

A Qualitative Video Analysis of motorcyclists' behavior

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This study examines the visibility and preventive riding of motorcyclists at intersections, focusing on how these factors affect traffic safety.



Using the Tobii Eye Tracker system, we recorded the riders' eye movements, while the forward-facing video showed how they navigated through traffic





Involving 62 motorcyclists, divided into three groups based on their riding experience and driving competence.

1. Novice: Motorcyclists with less than three years of riding experience who use motorcycles for leisure and utility riding.
2. Experienced Riders: Motorcyclists with more than three years of riding experience who regularly use motorcycles for leisure and utility riding.
3. “Professionals”: Motorcyclists with extensive professional experience, such as police officers who ride motorcycles for emergency response, motorcycle traffic instructors, and examiners for motorcycle driving tests, as well as instructors at motorcycle driver development courses, specifically for track riding.



We analyzed motorcyclists' driving through intersections in situations where they do not have the right of way but may be exposed to a collision with a road user who does not yield.

The driving behaviors were analyzed and categorized into three categories:

- positioning,
- preventive riding,
- attention and readiness at intersections.

Still image captured from video footage showing a typical intersection scenario where a motorcyclist is navigating a roundabout and the car driver is required to yield to the motorcyclist.



In this scenario, the focus is on the motorcyclist's behavior in relation to the black Tesla.

Categories	Dimensions
1. Visible Positioning The motorcyclist's visible position (not speed) in typical intersection situation where accidents often occur	A: Visible to road users with the right of way B: Less visible positioning
2. Preventive riding	A: Preventive B: Not preventive (Just riding) C: Creates risky situation
3. Attention and Decision. Attention and Decision Timing through Hazard Zones	A: Does not trust road users in the hazard zone B: Trusts road users who indicate they will stop in the hazard zone C: Uncritical riding

The results for the three categories are presented as dimensions, which describe the level of the barrier intended to prevent an unwanted incident from occurring.



Manifest Analysis

Latent Analysis

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, 2, 8–14. <https://doi.org/10.1016/j.npls.2016.01.001>

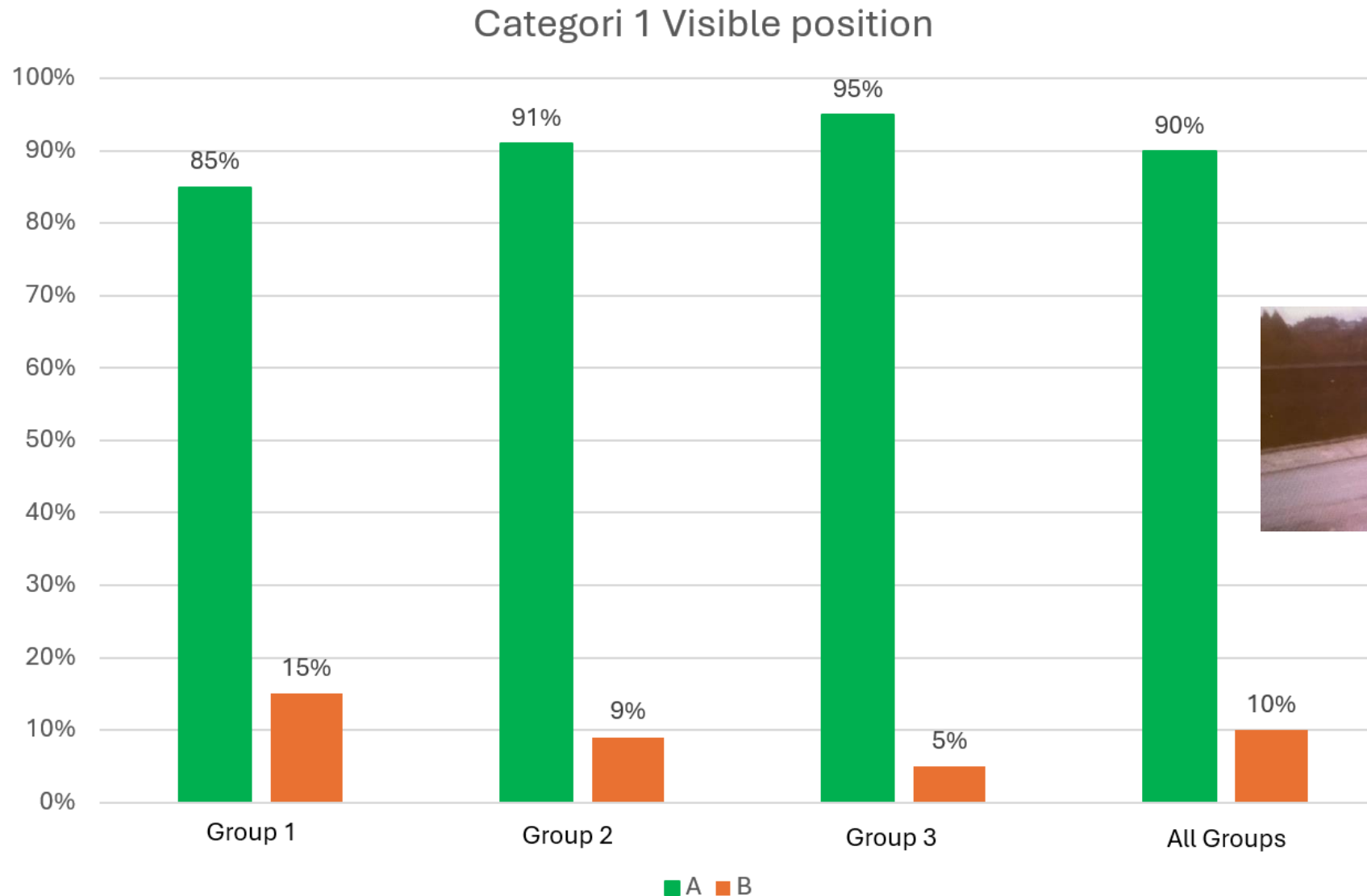
Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, 24(2), 105–112. <https://doi.org/10.1016/j.nedt.2003.10.001>

Heath, C., Hindmarsh, J., & Luff, P. (2010). *Video in qualitative research: Analysing social interaction in everyday life*. SAGE Publications.

The "Visible Position" category (1) addresses how motorcyclists make themselves visible to other road users through their positioning when approaching intersections.



In this context, visibility means that the motorcyclist has an unobstructed line of sight to the road user who must yield. We do not consider the duration of visibility to other road users in this category; time is included as a factor in the next category (2) concerning preventive riding.



Dimension A (green in figure 1) represents motorcyclists who “ride with a position that can make them visible to road users who is obliged to give way to the rider”.

Dimension B (orange in figure 2) are motorcyclists who “ride with a position that is not very visible”.

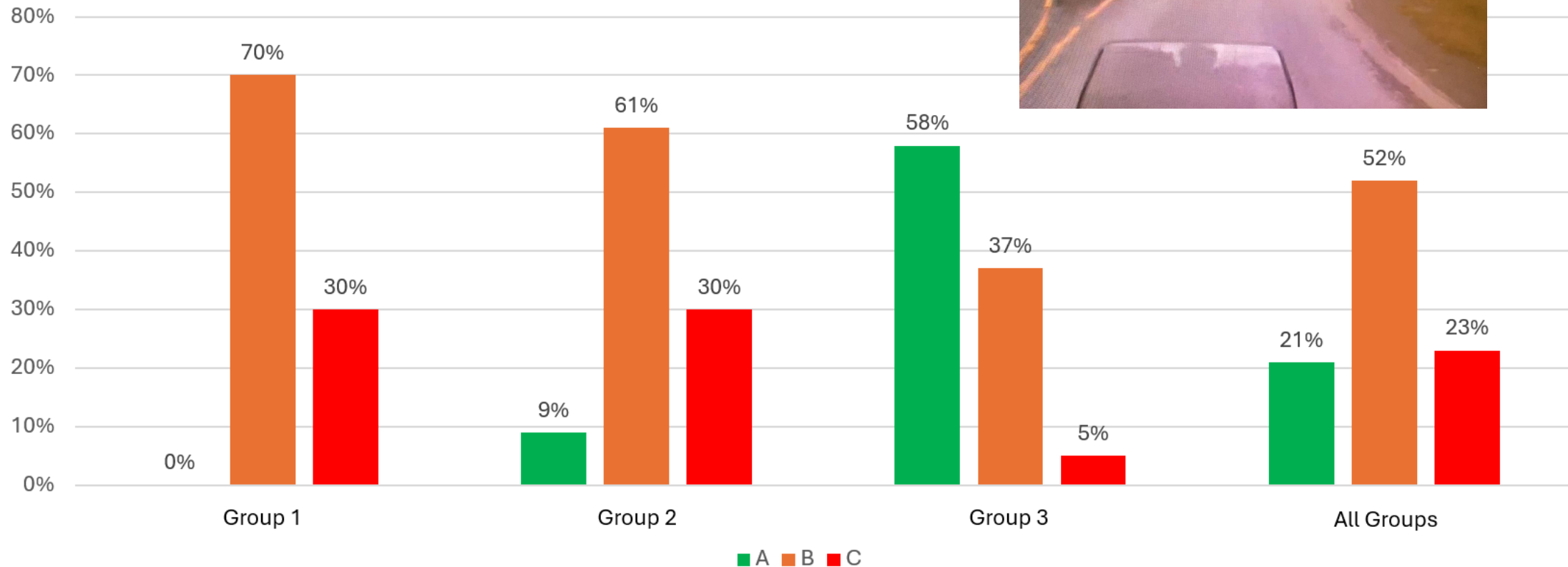


Preventive riding

This category (2) examines the extent to which motorcyclists avoid (prevent) or create dangerous situations at intersections, in scenarios where other road users must yield to the motorcyclist.

These situations include riding on a priority road where oncoming traffic must cross the road, or intersections where traffic from the side must enter the priority road. We also analyzed how the motorcyclist interacts with other road users who must yield to the motorcyclist before and within roundabouts, and when passing exits and parking lots.

Category 2. Preventive riding



Dimension A (green) are the motorcyclists who “ride preventively”.

Dimension B (orange) are those who “does not ride preventively or just ride”.

Dimension C (red) are those who “creates dangerous situations and makes it difficult for other road users to notice them”.

Category 3. Riders' attention and decision

This “Riders' attention and decision” examines how motorcyclists interact with other road users who must yield to them at various types of intersections, considering the vulnerability of motorcyclists to accidents at intersections.

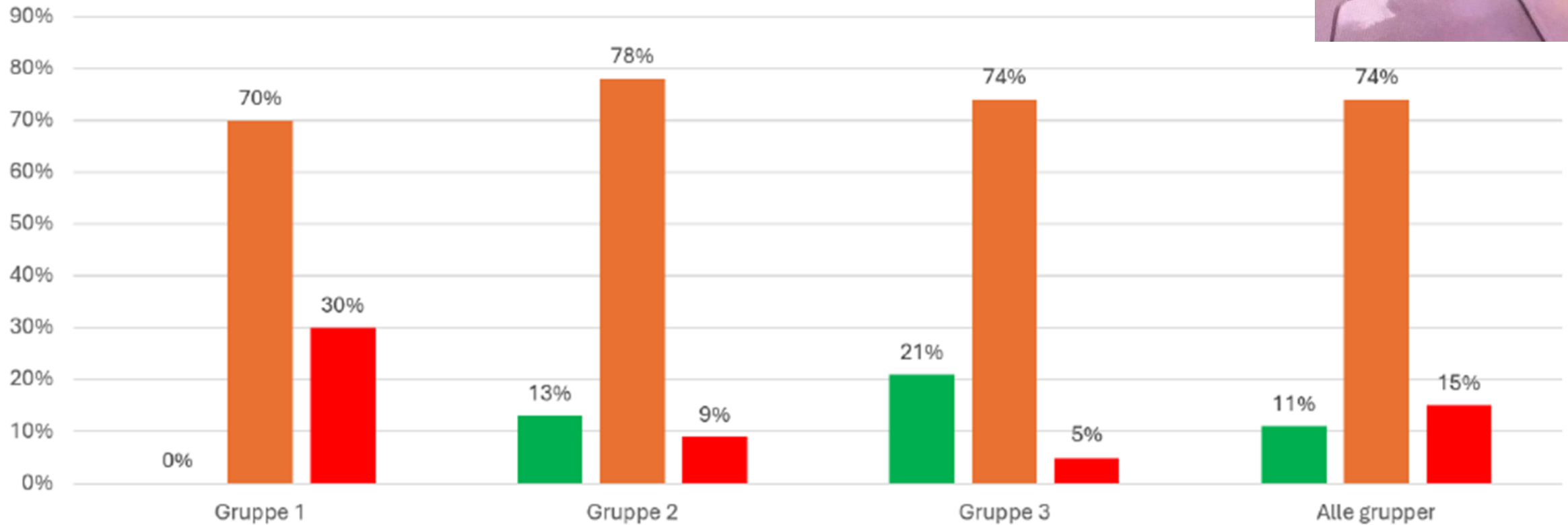
It focuses on how the rider observes other road users and maintains readiness through the intersection, in situations where there is a risk of collision if the other road user fails to yield.

Readiness is defined as an adequate combination of speed adjustment, positioning, and mental and/or physical braking readiness.



The stretch where there is a risk of collision is referred to as **the danger zone.**

Category 3. Riders' attention and decision



The three dimensions (A, B and C) are the following:

A (green): The motorcyclist does not trust road users who are in the motorcyclist's danger zone

B (orange): The motorcyclist "relies on road users who indicate to stop in the danger zone"

C (red): The motorcyclist rides uncritically through the danger zone

Conclusion



All groups generally have “good” visibility, with novices at 85%, experienced drivers at 91%, and professionals at 95%. Improving visibility can help prevent accidents.

Significant deficiencies in preventive driving exist across all groups, with only 21% of all drivers practicing it, suggesting a need for better training and evaluation.

Few drivers are vigilant throughout danger zones, with only 58% of professionals maintaining vigilance.

Motorcyclists should learn to be critical of other road users and remain vigilant throughout the entire danger zone where they might be hit at intersections. They must learn not to trust other road users, even if they make eye contact.



Young riders (A1)

Young A1(light motorcycle) drivers in Norway are overrepresented in fatal motorcycle accidents

Cognitive process underlying decisions and actions.

Public debate

Earlier studies on motorcycle

Young A1 riders face 36× the fatal or serious injury risk

Risk per distance travelled, compared with young car drivers

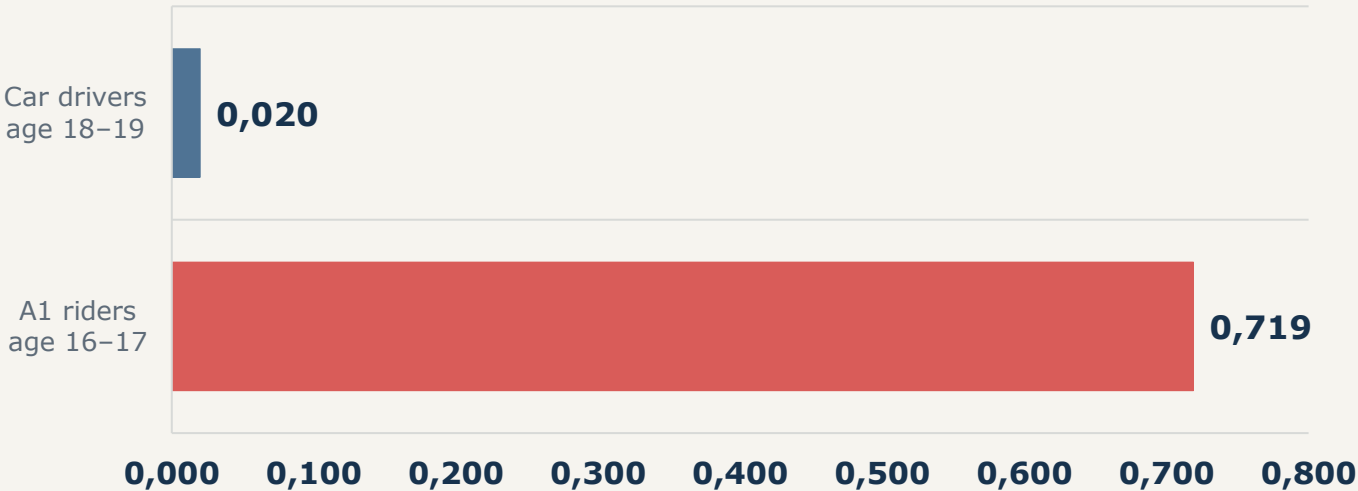
36×

as high

Killed or seriously injured
per million kilometres
travelled

Risk rate

Killed or seriously injured per million km



COMPARISON

A1 riders aged 16–17 vs car drivers aged 18–19

MEASURE

Annual average, 2021–2024

INTERPRETATION

Risk per distance travelled, not the total number of crashes

Survey of Light Motorcycle Use

SURVEY SAMPLE

3,580

RESPONDENTS

N = 3,580

 NETTSKJEMA

Rapport

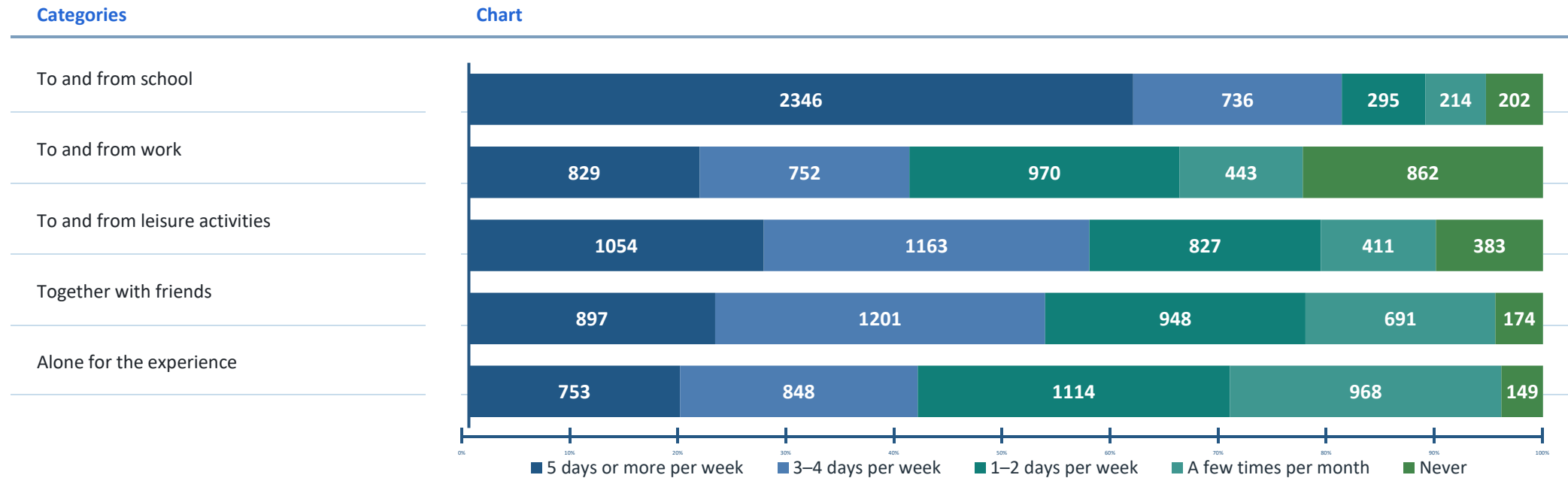
Spørreundersøkelse om bruk
av lett motorsykkel

AGE RANGE

16–18

YEARS

How often do you use your motorcycle for the following activities?



⌚ Have you personally been involved in a road traffic accident as a motorcycle rider?

Number of responses: 3,580

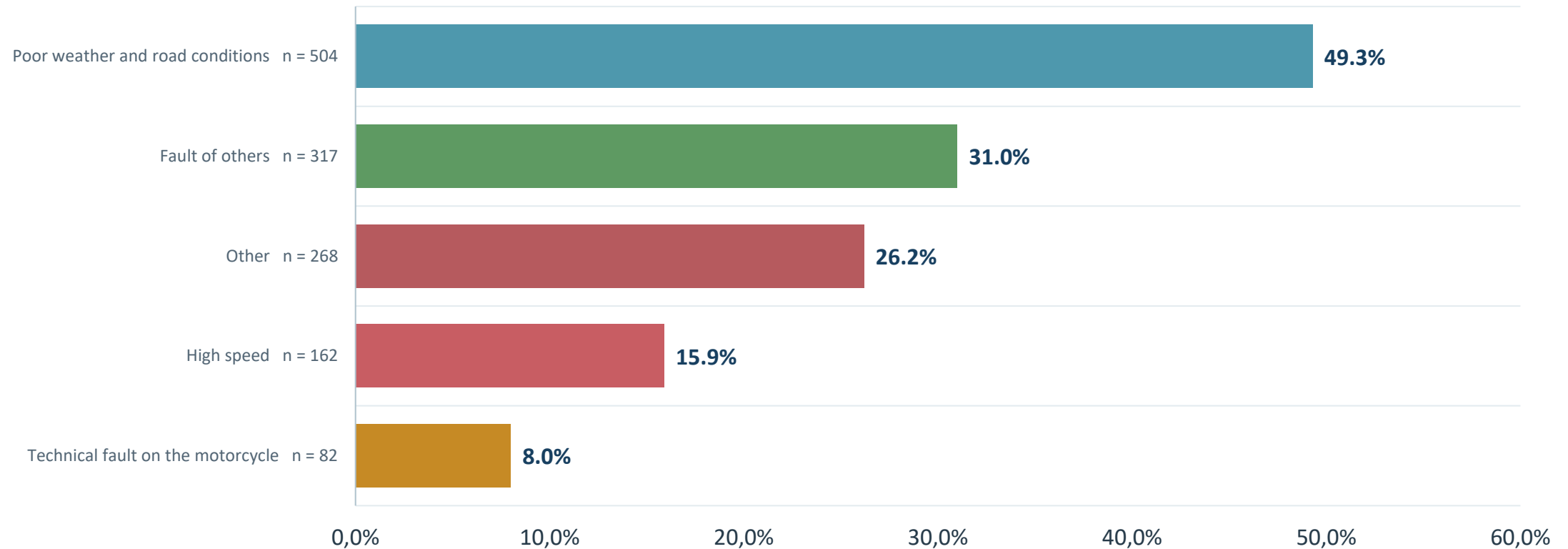
Response	Number	% of responses	Chart
Yes	1,022	28.5%	28,5%
No	2,558	71.5%	71,5%

What caused the accident or accidents?

Reported causes among riders involved in an accident

1,022

RESPONSES





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Understanding Young Rider's Behaviour through In-Depth Interviews

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Young riders of light motorcycles (A1) face a substantially elevated crash risk, with rates of serious injury and fatality reported to be more than fifty times higher than those of car drivers. Limited riding experience, inappropriate speed adaptation, and insufficient hazard anticipation are consistently identified as central characteristics in severe motorcycle crashes involving young riders. Despite comprehensive formal training, this group remains markedly overrepresented in loss-of-control and interaction-related crashes. The present article forms part of a broader research project examining the behaviour of young A1 riders through a combination of empirical methods, including mobile eye-tracking during real-world riding, retrospective video-assisted interviews, and in-depth interviews focusing on riders' own reflections on their behaviour in traffic. While the larger study explores several aspects of novice riders' behaviour, the current article specifically examines the riders' articulated plans, strategies, and interpretations of their own riding behaviour based on the in-depth interview material. Eighteen novice riders aged 16–18 participated in the study. Through semi-structured in-depth interviews, participants were invited to reflect on their riding experience and to describe the considerations, strategies, and decision-making processes that guide their behaviour in traffic situations. By focusing on how riders themselves describe and rationalize their behaviour, the analysis provides insight into the cognitive and interpretative frameworks that shape their tactical choices in traffic. Particular attention is directed towards how young riders conceptualize safety margins, anticipate potential hazards, and understand their own role in interaction with other road users. Based on this, the research question was formulated as follows: *What plans and strategies do young A1 motorcycle riders employ when navigating intersections and curves?*

Keywords: A1, Light Motorcycle, Young Riders, In-Depth Interviews, Traffic Safety

1. Introduction

Adolescents in Norway use motorised vehicles to travel between home and school, participate in leisure activities, and commute to and from work. At the same time, vehicles are used for social activities as well as recreation and enjoyment (Wold, T., & Wigum, J.P. 2024). The A1 licence (light motorcycle) therefore represents a relevant transport option for young people aged 16–18. After the age of 18, most individuals will typically acquire a car driving licence. Adolescent road users constitute a particularly vulnerable group. According to the Institute of Transport Economics (TØI, 2018), young riders of light motorcycles (A1) face a relatively high crash risk during

their first year after licensing. In Norway, the authorities have recently debated whether increasing the minimum age requirement could constitute an effective measure to reduce crash involvement among young A1 motorcycle riders (Norwegian Public Roads Administration [NPRA], 2025). Additional regulatory measures have also been considered, including periodic vehicle inspections, mandatory use of protective riding equipment, and restrictions on carrying passengers. The present study aims to examine the cognitive processes employed by this age group in traffic situations, to assess whether targeted educational interventions may also contribute to a reduction in future crash risk.

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Espoused Strategy versus Theory-in-Use in Young A1 Riders: Video and Eye-Tracking Evidence of Learning Gaps

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Young riders of light motorcycles (A1) are exposed to a markedly higher crash risk than car drivers, with rates of serious injury and fatality reported to exceed those of car drivers by more than fiftyfold. Severe crashes involving this group are consistently associated with limited riding experience, inadequate speed adaptation, and insufficient hazard anticipation. Despite comprehensive formal training, young A1 riders remain disproportionately represented in both loss-of-control and interaction-related crashes. This study examines young motorcyclists' stated strategies, their actual on-road behaviour and their own self-assessment after viewing themselves. Eighteen A1 licence holders (16–18 years) participated in a mixed-method field study combining on-road riding with video-assisted interviews afterwards. Participants completed a ride along a given route wearing mobile eye-tracking glasses. Along this route four Areas of Interests (AOIs) representing normal but demanding traffic contexts was selected for summative video analysis. This analysis focused on observable factors such as speed, positioning, riding line, technical handling of the motorbike, and behaviour in relation to hazards. Post-ride, semi-structured interviews were conducted, where each participant also viewed recordings of their own rides. After an interview analysis the results of the video analysis was compared to both the espoused strategies of the participants and their own reflections on their theory-in-use. The findings show that young riders articulated curriculum-consistent strategies before riding and were satisfied with their own performance, while video analysis revealed a mismatch between their espoused strategies and their theory-in-use. Against this background, the research question was formulated as: How do discrepancies between young A1 riders' espoused theories and their theories-in-use illustrate limitations in their development of double-loop learning?

Keywords: Motorbike, youth, reflection, video, interview, espoused strategy, theory-in-use, double loop learning, wickel competence.

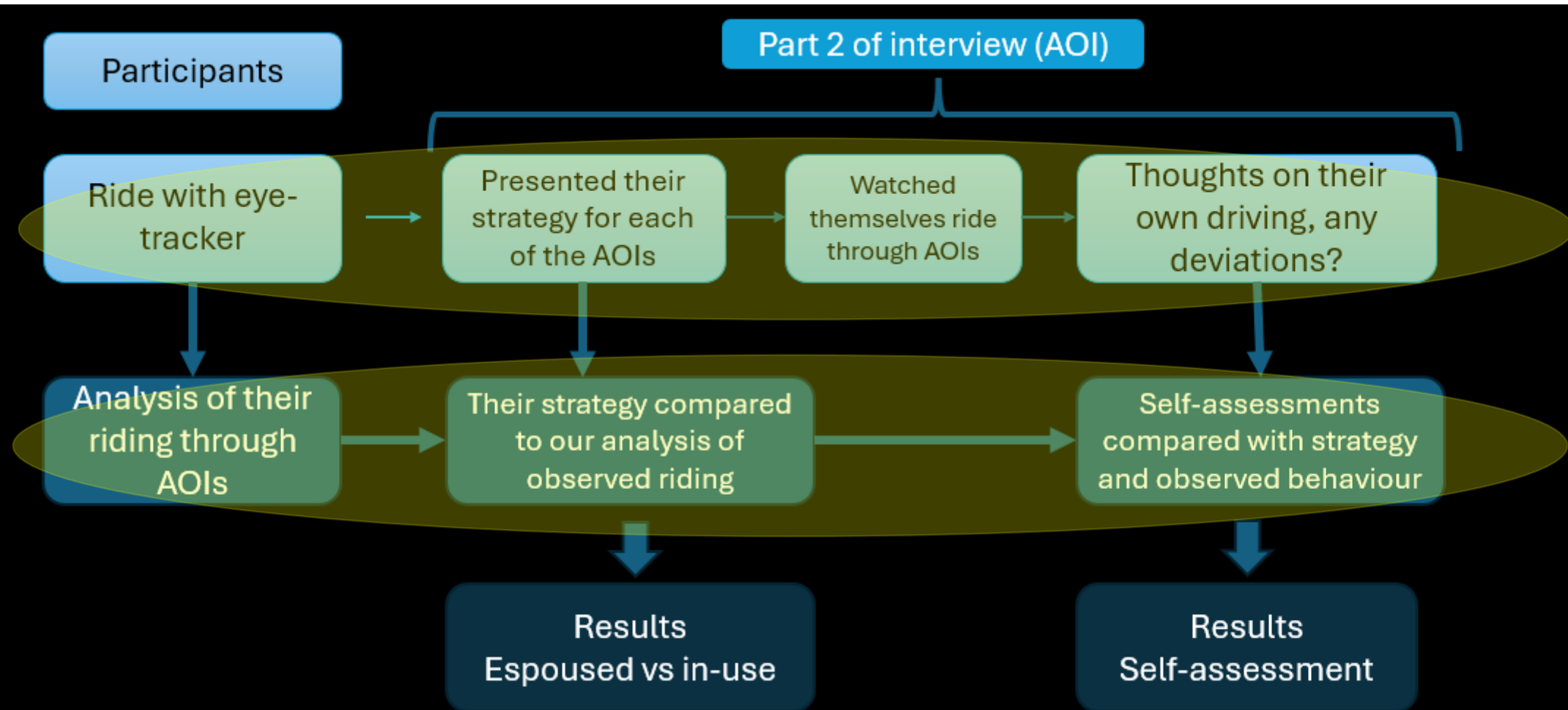
1. Introduction

The National Transport Plan 2022–2033 calls for renewed, targeted measures to reduce high-risk factors among vulnerable road users and highlights the need to revitalise work on motorcycle safety (Norwegian Ministry of Transport, 2021). Young riders of light motorcycles (A1) remain a pronounced high-risk group: rates of serious injury and fatality far

exceed those of car drivers, and novice status, inadequate speed adaptation and limited hazard anticipation are repeatedly implicated in crashes (Høy, 2017; Høy et al., 2016; Iversen & Njå, 2022). National analyses further show a sizeable proportion of A1 accidents are run-of-road or interaction related and occur without extreme speeding or substance use, indicating shortcomings in routine riding decisions rather

Project

- 18 participants
 - 1-2 years of A1 experience
 - Riding 2,000 to 12,000 km per season
- Ride
 - Eye tracker glasses
 - Pre-determined route with four areas of interest (AOI)
- Qualitative in-depth interviews
 - Part 1: General self-descriptions of their own riding
 - Part 2: AOI specific reflections based on video
- Methods
 - Systematic video analysis
 - Thematic analysis of interview data
 - Comparative analysis of eye-tracking data



Espoused strategy:

- Curriculum-consistent
 - For both intersections and curves
 - Speed
 - Positioning
 - Signalling
 - Long-range visual scanning
 - Limited trust in other drivers
- Intersections
 - No deep understanding
 - No comments regarding where other drivers could make errors
- Curves
 - Some deeper understanding
 - Some comments regarding where other drivers could make errors

Observed behaviour:

- Observation
 - Limited anticipatory scanning
 - Narrow visual attention
- Intersections
 - Not curriculum-consistent
 - High speeds
 - Unclear positioning
 - Created uncertainty for others and increased risk
 - Vigilant when required to yield, but less so when having priority
- Curves
 - Some rode curriculum-consistent
 - Limited use of lane-width
 - Many were very close to lane-boundary in left-hand curves
 - Some drifted outwards in sharper turns
 - Some performed abrupt speed-adjustments mid-curve
- Technical
 - Often used engine braking, and downshifted









Conclusions

- Their learning haven't been incorporated into their driving (single-loop)
- Gap between formal educational intent and experienced competence
- They're lacking wicked competence

Discussion topic:

- Hidden curriculum?
 - Deeper understanding of curves than of intersections
 - Public discourse centres around accidents in curves, which may affect both teachers and learners - could this be a reason for more reflection around curves?



Implications

- More focus on learning why and not only how (double-loop learning)
 - More exposure to complex situations might be needed
 - Builds wicked competence
- Separate starter course for A1 rider from A2-A
- Get rider learners to ride more with a reflective practitioner before getting the license
 - Involving parents in their learning