

ABS and more: Settings and Knowledge on Advanced Rider Assistance Systems of Motorcyclists in Germany

ABS und mehr: Einstellungen und Kenntnisse zu Fahrer-Assistenzsystemen der Motorradfahrer in Deutschland

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Abstract

With its present study ifz surveyed German motorcycle riders (n = 3,805) about the topic of Advanced Rider Assistance Systems for Powered Two-Wheelers (ARAS-PTW) and reveals the level of awareness of this modern technology as well as the riders' knowledge and attitudes towards different current systems.

In recent years, assistance systems for motorcycles have become increasingly important. But how well known are the various ARAS and how much knowledge about individual systems exists? The study provides a corresponding insight into the usage habits, handling skills and user acceptance. Additionally, tendencies regarding a possible over- or underestimation of the potentials of common, safety-relevant ARAS are analyzed. Among other things the results of the study will help to assess the image and user know-how of safety-related ARAS.

Zusammenfassung

Ein Schwerpunkt der vorliegenden ifz-Studie liegt in der Analyse der Einstellungen der befragten Motorradfahrer (n= 3.805) zu Fahrer-Assistenzsystemen an Krafträdern (FAS-M). Die Studie zeigt den Bekanntheitsgrad moderner Technik auf, ebenso Wissen und Einstellungen der Teilnehmer zu verschiedenen Systemen aus dem Motorradbereich.

Insbesondere in den letzten Jahren haben Assistenzsysteme für Motorradfahrer an Bedeutung gewonnen. Doch wie bekannt sind die verschiedenen FAS-M und wie ist das Wissen über einzelne Systeme ausgeprägt? Die Studie liefert einen entsprechenden Einblick in die Nutzungsgewohnheiten, Kompetenzen im Umgang und die Akzeptanz beim Nutzer. Analysiert werden zudem Tendenzen hinsichtlich einer möglichen Über- oder Unterschätzung der Potenziale gängiger sicherheitsrelevanter FAS-M. Die Ergebnisse der Studie sollen unter anderem dabei behilflich sein, das Image sowie das Nutzer-Know-how sicherheitsrelevanter Systeme einschätzen zu können.

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1 Information about the Study and the Collective

1.1 Task and Goal Setting

The results of this study should provide an insight into the attitudes and behavior of motorcyclists – especially with regard to “Advanced Rider Assistance Systems (ARAS)”.

The technical and also other developments of “Advanced Rider Assistance Systems (ARAS)” are of great interest. Although these are currently attracting the media’s attention, there have so far been hardly any rider-centered investigations in the field of Powered Two-Wheelers, in contrast to the passenger car sector. For this reason, we have investigated how motorcyclists in Germany think about these technical aids, what they know about them and where they see future challenges. Especially in recent years, assistance systems for motorcyclists have greatly gained in importance. But how prominent are the individual systems and what do motorcyclists know about the proper handling of them? The study provides an insight into the usage habits, handling competences and user acceptance. It also analyses tendencies with regard to a possible over- or underestimation of the potential of common, safety-relevant ARAS. The results of the study are intended to help, among other things, to present the image and user know-how of safety-relevant systems and to better evaluate riders' knowledge of these systems in order to close gaps in the long term here.

The online-survey carried out for this purpose gathered statements from a total of almost 4,000 participants.

1.2 Method

1.2.1 Questionnaire

Based on the motives described above, a comprehensive questionnaire was created to obtain detailed statements from motorcyclists that are active in Germany. The catalogue of questions has an extent of up to 70 core questions. Depending on the individual answer of a participant, constellations of questions based on each other could also lead to a reduction of the total number of questions if the filter questions were negated.

The answers to the individual questions were prescribed in various ways. These were the possibilities to make a selection within the framework of multiple-choice or to also formulate additional free answers.

For some questions, multiple answers were possible with regard to the multiple-choice solutions. This means that not only one but also several answers could be ticked off. The combination of given and free answers was also possible. Another possible answer to various questions was to be able to make a personal evaluation/weighting on a five-level Likert scale (see Fig. 1).

Fig. 1: Sample, Questionnaire

1.2.2 Online-Survey

On March 1, 2018 the opportunity to participate in the survey was made available online. The survey was carried out anonymously. The motorcyclists had the opportunity to take part in the online survey via the ifz's website (www.ifz.de). Calls for participation were delivered via the trade and daily press as well as via the common social media platforms. The questionnaire could be filled in directly online and transmitted to the ifz.

At events such as the motorcycle fair "MOTORRÄDER Dortmund 2018" visitors as well were given the opportunity to fill in the questionnaire at the ifz stand via online terminals. This was also offered to the visitors of INTERMOT COLOGNE 2018.



Fig. 2: Online-survey at events and at www.ifz.de

1.2.3 Timeline

Start of survey: March 1, 2018

Publication of interim results: October 1, 2018 (12th International Motorcycle Conference, Cologne)

End of survey: October 31, 2018

Final results: August 5, 2020

1.3 Participants

Extent

In the course of this study 3,805 motorcyclists took part in the ifz online-survey. All answers from motorcyclists with a minimum age of 18 years were evaluated. The share of survey participants who were also actively riding motorcycles at the time of participation was 97.2 percent. This was important to us, as statements made by currently active riders are to be incorporated into the results, particularly with regard to safety-relevant usage habits.

Riding Activity

At the time of the survey 97.2 percent of the participants were active motorcyclists.

Gender



The collective of respondents consists of 88.2 percent male and 8.9 percent female. 2.9 percent did not provide any information in this regard. The distribution of the sexes thus corresponds approximately to that of the total stock of motorcycles in Germany (source: Kraftfahrtbundesamt (KBA)¹)

Age



59.1 percent of the respondents can be assigned to the "50+" age group. The second largest share is made up of the 40- to 49-year-olds with 18.0 percent, followed by the age group of the 20- to 29-year-olds (10.1 %). The 30- to 39-year-olds follow at an almost identical level with a share of 9.7 percent. Young riders up to the age of 20 years are only represented with 2.2 percent. This age distribution approximately lines up with the distribution of the ownership age according to the German motorcycle stock.

The average age of the respondents is 49.1 years (median: 52.0 years), which according to the KBA complies fairly accurate to the average age of motorcyclists in Germany (50.4 years according to the Kraftfahrtbundesamt (KBA)²).

¹ Source: Kraftfahrt-Bundesamt (KBA), Flensburg, 1. Januar 2019.

² Source: Kraftfahrt-Bundesamt (KBA), Flensburg, FZ 23, 1. Januar 2018.

School-Leaving Qualification



To further examine various statements delivered by the participants, also against the background of their level of education, the disclosure of relevant school-leaving qualifications was requested. 1.1 percent of the participants did not respond to this. With 53.3 percent the largest share is made up of the participants who have completed the Abitur (general higher education entrance qualification). After that, with a percentage of 31.9 percent, the Realschulabschluss (secondary school certificate) follows. 13.7 percent of the collective reached a Hauptschulabschluss (lower secondary school certificate).

Starting Age "Powered Two-Wheelers"



When posing the question of when the participants started riding a Powered Two-Wheeler (PTW) it can be shown that 43.2 percent had ridden a moped (average starting age here according to the participants' statements between the age of 15 and 16). 53.6 percent of the collective started their "two-wheeled career" with a moped or light motorcycle (average starting age here according to participants' statements between 16 and 17 years). Therefore, more than half of the participating motorcyclists have been on the road on Powered Two-Wheelers since the age of 15 or 16. These motorcyclists have been riding on two-wheeled motorized vehicles since their youth and got to the motorcycle via vehicles subject to compulsory insurance (mopeds) and light motorcycles. 45 percent of the 3,805 study participants started motorcycling at the age of 18 regardless of any experiences with mopeds or light motorcycles.

At the ages immediately following, about five percent per each started riding motorcycles at the ages of 19 (5.2 %) and 20 (4.6 %). 3.5 percent started at the age of 21 years (direct entry until January 2013) and further 3.2 percent at the age of 25 (direct entry from January 2013). Almost 10 percent entered between the ages of 30 and 39 (9.9 %), 10.1 percent between the ages of 40 and 49. The remaining "starting ages" are distributed up to the entry age of 71. Up to and including the age of 50, 95.6 percent of the participants had found their way into motorcycling. From the age of 51 upwards, the figure equals only 4.4 percent.

Owning a Motorcycle / Different Types



97.2 percent of the collective own at least one motorcycle. With regard to different types of motorcycles, the intramural participant stock are as follows: The majority of participants by their own account move a vehicle that can be assigned to the category "Touring Bike". The group of riders of "Naked/Classic" motorcycles adds up to 23.3 percent, closely followed by the "Enduros" with 20.9 percent. With a share of 5.1 and 4.4 percent the types "Chopper" and "Sportsbike" are almost equal.

Scooters and others make up 3.3 percent. Riders of sporty machines ("Supersports Bikes") are represented with nine percent of the total share.

This distribution for the most part corresponds to the market shares of the segments according to information delivery by the KBA/IVM³. While the "Enduro", "Classic", "Supersport" and "Chopper" segments are more

³ Industrie-Verband Motorrad Deutschland, IVM-Jahresbericht (Annual Report) 2018.

or less congruent with the stock statistics, it is striking that the share of "Tourers" happens to be greater in the study, while that of "Sportsbikes" is smaller. The market shares according to the stock statistics of the German Motorcycle Industry Association (IVM) are the opposite. However, the totals for the two segments (Tourers + Sportsbikes) are comparable. Deviations for the unequal distribution at this point may be caused by the fact that the participating motorcyclists did not manage to classify their vehicles correctly in all cases. Whether "Sportsbike" or "Tourer" is the correct group to choose can be quite difficult to distinguish for some models. Many motorcycle models are considered to be so-called "Sports-Tourers", so that the participants had to choose one of the two groups with regard to the classification.

Year of Construction



With a share of 38.2 percent, most participants ride a motorcycle built between 2014 and 2018. The second largest sector: the years of construction 2009 to 2013 with 18.7 percent, relatively closely followed by motorcycles built between 2004 and 2008 (16.5 %). At 23.7 percent, more than a fifth of the participants ride vehicles that were built until 2003.

Annual Mileage



Only 6.9 percent of those surveyed ride their motorcycle for less than 2,000 km per year. 28.2 percent of the respondents state that they travel up to 5,000 km a year. The collective's majority (40.7 %) rides up to 10,000 km per year. 3.6 percent ride their motorcycle for more than 20,000 km a year.

The arithmetic mean of these figures lies at 8,703 km per year, the hereby more meaningful median at exactly 7,000 km. In the latter case, extreme outliers (very low and very high mileages) have little impact. The Federal Highway Research Institute (BAST) most recently determined an average annual mileage for motorcycles of 2,982 km per vehicle on the basis of a mileage survey for the year of 2014 ⁴.

⁴ Marcus Bäumer, Heinz Hautzinger, Manfred Pfeiffer, Wilfried Stock, IVT Research GmbH, Mannheim
Barbara Lenz, Tobias Kuhnimhof, Katja Köhler, Institut für Verkehrsforschung DLR, Berlin; BAST-Bericht V290, 2017.

2 Advanced Rider Assistance Systems on Motorcycles (ARAS-PTW)

A pronounced safety awareness and appropriate behavior in road traffic form an important basis for the reduction of the number of accidents. The users of motor vehicles, regardless of their type, thereby have a great responsibility. However, the possibilities for greater safety are also taking hold more than ever on the vehicle side, especially where technical systems support riders in traffic situations. A majority of all accidents are due to human error, as, for example, hazards are not recognized at all, too late or are even misinterpreted. The riding skills of road users also vary, which can lead to different results in extreme situations, particularly in the case of single-track vehicles. A central measure to improve road safety is therefore the support of the rider by technical systems. In recent decades, these systems have already made a considerable contribution to reducing the number of road traffic accidents. Modern rider assistance systems contribute to this by using the latest and most precise technology, can inform the rider at an early stage and thereby help to optimize the execution of his riding tasks. Growing rates of equipping rider assistance systems in vehicle fleets are expected to further increase road safety in the future.

As we know from another part of the ifz-studies, the safety awareness of German motorcyclists is at a high level. In addition to the aspects of technical safety of the machine, rider safety or the importance of rider equipment, which have already been examined, we aim to examine in the further course of the study what the knowledge, the attitudes and the handling of the questioned motorcyclists are with regard to Advanced Rider Assistance Systems for Powered Two-Wheelers (ARAS-PTW) on motorcycles.

Studies from the car sector show that user knowledge of individual systems needs to be improved. But how well known are the various motorcycle-specific ARAS among motorcyclists and how pronounced is their knowledge of individual systems? In recent years in particular, assistance systems for motorcyclists have become increasingly important and it is foreseeable that they will continue to penetrate the market. The following results should, among other things, help to estimate the image and user know-how of safety-relevant systems in the motorcycle sector more accurately.

2.1 The Necessity of ARAS-PTW

Anyone using a motor vehicle on public roads inevitably finds themselves in situations that can be dangerous, both for themselves and for other road users. This is also confirmed by the results on the question of whether the participants have been in one of the dangerous situations (listed in Figure 3) on their motorcycles at least once in the last twelve months.

At 14.8 percent, only slightly more than one in seven of the survey participants has not been involved in at least one of the critical situations indicated in the last twelve months. In contrast, the majority (85.2 %) had experienced a dangerous situation at least once.

Figure 3 reveals which situations these are, according to which 53.1 percent of the study participants were overlooked by another road user within the last twelve months. It is interesting to note that the need to brake in bends is already mentioned in second place: In 38.4 percent of cases, braking was necessary in an inclined

position, which must not necessarily have been a dangerous trigger. Nevertheless, for riders who are inexperienced in this area, there are risks which can be significantly minimized with appropriate technical assistance (Cornering ABS).

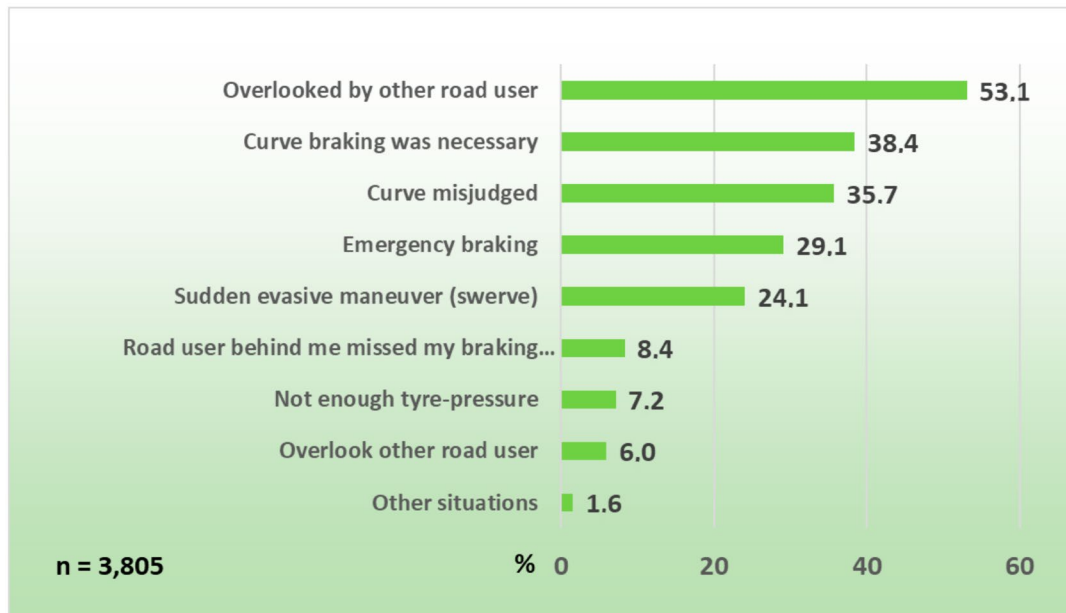


Figure 3: Critical situations on the road in the last twelve months

In most cases, these situations have turned out all right. In many cases, luck is one of the reasons for that, but it also shows that most road users are able to deal with these situations in everyday riding on the basis of their training and experience. Unfortunately, this is not always the case. Modern technology therefore represents a welcome opportunity to alleviate such conflicts and to relieve the riders in the accomplishment of complex riding tasks.

How useful and literally 'necessary' ARAS-PTW is, is shown by the statements made by the motorcyclists questioned about the riding situations that cause them the greatest difficulties in another ifz-study. The greatest challenge stated there is riding in the wet. Approximately 40 percent of the respondents answered that they had difficulties with this. For 30.3 percent of the riders, braking in an inclined position is a stress factor, and also in the third and fourth place on the scale, there are challenges resulting from cornering (assessing the corner correctly, driving in an inclined position). In all these cases, ARAS-PTW such as Cornering ABS or Traction Control, an adapted Mapping, but also a Semi-active Suspension System can make a considerable, possibly even decisive contribution to alleviating dangerous situations and providing greater security for riders in the problem areas mentioned above.

2.2 Defining ARAS-PTW

Already in 2010, the ifz dealt with Advanced Rider Assistance Systems within the scope of its study „Advanced Rider Assistance Systems For Powered Two-Wheelers (ARAS-PTW)⁵.

In the course of the research work carried out at that time, it was established that there are various existing definitions of rider assistance systems in literature. For this reason, the study attempted to give a definition for “Advanced Rider Assistance Systems for Powered Two-Wheelers” that would do justice to the vehicle or the riding of a Powered Two-Wheeler and its specific characteristics. ARAS-PTW also occupies a large space in the study at hand. In this respect, it seems helpful and reasonable to briefly outline the definition of “Advanced Rider Assistance Systems for Powered Two-Wheelers” formulated at that time. The definition refers exclusively to the vehicle level, i.e. to systems that can be assigned to the vehicle. A distinction has been made here quite deliberately, although numerous solutions exist starting at the level of personal rider equipment for riders of Powered Two-Wheelers. The background to this decision is the fact that it is based on the automotive sector, where no driver equipment is required.

Definition:

The term “Advanced Rider Assistance System for Powered Two-Wheelers” (abbr. ARAS-PTW) denotes equipment which supports and assists the operator of a Powered Two-Wheeler and/or reduces the stress and strain for the rider. It is a means of active safety (accident avoidance) but also influences accident results during a precrash-phase in a positive way. An ARAS-PTW should be assigned to at least one of the three levels of rider tasks (navigation level, maneuver level, operating level).

According to this definition, Advanced Rider Assistance Systems for Powered Two-Wheelers are mainly used for active safety. Thus, systems such as eCall or those that reduce fuel consumption and thus emissions, for example, do not fall into the group of ARAS-PTW.

A characteristic of ARAS-PTW, according to the definition above, is that the load and thus the strain on the rider is reduced by systems that, among other things, promote comfort. The field of ARAS-PTW also includes systems which draw attention to a Powered Two-Wheeler and its “unprotected rider” (self-protection) by giving acoustic and/or visual warnings to other road users. These can, for example, be vehicle-to-vehicle systems which are currently still under development but will have an enormous influence on traffic in the future.

In the following explanations and presentation of results, the abbreviation “ARAS-PTW” is mainly used to represent the term “Advanced Rider Assistance Systems for Powered Two-Wheelers”.

⁵ Kuschefski, A.; Haasper, M.; Vallese, A.: Fahrer-Assistenzsysteme an motorisierten Zweirädern (FAS-M), Studie des Instituts für Zweiradsicherheit, 2010.

2.3 Name Recognition of ARAS-PTW

Certainly, most motorcyclists will know the pure terms or names of most ARAS-PTW or have heard of them before. We did not want to pursue a general inquiry of the terms at this point. We are rather interested in which ARAS-PTW can be spontaneously (actively) named by participants.

Within the scope of a previous ifz-study from 2010, a total of 2,317 motorcyclists were asked at that time, among other things, which „Advanced Rider Assistance Systems for Powered Two-Wheelers (ARAS-PTW)“ they know or are able to name. The former answers indicated significant deficits in the knowledge of rider assistance systems. Today, ten years later, it is reasonable to assume that the participants in the current study are more familiar, at least in name, with those systems that have been in use for some time, i.e. are more established, due to the increasing market penetration of ARAS-PTW. In order to provide clarity here, in the current study, the participants were also asked whether they are familiar with ARAS-PTW and if so, which ones.

What should be noted here is that the participants were not provided with any specifications at this point. In other words, up to five ARAS-PTW should be mentioned. In the context of the replies, some participants sometimes listed systems that do not belong to the ARAS-PTW, such as the airbag. The needed deletion of this information led to the following result.

First nomination		Second Nomination		Third Nomination	
ABS	3,158	ABS	145	ABS	54
Cornering ABS	82	Cornering ABS	604	Cornering ABS	340
Stoppie Control	2	Stoppie Control	17	Stoppie Control	40
Wheelie Control	5	Wheelie Control	62	Wheelie Control	182
Mapping	3	Mapping	24	Mapping	93
Combined Braking System	11	Combined Braking System	70	Combined Braking System	91
Traction Control System	49	Traction Control System	1,335	Traction Control System	529
Semi-Active Suspension	8	Semi-Active Suspension	72	Semi-Active Suspension	113
Tire Pressure Monitoring System	4	Tire Pressure Monitoring System	62	Tire Pressure Monitoring System	154
Adaptive Brake Light	2	Adaptive Brake Light	3	Adaptive Brake Light	7
Cornering Light	1	Cornering Light	25	Cornering Light	69
Daytime Running Light	2	Daytime Running Light	10	Daytime Running Light	8
Cruise Control	10	Cruise Control	43	Cruise Control	128
Quickshifter	4	Quickshifter	20	Quickshifter	64
Hill Start Assist	3	Hill Start Assist	19	Hill Start Assist	38
Side View Assist	2	Side View Assist	1	Side View Assist	8
Automatic/Dual-Clutch Transmission	1	Automatic/Dual-Clutch Transmission	7	Automatic/Dual-Clutch Transmission	22
		Hazard Warning Light	7	Radio with Traffic Information	1
				Hazard Warning Light	4

Fig. 4: Frequencies of the mentions of ARAS-PTW

It is not surprising that the ABS assistance system is ranked number one in the first nominations. 3,158 participants actively named the antilock braking system at first (89.7 % of first answers). This is undoubtedly the best-known ARAS-PTW up to now. In the 2010 ifz-study, 75.6 percent of three answers given or ARAS-PTW mentioned were ABS first. While only one ARAS-PTW could be named at that time, the answer was ABS in 93 percent of cases. Back to the current study: In second place comes the equally popular ARAS-PTW "Traction Control" (39.1 percent of the second answers). In third place, the majority of participants named the "Traction Control" as well (15.8 %). Those who already mentioned this system in the second place, self-evidently stated a different ARAS-PTW in the third place. Here, the Cornering ABS dominates with 340 entries.

In comparison to the above mentioned previous survey from 2010, it can be noted that the proportion of those who were not able to name an ARAS-PTW has decreased significantly. More than one fifth of the respondents (20.9 %) were not able to name an ARAS-PTW at the first go, even though it was assumed in 2010 that almost everyone must have heard of “ABS” and its level of awareness at that time. The current figures look different here: This time only 4.8 percent of motorcyclists were not able to name an ARAS-PTW or gave an incorrect answer. On the part of those questioned, the difficulty at the time may have been to make sense of the term “Rider Assistance System”. The initial situation was therefore different in 2018, as the term has become established. The proportion of respondents who were able to name the required three rider assistance systems in 2010 was one third.

2.4 Participants’ General Knowledge about ARAS-PTW

2.4.1 General Knowledge on the Subject of ARAS-PTW available

With a share of 40 percent, the majority of the participants with their knowledge about ARAS-PTW is located in the middle of the field (Fig. 5). In contrast, only 6.1 percent of those surveyed consider their ARAS-PTW-knowledge to be excellent, while a good fifth (22.9 %) believe that they are well informed.

In terms of this very general question, the participants were able to classify their knowledge on a five-level Likert scale between the poles 1= “excellent” and 5= “not at all”. For the evaluation, the first and last two classifications above and below the “neutral” value ‘3’ were combined. According to this, 29 percent of the entire group rated their own knowledge as positive and 31 percent (rather) as negative or non-existent. Evaluations also showed that 91 percent of those who assess their knowledge about ARAS-PTW as good to very good have practical experience with systems. In the middle field (3), the proportion of participants with practical experience is 79.8 percent. Among those who assess their knowledge rather negatively, only half of them have their own experience with assistance systems (53.7 %).

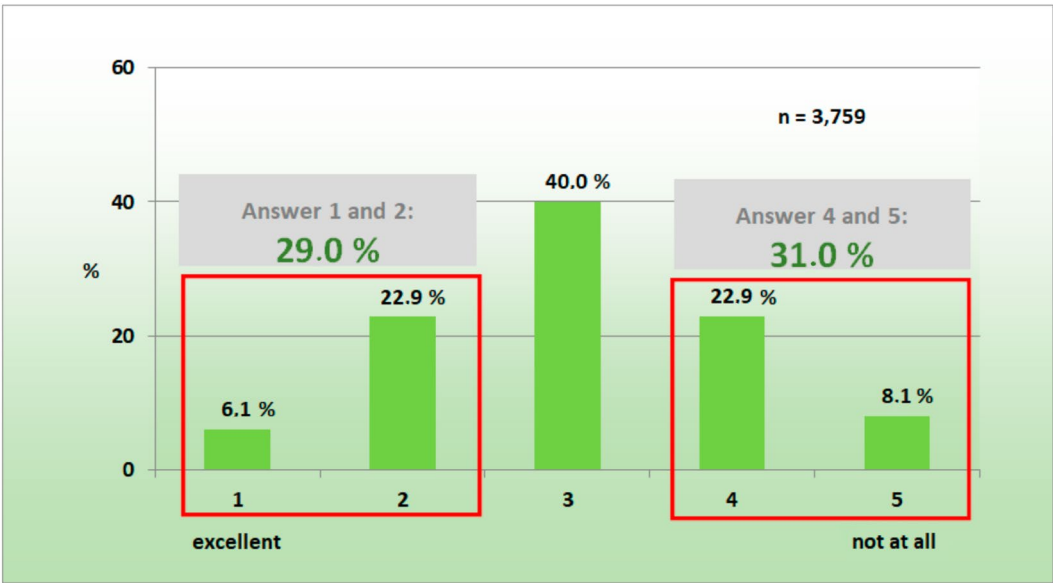
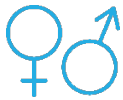


Fig. 5: Participants' general knowledge about ARAS-PTW

If the positive response values 1 and 2 are added together with response 3, i.e. those that are in the middle of the field in terms of knowledge, the resulting value is 69 percent. This means that significantly more than two thirds of the participants assess their general knowledge about the topic "ARAS-PTW" as ranging from excellent to average.



There is a big gap between the sexes in this self-assessment. While only 12.2 percent of female riders consider their knowledge about ARAS-PTW to be good or better, this figure is significantly higher for male riders at 30.8 percent. The group of those who assess their own knowledge rather negatively is already quite large among the male participants with 28.3 percent. Among the female participants, the figure is even more than half (57.6 %).



Differences also arise with regard to the age of motorcyclists. In the group of under 30-year-olds, only a quarter (25.1 %) stated that they were good to excellent. 34.4 percent saw themselves as having little to no knowledge. With increasing age, the proportion of participants who assess their own knowledge in this area positively then increases significantly.



The annual mileage also has an influence on the general ARAS-PTW-knowledge. With increasing annual mileage, the proportion of those who have a better knowledge increases. For riders with an annual mileage of more than 10,000 km, the proportion is above average. Exactly the opposite is the case for low annual mileage. Riders with an annual mileage of up to 2,000 km attest to a low general knowledge level of over 50 percent.

In view of the fact that a large number of new, often complex systems have only been installed in recent years, the current state of knowledge can be assessed positively. Furthermore it can be expected that with the increasing spread of rider assistant systems, more and more motorcyclists will gain additional knowledge. At the latest when their own new machine comes with a variety of safety-relevant features, riders will deepen into the subject matter. A causal relationship which is substantiated by the following chapter.

2.4.2 Source of ARAS-PTW Knowledge

The general knowledge about the subject of ARAS-PTW primarily arises (38.7 %) from own experience with the systems installed on one's own motorcycle (Fig. 6). This leading position in the range of information sources suggests that the best way to increase knowledge about ARAS-PTW is to use it oneself ("learning by doing"), which is also confirmed by the corresponding contexts of other questions. Again, it should be noted that more than 60 percent of the study participants ride a motorcycle that is older than four years, which limits the possibility of gaining their own experience with more recent systems. This also explains the relatively low level of awareness of newer, more advanced systems documented in 2.3.

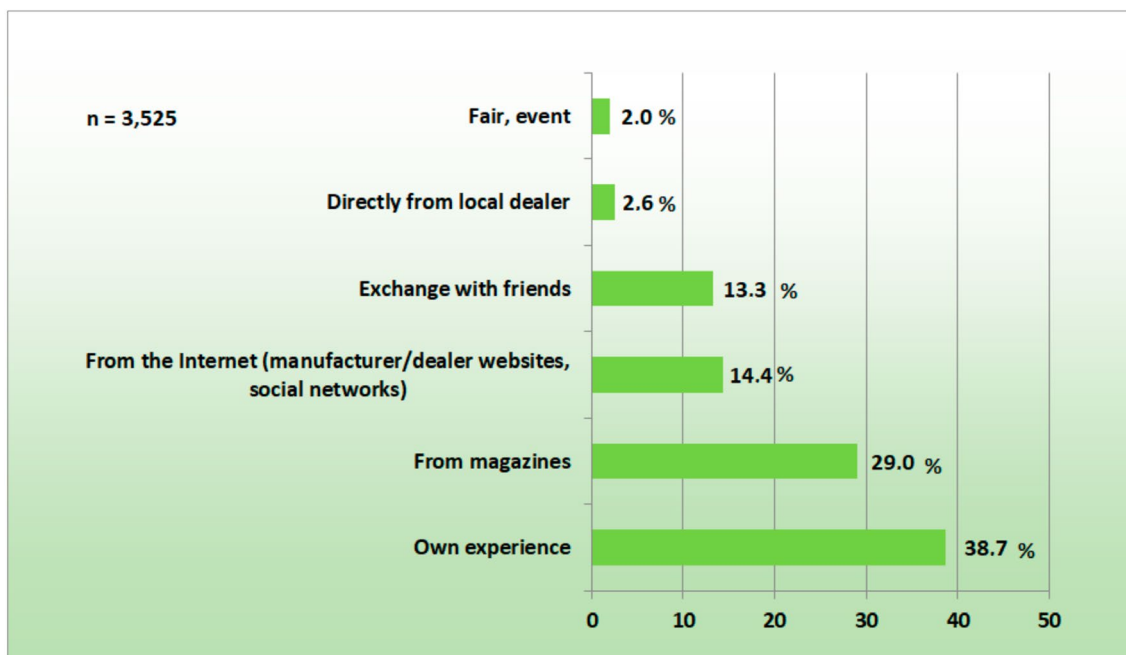
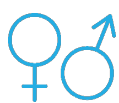


Fig. 6: Origin of general knowledge regarding ARAS-PTW

Almost one third (29 %) of knowledge about rider assistance systems stems from reading specialist journals. The internet and social networks follow at a noticeable distance as a source of knowledge about rider assistance systems (14.4 %). 13.3 percent of the participants obtain their knowledge from the exchange with friends and acquaintances. Information provided by motorcycle traders does not yet play a major role with regard to the general knowledge about ARAS-PTW surveyed here (2.6 %) but becomes more important in the field of specific information (see 2.5.2). Trade fairs and events represent the smallest area, at two percent, for obtaining or recording specialist information about ARAS-PTW.



With regard to the origin of knowledge about ARAS-PTW, cross-comparisons allow to identify gender-specific differences. While the internet and knowledge gained from experience with the own motorbike are mentioned by both genders with approximately the same frequency, men draw more knowledge from specialist journals (28.3 % compared to 11.6 %). Women make more frequent use of exchanges with friends and acquaintances (28.5 % compared to 10.6 %). Women also rely more often on information gained directly from the trader (4.5 % compared with 2.1 %).



In terms of age, it is the younger riders (up to 39 years) who make more use of the internet. Social media are also increasingly used by younger riders, but only up to the age of 29. Knowledge gained from experience with their own motorcycles increases with age, as does the use of specialist magazines. Younger riders dominate the acquisition of knowledge via friends and acquaintances, although this source of information is used less and less with increasing age. Information from the trader and through visits to trade fairs/events is balanced according to age.



With regard to school-leaving qualifications, there are at best slight differences in the field of knowledge acquisition, and there are no differences at all between everyday and leisure-time riders.

One final observation seems interesting here: Those who stated that they intended to buy a brand-new motorcycle in the near future have gained most of their ARAS-PTW-specific knowledge from their own experience with the current motorcycle.

2.4.3 Specific Knowledge about selected ARAS-PTW

In 2014 the German Academy of Driving Instructors had examined the subject-specific knowledge of car drivers with regard to various driver assistance systems and concluded that some of the respondents had some knowledge about the functionality of ARAS, but that the exact modes of action are still insufficiently known ⁶. The following figure illustrates the individual levels of expertise among the group of motorcyclists who took part in the ifz-survey.

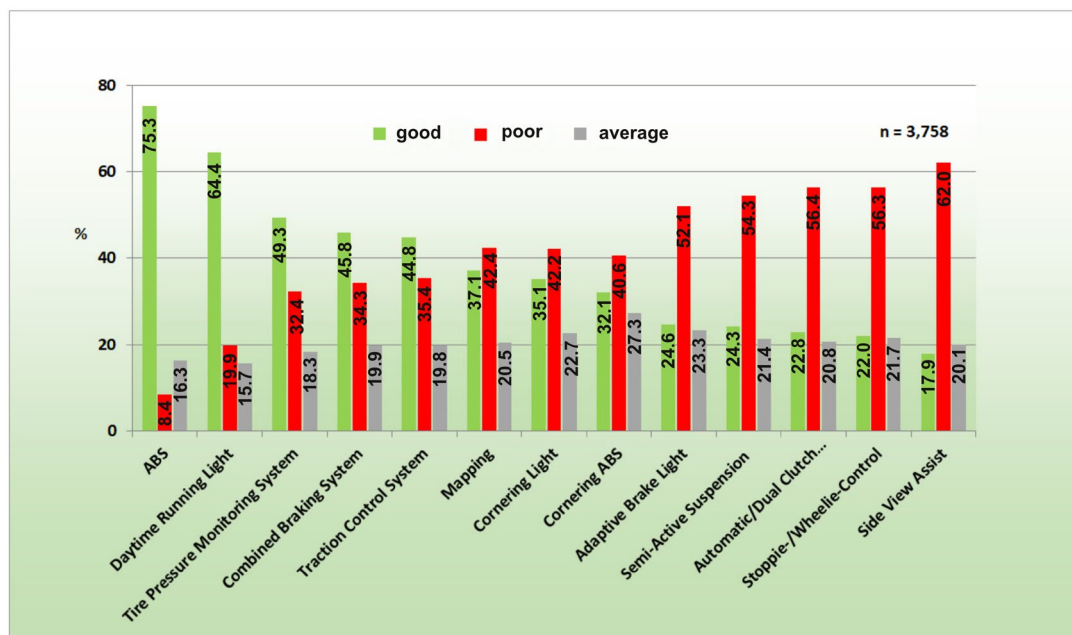


Fig. 7: Participants' level of knowledge about ARAS-PTW

Also for this question, the participants were able to assess their knowledge or expertise in various rider assistance systems on a five-level Likert scale (1= "excellent"; 5= "poor").

The green bars in Figure 7 show how many of the participants rated their knowledge as good to excellent (=1-2 on the scale). The figure illustrates that greater knowledge is available, above all, in the case of systems that have been on the market for some time and are therefore more established. Conversely, the shares of those with a low level of knowledge increase for systems that have not yet become widely used by comparison.

⁶ Maier, F.: Wirkpotentiale moderner Fahrerassistenzsysteme und Aspekte ihrer Relevanz für die Fahrausbildung, Korntal-Münchingen: Deutsche Fahrlehrer-Akademie e.V., 2014.

The latter observation can be demonstrated particularly vividly by using the example of ABS, which represents the classic rider assistance system. This best-known system was first fitted as standard on motorcycles in 1988 and was present on 68.5 percent of the participants at the time of the survey. More than three quarters of those surveyed stated that they were well informed about antilock braking systems (75.3 %). However, the figures are already significantly lower for another development stage of ABS, namely Cornering ABS, which enables technically controlled braking even in leaning positions. At 32.1 percent, less than half of the motorcyclists surveyed stated that they had knowledge. Here, the fact that so far only 12.1 percent of the participants own a motorcycle equipped with this technology certainly plays a role. The grey bars, however, prove that Cornering ABS has arrived in the minds of motorcyclists. After all, it is the assistance system that is most frequently used in the area of mediocre knowledge (27.3 %).

Although Daytime Running Light is only "on board" for 30.6 percent of the participants, more than twice as many (64.4 %) have good to very good knowledge of it. The influence of a technology already familiar from the automotive sector is unmistakable here.

The situation is similar with the Tire Pressure Monitoring System, which about half of the participants know well to very well, although it is only part of the equipment on the motorcycle in 17 percent of cases. At the other end of the scale, the low level of familiarity with the Side View Assist, which is already frequently used in cars (also known as Blind Spot Assist), is striking. Here, 62 percent of the participants have little or no knowledge of this ARAS-PTW. However, this system has not yet found its way into the motorcycle sector (see 2.7.2).

90.1 percent of the participants stated that they already had experience with driver assistance systems in passenger cars. Many of the available results indicate that the dissemination of participants' experience with ADAS in passenger cars has an impact on the participants' knowledge about motorcycles. However, this is not mandatory in every case, if one recalls the example of the Side View Assist. ARAS-PTW is an independent category of assistance systems with specific functional logic. Understanding and correctly using them requires a targeted approach to their respective characteristics and possibilities, a point which is also confirmed in the following chapter when it comes to functional knowledge.

The following table provides detailed correlations regarding the level of knowledge about individual systems for selected characteristics. The values within the table refer to the information on the respective Likert scale 1 to 5 (1= "excellent"; 3= "medium"; 5= "poor").

ARAS-PTW	Sex	Age	Purchase Intention Motorcycle	Annual Mileage	Type of Motorcycle owned
ABS	Males tend to 1 & 2; Females: strong center (3)	Almost no differences Youngsters (under 20) stand out slightly with good knowledge (1 & 2)	If 1 & 2 combined: New bike: 80.9 % Used bike: 72.0 % No intention: 75.5 %	Higher level of knowledge with increasing mileage	Almost no differences Chopper riders with significantly less knowledge
Daytime Running Light	Men generally rate their knowledge better	Almost no differences People under 50 stand out slightly with good knowledge (1 & 2)	Almost no differences Purchasers of new bikes stand out slightly positively (1 & 2) (<i>no significance</i>)	No noticeable features	No noticeable features
Tire Pressure Monitoring System	Males strongly tend to 1 & 2 Female answers concentrate slightly on the midfield (3)	No noticeable features	Almost no differences Purchasers of new bikes stand out slightly positively (1 & 2)	Higher level of knowledge with increasing mileage	Almost no differences Chopper riders with significantly less knowledge
Combined Braking System	Men strongly tend to 1 & 2 Female answers concentrate slightly on the midfield (3) Two thirds of women show a negative level of knowledge	Higher level of knowledge with increasing age, whereas youngsters (under 20) stand out with good knowledge	Almost no differences Purchasers of new bikes stand out slightly positively (1 & 2)	Higher level of knowledge with increasing mileage Compared to less frequent riders (up to 2,000 km/year), the knowledge of frequent riders (5,000 to 10,000 km/year) is twice as high	Chopper riders with significantly less knowledge Riders of naked and classic bikes show lesser knowledge
Traction Control System	Men strongly tend to 1 & 2; 3: balanced; Two thirds of women show a negative level of knowledge (4 & 5)	Almost no differences Youngsters (under 20) stand out slightly with good knowledge (1 & 2)	If 1 & 2 combined: New bike: 59.0 % Used bike: 39.6 % No intention: 44.0 %	Higher level of knowledge with increasing mileage Compared to less frequent riders (up to 2,000 km/year), the knowledge of frequent riders (5,000 to 10,000 km/year) is twice as high	Almost no differences Chopper riders with significantly less knowledge
Mapping	Men tend to answers 1 & 2 3: balanced More than two thirds of women show a negative level of knowledge (4 & 5)	Almost no differences Youngsters (under 20) stand out slightly with good knowledge (1 & 2)	If 1 & 2 combined: New bike: 50.5 % Used bike: 33.4 % No intention: 35.9 %	Higher level of knowledge with increasing mileage	Chopper riders with significantly less knowledge Riders of naked, classic and touring bikes show lesser knowledge

ARAS-PTW	Sex	Age	Purchase Intention Motorcycle	Annual Mileage	Type of Motorcycle owned
Cornering Light	Fairly balanced Males show a slightly higher level of knowledge	Younger riders tend to have more knowledge. Riders under 30 years of age with good knowledge	If 1 & 2 combined: New bike: 44.3 % Used bike: 37.2 % No intention: 33.4 %	Higher level of knowledge with increasing mileage	Almost no differences Chopper riders with significantly less knowledge
Cornering ABS	Men prefer answers 1 to 3 More than 50 % of women show a negative level of knowledge (4 & 5)	Almost no differences	New bike (1 & 2): 46.3 % Used bike: 31.8 % No intention: 30.3 %	Higher level of knowledge with increasing mileage	Almost no differences Chopper riders with significantly less knowledge
Adaptive Brake Light	Men prefer answers 1 to 3 More than 50 % of women show a negative level of knowledge	Almost no differences	If 1 & 2 combined: New bike: 31.8 % Used bike: 23.5 % No intention: 23.8 %	Higher level of knowledge with increasing mileage	Almost no differences Chopper riders with significantly less knowledge
Semi-active Suspension System	Men generally rate their knowledge better More than 60 % of women show a negative level of knowledge	Higher level of knowledge with increasing age	If 1 & 2 combined: New bike: 36.5 % Used bike: 20.6 % No intention: 23.3 %	Higher level of knowledge with increasing mileage	Chopper riders with significantly less knowledge Riders of naked and classic bikes show lesser knowledge
Automatic; Dual-Clutch Transmission	Men prefer answers 1 to 3 More than 50 % of women show a negative level of knowledge	Almost no differences	If 1 & 2 combined: New bike: 27.5 % Used bike: 25.5 % No intention: 21.8 %	Higher level of knowledge with increasing mileage	Almost no differences Chopper riders with significantly less knowledge
Stoppie & Wheelie Control	Men generally rate their knowledge better More than 65 % of women show a negative level of knowledge (5)	Almost no differences Riders under 20 show outstanding good knowledge (1 & 2)	If 1 & 2 combined: New bike: 33.4 % Used bike: 23.4 % No intention: 21.2 %	Higher level of knowledge with increasing mileage	Variances between different types of bikes owned Remarkable: Higher level of knowledge among riders of supersport machines

ARAS-PTW	Sex	Age	Purchase Intention Motorcycle	Annual Mileage	Type of Motorcycle owned
Side View Assist	Men generally rate their knowledge better	Riders up to the age of 30 reveal a slightly higher level of knowledge than older ones	If 1 & 2 combined: New bike: 23.8 % Used bike: 18.9 % No intention: 16.9 %	Almost no differences Frequent riders (over 20.000 km/year) stand out positively	Almost no differences Chopper riders with significantly less knowledge

Tab. 1: Correlations to the level of knowledge

At this point, we would like to note that especially the riders of scooters indicated a consistently good level of knowledge about all systems. It was also noticeable in the evaluation that the riders of super sports motorcycles showed a rather moderate level of knowledge.

2.5 Knowledge in Dealing with ARAS-PTW

74.5 percent of the study participants have their own practical experience with motorcycles equipped with rider assistance systems.



While more than three quarters of the men surveyed have practical experience with ARAS-PTW, the proportion is somewhat lower among women, at just under two thirds.



With increasing age, these experience values increase slightly but noticeably for both sexes.

2.5.1 Use of Rider Assistance Systems

Although the topic of assistance systems is not only booming in the motorcycle sector, it is not a new one. Rider assistance systems have been available for many years, some of them have been in use for decades. The following Figure 8 provides information on which of them have become correspondingly more widespread.

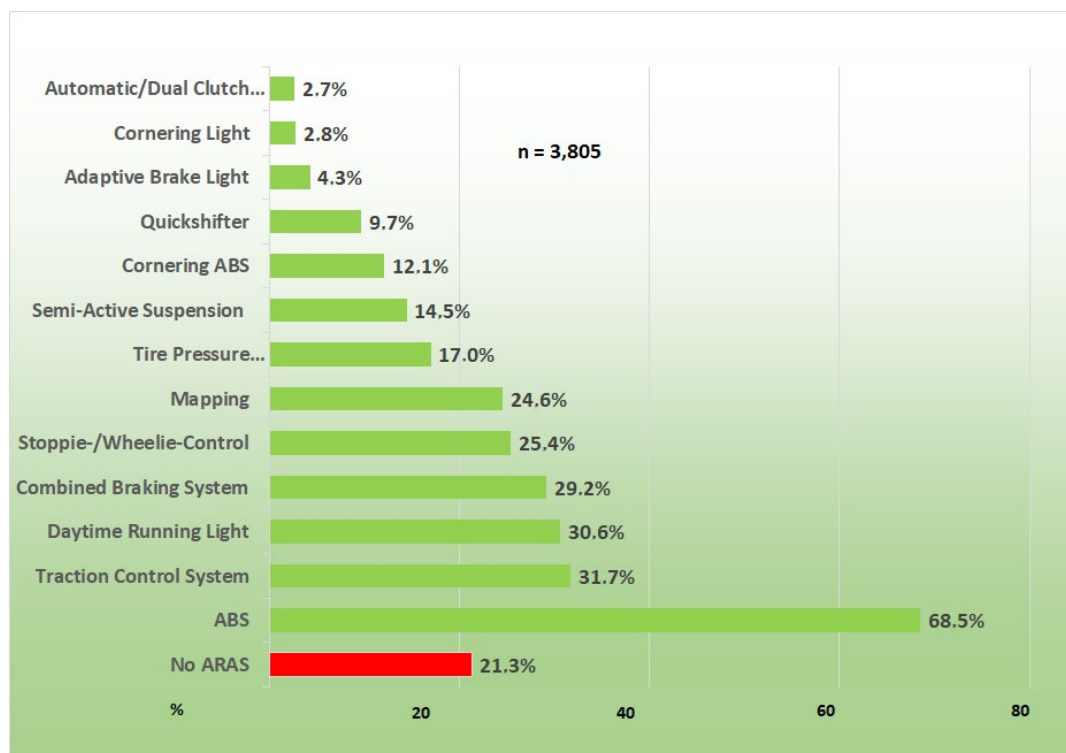


Fig. 8: Available/ used ARAS-PTW

First of all, it should be noted that one fifth (21.3 %) of the vehicles used by the respondents still do not have an ARAS-PTW at all, which can mainly be explained by the year of construction of the motorcycles used. The example of ABS shows that only 19.9 percent of the vehicles in use that were manufactured in 1998 or earlier are equipped with ABS.

As the age of the vehicles increases, the proportion of riders who have no practical experience with ARAS-PTW also increases significantly. It was to be assumed that ABS will also be far ahead when it comes to which rider assistance systems are used in practice by the study participants. 68.5 percent own or ride a motorcycle with this technical braking aid. Traction Control, which is technically closely related to ABS, is by far the second most frequently used system.

2.5.2 Functional Knowledge of existing ARAS-PTW

More than three quarters of all respondents (78.1 %) say they know how the ARAS-PTW they use on their own vehicle works or how to use it. 14.2 percent are uncertain about this, while 7.7 percent take a clear stand and admit to having no idea about it (Fig. 9).

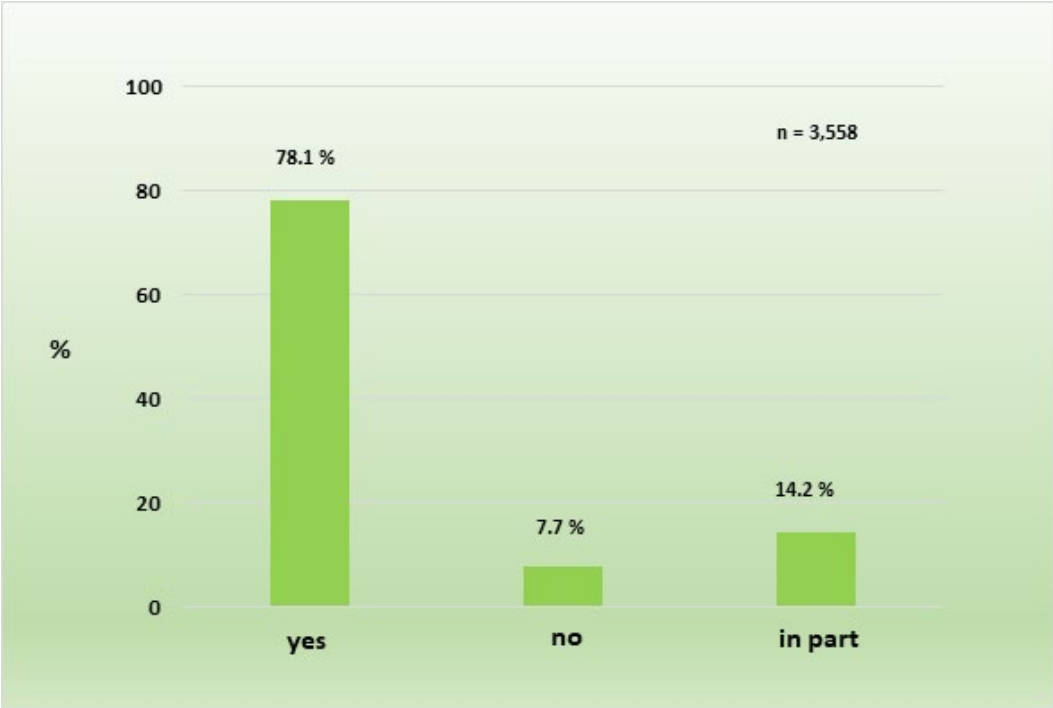


Fig. 9: Knowledge: Usability of utilized ARAS-PTW



The gender evaluation shows a clear difference here. While 74.9 percent of the male participants indicate that they have knowledge, the female respondents, at 54.3 percent, are significantly below this figure.



A significant dependence can also be seen when looking at the age of the participants. Younger riders know less about this than older ones. The self-assessment of knowing how to use their own ARAS-PTW therefore increases with age.

In order to further deepen the topic of functional knowledge regarding ARAS-PTW used by or installed on the motorcycle, we also wanted to know from the respective participants from which source they obtained their knowledge about the handling of the systems. The 2,835 participants in question responded as follows:

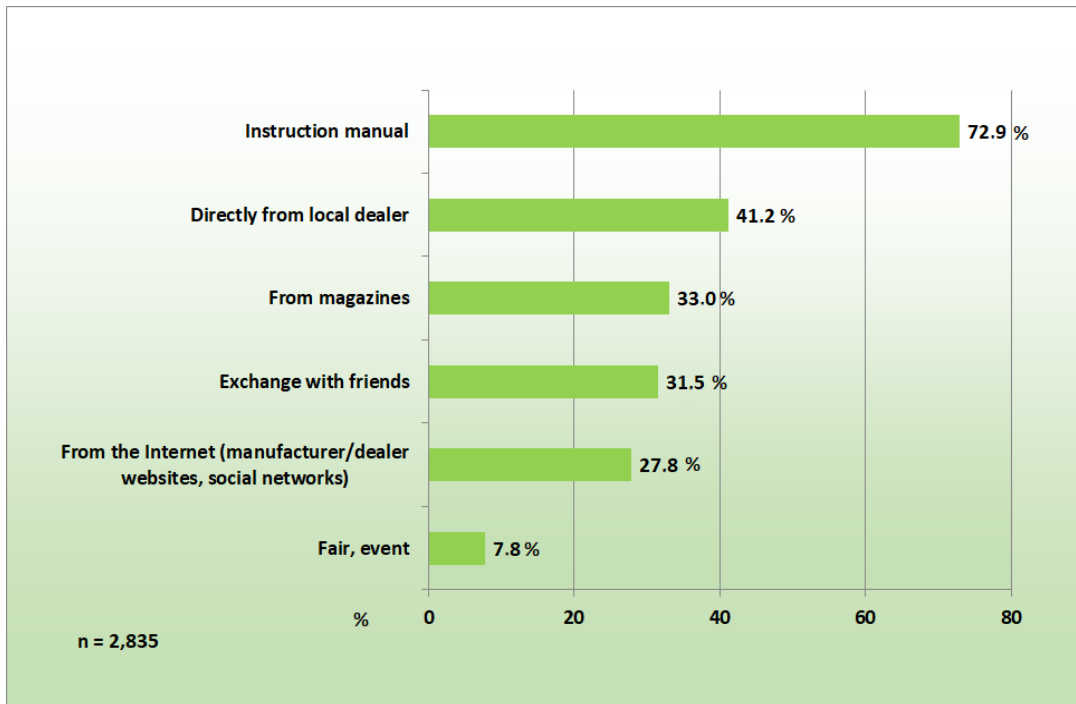
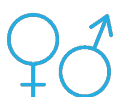


Fig. 10: Source: Knowledge operability of utilized ARAS-PTW

At 72.9 percent, the owner's manual of the owned vehicle is the primary source of information on the operation and handling of ARAS-PTW. While the motorcycle traders have hardly played any role as a source of general knowledge about ARAS-PTW (2.6 %; see 2.4.2), here they are the second most frequent source of information (41.2 %). When it comes to detailed technical questions about one's own motorcycle or the ARAS-PTW installed, the specialist therefore plays a greater role than with knowledge on general topics, which one prefers to obtain from specialist magazines and discussions with friends and acquaintances. ARAS-PTW explanations often take place when the vehicle is handed over, which further emphasizes the important role of the traders in this context.

Trade fairs and events also seem to be more popular in direct comparison for specific technical questions (7.8 %) than for general information about ARAS-PTW (1.9 %; see 2.4.2). "Fuel talks" with like-minded people (friends and acquaintances) are equally well represented in both areas and represent a frequently used opportunity to exchange knowledge. Some participants also pointed out that driving schools have already provided them with system knowledge. Others mentioned safety training courses. In this respect, both areas represent an area that can be expanded.



Also on this occasion, the analysis was able to identify gender-specific characteristics. While men use technical journals and operating instructions much more often, women prefer to exchange information with friends and acquaintances more often than average. They also mentioned riding schools and advanced rider training courses proportionately more often than men. The local dealer, on the other hand, was an almost equally important source of information for both sexes.

In addition to motorcycles, most participants (90.1 %) also use the car to be mobile. Certainly, experience in this area also plays a certain role as "Advanced Driver Assistance Systems (ADAS)" in the passenger car sector

already have a longer history. Although the systems installed there cannot be transferred one-to-one to the Powered Two-Wheelers, it can nevertheless be assumed that they provide a foundation of experience.

2.5.3 Rider Information for ARAS-PTW

Certainly, it is important and necessary to deal with most of the ARAS-PTW already before the journey in order to understand their mode of operation. To be able to use them optimally, additional operating knowledge is usually required. For this reason, the study participants were also asked how motorcyclists should best be informed in future about the ARAS-PTW installed, i.e. about the “individual ability of their vehicle”.

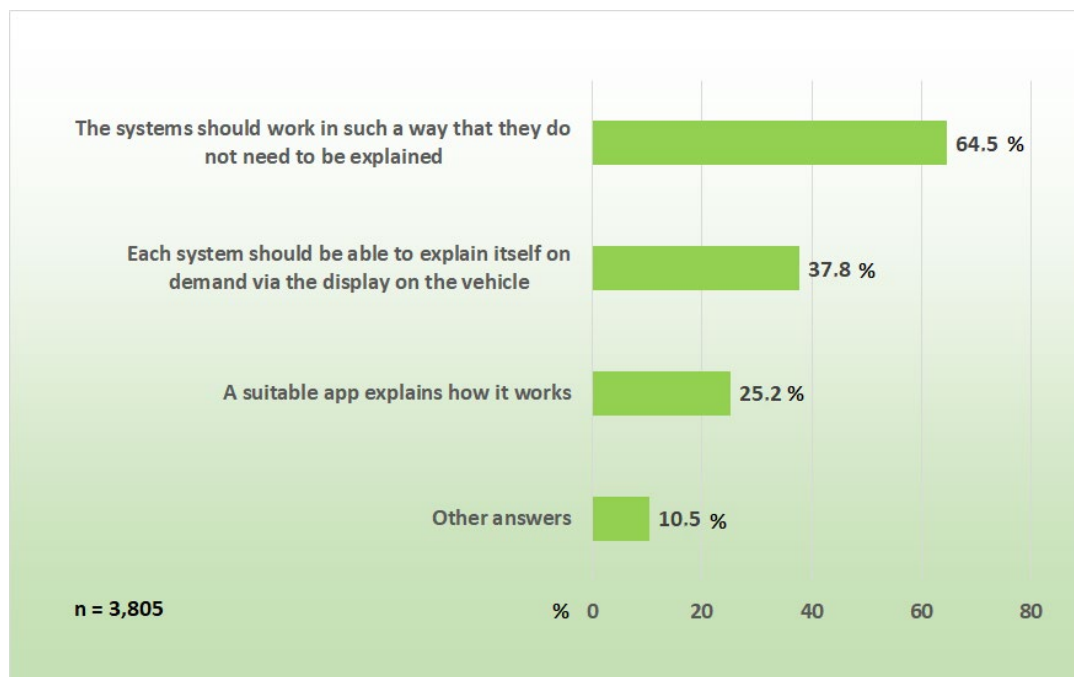


Fig. 11 Wish/ideas: Information on the operability of utilized ARAS-PTW

Figure 11 shows the most frequent answers (multiple answers were possible) to this question. Almost two thirds of the respondents (64.5 %) are of the opinion that a safety-related system must function in such a way that no explanation is required. However, as soon as a system has different modes, for example, for different purposes, this becomes difficult. 37.8 percent would like the ARAS-PTW in question to be able to explain itself on demand via the display on the motorcycle (if available).

Anyone who wants to find out about the capabilities of their ARAS-PTW at home on the sofa or on the motorbike could do so via a corresponding app. A quarter of the participants would prefer this (25.2 %).

A good one in ten respondents (other answers: 10.5 %) had also made use of the possibility of formulating their own suggestion in addition to the choice of answer specifications. The participants particularly often requested a (supplementary) explanation/instruction by the specialist trader. Another suggestion that was often made was that the operation of the various systems could be explained and practiced in advanced rider trainings.

2.6 Personal Benefit through ARAS-PTW

Some questions of the study deal with the personal benefit of ARAS-PTW. The question is whether the participants have both positive and negative experiences with the technical helpers. Under certain circumstances, these can have a significant influence on general attitudes towards the topic of ARAS-PTW.

2.6.1 Own Experience with ARAS-PTW

With 65.2 percent, almost two thirds of the participants have positive experiences with ARAS-PTW. When it comes to specifying the system on which the experience is based, ABS clearly dominates, followed by the Traction Control System.

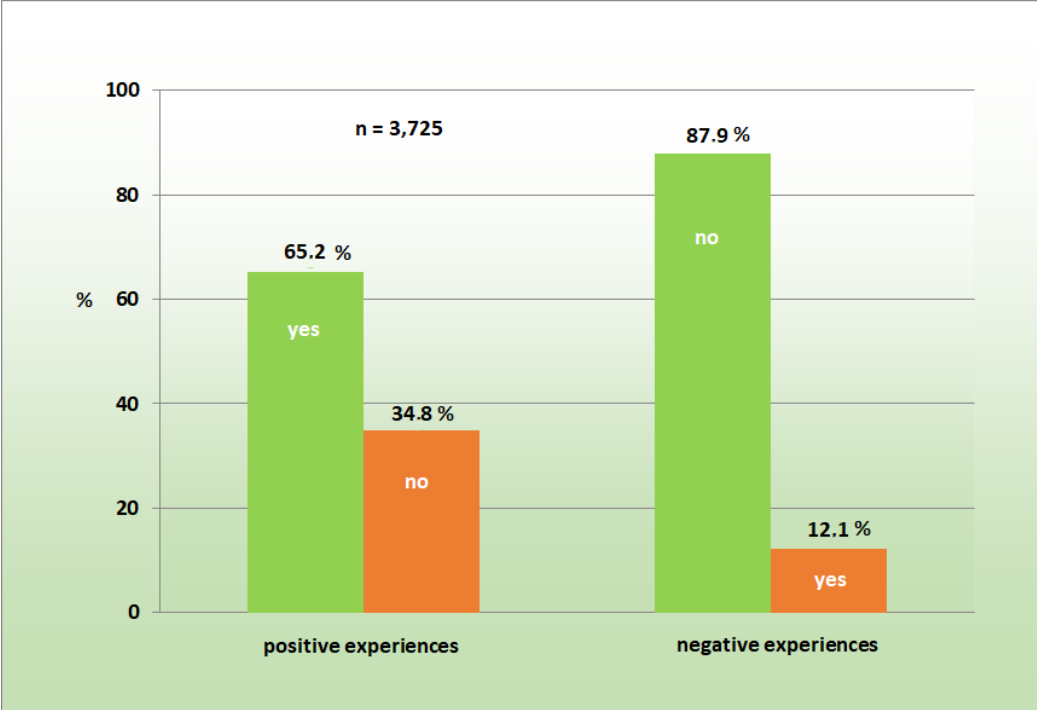


Fig. 12: Experience with ARAS-PTW

On the other hand, more than a third (34.8 %) do not have this positive experience. This does not mean, however, that this proportion of respondents has a negative opinion of ARAS-PTW. The only difference is that there are no positive experiences. The direct counter question about negative experiences provides more clarity here. The majority of the participants (87.9 %) had no negative experiences with ARAS-PTW. Only 12.1 percent of the participants had negative experiences. The survey did not determine what these experiences were.



While no gender-specific conspicuities are apparent, the age of the participants plays a role in that motorcyclists report positive experiences more frequently with increasing age.



The age of the own motorcycle is also relevant. Positive experiences with ARAS-PTW decrease with increasing age of the vehicle. Probably simply because no systems are installed. The age of the vehicle is not important for negative experience values.



As far as the motorcycle type is concerned, it is mainly the “Adventure” type, 75 percent of whose riders have had positive experience with ARAS-PTW. The group of “Enduro”-riders comes to 68.2 percent, on a par with the “Tourers” (68.2 %), and the owners of “Naked Bikes” to 62.8 percent. In contrast, 41.3 percent are “Chopper” users.

2.6.2 Accident Prevention by ARAS-PTW

64.2 percent of all participants have already experienced a fall/accident with their motorcycle. Specifically, we would like to know from this group whether a corresponding ARAS-PTW could have prevented this fall or accident.

About one in five of those affected (20.3 %) believes that an ARAS-PTW could have prevented at least one of their accidents. With 16 percent of undecided (“I don’t know”), a large proportion of this group (63.7 %) believe that a suitable ARAS-PTW (concerning the cause of the fall/accident) would not have prevented the incident.

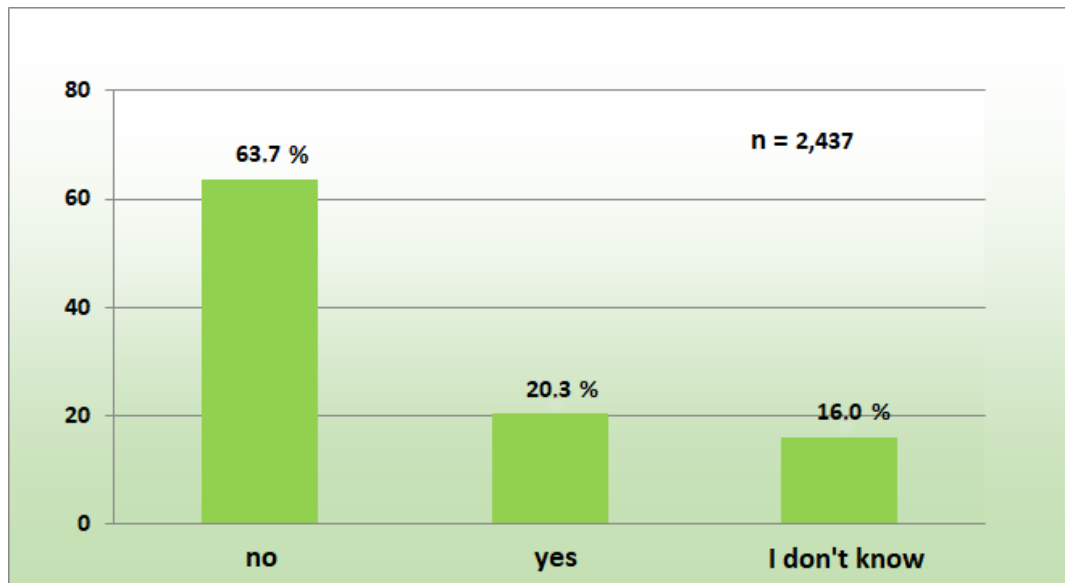


Fig. 13: Review: Fall prevention with the help of ARAS-PTW



This opinion varies greatly between the different age groups.



However, there are gender-specific differences. After deducting those who did not provide any information, the proportion of male participants who are certain that an ARAS-PTW could have prevented a fall or accident was 20.9 percent. For women, this is only 13.1 percent. Overall,

around three quarters of the female participants (74.3 %; men 63.1 %) were certain that an ARAS-PTW would not have helped.

If the systems are not sufficiently known, it will be more difficult to assess whether and when a system could have been helpful. In order to substantiate this obvious thesis empirically, we have examined the subgroup of accident victims to what extent their respective knowledge about ARAS-PTW influences the judgement above. This revealed a clear correlation: The less knowledge about ARAS-functions, the greater the uncertainty, but also the skepticism about whether a suitable ARAS-PTW could have prevented the accident. If very good to good knowledge of the system is available, only 11.3 percent will not want to commit themselves. Among those who say they have little or no knowledge about ARAS, 19.9 percent do not want to or cannot make a clear judgement.

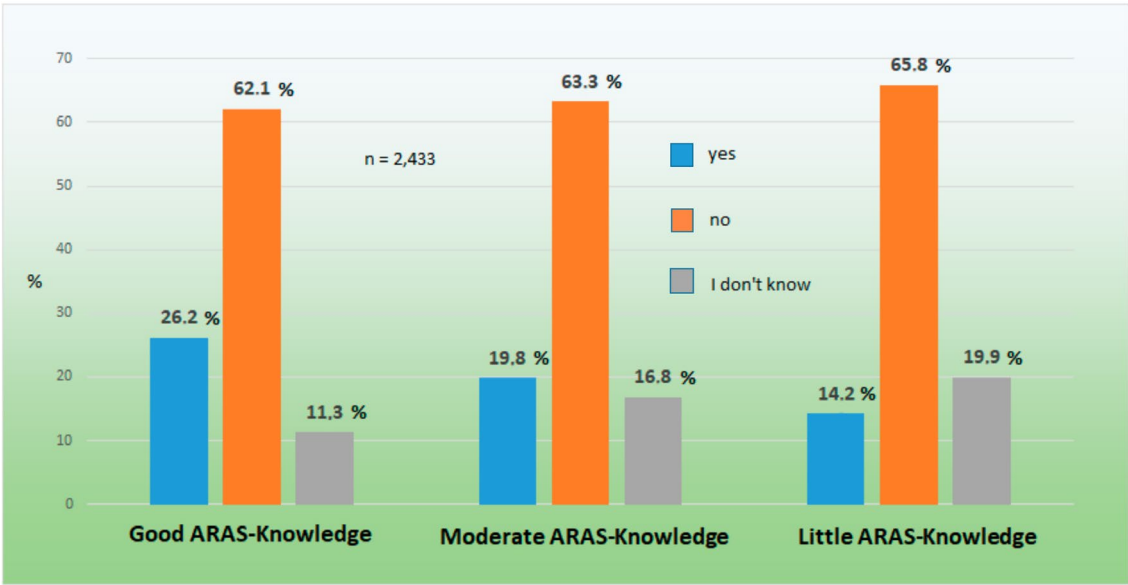


Fig. 14: ARAS-PTW

This is also true in the case of the ARAS-PTW retroactively being attributed an accident-preventing effect. Here as well, those participants with good knowledge are more likely to come to a positive assessment of the potential protective function of systems that were not yet present on the motorcycle at the time of the accident. The relatively high number of negations across all three groups can be explained primarily by the fact that a significant proportion of accidents are due to causes that even ARAS-PTW cannot counteract. For example, no assistance system has yet been deployed in the motorcycle sector to prevent accidents resulting from being overlooked at intersections.

The retrospective individual assessment of the abatement potential of an ARAS-PTW is certainly influenced by subjective factors. This thesis is supported by another observation: In the group of those accident victims for whom an ARAS-PTW would not have prevented the accident/fall, an above-average proportion also believe that rider assistance systems on motorcycles are generally not useful for safety reasons. This can be interpreted as an

indication that even fundamental reservations about the usefulness of ARAS-PTW may have a negative impact on the assessment of its potential protective function in individual cases.

The subjective experience, the subjective perception of the participants also has a great influence on the formation of opinion or the assessment of the future effectiveness of ARAS-PTW on the accident situation in general (see 2.7.6). It can be seen, for example, that 74.5 percent of those who believe that a corresponding ARAS-PTW could have prevented their own fall assume that ARAS-PTW will further reduce the number of accidents in the future. Among those who do not have this experience, the figure is only 55.9 percent. Also, in this second group, the proportion of those who are uncertain about this is larger.

2.7 Opinions on ARAS-PTW

2.7.1 ARAS-PTW make Sense for Road Safety Reasons

When asked whether the participants consider rider assistance systems on motorcycles to be useful for safety reasons, the vote was unequivocal: 94.6 percent of the participants see a safety gain in ARAS-PTW (see Fig. 15). Riders' age and gender have hardly any influence on the assessment, and the level of education (measured by the highest level of education) is also irrelevant here. Even the hypothesis that participants who consider themselves to be particularly safe riders tend to regard ARAS-PTW as less useful could not be consistently confirmed. Only those who rated themselves as "very safe" on the five-level Likert scale denied ARAS-PTW as road safety support twice as often as the "supporters" (20.0 % vs. 10.6 %).

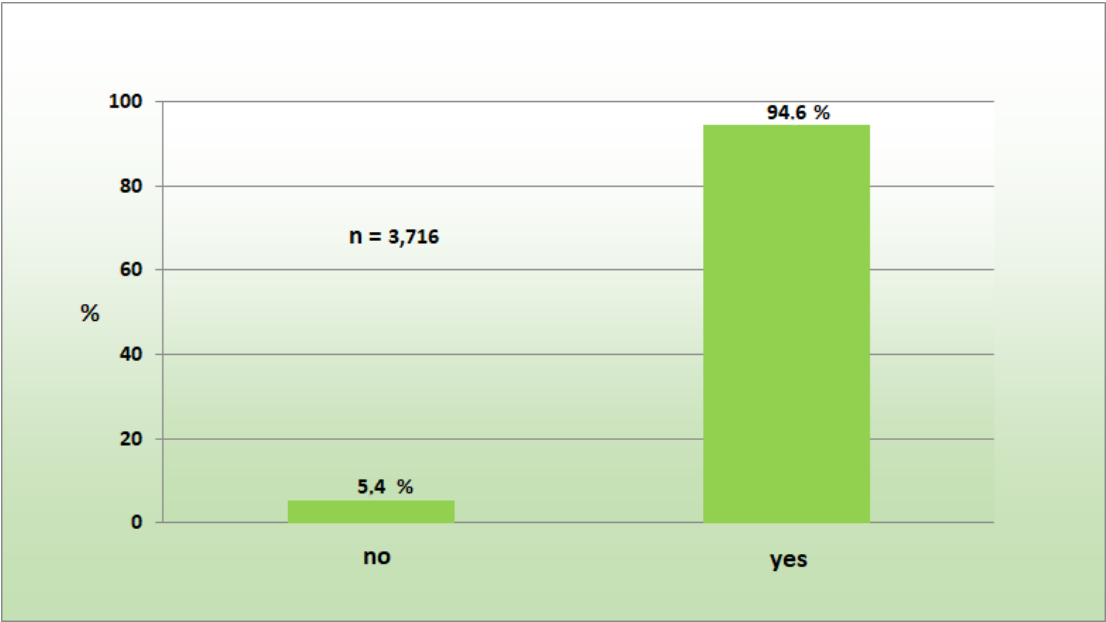


Fig. 15: Assessment of safety gain by ARAS-PTW

Let us consider separately only the 2,835 participants for whom “own experience with ARAS-PTW is available”. In this group, 96 percent agreed, while just four percent of them (instead of 5.4 % above) denied that the security aspect made sense. On the other hand, it is noticeable here that motorcyclists without their own experience tend to doubt the safety benefit more frequently (11.7 % instead of 3.2 %). In addition, experience from passenger cars is also particularly relevant. More positive assessments of ARAS-PTW for road safety are made by those who already have experience with ADAS from passenger cars.

Conclusion: Anyone already familiar with rider assistance systems in practice is almost always convinced of their relevance to riding safety. Thus, in the end, it is not surprising when 93.9 percent of all riders who already have experience with ARAS-PTW say that their next motorcycle should be equipped (again) with such assistance systems. A similar correlation was also confirmed by other parties: “Riders who experience the support of driver assistance systems (DAS) on a daily basis are also open to other DAS”⁷.

In contrast to that, those with little or no experience with ARAS-PTW, tend to be “skeptical”, according to a press release issued by the German Road Safety Council (DVR)⁷ as part of the “Best Co-Rider” campaign.

2.7.2 Individual Consideration of ARAS-PTW: Benefits for the Security of ARAS-PTW

The green columns in Figure 16 show the participants' assessment of various ARAS-PTW with regard to their safety relevance. The systems that have already been on the market for a longer time and are therefore more established, stand out particularly here. On the other hand, two more recent systems in particular stand out: On the one hand the Cornering ABS. Based on the classic ABS, this system attracted a lot of attention when it was introduced just a few years ago. The possibility of being able to brake to a certain degree in a curve was until then rarely used by many motorcyclists for fear of falling. Cornering ABS is and will continue to help motorcyclists to overcome these fears and thus increase safety in extreme situations – and 89.5 percent of the motorcyclists surveyed are already convinced of this.

More conspicuous at this point, however, is the Side View Assist. This is considered by the participants to have an above-average effect on safety, even though it has not yet made any inroads into the motorcycle sector and the specific knowledge in this area is not yet very well developed (see 2.4.3). Only one scooter of a renowned manufacturer is equipped with this system. The generally quite popular problem of blind spots as well as the experiences of the respondents from the passenger car sector probably play a major role here. The fact that the Cruise Control, the Quickshifter and the Hill Start Assist, three systems that are more conducive to riding comfort, end up in the rear places, shows that motorcyclists are able to make a differentiated and informed assessment of the safety benefits offered by the various ARAS-PTW.

⁷ Pressemitteilung des DVR vom 07.06.2016: „Auf den Geschmack gekommen: Fahrerassistenzsysteme überzeugen in der Praxis“.

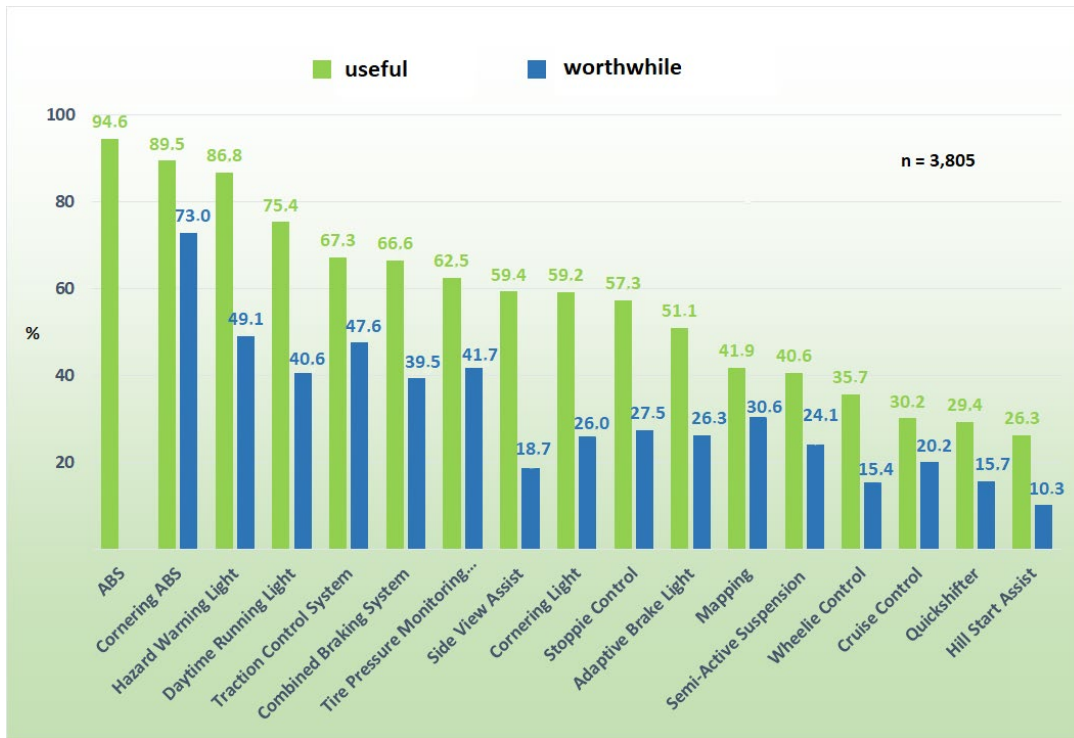


Fig. 16: Assessment of security gain through ARAS-PTW-Desire

If we take a look at the blue columns in Figure 16, we can see the characteristics of the different ARAS-PTW, which tell us whether the next motorcycle should be equipped with such a system. In general, it is noticeable that the respondents consider the different ARAS-PTW more often than they consider these systems necessary or desirable as equipment for their future motorcycle. The discrepancies are in most cases quite marked. The Cornering ABS, where the deviation between the two postures is the smallest, comes off best here. 89.5 percent of those surveyed consider the system to be useful and 73 percent of those surveyed expect their next own motorcycle to be equipped with it. This is a proportion of 82.6 percent of those who generally consider Cornering ABS to be useful. Mapping and Traction Control System also scored quite positively, with over 70 percent agreeing between sensible and desirable.

The discrepancy is particularly large for the Side View Assist and the Hill Start Assist. 59.4 percent of those surveyed consider a Side View Assist system to be useful, but only 18.7 percent of all respondents want to see their next motorcycle equipped with it. Here, knowledge or presumption about the still very low availability of this equipment feature mentioned above may play a role. Only 10.3 percent can imagine a Hill Start Assist on their own motorcycle, although 26.3 percent still consider this equipment feature to be useful from a safety perspective. However, there are differences according to motorcycle type. While riders of touring motorcycles in particular consider the Hill Start Assist to be sensible (34.4 %) and also personally desirable (15.4 %), the majority of “sports motorcycles” and “super sports motorcycles” users reject the system. Only 6.1 percent of riders of both motorcycle types would like to see their future two-wheeler equipped with it.

ABS was only placed here in the context of the assessment concerning safety relevance. The wish with regard to the next purchase is not taken into account, as ABS has been mandatory for all new vehicle registrations since January 2017 and is no longer an option.

2.7.3 Feeling of Safety through ARAS-PTW

Whether the study participants feel more comfortable on a motorcycle equipped with rider assistance systems (e.g. ABS, Cornering ABS, Traction Control, etc.) could also be assessed on a Likert scale from 1 (“exactly”) to 5 (“completely wrong”).

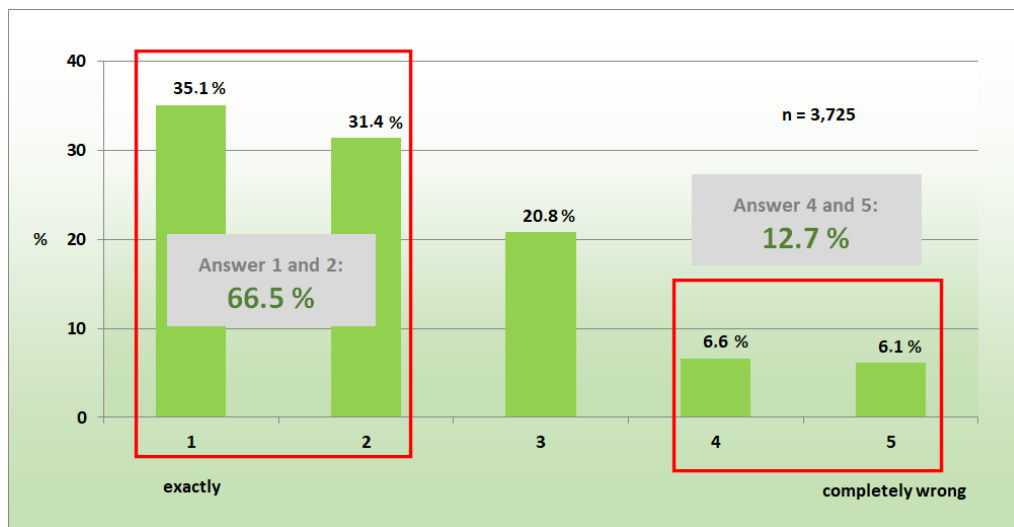


Fig. 17: Feelgood factor ARAS-PTW

Figure 17 shows a clear left-weighting trend towards “exactly”. If we combine the two values above and below the middle value 3, i.e. 1 and 2 as well as 4 and 5, we receive the “rather agree” and “disagree” answers summed up. According to this, two thirds of the participants (66.5 %) agree with the statement; they feel more comfortable with the support of ARAS-PTW. Only 12.7 percent do not feel more comfortable on a motorcycle equipped with ARAS-PTW. We can conclude from this that ARAS-PTW makes an important contribution to a more positive driving experience.



The mood is slightly different for the different age groups. While riders under the age of 30 and, even more so, riders between the ages of 30 and 39 are disliked more than average, the group of riders aged 40 and over is characterized by higher approval ratings.



The feelgood factor, on a motorcycle equipped with ARAS-PTW, is also assessed differently according to gender. Simply put, among men, approval is higher. Women, in contrast, reject the statement more frequently, but tend to remain in the middle of the field: 29.1 percent of women voted for the 3 on the Likert scale (among all participants, the figure was only 20.8 percent).

Incidentally, the greater skepticism expressed here is independent.

The latter finding is surprising in that those participants with their own ARAS-PTW-experience generally have much more positive opinions about ARAS-PTW than respondents who have not yet ridden a motorcycle with ARAS. As a reminder, 96 percent of participants with ARAS-PTW-experience, but ‘only’ 92.5 percent of all

respondents consider such systems to be useful. The following answers are similar, limited to the almost 75 percent large subgroup who know at least one ARAS-PTW from their own experience.

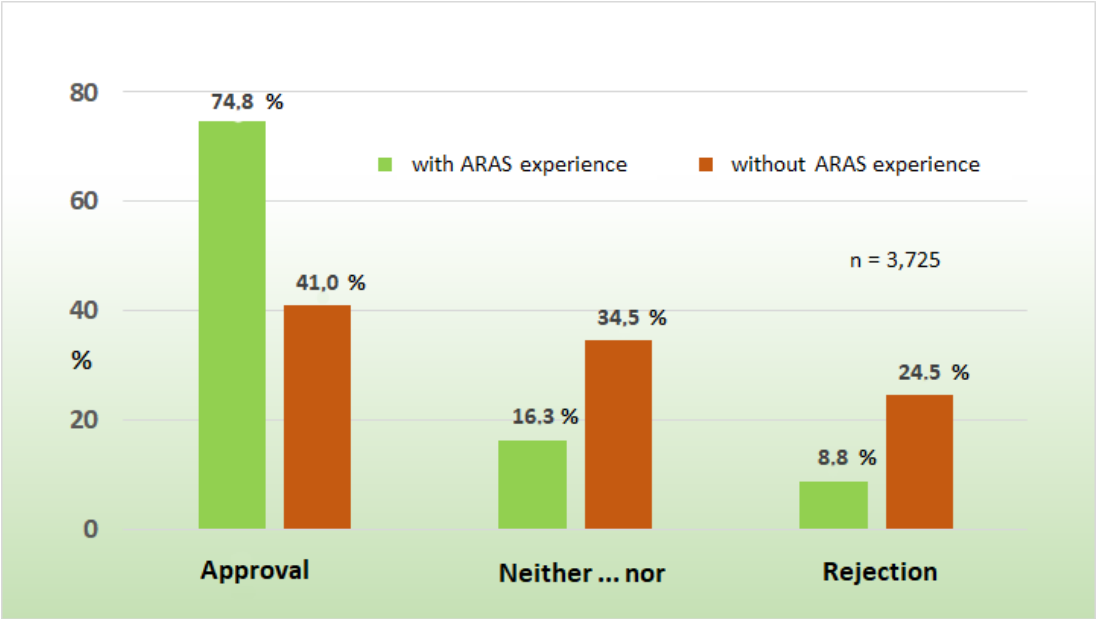


Fig. 18: ARAS-PTW feel- good factor based on experience with systems

First of all, it is noticeable that there is a clear increase in agreement with the question posed at the beginning of the question. Instead of a total of 66.5 percent (see Fig. 17), 74.8 percent of respondents with their own practical experience stated that they felt more comfortable on a motorcycle equipped with ARAS-PTW. Accordingly, the proportion of refusals also fell from 12.7 to only 8.8 percent. The situation is similar, but at a significantly lower level, in the group of those without own experience. The findings can be seen as a clear indication that own experience plays a central role in the positive formation of opinion about ARAS-PTW.

2.7.4 Less “Rider Skills” through ARAS-PTW?

The extent to which the participants in the study believe that ARAS-PTW reduces their own ability on the motorcycle is being analyzed again, using a five-point Likert scale (1= “exactly” to 5= “completely wrong”). The answers provide a fairly evenly distributed picture. And here again we have combined the two choices listed above and below the middle value 3 (Fig. 19).

When considering bundling, a balanced picture emerges between agreement with the statement (36.9 %), indecision (30.8 %) and rejection (32.2 %).

Obviously, it is not yet clear among motorcyclists whether or how the use of ARAS-PTW will affect their own riding skills. A clearer mood could emerge in the future as such systems become more widespread.

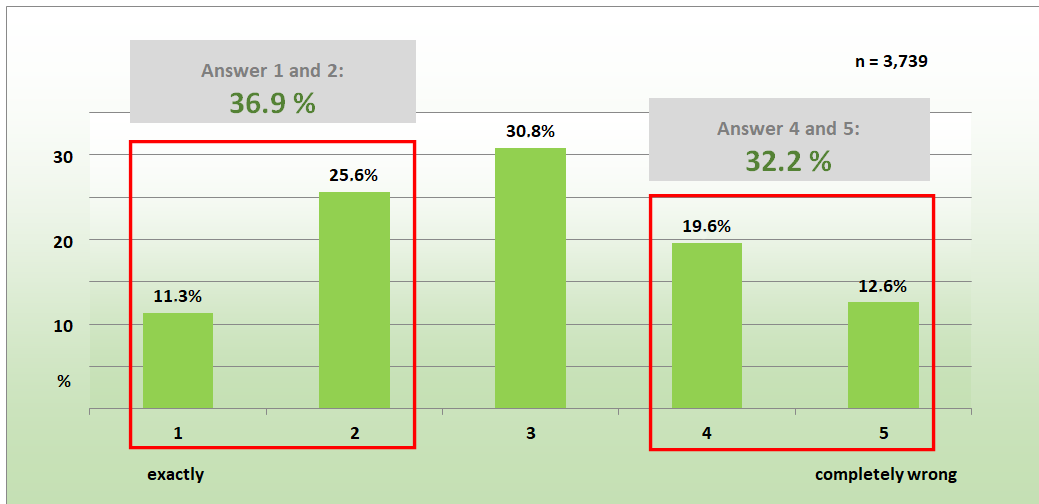


Fig. 19: Unlearning of riding skills through ARAS-PTW

Even if, as in the previous chapter, the focus is on the group of respondents who have their own practical experience with ARAS-PTW, the mood will only be slightly clearer, as Figure 20 shows. Of these, 32.9 percent (one third) still believe that their own riding skills decrease with the use of ARAS-PTW (combined answers 1 and 2). 36.9 percent of the “experienced” do not see it this way (combined answers 4 and 5).

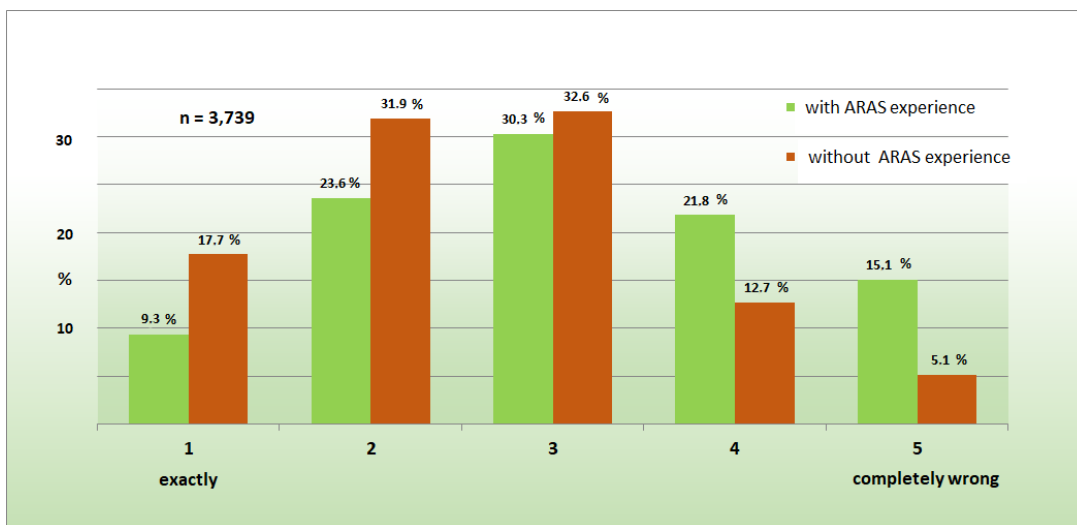


Fig. 20: Unlearning of driving skills through ARAS-PTW

It is striking that there are clear differences of opinion with regard to the existing experience with ARAS-PTW. Motorcyclists who have not yet had any experience with ARAS-PTW are far more skeptical about it.



When looking at the age groups, the first thing that stands out is that the assessments do not vary greatly. However, it is interesting to note that the group of younger riders (up to 29 years of age) tends to agree most strongly with a rather skeptical assessment (41.1 %). After all, it is precisely the riders of the younger generations who have been able to gain experience on modern

motorcycles equipped with ARAS-PTW from the very beginning during their driving school training and in many cases have no experience at all with motorcycles without these systems.



The possibility of ARAS-PTW being able to help to unlearn important driving skills is seen above all by frequent riders (47.3 % with over 20,000 km of annual mileage).



While a differentiation according to gender does not show any conspicuous features, the self-assessment of whether someone considers him- or herself a safe or less safe rider is certainly relevant for the assessment of the question asked. The approval rate (skills get lost) of 39.4 percent among participants who consider themselves to be safe riders is slightly above the rate for all respondents (36.9 %). In the camp of the “rejecters” the situation is mirrored. 32.2 percent of all respondents, but 35.1 percent of riders who consider themselves to be less safe do not believe that they unlearn important skills when assistance systems are on board. Overall, therefore, we can speak of a striking correlation. The assumption that riders who rate themselves as less safe also tend to answer the question with a neutral “neither, nor” plays a role here.

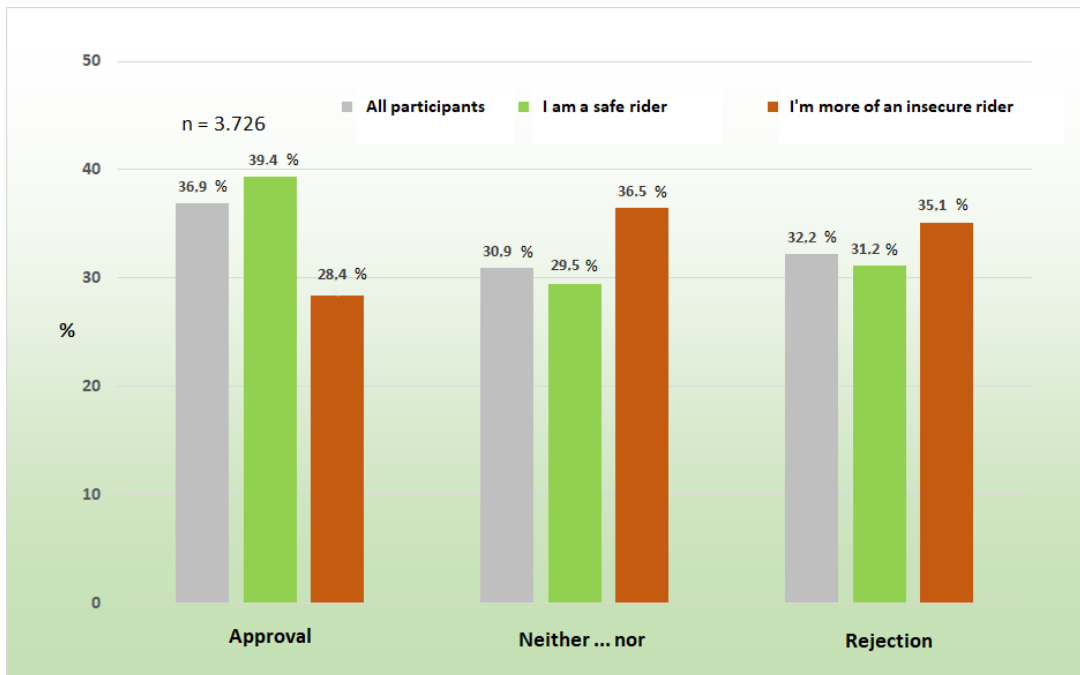


Fig. 21 Unlearning of driving skills through ARAS-PTW- Assessment of driving ability

As in other contexts before, the factor “own practical experience” plays a significant role here as well. The judgements of those who consider themselves ‘safe’ and those who consider themselves to be rather insecure riders differ considerably with regard to whether or not they have their own practical experience with ARAS on motorcycles. For example, among those who consider themselves being a safe rider, the approval rate (skills lost through ARAS-PTW) rises rapidly if there is no practical experience with ARAS-PTW. In this subgroup, the approval rate of 54.9 percent is significantly higher than the 39.4 percent measured for all “safe” riders. Also in this case, the reverse is true: In the group of riders who consider themselves to be “unsafe riders”, the approval

rate for the above statement drops even further as soon as the rider has his own practical experience with ARAS-PTW. It is in this subgroup that the greatest rejection is logically evident: 37.2 percent of them do not believe that important skills are forgotten when assistance systems are on board.

Conclusion: Overall, the skepticism that rider assistance systems could have a negative impact on one's own riding skills is comparatively high. Although this skepticism decreases significantly as soon as the respondents are familiar with the systems from their own experience, even within subgroups which, for various reasons, are generally very positive towards the ARAS-PTW, there is still a relatively high proportion of people, regularly more than a quarter, who expect a decrease in riding skills through the use of rider assistance systems.

2.7.5 Risk Compensation through ARAS-PTW

As with many of the questions in this study, a five-level Likert scale was used as standard to answer the question. The question aims to determine whether ARAS-PTW (albeit unconsciously) induce people to risk more or whether they favor a riskier riding style because they feel safer or more advantaged due to the technical support. The titles of the extreme values are: 1= “exactly” and 5= “completely wrong”. Figure 22 shows a strong tendency towards the negative answers of the extreme values.



Fig. 22: Risky driving through ARAS-PTW

For further analysis, we summarized the pairs given above and below the middle answer option. According to this, only 13.4 percent of the participants believe that ARAS-PTW tempts them to ride riskier. Almost two thirds of the participants, however, do not want to attribute such a risk potential to the assistance systems.



A separate consideration of the sexes does not reveal any striking deviation from this result.



The assessment is also independent of the annual mileage.



However, what clearly influences this assessment with regard to a possibly riskier riding style due to the equipment with ARAS-PTW is the age of the rider. With increasing age, motorcycle riders are less and less likely to believe that the safety potential of the ARAS-PTW can be the cause of a riskier riding style. While younger riders (up to 29 years of age) still admit to “ride riskier” at 23.2 percent against this background, this proportion falls continuously as the rider age increases.

30- 39 years: 16,9 %

40- 49 years: 15,1 %

50 years and older: 10,4 %

A connection between the answer to this question and own practical experience in dealing with ARAS-PTW, as has frequently occurred above, is only given to a lower level. Thus, 15.6 percent of those who only know ARAS-PTW from theory or not at all are of the opinion that a negative influence on safe riding is possible.

By contrast, only 12.8 percent of respondents with ARAS-PTW- experience believe that it can have a negative impact (all: 13.4 %). So, this time the differences are comparatively small.

2.7.6 Impact of ARAS-PTW on future Accident Figures

With regard to this question, participants should assess the impact of ARAS-PTW on future accident figures. Will they decrease, remain unchanged or even increase due to increased use of ARAS-PTW?

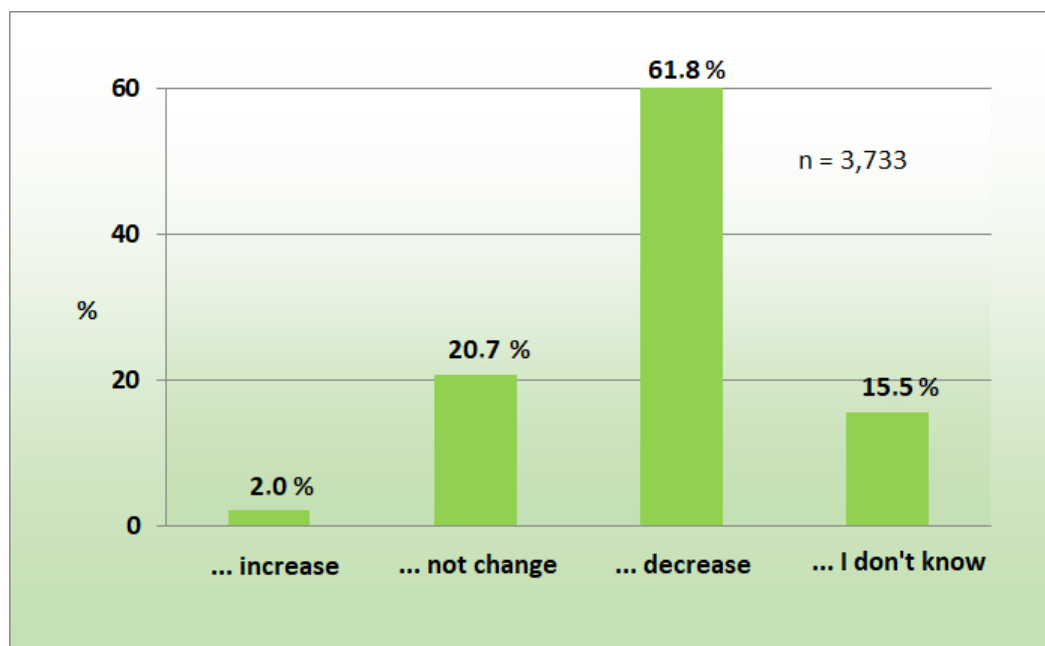
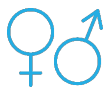


Fig. 23: Influence of ARAS-PTW on the development of accident figures

The majority of participants (61.8 %) believe in the positive influence of the ARAS-PTW on future accident figures. Only two percent expect the ARAS-PTW to increase accident figures. An opinion that runs through all age and annual mileage groups.

The group of participants with experience with ARAS-PTW is again above the average of all respondents. With 66.5 percent, they are of the opinion that ARAS-PTW will change the accident situation positively in the long term. In the group without ARAS-PTW-experience values, in contrast, 47.3 percent maintain this. Even those who are just about to buy a new motorcycle are more positive about the assumption of an accident-reducing effect of the development.



Only when the sexes are considered separately, a conspicuous feature can be identified: While 62.9 percent of men expect the number of accidents to fall as a result of the use of ARAS-PTW, women are more skeptical about the influence of ARAS-PTW and only expect this development to occur to a degree of 46.9 percent.

As already described under 2.6.2, the personal experience of the participants plays a major role in this opinion-forming process. The experience with falls/accidents also has an impact here.

Anyone who has already had a fall or accident in the past and is of the opinion that an ARAS-PTW could have prevented it, attaches much greater importance to the future positive influence of the ARAS-PTW on the occurrence of accidents. Here, the figure is almost 75 percent compared to those who say that an ARAS-PTW would not have helped them in the past, at just under 56 percent.

2.7.7 Future Outlook: Human or Technology

The riders themselves or technical systems? The answers to the question of who will make a greater contribution to reducing the number of accidents involving Powered Two-Wheelers on the roads in the future are relatively evenly distributed. The rider himself is just ahead in the participants' assessment. Of the 3,720 participants who responded at this point, exactly 56.6 percent believe that it is mainly the rider himself who will control future developments. In contrast, 43.4 percent of the respondents predict that technology will have the greater influence here.

Again, the result is interesting when personal ARAS-PTW knowledge (here: theoretical knowledge) is taken into account. It shows that those who assess their knowledge as excellent to good are, with 53 percent, more likely to rely on technology. Those who are familiar with the technology (mode of operation) of ARAS-PTW are therefore confident that it will provide significantly more accident protection in the future. Conversely, those who are less familiar with the subject continue to rely primarily on the skills of the rider. This attitude is supported by the group of participants who can draw on practical experience with ARAS-PTW. Here, 45.4 percent of the participants ascribe safety successes to the technology. By contrast, for the riders without practical ARAS-PTW-experience this is only 34.9 percent.

Years ago, the results here might have been different. One just has to think, for example, of the great skepticism surrounding the advent of the first ABS systems on motorcycles, which today are almost a matter of course. The enormous technical progress has already made its contribution and has thus proven many skeptics of that time wrong. Nevertheless, it should not be forgotten that, at the moment, confidence in the potential of the riders dominates, albeit narrowly. This is an exciting development that we will certainly continue to pursue.

3 Intelligent Transportation Systems

When looking at the number of traffic accidents in Germany, the long-term declining trend is striking. Both, the number of accidents and fatalities in the Powered Two-Wheeler sector are falling – both in absolute terms and in relation to the number of vehicles on the road, which does not exclude occasional deviations from this trend.

Car drivers are still the main opponents in terms of accidents involving Powered Two-Wheelers in Germany. On average, car drivers are the main cause of two thirds of all collisions between cars and motorcycles every year. The causes here usually lie in overlooking or ’’misinterpreting’’ an approaching motorcyclist. In addition, the risk of injury to the two-wheeler occupant as the so-called ’’external road user’’ is higher in case of a collision, even though modern motorcycle helmets and motorcycle clothing can noticeably reduce the consequences of a collision.

Where there are limits to human perception, technology can enable communication between vehicles and the traffic infrastructure that supports drivers/riders on ’’both sides’’. The keyword here is: Networking. By this, for example, other road users who may not yet be visible to the driver/rider can be pointed out and the risk of a collision reduced. At this point, future technology could – as it is already the case for other ARAS-PTW – provide useful support for the rider. The development potential in this area gives rise to hopes for the future of two-wheel-safety. However, it will take a long time before any effectiveness sets in and becomes noticeable. Supplier companies are putting forward figures which assume that all newly sold motorcycles will be networked by around 70 percent by 2025. Numerous manufacturers have been active in this field for some time now and are developing suitable systems under high pressure.

Manufacturers and numerous research institutes are active in promoting and developing cooperative intelligent transport systems (C-ITS) at a global level. For example, the Connected Motorcycle Consortium (CMC) has been in existence since 2015. This is a collaboration between manufacturers, suppliers, researchers and associations with the aim of making the motorcycle and scooter vehicle group a part of future networked mobility and improving the safety and comfort of motorcyclists. The CMC’s aim is to create a common basic specification for Motorcycle ITS with as many manufacturer-independent standards as possible.

In anticipation of this promising development, the participants of the study were asked about their knowledge of modern and future possibilities.

3.1 Connectivity

3.1.1 Popularity of the Term ’’Connectivity’’

Frequently, in the media, amongst others, terms are used that establish themselves relatively quickly. However, if one questions the meaning of some of these terms, it often turns out that many people are not really aware of what it is about. At this point, we asked the participants to tell us whether they are familiar with the term ’’connectivity’’ or ’’Konnektivität’’, the German word for it, or what it stands for. In addition, to the correct information, two incorrect answer options were placed among the answer choices. It was also possible to indicate being unsure or never having heard of it before. 47.4 percent of the participants were able to select the

correct answer (“Yes, it stands for the networking of rider, vehicle and traffic environment”). 18.7 percent of the participants chose the term “never heard of it”, another 23.7 percent chose “already heard of it, but do not know exactly what it means”. 10.2 percent of those surveyed associate incorrect contents with this term and chose definitions that are simply wrong. As a consequence, not even half of the motorcyclists who took part in the survey knew exactly what the topic “connectivity” is about.

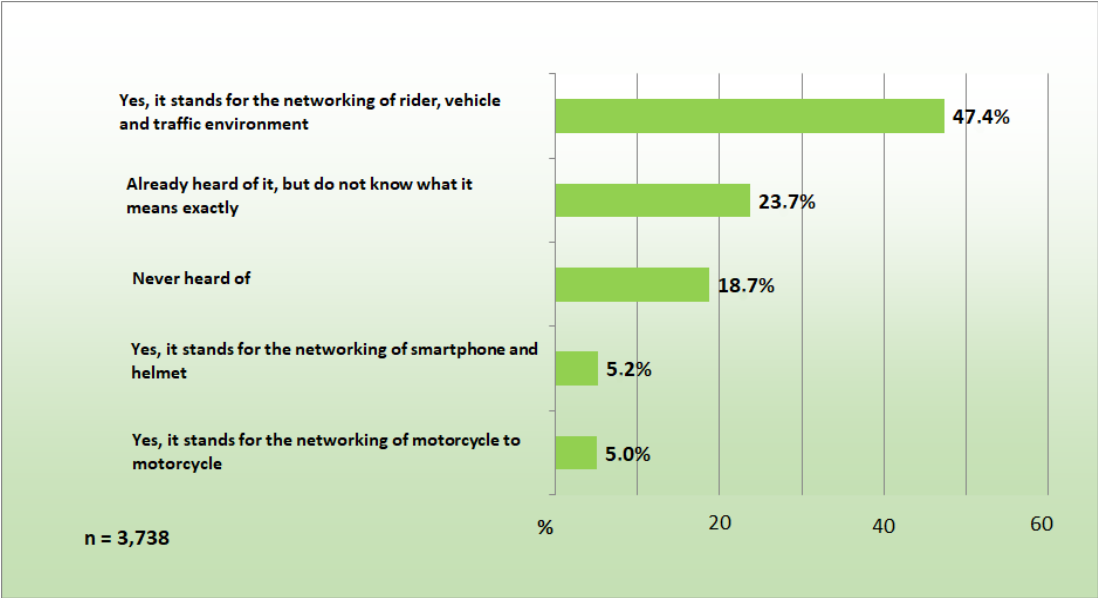


Fig. 24: Popularity “connectivity”



Bringing together the statements with the age group variables, it becomes clear that ambiguity about this term is most likely to be found among the youngest and oldest riders, while the groups in between achieve better results.



The results vary greatly when considering the sexes separately. While only 16.8 percent of men state that they have never heard this term, this statement applies to 41.2 percent of women. While 49.5 percent of men give the correct answer, this is true for 24.9 percent of women.

3.1.2 Connectivity: Does it Make Sense?

At the beginning of this question, the participants were given a definition of what the term “connectivity” in connection with the motorcycle is all about. After that, they were asked to express their opinion on the influence on future accident development. The opinions are as follows:

The majority of respondents consider connectivity on the motorcycle to be a tool that “serves the safety on the road” (47 %). Another large proportion is undecided (“don’t know”: 40.2 %), while the smallest proportion of 12.8 percent believe that connectivity on the motorcycle has a rather disadvantageous effect on road safety.

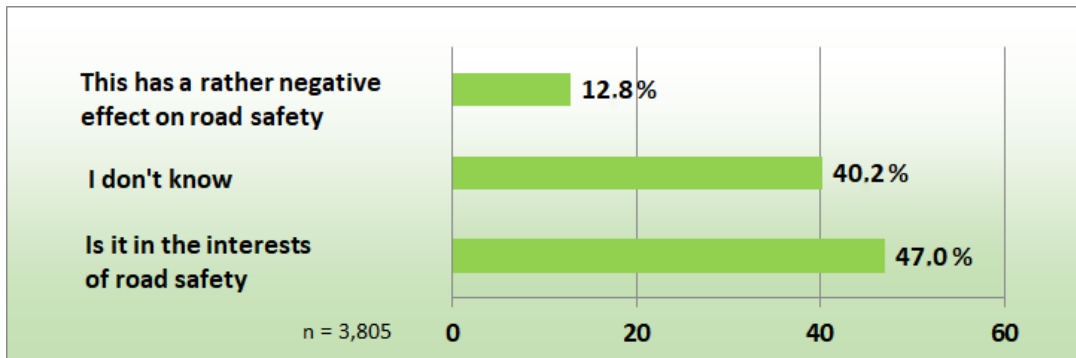


Fig. 25: Evaluation of connectivity in terms of motorcycle safety



Taking into account the different age groups, an increase in the field of agreement “serves the safety on the road” is noticeable with increasing age.



The female participants take over a more skeptical position in terms of the advantages of connectivity. 32.6 percent of them regard connectivity as being beneficial to safety on the road. Among men, this figure is 47.2 percent. Among those who generally view connectivity negatively, the gender-specific responses are balanced.



The annual mileages do not play a significant role in the assessment of connectivity options.

It is also noticeable that there is less distrust than a large portion of uncertainty in connection with the topic of “connectivity”. The uncertainty about this still relatively new topic is obviously due to the current low level of knowledge of the majority of participants (see 2.1.1).

3.2 Vehicle-To-Vehicle Communication (V2V)

Intelligent networking inside and outside the vehicle will play an increasingly important role in the future. Experts agree on the fact that, in the long term, this is a great opportunity to significantly reduce the number of accidents and casualties. As already shown under 2.1, over 53 percent of participants have experienced situations in which they were overlooked by other road users. This is also in line with the urgent need to think about risky situations while riding a motorcycle. Here, 51.3 percent of those surveyed put being overlooked in the first place. It is precisely in these situations that future technology can help to prevent accidents.

After the study’s participants had been given a brief outline of what V2V is all about, they were asked to assess the potential of vehicle-to-vehicle communication (V2V) for an increase of motorcycle safety. While 50.5 percent of the participants are not sure, 13.7 percent assume that V2V will not bring any improvements. In contrast to that, the remaining 35.8 percent believe that this will reduce the number of accidents.

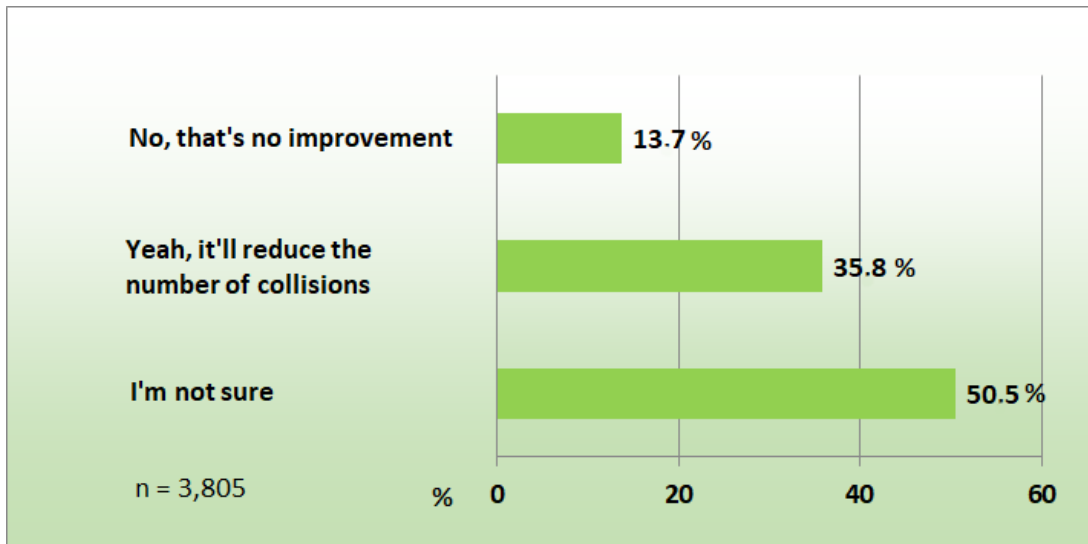


Fig. 26: Evaluation of connectivity in terms of motorcycle safety



Essentially, this result pulls through all age groups. The results vary only marginally, with only a slight increase in the expectation of fewer collisions with increasing age.



Men (36.3 %) proportionally believe much more strongly in an improvement in road safety through V2V than women (22.8 %), who are similarly skeptical about this as they are about the benefits of connectivity.

4 Summary of the Results

In recent years, assistance systems for motorcycles have become increasingly important. Advanced Rider Assistance Systems for Powered Two-Wheelers (ARAS-PTW) hold enormous potential for improving the road safety of motorcycles, which will become even more noticeable in the future. But how well known are the various technical aids and how much knowledge about individual systems exists? What are motorcyclists' opinions on these and other modern technology scenarios? Are they open towards new developments or do they react with reservation?

With the help of this study, the ifz is breaking new ground, as studies of this kind have not been available for the motorcycle sector to date. Besides technical aspects related to the topic ARAS-PTW, there is hardly any information available so far for the Powered Two-Wheeler sector, in contrast to the passenger car sector. Thus, the study, for the first time, does not only provide a deeper insight into the opinions of the riders. It also asks about existing skills in dealing with assistance systems and provides information about their current acceptance among users and those who are not users yet. In short, the results of the study, which are the result of a nationwide survey among almost 4,000 motorcyclists, are thus intended to provide information and to assess the image and user know-how with regard to safety-relevant rider assistance systems.

To summarize, one fact above all can be captured: The majority of the survey participants is already convinced that Advanced Rider Assistance Systems for Powered Two-Wheelers can help when facing dangerous situations, and this is not only recognized, but also evaluated positively. The openness that is thus emerging in this area offers an excellent basis for further anchoring safety-relevant topics among motorcyclists and for making even better use of the potential of the individual systems. How many of the motorcyclists surveyed can be taken along shows the following figure: 94.6 percent of the participants consider ARAS-PTW on motorcycles to be useful for safety reasons. Characteristics such as the rider's age and gender have hardly any influence on this assessment, and the level of education is also irrelevant in this respect. In contrast to this, own experiences with ARAS-PTW positively reinforce the attitudes towards these helpers, as do corresponding experiences from driving a car.

Many of the rider assistance systems discussed are familiar to motorcyclists. It has been shown that systems that have been on the market for a longer period of time generally achieve a higher level of awareness and popularity than newer assistance systems. Whereas ten years ago, over a fifth of motorcyclists were unable to name an ARAS-PTW at the first go, the available study results show that this figure is now only just under five percent. The conclusion to be drawn from this is that the term "rider assistance system" has now become established, just as the multitude of systems behind it is no longer unknown terrain.

The use of rider assistance systems on Powered Two-Wheelers is already widespread and will increase in the future. The main motives for this are: To provide the rider with more riding comfort and, above all, more safety and to reduce the number of accidents in the long term. As the term "assistance" already suggests, the new technologies are intended to relieve the rider in complex situations and thus make riding more comfortable and above all safer. In the case of Powered Two-Wheelers, systems are used primarily with a view to active safety. They aim at ensuring that a fall or an accident does not happen. Many improvements have only been made

possible by modern measurement technology and corresponding reliable control and regulation systems. Starting with the established assistance system, ABS, through Traction Control Systems to Semi-active Suspension System, the useful aids that make riding more comfortable and offer enormous safety potential are an integral part of everyday riding.

Nevertheless, not all motorcyclists are sufficiently aware of the modern systems. At this point it is all about the general knowledge about the topic ARAS-PTW. While just under 30 percent rate their own knowledge as good, the majority (40 %) consider their general knowledge of ARAS-PTW to be in the broad middle range of a “goes like this” between good and moderate. Overall, more than two thirds of the participants rated their general knowledge of the topic ARAS-PTW to be positive. This leaves 30 percent of motorcyclists who do not have any knowledge at all. As the market penetration of the systems continues to increase, knowledge about them has not yet been able to keep up with the same degree.

The general knowledge of ARAS-PTW primarily (39 %) comes from own experience with the systems installed on one's own motorcycle. Among the participants who tend to judge themselves or their knowledge in a negative light, only half have own experiences with assistance systems. Almost a third (29 %) of the motorcyclists cite reading specialist journals as a source of general knowledge about rider assistance systems. This is followed by the internet or social networks as a source of information (14 %).

In view of the fact that a large number of new, often complex systems have only been installed in series in recent years, the current state of knowledge can be assessed as positive overall. This becomes even more obvious when one considers that over a fifth of the motorcyclists surveyed are not yet using an ARAS-PTW or have not installed a system on their own motorcycle, which can be primarily justified by the year of manufacture of the machine used. It is therefore to be expected that with the increasing spread of rider assistance systems, which are already conquering the middle class on a broad front, more and more motorcyclists will gain further knowledge. At the latest, when their own new machine comes with a variety of safety-relevant features, most riders will become more familiar with the subject. According to the survey, almost 80 percent of those participants who already ride a motorcycle with ARAS-PTW on board state that they are aware of its function and operation.

This causal link is, incidentally, underpinned by the questioning about specific knowledge of individual systems. Here, it is particularly the more established ARAS-PTW, with which the participants are more familiar with. This is reinforced by the fact that 90 percent of the participants state that they already have experience with assistance systems in passenger cars. Many of the available results indicate that the dissemination of and experience with ADAS in the passenger car sector has an impact on the participants' knowledge regarding the motorcycle.

In terms of gender, around three quarters of men have specific skills in dealing with existing ARAS-PTW. At 54 percent, the womens' results are significantly lower. There are also significant differences in the age of the participants. Younger riders are more conspicuous by their lower knowledge than older riders. According to this, the self-assessment of knowing how one's own ARAS-PTW works and how to use it increases with increasing age. The first source of this knowledge of the functions of their own systems is the vehicle's operating manual (73 %). Then, in second place, come the motorcycle traders, where over 40 percent of the participants have the special handling of the technology explained to them. In most cases, the systems are explained when the vehicle

is handed over. With over 30 percent, the circle of friends and acquaintances serves as a source of information. The analysis was also able to reveal gender-specific characteristics at this point. While men use technical journals and operating instructions much more often, women prefer to exchange information with friends and acquaintances more often than average. They also mentioned initial and advanced rider training proportionately more often than men. In contrast, the local trader was an almost equally important source of information for both sexes.

As far as the specific experience with the ARAS-PTW is concerned, this can be summarized as positive in two ways: While on the one hand almost two thirds of the respondents are speaking of positive experiences with the systems, almost 90 percent of them have no negative experience with ARAS-PTW. There are no gender-specific conspicuous features here. It is not surprising that 94 percent of ARAS-PTW-experienced riders do not want to give up on the assistance systems for their next motorcycle. Two thirds of motorcyclists also agree with the statement that they feel more comfortable on the bike with the support of ARAS-PTW. Only 13 percent do not feel more comfortable on a motorcycle equipped with ARAS-PTW. We can conclude that ARAS-PTW makes an important contribution to a more positive riding experience.

Almost two thirds of the participants disagree with the repeatedly heard assumption that motorcyclists tend to more or less "think themselves safe" due to the technical support and are tempted to perform riskier riding maneuvers. When asked directly about the topic of risk compensation, only 13 percent of the participants feel tempted to ride more risky maneuvers at times because of ARAS-PTW at work.

Another prejudice about ARAS-PTW that is sometimes expressed in fuel talks can only be partially refuted on the basis of the survey results: The skepticism that rider assistance systems could have a negative effect on one's own riding skills is comparatively high. Thus, almost 40 percent of the participants are of the opinion that the use of ARAS-PTW could lead to the fact that one unlearns riding skills. All in all, this results in a comparatively balanced picture among the participants (agreement = 37 %, undecided = 31 %, rejection = 32 %). That this is a prejudice is indicated by further evaluations. As a consequence, this skepticism decreases significantly as soon as the respondents know and appreciate the systems on the basis of their own experience. Modern rider assistance systems and future traffic scenarios see the rider as having the primary control function, especially for Powered Two-Wheelers. This knowledge has not yet been sufficiently disseminated among motorcyclists without practical experience of rider assistance systems.

Equally interesting remains the slightly ambivalent attitude of the respondents with regard to the safety relevance of ARAS-PTW, which becomes apparent when their general assessment of different ARAS-PTW with regard to promoting motorcycle safety is compared with their own wishes and future purchase intentions. The various ARAS-PTW are all considered to be more useful or helpful than being desired or planned as equipment for the future motorcycle. Financial aspects may play a role here. Often, the new systems are only available for an additional charge, which the participants self-evidently include in their purchase decision. Technology-related follow-up costs can also play a role in this respect.

The image of the ARAS-PTW, which is quite positive based on the results of this study, is also reflected in the expressed expectations of future developments. For example, over 60 percent of motorcyclists believe that ARAS-PTW will continue to contribute to reducing the number of accidents in the Powered Two-Wheeler

sector. Just under 36 percent expect no changes and only two percent expect an increase in accident figures as a result of the increase in technology.

As far as the future “networking” of road users and infrastructure is concerned, half of motorcyclists are not sure in which direction the number of accidents will develop due to increased use of technology. Around 14 percent are of the opinion that networking will not bring about any improvements. The remaining 36 percent, in contrast to that, are confident about a technology that is not yet very well known. A certain skepticism on the part of motorcyclists cannot yet be dismissed, which, it must be assumed, is primarily based on a still rather low level of knowledge about the topic.

The advancing technology will continue to provide further services for motorcycle safety in the future, especially with regard to the networking of vehicles and road users. On the one hand, cooperative systems will then react within the framework of the infrastructure, for example to traffic lights or traffic guidance systems. On the other hand, the vehicles communicate with each other, react automatically or pass on safety-relevant information to the rider. But there is still a long way to go to achieve these changes. Until this point in time, the rider still has central responsibility and acts as such with regard to the safety awareness at a pleasantly high level, as we were able to ascertain in the course of this study.

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