speed, riding with foresight: • Inform about longer braking distance in slippery and wet conditions as well as the danger of slipping during heavy braking maneuvers (loss of tire grip) • Reduce speed and prepare to brake in slippery or wet conditions, especially in curves • Watch out for wet leaves, especially in fall/winter (ride with foresight), appropriate visual strategy • Ride around slippery spots/wet leaves	Video clips: • Visually present vehicle handling problems • Demonstrate longer braking distances App: • Show warning message, e.g. "icy" symbol (as in cars) when starting a journey under unfavorable weather conditions Training: • Demonstrate and experience how braking changes under wet conditions, train braking	• *Humorous:* e.g., cartoon, mini-game • *Rational:* inform about problem of wet/slippery conditions, point out characteristics of "slippery" areas • *Constructive:* demonstrate visual strategies (regular change of gaze between directly in front of the e-scooter and looking ahead), do not show falls • *Social norm:* depict peers, celebrities	Differences from bicycle use: rain, dew and wet leaves are a bigger problem for e-scooters

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Critical events	Car/truck turning right	E-Scooter is driving straight ahead on cycling infrastructure. A car or truck driving next to the e-scooter turns right, fails to notice the e-scooter rider and takes his/her right of way. • Problems at intersections with and without traffic lights • Problems at driveways	Create/improve hazard awareness in turning situations: • (Quickly and) correctly assess situations at intersections/situations at driveways • Raise awareness that motorized road users might fail to notice the e-scooter rider • Recognize the intention to turn or anticipate behavior of car/truck drivers at intersections and driveways • Appropriate speed and increased readiness to brake at intersections/ junctions; if necessary, concede the right of way	Video clips: • Development of the situation from the point of view of e-scooter rider and car/truck driver (depiction of the mental model) App: • Select appropriate information for riding situation, e.g. "only" warning signs before intersection/junction while riding vs. use of complex graphics in tutorial before starting to ride Training: • Raise awareness of turning scenarios, re-enact and practice situation • Train braking in danger situations	• *Humorous:* e.g., cartoon, mini-game • *Rational:* impart knowledge about problems of intersections, e.g. through hazard perception training • *Constructive:* present desired behavior (speed reduction, communication with other road users), do not show collisions • *Social norm:* depict peers, celebrities	Similarities to bicycle use: problem also relevant for cyclists → possibility of using or revising existing material and hazard perception training
Critical events	Pedestrians crossing the road	Pedestrians, especially children, can step abruptly into the roadway. • on segregated paths or shared-used paths, • in the area of bus stops, • on cycle paths, e.g. when pedestrians want to cross the road	Hazard awareness when there are large numbers of pedestrians, when there are children around or in the area of bus stops: • Speed adjustment and readiness to brake • Raise awareness that pedestrians might fail to see/hear the e-scooter or not expect it • Master hazard braking • Appropriate communication with pedestrians so as not to scare them and possibly trigger an unfavorable reaction	Video clips: • Illustrate development of the situation and the benefits of riding at an appropriate speed App: • Visually present the traffic situation, do not just describe it Training: • Create awareness for crossing situations • Re-enact and practice the situation, adapted to the participants' capabilities • Train hazard braking	• *Humorous:* e.g., cartoon, mini-game • *Rational:* impart knowledge about problems of crossing situations, e.g. through hazard perception training • *Constructive:* present desired behavior (speed reduction, communication with other road users), no collisions • *Social norm:* depict peers, celebrities	Similarities to bicycle use: problem also relevant for cyclists → possibility of using or revising existing material and hazard perception training; The topics "pedestrians crossing" and "not riding on dedicated cycling infrastructure" can be presented in combination

Topic		Description	Objectives	Format requirements	Target group-specific strategies	More tips
Critical events	Conflicts on cycling infrastructure	Shared use of bicycle infrastructure can lead to conflicts with bicycle traffic, among other things due to different speed/acceleration profiles (e-scooters: faster acceleration, low constant km/h; bicycles: slower acceleration, higher constant km/h). • Cyclists not leaving enough distance when overtaking and cutting in afterwards • Cyclists suddenly turning left • Oncoming cyclists, e-scooter users (wrong-way drivers) • Rear-end collision with cyclists/e-scooter users in front of the rider	Cooperation and mutual consideration on cycling infrastructure: • Make it clear that cyclists may underestimate the speed/acceleration of the e-scooter • Make it clear that cyclists may not leave sufficient space when overtaking and may cut in • Keep at a suitable distance from cyclists • Readiness to brake, especially when cyclists are overtaking • Improve vehicle control at narrow points, during stopping and starting maneuvers, and during overtaking maneuvers • Avoid rapid acceleration when starting off and merging into the traffic • Look over shoulder before overtaking	Video clips: • Illustrate differences in speed/acceleration between bicycle and e-scooter • Depict calm behavior when overtaking and being overtaken App: • Visually present the traffic situation, do not just describe it • Illustrate differences in speed/acceleration between bicycle and e-scooter Training: • Raise awareness concerning conflicts on cycling infrastructure • Talk about differences in speed/acceleration between bicycle and e-scooter • Re-enact situations and train control over vehicle	• *Humorous:* e.g., cartoon, mini-game • *Rational:* communicate problems of these situations, e.g. through hazard perception training • *Constructive:* present desired behavior (speed reduction, communication, successful interaction between bicycle and e-scooter), do not show collisions • *Social norm:* depict peers, celebrities	Emphasis on cooperation and understanding of the cyclists' perspective; avoid creating an "opposition" between bike and e-scooter

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Critical events	Dooring / stationary traffic	Danger of collision with parked vehicles or vehicles just driving off: • Sudden opening of doors of vehicles parked parallel to the roadway (Dooring) • Being overlooked when a vehicle is backing out of a parking space	Raise awareness of the hazards and encourage appropriate riding behavior when vehicles are parking in the vicinity: • Make it clear that doors may open without warning, that car drivers reversing out of parking space may fail to notice e-scooter riders • Speed reduction and increased braking readiness when vehicles are parked parallel to the roadway or vehicles are backing out of parking spaces • Keep a safe distance from parked vehicles • Improve control over vehicle, e.g. evasive actions	Video clips: • Development of the situation from point of view of e-scooter rider App: • Visually present the dangerous situation, do not just describe it Training: • Raise awareness concerning Dooring situations • Demonstrate and practice evasive maneuvers and hazard braking	• *Humorous:* e.g., cartoon, mini-game • *Rational:* communicate problems of these situations, e.g. through hazard perception training • *Constructive:* present desired behavior (speed reduction, successful hazard braking), do not show collisions • *Social norm:* depict peers, celebrities	Similarities to bicycle use: problem also relevant for cyclists → possibility of using or revising existing material and hazard perception training
Handling / Driving dynamics	Inexperience with braking systems	Lack of experience with the operation of the various e-scooter braking systems, lack of knowledge: • Electronic brakes • Disc brakes • Drum brakes • Foot brakes	Raise awareness of the different e-scooter braking systems: • Different models of e-scooters have different braking systems [before first ride on a rental e-scooter or before buying an e-scooter] • Before riding, check how the braking system is operated, e.g. to make sure that emergency braking is possible [especially users of rental vehicles]. • Start at low speed and test front and rear brake function [if type of braking system is unknown]	Video clips: • Illustrate the operation of different braking systems and their effects App: • Comprehensibly describe or illustrate the operation of braking systems and their effects Training: • Demonstrate different braking systems and train riders how to use them	• *Humorous:* e.g., cartoon, mini-game • *Rational:* Pros and cons of different braking systems • *Constructive:* desired behavior (successful hazard braking using different braking systems), no falls due to incorrect braking • *Social norm:* depict peers, celebrities	The topics "braking" and "steering" can be presented together.

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Handling / Driving dynamics	Standing position	If users stand on the e-scooter with their feet next to each other, they cannot shift their weight during the braking process.This increases the risk of falling.	Raise awareness for safe standing position when riding an e-scooter: • Stand with feet offset on the e-scooter as this allows the rider to shift their body weight when braking • When braking, bend knees a little and shift weight backwards • For braking systems with foot brakes: ensure the combination of a safe standing position and braking	Video clips: • Visually present the effects of a safe standing position on the ability to shift weight App: • Illustrate the effects of a safe standing position and provide information on the foot position on the footboard, e.g. by displaying an icon Training: • Demonstrate and practice the safe standing position, possibly in combination with braking	• *Humorous:* e.g., cartoon, mini-game • *Rational:* effects of correct standing position • *Constructive:* desired behavior (correct standing position), no incorrect positions • *Social norm:* depict peers, celebrities	There may not be one single correct standing position, but standing with both legs parallel should be avoided. It is also necessary to communicate that the standing position must be varied depending on the driving situation.
Handling	Steering maneuvers	Lack of experience with the steering of the e-scooter when taking curves and during evasive maneuvers increases the risk of falling	Safer steering maneuvers, improve control over vehicle: • Master steering at different speeds, curve radii, evasive maneuvers • Keep both hands on the handlebar	Video clips: • Show different steering maneuvers and associated weight shift App: • Animated display of how to take curves Training: • Demonstrate and practice different steering maneuvers	• *Humorous:* e.g., cartoon, mini-game • *Rational:* point out the problems of steering • *Constructive:* desired behaviur (correct steering), do not depict falls • *Social norm:* depict peers, celebrities	The topics "braking" and "steering" can be presented together.

Topic		Description	Objectives	Format requirements	Target group-specific strategies	More tips
Traffic rules/Rules of behavior	Alcohol	Consuming alcohol can lead to accidents due to longer reaction times and riding in pairs or against the intended direction of travel	Avoid riding under the influence of alcohol: • Make clear/demonstrate how strongly alcohol affects reaction time • Organize/plan how to return from the disco (or similar) in advance in order to avoid spontaneously taking the e-scooter	Video clips: • Demonstrate impaired responsiveness App: • Identify a form of communication that is effective even under the influence of alcohol (in the case of overconfidence), e.g. technically prevent riding depending on the results of a reaction test Training: • Raise awareness of dangers when riding under the influence of alcohol • Teach strategies, e.g., planning the trip home in advance	• *Humorous:* e.g., cartoon, mini-game • *Rational:* effects of alcohol • *Constructive:* desired behavior (avoid drinking alcohol), do not depict drunk persons • *Social norm:* depict peers, celebrities e.g. "drinking alcohol is not cool"	Existing educational material for car drivers (to prevent driving under the influence of alcohol) can be adapted (e.g. Baumann, Rossmann and Hastall, 2015). Difference to bicycle use: the legal alcohol limit is lower when riding an e-scooter than when riding a bicycle. The topics "alcohol", "riding in pairs", and "not riding on dedicated cycling infrastructure" can be presented in combination.

Topic		Description	Objectives	Format requirements	Target group-specific strategies	More tips
Traffic rules/Rules of behavior	Riding in pairs on an e-scooter	E-scooters are technically and legally intended to be ridden by only one person at a time. Riding in pairs on an e-scooter increases the risk of an accident. • The additional load changes the driving dynamics and increases the braking distance. • In the case of e-scooter models with foot brakes, the brake would have to be operated by the "passenger", meaning that this type of braking system is almost completely unavailable when riding in pairs.	Only one person should ride an e-scooter at a time: • Point out change in driving dynamics due to the additional load • Point out longer braking distance and associated risk of falling	Video clips: • Visually present longer braking distance when there is additional load on the e-scooter App: • Clearly explain the traffic rules and test participants' understanding of them (recall vs. recognition), e.g., by means of a mini-quiz and incentives (e.g., free minutes) • Provide incentives to encourage solo riding, e.g. discounts for group journeys • Technical solutions that prevent riding in pairs Training: • Do not practice riding in pairs (not even to demonstrate the longer braking distance)	• *Humorous:* e.g., cartoon, mini-game • *Rational:* effects of riding in pairs on driving dynamics • *Constructive:* desired behavior (one person per e-scooter), do not show riding in pairs on one e-scooter • *Social norm:* depict peers, celebrities e.g. "riding on your own is cool"	The topics "alcohol", "riding in pairs", and "not riding on dedicated cycling infrastructure" can be presented in combination.

Topic		Description	Objectives	Format requirements	Target group-specific strategies	More tips
Traffic rules/Rules of behavior	Not riding on dedicated cycling infrastructure	E-scooters ridden on the sidewalk or against the intended direction of travel can collide with other road users (in particular as they do not expect the e-scooter to be there). E-scooters may only be ridden on cycling infrastructure. If no cycling infrastructure is available, riding is also permitted on the roadway.	Avoid riding against the intended direction of travel and/ or riding on the sidewalk: • Show the areas on which e-scooters may be ridden [cycle paths, on-road cycle lanes firmly restricted to bicycles, advisory bike lanes; if no cycling infrastructure is available, riding is permitted on the roadway] • Raise awareness that other road users might not expect e-scooter riders who ride against the direction of travel; encourage the adoption of the other party's perspective • Point out that e-scooter riders cannot predict the behavior of pedestrians	Video clips: • Demonstrate correct choice of infrastructure – where is riding permitted? App: • Clearly explain the traffic rules and test participants' understanding of them (recall vs. recognition), e.g., by means of mini-quiz and incentives (e.g., free minutes) • Provide incentives for using the correct infrastructure, e.g. by using internal GPS Training: • Inform about the different kinds of cycling infrastructure and what it means to ride in the right direction	• *Humorous:* e.g., cartoon, mini-game • *Rational:* effects of not riding on cycling infrastructure • *Constructive*: desired behavior (riding on dedicated cycling infrastructure), do not show riding on the sidewalk or against the intended direction of travel • *Social norm:* depict peers, celebrities, e.g. "I always ride on cycle paths. People who ride on the sidewalk are not cool."	Relation to conflicts with cyclists and crossing pedestrians. Similarities and differences to bicycle traffic must be pointed out, e.g., in Germany the additional sign 1022-10 "open for cyclists" does not apply to e-scooters [except at one-way streets]. The topics "alcohol", "riding in pairs", and "not riding on dedicated cycling infrastructure" can be presented in combination.