Impact of Visual Attention and Useful Field of View in Driving: A Narrative Review

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ABSTRACT

Driving includes a complex task of visual information processing and cognitive functions. Two of the most studied and complex factors in this context are visual attention and the useful field of view. These visual tasks are interconnected and play a crucial role in driving safety and hence have to be incorporated in the comprehensive assessment in the evaluation of driving performances.

Aim of the review is to delve into the significance of visual attention and UFOV in driving, exploring their relationship with driving performance, factors that influence them, and potential interventions to enhance these cognitive abilities. Articles were selected based on the topic relevance and methodological rigor. Further articles were selected based on the cross-referencing from the relevant articles. The search included articles from the year 2003 and further. Articles in languages other than English were not included

Results show that Visual attention is important for viewing and reacting to relevant information from clutter. Problems with visual attention can lead to delayed reaction time in perception of hazards, hence resulting in accidents. Reduced Useful field of vision may lead to limitations on peripheral information processing that can impact driving related tasks.

This narrative review aims at providing the basic understanding of the existing literature on Visual attention and useful field of view. It also covers the impact of these factors on driving performance and safety, influencing factors, existing literature, and future scope.

*Keywords: Driving; Peripheral awareness; Selective attention; Useful Field of View; Visual attention.*

1. INTRODUCTION

Driving involves a range of dynamic and unpredictable visual stimuli, therefore maintaining constant, vigilant attention and visual awareness which is essential for safety.(Crundall & Underwood, 2011). One such cognitive process of selectively focusing on the relevant stimuli and filtering out the distractions, is Visual Attention. It helps in maintaining situational awareness and avoiding potential hazards on the road appropriately. Driving is a visual task with constant display of visual information, both dynamic and static. As a result, visual attention is crucial in helping drivers prioritize pertinent indicators including traffic signals, pedestrians, and possible hazards. Yet another essential feature for the driving activity is Useful Field of View (UFOV). It is a measure of the spatial extent of visual attention and is a valuable tool for assessing the ability to process visual information from a wide area without head or eye movements. In contrast to conventional visual field tests, which evaluate an individual's ability to see beyond one's immediate field of vision, UFOV concentrates on the functional extension of visual attention, or the ability to effectively process information from a wider field. (Wood & Owsley, 2014)

The ability to process visual information, quickly and accurately, from a wide area, while ignoring irrelevant distractions, is essential for making safe and timely decisions on the road, especially in complex driving scenarios. These two tasks can significantly reduce the risk of accidents. (Kotseruba & Tsotsos, 2021),

Understanding the role of visual attention and UFOV in driving is important for developing effective strategies that can improve driver safety and, in turn, reduce the risk of accidents. This review will look at the significance of visual attention and UFOV in driving, as well as how they relate to driving performance, what influences them, and possible ways to improve these cognitive skills. Driving requires complex cognitive and visual information processing and the two crucial elements that have been extensively studied in this field are visual attention and useful field of view. These visual activities are closely related and play an important role in driving safety, so they must be considered when evaluating overall driving performance

2. methods

An extensive search of the existing literature on the impact of visual attention and ufov was conducted. Peer reviewed articles, reviews were studied from the databases such as pubmed, medline, web of science, google scholar, and general google search. keywords like “visual attention”, “useful field of view”, “drivers”, “driving”, “selective attention”, and “peripheral awareness” were used for the basic search. articles were selected based on the topic relevance and methodological rigor. further articles were selected based on the cross-referencing from the relevant articles. the search included articles from the year 2003 and further. articles in languages other than English were not included.

This review sheds information on the basic understanding of the visual attention, useful field of view and its relationship in the context of driving. it does not include the other visual factors that contribute to the driving performance.

**2.1. Visual Attention in Driving**

Visual attention is more than a simple visual task. It represents a collection of complex interplay of cognitive processes with which drivers can successfully navigate the mixture of various visual stimuli on the road. All these processes are crucial for different tasks like hazard perception, informed decision making, etc. The key components of visual attention are selective attention, divided focus, visual search and attention switching.

**2.1.1. Selective attention**: It is the ability to filter out the unwanted stimuli and perceive only the required and important information. For example, on a heavily trafficked road, a driver will come across different types of visual stimuli such as attention seeking advertisement boards, people crossing the road and other cars joining or leaving the traffic flow. Among all these distractions, selective attention acts as a filter and is an important and very crucial ability, allowing drivers to focus on specific objects or areas of interest while suppressing irrelevant information. (Le Callet & Niebur, 2013) It helps the driver to selectively attend to the traffic signal, while filtering out the visual noise including the brightly lit storefronts, even when approaching a cross-sectional junction. These consequences namely include RTAs due to lost or reduced visional attentions.

**2.1.2. Divided attention**: As previously mentioned, driving is a complex activity that entails numerous individualistic and overlapping tasks. It usually involves dividing one’s focus among multiple things at once. Divided attention involves the allocation of focus to various stimuli at the same time. In driving, it includes maintaining your lane while looking in the rearview mirror as well as scanning your blind spots when driving (divided attention). In stressful situations where many stimuli must be balanced for safe movement this is very important. We must also remember that we have a limited span of attentiveness. More so, it is advised that driving also depends on whether the undertaken tasks are visuo-manual or manual, or visual activities.(Kotseruba & Tsotsos, 2021)

**2.1.3. Visual search**: From a simpler viewpoint this part of visual attention implies skillful scanning of the environment for signs like possible dangers and useful details on them.(Huizeling et al., 2020) However, methodically focusing on several areas, assessing the importance of each stimuli, and spotting possible dangers is also a component of this cognitive process. Let us consider an example of a driver approaching a school zone. He needs to use more sophisticated visual search patterns because he needs to be more aware of crosswalks and sidewalks and be prepared for the possibility of seeing children. Drivers with more experience frequently acquire more effective visual search patterns, foreseeing dangers and scanning beforehand. It has been suggested that enhanced attention or motor preparation, a part of the effective visual search process helps in preparing for a response event.

**2.1.4 Attention switching**: Switching attention is quickly changing focus from one task or place to another. Hence, with driving being a very intricate and dynamic process, it has numerous applications as well. [6] That is while on the process of shifting lanes whereby a driver may look from road ahead to dashboard to check on their speed before returning again towards the road so as to see how traffic goes and then finally sideways through side mirror. It must be accurate and fluid to guarantee that no important information is lost in the rapid changeover. When Geoffrey et al, in 2014, studied various aspects of driving, with the help of Liu’s stimulator, he described that this attention switch was significantly higher in drivers with experience.

**2.1.5. The Crucial Role of Visual Attention in Driving Performance**: More specifically, situational awareness, decision-making and hazard perception of a driver can be seen through visual attention. In this light, researchers are studying to establish its significant role in determining driving ability. When somebody is at the verge of crossing the road without using a crosswalk or when a car stops suddenly, these are considered as hazards that need to be detected immediately. This helps to minimize accidents. (Velichkovsky et al., 2002) Drivers can identify them and avoid getting involved in such dangers by selectively attending to these visual cues and filtering out distractions. Right from deciding whether it’s safe for them to switch lanes or calculating how much distance there should be between them and the vehicle ahead, drivers continue making decisions constantly while driving their vehicles. (Zhao et al., 2014) Visual attention plays a major role in effective decision-making since driving requires the collection and processing of all the relevant visual data from a mixture of various environmental data, to make decisions. Situational awareness is also associated with visual attention which refers to an individual’s ability to maintain a holistic perception of the environment around him/her including other vehicles on the road, nearby pedestrians, etc. (Chaparro et al., 1999)

**2.2. Useful Field of View**

UFOV refers to the ability to process visual data from a large field. (Wood & Owsley, 2014) It is an important responsibility for driving safely. The purpose of the UFOV test is to evaluate visual impairments that are typically missed by more conventional visual exams. The ability to distinguish important information from visual noise or to allocate visual attention among the several other visual data are not assessed by the traditional assessments. The UFOV tests are used to evaluate the cognitive components of visual attention which also includes processing speed. (Wood et al., 2012) Therefore, it can be used as a standard tool for evaluation of visual functions specific to driving.

The test comprises three subtests, each designed to assess specific functions and skills essential for driving. The Central Vision test assesses the ability to spot and recognize a visual target in the center of the visual field quickly and accurately, in the presence of a variety of peripheral distractions. This subtest evaluates the processing speed and the selective focus in the face of distractions. In the context of driving, this particular visual task is applied in detecting and reacting to the potential hazards on the road. The ability to pay attention to several stimuli at once is assessed using the Divided Visual Attention test. The purpose of this test is to make the individual locate a central target while also identifying a peripheral target that appears briefly, at the same time.(Wood et al., 2012) The third subtest evaluates the Selective attention. A central target is presented that is dynamic and keeps changing its position. The individual is required to track its movement while ignoring the presentations of peripheral visual distractions. This assessment of the ability to maintain focus on a moving target gives a direct measure of the ability to track other vehicles, pedestrians and potential hazards in the driving environment. (Andersen et al., 2011)

**2.2.1. The role of UFOV in predicting Driving performance**: Numerous studies have revealed a significant relationship between driving skill and UFOC performance, especially in older adults and those with visual impairments. (Clay et al., 2005) It assesses visual processing thereby also predicting real world driving performance and safety.

A specific study in 2002, assessed the UFOV using a computer-generated task in which targets were presented for 90 milli seconds centrally and then peripherally. The study also revealed that age and visual impairment had a significant detrimental effect on various driving-related tasks, including recognizing signs and hazards, completing driving courses, steering efficiently, and maintaining divided attention. To determine this, a study was done which included dot motion, UFOV, Pelli-Robson letter contrast sensitivity, and dynamic visual acuity and could predict 50% of the variance in the overall driving score (multiple r = .71, Score = –0.50(0.14) (motion) – 0.03(0.007) (UFOV) + 0.48(0.23) (Pelli) – 0.007(0.003) (dynamic) – 0.76). 8 This suggests that driving experience sharpens the ability to efficiently distribute visual attention across both the central focus area and peripheral objects, a skill closely aligned with the concepts measured by the UFOV test. This finding proves the significance of the results of the UFOV test as a key indicator of driving performance, over and above the traditional vision tests. (Wood, 2002)

Furthermore, Zhao et al, in 2014 studied the link between visual attention patterns and driving experience. It is shown that drivers outperform non-drivers in detecting changes in driving scenes, but only when the task requires a pattern of visual attention distribution typical of actual driving.

The UFOV test provides a comprehensive and insightful assessment of visual attention and processing speed to capture the complex cognitive demands of driving, which goes beyond the simple visual acuity measurements. Research proves that UFOV test has a strong predictive power of driving performance and safety, making it a valuable tool for identifying at-risk drivers, informing interventions, and promoting safer driving practices for all.

A person driving a car

Description automatically generated

UFOV

Visual attention

Figure1 showing UFOV and Visual attention while driving

**2.3. Factors Influencing Visual Attention and UFOV in Driving**

As for any other complex cognitive functions, Visual attention and UFOV are also affected by the process of aging. 6 However, it is important to note that aging is not the only factor that impacts these two abilities. Various elements like distractions, cognitive load and other environmental factors significantly influence the visual attention and UFOV across drivers of all age groups.

**2.3.1. Aging:** There is natural decline in the cognitive visual processing speed as one ages. Hence, older drivers who are naturally under the risk of falls, are also at an increasingly higher risk of accidents. This was proven with the findings of a study in 2002. The overall driving score, analyzed by post-hoc showed a significant decrease (p < 0.05) for the older age groups compared to the young ones. (Wood, 2002)

**2.3.2. Distractions**: Distractions, both internal and external act as the silent threat to these two tasks significantly. Internal distractions can include the driver engaging in conversations with passengers, mobile phone usage, or even mental stress. These can hinder the driving capacity as there is already an overload to the cognitive processes. (Yuen et al., 2021) ] Internal distractions and the external distractions on the road lead to division of attention, which in turn reduces the reaction time and increases the likelihood of missing critical visual cues. Behavioral research has proven that complex tasks like driving can demand highly complex cognitive resources.

**2.3.3. Cognitive load**: Like any system, adding up more tasks to the already present heavy mix like navigating through unfamiliar routes, managing music systems, or engaging in complex conversations, can only increase the cognitive load. A study on the brain activity of drivers in normal and distracted conditions revealed a significant activation of the temporal and frontal cortices (p < 0.001) during distracted driving conditions suggesting the increased cognitive load during distractions. (Yuen et al., 2021) Therefore, multitasking and being stress-free are crucial for drivers to minimize distractions and multitasking.

**2.3.4. Environmental factors**: Safe driving requires clear visibility. Weather conditions like fog, rain, snow, or an extremely sunny day and environmental factors like headlight glares from cars, can hinder the visibility of the driver. Judging gaps, spotting dangerous cues, and maintaining the lane positions are major tasks involving both the central and peripheral vision. 1 When these are affected, driving becomes more challenging. Increased caution is advised particularly in the presence of such adverse environmental conditions.

**2.3.5. Experience**: Driving experience enhances the ability to center attention and process the visual information effectively. Drivers develop what can be called as ‘a visual expertise’, becoming more habituated to the patterns and recognizing potential hazards. (Zhao et al., 2014)This expertise enables the drivers in predicting the potential movements and the interactions in the dynamic view of traffic flow. The study showed a significantly better ability of change detection in static real-world driving simulations in drivers when compared to non-drivers. Experience had a significant effect when the peripheral awareness(F(1,41) ¼ 5.17, p = 0.028). 8 These results imply that the rigorous driving experience probably enhances filtering out distractions, prioritizing of relevant visual cues and anticipation of hazards. All these tasks are important for safety during driving. However, for a proficient driver, while expertness may have led to effective filtration of superfluous information like advertisement-boards, even him can face high cognitive load resulting from involvement in intricate in-vehicle technologies which can eventually reduce his capacity to respond to unpredictable risks. Therefore, experience alone doesn’t make a driver immune to lapses of attention. On studying the effects of relevance and distractions or hazards on gaze directions, it was found that driver eye movements and therefore their attention were sensitive to the relevance to the driving task (ad-boards to signs, t(17) = 2.26, p < .05, and from ad-boards to hazards, t(17) = 4.42, p < .001). (Garrison & Williams, 2013) Other factors like fatigue and stress can also increase the risk of errors for drivers of all experience levels.

However, it should also be considered that lifestyle factors such as sleep quality, stress levels and physical activity can impact cognitive function and need to be properly addressed. Furthermore, for people with some specific medical disorders such as ADHD (attention-deficit/hyperactivity disorder), appropriate treatment options should be taken into account so as to improve driving safety by normalizing abnormal visual attention.

Thus, drivers can appreciate the influences of age, distractions, cognitive loads and environment as well as past experiences when they make decisions that minimize risk and promote safe driving habits. Therefore, it is necessary to comprehend how this complex interaction affects both attentional control aspects and UFOV performance. It also contributes to safe driving practices that span across different age groups and experience levels. Nevertheless, we need more extensive research that will lead us to develop targeted interventions aimed at reducing the risks involved and enhancing safer driving. In order to identify and support drivers who may be at increased risk, it is important to understand the relationship between visual attention, UFOV, and driving performance, as this will ultimately contribute to a safer transportation system.

**2.4. Existing Literature on Visual Attention, UFOV and Driving Performance**

Numerous studies demonstrate the profound impact of UFOV and visual attention on real-world driving scenes. All these prove that both these factors have a crucial link to driving performance. In 2012, Wood et al, reinforced this by reporting in their study that individuals with poorer UFOV results, exhibit high-risk on-road driving behaviors with an increased risk of being involved in crashes. (Wood et al., 2012) Moreover, studies show that cognitive abilities are important in safe navigation, highlighting that visual attention significantly affects specific driving tasks. (Ahlström et al., 2021) Another study showed that drivers with lower UFOV scores are likely to experience challenges in carrying out these activities that require fast processing of visual data and some divided attention. (Marcotte et al., 2006) These tasks, crucial for safe driving, include merging into traffic, navigating intersections, and responding swiftly to unexpected hazards. Another study showed that drivers with diminished UFOV have slower reaction times, misinterpret the gaps in traffic and find it difficult to maintain the situational awareness. Thus, minute but important driving tasks like ability to effectively scan the environment, detect potential threats, and make timely decisions is compromised. (Chaparro et al., 1999) All this evidence highlights the direct link between visual attention, visual information processing speed and driving safety. Researchers are also interested in studying the visual scanning patterns of the drivers. For instance, advanced eye-tracking technology is being studied on, to gain more precise and detailed insights into the visual scanning patterns, selective attention, and responses to distractions. (Yuen et al., 2021)

Efficient visual information processing and selective attention is crucial for safe driving. Nevertheless, lifestyle factors such as sleep quality, stress levels and physical activity and certain medical conditions like ADHD also influence cognitive functioning and must be well attended for better results when it comes to optimizing safety during driving.

**2.5. Training and Interventions for Safer Driving**

Different training programs and interventions can improve these cognitive abilities. Efforts are being made to help deal with the defects of these abilities that occur because of age-related decline. (Belchior et al., 2013) One such is the driving simulator training which is emerging as a promising method of enhancing visual attention and UFOV. (Agrawal et al., 2018) Another study showed that simulator-based training of specific skills like hazard perception, sustained attention and decision making in complex situations. (Akinwuntan et al., 2010)In 2014, research on the elderly demonstrated that simulators could improve driver safety among those who suffer from age-related cognitive impairments by providing a controlled environment for practice and training. (Matos et al., 2014) Other than driving simulators, cognitive training programs, are effective in improving UFOV performance and reduce visual attention deficits in drivers. (Richardson & Marottoli, 2003)

While designing automotive technologies and in-vehicle visual aids, it is necessary to consider the factors that can influence visual attention and UFOV. (Merenda et al., 2018) Engineers and designers are working on integrating the importance of UFOV into the development especially among the older drivers and those with cognitive impairments. (Meza et al., 2009) These can include designing the head-up displays or other information systems, to avoid exceeding the limits of UFOV and minimize distractions.

Table 1. Studies on Visual Attention and its assessment for driving performance.

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| Title of the study | Objective | Methods | Result | Conclusion |
| Visual attention and driving behaviors among community-living older persons. (Richardson & Marottoli, 2003) | To identify the cognitive variables linked to driving behaviors in older individuals. | Cognitive tests like Visual attention and visuospatial cognition were performed for older driving individuals.  n = 35 active drivers aged 70 and above. | Visual attention correlated with driving score. | Key driving maneuvers are associated with visual attention in older drivers. |
| Visual Attention and Applications in Multimedia Technologies.  (Le Callet & Niebur, 2013)3/18/25 3:29:00 PM | To explore mechanisms of visual attention in primate vision and computational models. | Review of visual attention, bottom-up, top-down processing and gaze prediction with eye-trackers. | Visual attention impacts multimedia technologies and 3D visual experience. | Computational models for visual attention improve the perception. |
| Visual Attention as a predictor of on-road driving performance. (Baldock et al., 2007) | To determine predictors of driving ability to enhance screening of at-risk drivers. | Computerized Visual Attention Test (CVAT) and Functional measures including contrast sensitivity, visuospatial memory, and visual attention tests were performed.  n = 90 older drivers aged 60-91 | Regression analysis shows reaction times, contrast sensitivity, and spatial span predict driving. | Functional abilities are better predictors of driving performance than age. |
| Visual Attention deficits associated with driving accidents. (Marcotte et al., 2006) | To examine UFOV and Visual attention impairments in HIV-infected individuals | UFOV test assessed visual attention in HIV+ and HIV- participants analyzed with non-parametric and chi-squared tests.  n = 63 | 'High risk' UFOV status correlated with varying levels of cognitive impairment. |  |
| Visual Attention for Behavioral Cloning in Autonomous Driving. (Mohandoss et al., 2019)3/18/25 3:29:00 PM | To enhance autonomous driving with visual attention prediction using supervised learning | Analysis of supervised and unsupervised approach 3 different training models to predict attention while driving. | Supervised visual attention model (RoadSal) outperformed other approaches in predictions. | Computational models like AutoTaskSal can be recommended for task-specific assessment of visual attention. |
| Visual Attention in Driving - The Effects of Cognitive Load and Visual Disruption. (Li et al, 2018) | To investigate cognitive load effects on visual attention in driving scenarios. | Participants were engaged in auditory tasks while driving in a simulator. Change detection tasks were administered using a dynamic change blindness paradigm.  n = 12 in each group aged between 20 to 30. | Participants were less sensitive to parked-vehicle changes s (d′ = 1.11), F(2, 121) =  8.98, p = .0002. Confidence was highest with (M = 7.48) backward changes (M = 6.51) and lowest with parked-vehicle changes (M = 5.39) (F(2, 121) = 27.61, p < .0001). Cognitive load undermined both endogenous and exogenous control of attention | Cognitive load and glances away from the road increase missed events. Drivers' confidence in detecting changes is reduced by cognitive load. |
| Visual attention in realistic driving situations\_ Attentional capture and hazard prediction. (Ismael et al., 2020) | To develop a new Hazard Prediction test for future investigations' validity. | Developed new Hazard Prediction and Risk Estimation tests for driving scenarios. (n = 92) The study utilized Bayesian statistics and ANCOVA to analyze driving data. | Experienced drivers scored better than novices in Hazard Prediction test. | Experienced drivers outperformed novices, novices better than inexperienced drivers |

3. results

There are numerous emerging areas of research as both the tasks – Visual attention and UFOV are complex and are constantly evolving. Studies can involve powerful and stringent methodologies to understand complexity and applications. Visual attention is important for viewing and reacting to relevant information from clutter. Problems with visual attention can lead to delayed reaction time in perception of hazards, hence resulting in accidents. Reduced Useful field of vision may lead to limitations on peripheral information processing that can impact driving related tasks. Selective attention helps drivers to focus on various visual targets without distractions & deficiencies in this can lead to higher risk of road accidents. Drivers should also be able to give attention simultaneously to various stimuli including looking at mirrors,road signs and paedestrians and drivers with weaker divided attention can struggle with multitasking leading to slower reaction to hazards. UFOV test is a reliable indicator of driving ability, especially in older persons. delays in hazard recognition, a higher chance of crashes are linked to lower UFOV(Clay et al., 2005).Influence of Age and Visual attention is also an important factor with older drivers visual attention and UFOV deteriorate naturally with age which also affects their ability to recognize and respond to risks related to driving. External and internal influences such as distractions, cognitive load, and environmental conditions exert significant effects on visual attention and UFOV. While external distractions such as advertisements and pedestrians divert attention, internal distractions such as mobile phone use or psychological anxiety have a negative impact on cognitive functioning. Furthermore, poor vision induced by adverse weather conditions reduces visual attention and UFOV, making driving more challenging (Wood, 2002). Training on simulators can help to train drivers to enhance visual attention related skills mainly for old drivers. These cognitive training has been shown to reduce problems with visual attention and also improve UFOV performance.(Richardson & Marottoli, 2003) As discussed in previous sections, eye-movement tracking technologies can provide promising and sensitive developments for precise measurements of visual attention and UFOV. Analysis of the subtle eye movements, gaze patterns can provide deeper understanding of the underlying cognitive processes of these two tasks and their relationship in the driving world. (Ahlström et al., 2021) New areas are being explored to understand the complex interplay of these factors by using integration of computational modeling and machine learning techniques.(Mohandoss et al., 2019) Artificial intelligence based predictive models incorporating visual attention, UFOV are incorporated along with the relevant variables like age, driving experience, and medical history. All these factors, which can significantly affect driving tasks can be analyzed to identify individuals at higher risk of accidents and develop targeted interventions to eliminate those risks. Moreover, these models can also be used to process and analyze a robust database from various sources including driving simulators, naturalistic driving studies, and crash databases.

3. Discussion

The findings indicate that visual attention and useful field of view (UFOV) are crucial factors influencing driving safety. Drivers with excellent selective attention can effectively filter out distractions, resulting in faster reaction times and better hazard perception. Attention skills are essential for successful multitasking, which is required for handling complex traffic conditions(Skrypchuk et al., 2019). Findings reveal that, experienced drivers develop advanced visual search strategies, which improves their ability to anticipate and respond to possible dangerous situations. The UFOV assessment has been shown as a useful approach for determining driving performance, particularly among senior drivers. A research initiative employing computer-simulated UFOV tasks illustrated that age-related factors and visual impairments have a pronounced impact on driving competencies, with suboptimal UFOV performance being associated with higher accident susceptibility (Ball & Rebok, 1994). Moreover, findings indicate that seasoned drivers exhibit superior capabilities in detecting alterations within driving environments, thereby reinforcing the value of UFOV evaluations (Tapia et al., n.d.). Driving experience is also vital, as skilled drivers have efficient attentional patterns. However, depending solely on experience does not eliminate the possibility of attentional lapses, particularly in situations when there is a high cognitive demand (Marcotte et al., 2006). Consequently, while experience enhances the processes of hazard detection and decision-making, distractions and cognitive fatigue can still jeopardize safety. Interventional techniques such as cognitive training and driving simulations have been experimentally shown to improve visual attention and UFOV performance and are proven to increase hazard awareness and attentional management, particularly in senior drivers (Matos et al., 2014). Future research areas could give a deeper understanding of these tasks and will make it possible for the policy makers & licensing authorities to include more robust assessments and licensing procedures particularly for the elderly as well as medically affected drivers. (Krasniuk et al., 2023) Rather than relying on conventional vision tests that measure only static visual acuity, future assessments could also evaluate dynamic indices of visual attention, processing speed, and divided attention that will provide a more accurate assessment of one’s ability to safely navigate complex driving scenes. These results can be integrated into driving programs to emphasize the significance and increase awareness of visual attention’s importance. (Mohandoss et al., 2019) Besides all other forms of interventions and training plans, a safe-driving environment for all can only be created by using an evidence-based strategy that is updated with current research on visual attention and UFOV.

4. Conclusion

This review explored the in-depth understanding of visual attention, UFOV and its great significance for safe driving. To properly see and react to the appropriate information among many visual inputs, Visual attention is very important. Failure of this ability can have serious consequences in driving including delayed recognition of hazards, a longer time is taken to respond and an overall decline in situational awareness. On the other hand, UFOV functions as an important tool for assessing how much data we can perceive from a visual field without having to move our eyes or heads. Reduced UFOV which is often associated with old age may lead to limitations on peripheral information processing that impact on tasks such as lane keeping, blind spot checking and pedestrian detection.

However, there are ongoing studies on improving visual attention and UFOV that could help improve hazard perception, maintenance of attention and decision-making skills during complex driving situations. Eye-tracking technologies, computer-based training, simulators, and machine learning can be incorporated in the future to gain deeper insights, development of more ecologically valid assessment tools and distraction management in real-time driving scenarios. Moreover, integrating these research findings into the design of in-vehicle technologies and driver assistance systems can contribute to a safer and more intuitive driving experience. Computational modeling, however, can model the actual driving situations and predict how various things affect visual attention as well as driving ability. The development of these tools is expected to put to an end the conventional pen-paper assessments that fail to capture the demanding driving tasks. Instrumented vehicles or virtual reality simulations can be used for accurate measurement of such tasks in order to have a holistic evaluation of driving standards.

To sum up, visual attention and UFOV are some basic cognitive skills that are important in ensuring safe driving. With our understanding about these abilities growing each day, it will be possible for us to develop effective strategies which will promote driver safety better than before. A multidisciplinary approach embracing new technologies, advanced modeling techniques and ecologically valid evaluations could lead us into a future where all people would find driving safe and easily accessible.

Consent (where ever applicable)

It’s a narrative review and hence not applicable

Ethical approval (where ever applicable)

It’s a narrative review and hence not applicable

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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