

Psychological Impact of Horn Sounds and Headlight Flashing on Novice Drivers During Driving

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Abstract

This study investigates the psychological and behavioral responses of novice drivers to auditory and visual stimuli, specifically honking and headlight flashing. The primary objective of this study was to examine how novice drivers' emotional responses to environmental stimuli such as horn sounds and headlight flashing influence their driving behavior. Using face-to-face or online interviews, qualitative data were collected from 30 novice drivers, with a focus on their reactions to traffic stimuli and the resulting effects on their decision-making and overall driving performance. Thematic analysis was employed to identify key themes, resulting in five main categories: "Environmental Factors", "Emotional Responses", "Driver Behavior", "Communication", and "Attitudes." The findings reveal that external stimuli such as honking and headlight flashing significantly affect novice drivers' attention and emotional state, often leading to heightened levels of anxiety, anger, and stress. These emotional responses are closely linked to increased aggression on the road, including speeding, aggressive overtaking, and erratic lane changing. Furthermore, the study uncovered that novice drivers' attitudes toward these stimuli evolved with experience, with less emotional reactivity observed as they gained more driving experience. However, frequent exposure to these stimuli still led to a decrease in self-confidence in some cases. The results emphasize the importance of incorporating emotional regulation and stress management strategies into driver education programs. By equipping novice drivers with the skills to manage their emotional responses, it is possible to improve road safety, reduce aggressive driving behaviors, and enhance overall driving performance.

Anahtar Kelimeler: novice drivers, psychological impact, horn sounds, headlight flashing, emotional responses

Acemi Sürücülerde Korna Sesi ve Selektörün Sürüş Esnasındaki Olası Psikolojik Etkileri

Öz

Bu çalışma, acemi sürücülerin işitsel ve görsel uyaranlara, özellikle korna sesi ve selektöre verdikleri psikolojik ve davranışsal tepkileri incelemektedir. Bu çalışmanın temel amacı, acemi sürücülerin korna sesi ve selektör gibi çevresel uyaranlara verdikleri duygusal tepkilerin sürüş davranışlarına olan etkisini incelemektir. 30 acemi sürücü ile yüz yüze veya internet üzerinden görüşmeler yoluyla nitel veri toplanmış ve bu süreçte, acemi sürücülerin trafikte karşılaştıkları uyaranlara verdikleri tepkiler ile karar alma süreçleri ve genel sürüş performansları üzerindeki etkileri incelenmiştir. Katılımcılardan elde edilen veriler tematik analiz yöntemi kullanılarak beş ana kategori altında gruplandırılmıştır: "Çevresel Faktörler," "Duygusal Tepkiler," "Sürücü Davranışı," "İletişim" ve "Tutumlar." Bulgular, korna sesi ve selektör gibi dış uyaranların acemi sürücülerin dikkatini ve duygusal durumunu önemli ölçüde etkilediğini göstermektedir. Bu durum genellikle kaygı, öfke ve stres seviyelerinin artmasına yol açmaktadır. Bu duygusal tepkiler, hız yapma, agresif sollama ve şerit değiştirme gibi saldırgan sürüş davranışlarıyla yakından ilişkilidir. Ayrıca, acemi sürücülerin bu tür uyaranlara karşı tutumlarının zamanla değiştiği, deneyim kazandıkça duygusal tepkilerinin azaldığı tespit edilmiştir. Ancak, bu uyaranlara sık maruz kalmak bazı durumlarda sürücülerin özgüveninin azalmasına neden olabilmektedir. Çalışmanın sonuçları, sürücü eğitim programlarına duygu düzenleme ve stres yönetimi stratejilerinin dahil edilmesinin önemini vurgulamaktadır. Acemi sürücülerin duygusal tepkilerini kontrol edebilme becerisi kazanmaları, yol güvenliğinin artırılmasına, saldırgan sürüş davranışlarının azaltılmasına ve genel sürüş performansının iyileştirilmesine katkı sağlayabilir.

Keywords: acemi sürücüler, psikolojik etki, korna sesi, selektör, duygusal tepkiler

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1. Introduction

Transportation has existed for centuries as the movement and transfer of people, goods, or information from one place to another. Transportation is divided into three main categories: road, air, and sea transportation. Among these, road transportation is commonly used for short-distance travel within cities and also for intercity travel, making it one of the most widely used transportation methods globally. Road traffic accidents occur when a vehicle collides with another vehicle, a pedestrian, an animal, or an object, generally resulting in injury, death, or property damage. The factors causing road traffic accidents are multifaceted, including human, environmental, and vehicle-related factors (Pérez-Acebo et al., 2021). The prevalence of road transportation contributes to the high number of vehicles and people on the road, as well as the varying quality of roads across countries.

According to the World Health Organization (2023), approximately 1.19 million people die each year due to road traffic accidents. In Turkey, in 2023, 88.9% of fatal road traffic accidents were caused by drivers, highlighting the urgent need for traffic safety measures (Turkish Statistical Institute, 2023). Furthermore, for the age group 5-29, road traffic accidents are the leading cause of death, ranking first among all other causes of death in this demographic. This aligns with the fact that novice drivers, which often include a large portion of young drivers, are particularly vulnerable to road traffic accidents. Although novice and young drivers are not synonymous, the majority of novice drivers fall within the young driver category. This group's high vulnerability to traffic accidents underscores the need for targeted interventions and safety measures, as they represent a significant portion of the population most at risk of fatal traffic accidents. In this context, the present study focuses on the psychological and behavioral effects of specific external stimuli—namely honking and headlight flashing—which may either be perceived as aggressive or be intentionally used with aggressive intent—on novice drivers. In this study, novice drivers are defined as individuals with limited driving experience, typically having driven less than 3000 kilometers. While the Turkish Ministry of Interior uses a two-year probationary period to define novice status (Republic of Turkey

Ministry of Interior, 2015), prior research suggests that driving distance is a more accurate indicator of experience level (Al-Garawi et al., 2021). This study therefore adopts the criterion of driving less than 3000 kilometers to define novice drivers, as this threshold better reflects the cognitive and behavioral characteristics associated with inexperience.

To address concerns around conceptual clarity, it is important to note that while "driver behavior" and "aggressive driving" are terms that might occasionally be used interchangeably, in the current study a deliberate distinction is made. This study specifically focuses on honking and headlight flashing—actions that are commonly associated with aggressive driving. These behaviors may either be perceived as aggressive or be used with aggressive intent. Therefore, the research is conceptually framed within the context of aggressive driving. The terminology has been carefully chosen to reflect both observable traffic behaviors and the psychological processes underpinning these actions.

1.1. Aggressive Driving Behaviors among Novice Drivers

Aggressive driving behaviors are a significant and growing concern on roadways, particularly among novice drivers. These behaviors are characterized by actions that increase the risk of traffic collisions and endanger the safety of all road users. For novice drivers, inexperience often leads to risky behaviors such as illegal overtaking, tailgating, speeding, failure to signal, and failure to yield the right of way. In this study, honking and headlight flashing are treated as behaviors that may either be perceived as aggressive or be intentionally used with aggressive intent. Given their common association with aggressive driving, the study is conceptually framed within the context of aggressive driving. By focusing on this, the study aims to explore the effects of these specific behaviors, which are more likely to increase road safety risks among novice drivers. These behaviors can escalate into more dangerous actions, including running red lights and making sudden, unsafe lane changes. Novice drivers, due to their limited driving experience and unfamiliarity with road conditions, are especially vulnerable to engaging in these behaviors, which significantly heightens the risk of accidents (Day et al., 2018).

Research shows that although novice drivers typically exhibit a lower crash involvement rate during the initial months of driving, this tendency

changes over time. As novice drivers gain more experience, their driving becomes more aggressive, contrary to the earlier observed reduction in accidents. This paradox suggests that gaining driving experience can sometimes lead to an increase in risk-taking behaviors rather than a decrease (Day et al., 2018). The shift in driving habits among novice drivers may be influenced by a combination of psychological factors, developmental stages, and external stressors encountered on the road (Harbeck & Glendon, 2018).

Interestingly, research indicates that while novice drivers may initially exhibit a lower crash involvement rate shortly after obtaining their licenses, this trend can reverse as they gain more experience. Studies have shown that as novice drivers accumulate driving hours, their likelihood of engaging in aggressive driving behaviors increases, leading to a higher incidence of accidents over time (Wayne & Miller, 2018; Ehsani et al., 2020). This paradox highlights the complex relationship between driving experience and risk-taking behavior, suggesting that increased familiarity with driving may embolden novice drivers to take greater risks rather than fostering safer driving habits (Yang et al., 2019).

1.2. Psychological Factors Influencing Aggressive Driving in Novice Drivers

Psychological factors such as frustration, impatience, and low emotional regulation are especially prevalent among novice drivers and contribute significantly to aggressive driving behaviors. Novice drivers, due to their limited experience, often struggle to manage emotions like frustration when faced with delays, heavy traffic, or other drivers' behavior, which can lead to aggressive reactions such as tailgating, speeding, or unsafe lane changes (Yang et al., 2019; Dula & Ballard, 2003). This emotional dysregulation is particularly concerning as it can escalate minor irritations into aggressive driving incidents, especially in high-stress driving environments (Yang et al., 2019).

The frustration-aggression hypothesis offers a valuable psychological framework for understanding how driving-related stressors can lead to aggressive behaviors. According to this theory, frustration from challenging driving conditions, such as congestion or poor visibility, can trigger aggression, particularly among novice drivers who are still developing the emotional regulation skills needed for safe driving

(Kruglanski et al., 2023; Jovanović et al., 2011). In addition to emotional regulation, demographic factors like age and gender further complicate the relationship between psychological factors and aggressive driving. Studies consistently show that young drivers, especially males, are more prone to engage in risky driving behaviors due to personality traits such as dominance and impulsivity, which are strongly linked to aggressive driving (Rhodes & Pivik, 2011). Research also indicates that young drivers tend to report higher levels of aggressive driving compared to their older counterparts, underscoring their overrepresentation in traffic accidents (Ellison-Potter et al., 2001).

Novice drivers often struggle with poor situational awareness and decision-making due to limited driving experience. They may have narrower fields of vision and be less efficient at processing information from their environment compared to more experienced drivers (Fisher et al., 2006). This lack of experience, along with emotional regulation difficulties, can lead to poor judgment and risky driving behaviors, such as improper use of vehicle mirrors and failure to recognize potential hazards (McKnight & McKnight, 2003). The combination of emotional factors such as frustration and impatience, demographic influences, and the lack of driving experience significantly contribute to aggressive driving behaviors in novice drivers. Understanding these psychological dynamics is crucial for developing effective strategies to mitigate aggressive driving and enhance road safety.

1.3. Legal Interpretation of Horn and Headlight Use in the Context of Aggressive Driving

In Turkish traffic regulations, the use of horn and headlight flashing is permitted in specific circumstances. According to Article 56 of the Turkish Highway Code, the horn is to be used only when necessary to warn other drivers or avoid danger, and excessive or unnecessary use is prohibited. Similarly, headlight flashing is generally recognized as a communication tool but may be interpreted as aggressive or threatening depending on the context. In certain cases, such behaviors have been interpreted under Article 123 of the Turkish Penal Code as “disturbing the peace and tranquility of individuals”. While these behaviors are not inherently aggressive, their misuse or misinterpretation in real-world traffic can lead to conflict, stress, or risky maneuvers, especially among novice drivers. This duality underscores the importance of interpreting these

stimuli both within legal definitions and psychological contexts.

1.4. The Role of Inexperience in Aggressive Driving and Traffic Accidents

Inexperience is a key factor contributing to aggressive driving behaviors and elevated crash risks among novice drivers. Due to limited exposure to diverse traffic scenarios, novice drivers often lack the ability to appropriately assess hazards or regulate their emotional responses in dynamic road environments (Chen et al., 2021). This gap in experience makes them more prone to stress, impulsive decision-making, and risky driving actions—especially when provoked by external stimuli such as honking or headlight flashing.

In their early driving years, novice drivers are more likely to engage in high-risk behaviors such as speeding, abrupt lane changes, or tailgating—actions that align with definitions of aggressive driving (Drummond, 1989; Scialfa et al., 2011). Their underdeveloped judgment and slower response to unexpected events contribute significantly to this trend. The likelihood of traffic accidents is especially high during this period, as hazard perception and situational awareness skills are still in development (Rashid & Ibrahim, 2017; Scialfa et al., 2011). Additionally, novice drivers often experience cognitive overload, which impairs their ability to process environmental cues effectively and respond in a timely manner. This can lead to misinterpretations of other drivers' intentions or external signals—further escalating the risk of aggressive reactions or unsafe maneuvers (Smith et al., 2009; Castro et al., 2014; Žardeckaitė-Matulaitienė et al., 2018).

Although experience improves hazard perception and reduces cognitive strain over time, the early driving period remains the most vulnerable phase. Addressing this vulnerability through targeted training programs and behavioral interventions is essential for mitigating aggressive driving tendencies and improving novice driver safety.

1.5. Situational Factors and Aggressive Driving in Novice Drivers

Situational factors significantly contribute to the emergence of aggressive driving behaviors, particularly among novice drivers who are still developing the skills necessary for adaptive decision-making under pressure. One of the most influential

situational stressors is traffic congestion. In congested conditions, novice drivers often experience heightened levels of frustration, which can result in impulsive decisions such as speeding, failing to yield, or aggressively overtaking other vehicles. These reactions are closely aligned with definitions of aggressive driving and are exacerbated by the novice driver's limited ability to evaluate and adapt to complex traffic environments (Lazuras et al., 2019).

Research by Jovanović et al. (2011) reinforces the link between situational stress and aggression, showing that traffic-induced frustration can escalate into overtly aggressive behavior. This pattern supports the frustration-aggression hypothesis, which posits that perceived obstacles to goal achievement—such as delays or obstructions—can trigger aggressive reactions, especially in individuals with underdeveloped coping mechanisms. For novice drivers, these emotional responses may be particularly difficult to regulate, resulting in heightened risks for both themselves and others on the road.

1.6. Aim of the Study

Although studies have shown that novice drivers tend to overestimate their driving abilities and engage in riskier behaviors, resulting in more aggressive driving, it is equally true that their inexperience also causes them to allocate more of their cognitive resources to driving tasks. This often makes it easier for their attention to become distracted compared to more experienced drivers. Exposure to behaviors like honking and flashing headlights, and the ability to interpret the messages embedded in these stimuli, requires novice drivers to engage in multiple cognitive tasks simultaneously, a challenge they are less equipped to handle. This study aims to investigate the psychological effects of honking and headlight flashing, which might be perceived as aggressive external stimuli, on novice drivers.

2. Method

2.1. Participants

The study included 30 participants (15 males, 15 females) aged between 21 and 30 years ($M = 23.2$, $SD = 2.54$). Female participants reported an average age of 23.8 years ($SD = 2.89$), whereas the average age for male participants was 22.6 years ($SD = 2.11$). All participants held a valid driving license, with the duration of ownership ranging from 1 to 8 years. This

criterion ensured participants could reflect on their experiences as both drivers and pedestrians.

Participants were primarily from Ankara, İzmir, Konya, and other metropolitan cities in Turkey. The research was announced through social media platforms using a snowball sampling method. In the initial invitation, participants were asked to share the study announcement with others who might meet the participation criteria. To be included in the study, individuals had to (1) be aged between 18–30, (2) have held a driver's license for less than two years or driven less than 3000 kilometers, and (3) not have intensive professional driving experience (e.g., as a taxi or delivery driver). These criteria were explicitly stated in the recruitment announcement. As such, no interested participants were excluded, as those not meeting the requirements did not proceed with participation.

Participants' driving behaviors varied based on the time intervals they reported spending in traffic. As summarized in Table 1, driving patterns revealed notable gender-based and individual differences. For instance, male participants predominantly reported driving during Afternoon Only, while female participants showed greater variability, often indicating multiple time periods or responses such as "It depends." Combined categories like "Afternoon + Evening" and "Morning + Afternoon" showed more balanced participation across genders.

On average, participants drove 1206 kilometers (SD = 885) monthly, with male participants reporting slightly longer distances (M = 1250 km, SD = 910) compared to females (M = 1162 km, SD = 860). Traffic density perceptions also varied: 60% of participants described their driving environments as Moderate, with the remaining indicating Heavy, Very Heavy, or Light density levels.

The sample size of 30 participants was selected to balance the depth and breadth of responses, ensuring sufficient diversity while allowing recurring themes to emerge. This approach aligns with qualitative research methodologies, which prioritize the richness of data over sheer numerical representation. Malterud et al. (2016) suggest that smaller samples can yield valuable insights if saturation is achieved, while Vasileiou et al. (2018) highlight the importance of justifying sample size sufficiency in interview-based studies.

This diverse yet focused sample enabled an in-depth exploration of time-based driving experiences and the

factors influencing novice drivers. By purposefully selecting participants based on relevant criteria, the study supports the notion that qualitative research can effectively use smaller sample sizes to achieve meaningful results (Malterud et al., 2016; Vasileiou et al., 2018). Aligned with qualitative research guidelines, which suggest saturation is typically reached with 12 to 20 interviews (Braun & Clarke, 2006), the sample size of 30 allowed for a robust examination of participants' experiences and the identification of significant themes. The larger sample also enhanced the diversity of perspectives while maintaining the depth needed for meaningful insights.

2.2. Instruments

Data were collected through demographic information form and semi-structured interviews. The demographic form included questions regarding participants' age, gender, duration of driving license ownership, and the monthly distance driven in kilometers. This background information was essential for contextualizing participants' responses and identifying patterns related to their demographic characteristics and driving behaviors.

The semi-structured interview guide consisted of 16 open-ended questions designed to explore the psychological and behavioral effects of auditory and visual stimuli during driving, with a particular focus on vehicle horn and headlight usage. The questions were developed based on environmental psychology frameworks and previous research examining the impact of external stimuli on drivers' cognitive and emotional states (Takada et al., 2017; Balk & Tyrrell, 2011). Additionally, the transactional-cognitive theory of stress served as the theoretical foundation, highlighting how individuals assess and respond to environmental demands based on their perceived ability to cope (Lazarus & Folkman, 1984).

The interview questions aimed to capture participants' experiences and perceptions across several dimensions, including environmental factors that cause discomfort while driving, the psychological effects of horn and headlight stimuli, and their influence on driving behaviors and decision-making processes. For instance, participants were asked, "What environmental factors disturb you the most while driving?" and "How do horn and headlight stimuli affect your confidence while

driving?” Emotional and social implications of these stimuli were also explored with questions such as, “What do you think about drivers who frequently use horns or headlights in traffic?” This comprehensive

approach ensured diverse perspectives were included, facilitating an in-depth understanding of how external stimuli influence drivers' psychological states and behaviors.

Table 1. Characteristics of participants

ID	Age	Gender	Education	License	Active Driving Status	Distance Driven (km)	Traffic Density Perception	Time Intervals	City
1	22	Male	High school	1	Occasionally	300	Moderate	Afternoon	Ankara
2	23	Male	High school	1	No	2000	Heavy	Night	Ankara
3	24	Male	Bachelor's	2	No	1500	Moderate	It depends	Ankara
4	22	Male	High school	3	Occasionally	2000	Moderate	Afternoon	Aydın
5	21	Male	High school	1	Occasionally	1000	Moderate	Evening	İzmir
6	21	Female	High school	3	Yes	1500	Moderate	It depends	Ankara
7	22	Female	Bachelor's	3	Occasionally	1000	Moderate	It depends	İzmir
8	22	Male	Bachelor's	1	Occasionally	2700	Very heavy	Morning, Afternoon	İzmir
9	27	Female	Bachelor's	6	Yes	700	Moderate	Morning, Afternoon, Evening	Konya
10	22	Female	High school	4	Yes	40	Heavy	Morning, Evening	Ankara
11	23	Female	High school	4	Yes	1500	Heavy	Afternoon, Evening, Night	Konya
12	24	Female	High school	6	Yes	2800	Moderate	Afternoon, Night	Ankara
13	22	Female	High school	3	Yes	3000	Moderate	Afternoon, Evening	Ankara
14	21	Female	High school	2	Yes	1000	Heavy	Afternoon, Evening	Ankara
15	26	Female	Bachelor's	7	Occasionally	60	Moderate	Morning	İzmir
16	27	Female	Bachelor's	6	Yes	1000	Moderate	Afternoon	İzmir
17	21	Male	High school	1	Yes	900	Heavy	Morning	Konya
18	23	Female	Bachelor's	3	Yes	420	Moderate	Afternoon	Konya
19	30	Female	Bachelor's	8	Yes	1000	Moderate	Morning, Afternoon	Mersin
20	28	Female	Bachelor's	5	No	30	Moderate	Night, Evening	İzmir
21	22	Male	High school	3	Occasionally	800	Moderate	Afternoon, Evening	Edirne
22	23	Female	High school	4	Yes	800	Moderate	Morning, Evening, Night	Konya
23	22	Female	High school	4	Occasionally	2000	Light	Evening, Night	Trabzon
24	23	Male	High school	4	Occasionally	2000	Moderate	Morning, Afternoon, Evening, Night	İzmir
25	22	Male	High school	1	Yes	1800	Light	Afternoon, Evening, Night	Aydın
26	23	Male	High school	1	No	15	Light	Afternoon	Ankara
27	22	Male	High school	2	Yes	600	Moderate	Afternoon	Antalya
28	23	Male	Bachelor's	4	Yes	2500	Moderate	Evening	Ankara
29	22	Male	High school	3	Yes	2000	Moderate	Afternoon	Malatya
30	22	Male	Bachelor's	4	Yes	1000	Very heavy	Evening, Night	İstanbul

2.3. Procedure

Participants were recruited for the study using a snowball sampling method. Informed consent was obtained from all participants, emphasizing the voluntary nature of their participation and ensuring they understood the study's objectives and their rights. Interviews were conducted on a one-on-one basis, either face-to-face or online, based on the participants' preferences and convenience. The duration of the interviews ranged from 20 to 30 minutes. For participants who consented, audio recordings were made to ensure accuracy during transcription and analysis. In cases where participants declined audio recording, detailed notes were taken by the interviewer.

The semi-structured interview guide, as outlined in Section 2.2, was used to explore participants' experiences and perceptions regarding auditory and visual stimuli in traffic, with a particular focus on vehicle horn and headlight usage. This approach ensured consistency across interviews while allowing participants to express their perspectives freely. The data collected from these interviews were then analyzed using thematic analysis, as described in the following section.

2.4. Data Analysis

The collected data were analyzed using thematic analysis, following the six-phase framework outlined by Braun and Clarke (2006). In the first phase, interviews were transcribed verbatim for participants who consented to audio recordings, while for those who did not consent to recordings, detailed notes were used as the primary data source. The transcripts and notes were read multiple times to ensure familiarity with the data and to capture initial impressions.

In the second phase, initial codes were generated inductively, focusing on recurring patterns and significant elements in the participants' responses. These codes were then grouped into overarching themes and subthemes, reflecting the psychological, social, and behavioral dimensions of participants' experiences with auditory and visual stimuli in traffic. To ensure reliability and consistency, the identified themes were reviewed iteratively by three researchers, with at least two researchers agreeing on the final coding and theme structure.

An inductive and semantic approach was employed throughout the analysis, prioritizing the explicit

responses of participants over interpretive assumptions. Direct quotations from participants were used to support the identified themes, ensuring the findings remained grounded in the data. This approach facilitated a comprehensive understanding of how environmental stimuli, such as horns and headlights, influence drivers' psychological states and behaviors, contributing to the broader objectives of the study.

3. Results

The data obtained from participants' responses were analyzed using thematic analysis and classified under five main themes: "Environmental Factors," "Emotional Responses," "Driver Behavior," "Communication," and "Attitudes." In the "Driver Behavior" theme, two subthemes were identified: "Response to Stimuli" and "Driver's Use of Stimuli." Additionally, in the "Attitudes" theme, three subthemes were identified: "Attitudes Toward Others," "Attitudes Toward Own Driving," and "Experience-based Changes in Attitudes." Example quotes from participants are provided throughout the text to illustrate the themes and subthemes.

Table 2. Themes, subthemes and categories

Main Theme	Categories
Environmental Factors	Impact of Environmental Factors
Emotional Responses	Emotional Responses
Driver Behavior	Response to Stimuli, Driver's Use of Stimuli
Communication	Facilitating Communication, Hindering Communication
Attitudes	Attitudes Toward Others, Attitudes Toward Own Driving, Attitudes Changing with Experience

3.1. Environmental Factors

Participants mentioned the impact of environmental factors during the interviews. The overwhelming presence, excessive intensity, or sudden occurrence of environmental factors affect the driving performance of novice drivers. According to the interview results, the inappropriate behaviors of other drivers (such as changing lanes without signaling, failing to maintain lane discipline, high speeds, sudden lane switching, etc.) were observed as the most significant environmental factors affecting novice drivers' performance. The dangerous driving behaviors of other drivers impact traffic safety and

create a risk of accidents. Environmental factors such as lighting, sound, roadworks, temperature, pedestrian behaviors, heavy traffic, and noise also influence driver behavior.

"Suddenly appearing pedestrians or animals, vehicles that change lanes abruptly or brake suddenly distract my attention. Sometimes, conversations inside the car also distract me." (P2, 22, Male)

"The most disturbing factors for me are drivers who don't signal, those who do not follow lane discipline, roads altered due to construction, and noises at such a high level that I cannot understand traffic warnings." (P11, 23, Female)

3.2. Emotional Responses

Looking at the responses given by participants, honking the horn creates nervousness and fear for most participants. Flashing headlights, on the other hand, often results in anger. Some participants stated that they did not experience any change in their emotional state. Participants question the reasons for and the context in which they are honked at or flashed at. The emotional responses given can also influence their behaviors. In night driving, participants tend to perceive these stimuli as a form of warning and respond positively to other drivers.

"I get nervous when they honk at me. I check what I did wrong." (P9, 22, Female)

"I get angry because I try to follow the rules, but when I see headlights, I wonder, 'What happened now?'" (P16, 21, Female)

"I don't mind honking or flashing headlights, I stay calm." (P1, 21, Male)

Participants' emotional states during the day depend on how much they are exposed to these stimuli while driving. If they are exposed to honking and flashing lights frequently, they may feel angry or stressed during the day. However, they also mention that as they gain experience, the impact of these events on their emotional state decreases. Some participants indicated that their emotional responses do not affect how they feel throughout the day.

"It doesn't affect me that much anymore. I used to feel nervous when I was a beginner, but now I'm used to it. It always happens the same way; I can't change people." (P19, 30, Female)

"No. I forget about it after I get out of the car." (P23, 22, Female)

Participants who believe they have engaged in behaviors that would anger other drivers generally approach such situations with understanding. However, some drivers get angry in these situations.

"When someone is driving slowly in front of me, I try to be understanding. They might be a new driver or an older driver." (P7, 22, Female)

"When another driver does this to me, I get tense and either don't let them pass or intervene in the conflict." (P27, 22, Male)

3.3. Driver Behavior

The statements obtained from the interviews relate to both the responses of participants to horn and headlight usage by other drivers and their own use of these stimuli. The "Driver Behavior" theme has two subthemes: "Response to Stimuli" and "Driver's Use of Stimuli."

3.3.1. Response to stimuli.

Participants stated that when they perceive a horn or headlight, they increase their attention and believe they have made a driving mistake, prompting them to change their behavior. However, when they think they are driving according to the rules and the other driver is approaching aggressively, they do not change their driving. Those who change their behavior generally move to the right lane, speed up, or check their surroundings. Moreover, the majority of participants stated that they tend to make quicker decisions after being exposed to these stimuli.

"Of course, my attention is distracted. I try to understand what the person behind me is saying. Nowadays, people do this for anything. So, I first correct my concentration on the road and then try to understand." (P10, 21, Female)

"Definitely, my decision-making speed is affected; I try to make decisions much faster." (P25, 22, Male)

"If I think I've made a mistake, I act according to the appropriate behavior based on my traffic knowledge." (P17, 21, Male)

3.3.2. Driver's use of stimuli.

Participants described the situations in which they use the horn or flash headlights, mainly to attract the attention of other vehicles, respond to incorrect behaviors from other drivers, warn other vehicles, or when driving on narrow streets or side roads. While

all users use the horn, some participants indicated they do not use the headlights.

"When I'm passing through side roads, on a narrow street, or when I'm in the left lane and a fast vehicle is behind me." (P20, 22, Female)

"When I think the attention of other road users is distracted, I honk to make them aware of my presence." (P6, 23, Female)

About half of the participants believe they sometimes perform behaviors that might anger other drivers. These behaviors include driving slower than other vehicles, failing to signal, or changing lanes improperly. However, some participants think they are not the ones making drivers angry but rather that the other drivers are impatient.

"No, I don't think so. If they get angry, I think it's not because of something I did, but because they are impatient." (P29, 22, Male)

"Sometimes, I think I make other drivers angry. For example, I drive slower than other drivers, or when I park, there might be space for another car." (P6, 22, Female)

3.4. Communication

Participants noted that horn and headlight use both facilitated and complicated communication in traffic. They emphasized that the purpose of using these stimuli was key. Some participants stated that horn and headlight usage was the only communication method in traffic, contributing to smoother traffic flow. They also stated that using the horn to express gratitude positively affected communication. Other participants mentioned that horn and headlight usage should not be used for communication purposes, as any use in traffic should be considered inappropriate.

"I think both sides are cursing at each other. But flashing headlights feels more polite than honking the horn." (P9, 22, Female)

"I think it has a positive effect. There is no other way to communicate while driving, and even if I make a mistake, it lets me know." (P8, 23, Male)

3.5. Attitudes

Based on the interviews, the Attitudes theme was examined under three subthemes: "Attitudes Toward Others," "Attitudes Toward Own Driving," and "Experience-based Changes in Attitudes."

3.5.1. Attitudes toward others.

Participants in the study thought that the timing of horn and headlight usage by other drivers was what mattered most. They described drivers who use these stimuli at inappropriate times as aggressive and impatient. However, they had a positive attitude toward drivers who used them in necessary situations. Some participants also noted that horn usage caused noise pollution and affected their attention.

"Sometimes I think it is used unnecessarily. It is used just to express hatred." (P21, 23, Male)

"I think positively about drivers who use it when necessary. But I think honking excessively or using the horn when it is not necessary (such as honking immediately when the traffic light turns green) is wrong." (P28, 22, Male)

One participant, unlike the others, mentioned having a bias against drivers who use horns and headlights, thinking they are often male.

"I develop a bias that they are impatient or that they are male." (P12, 22, Female)

3.5.2. Attitudes toward own driving.

Participants who were exposed to honking or flashing headlights stated that in their early driving experiences, their confidence dropped, and they felt like bad drivers. As they gained more driving experience, the impact of these stimuli on their confidence decreased, and they thought it would continue to lessen. However, frequent exposure to these stimuli could still lead to a loss of confidence, even for more experienced drivers. Some participants stated that when they made a mistake, they tried not to repeat it.

"It has a negative effect because I always blame myself for the mistake." (P16, 21, Female)

"When I am exposed to these stimuli repeatedly, my confidence decreases. These stimuli cause panic and stress. However, when my driving performance decreases, being exposed to these stimuli serves as an important warning for me." (P17, 21, Male)

3.5.3. Experience-based changes in attitudes.

Participants mentioned that as they gained more driving experience, their attitudes toward external stimuli (such as honking or flashing headlights) evolved. While initially these stimuli would make

them feel nervous or self-conscious, over time they became less affected by them. However, frequent exposure to such stimuli could still negatively affect their confidence. Some participants also noted that the source of the stimuli (e.g., male drivers) influenced how it impacted their confidence.

"It doesn't affect me that much anymore. I used to feel nervous when I was a beginner, but now I'm used to it. It always happens the same way; I can't change people." (P19, 30, Female)

"Because I think I am a novice driver, I get nervous when I'm exposed to these stimuli, and this situation decreases my confidence. Also, the gender of the driver matters to me. If these stimuli come from male drivers, it damages my confidence even more." (P18, 22, Female)

4. Discussion

In this study, the findings reveal the psychological and behavioral responses of drivers to auditory and visual stimuli, particularly honking and headlight flashing. The qualitative data collected from participants through interviews were organized under five main themes: "Environmental Factors," "Emotional Responses," "Driver Behavior," "Communication," and "Attitudes." Each main theme was further divided into relevant subthemes. Specifically, the "Driver Behavior" theme included two subthemes: "Response to Stimuli" and "Driver's Use of Stimuli." Similarly, the "Attitudes" theme was broken down into three subthemes: "Attitudes Toward Others," "Attitudes Toward Own Driving," and "Attitudes Changing with Experience."

4.1. Environmental Factors

The first theme, "Environmental Factors," highlights the critical role external elements play in driving performance, especially for novice drivers. As Ni et al. (2024) noted, factors such as night driving, winding roads, and traffic congestion significantly increase stress levels in drivers. Our study confirms that environmental factors play a pivotal role in disrupting the attention of drivers, particularly for those with less experience. External stimuli not only divert attention but also force drivers to allocate more cognitive resources to basic driving tasks, as seen with novice drivers. Research by Lee (2007) supports this finding, showing that inexperienced drivers are more susceptible to distraction-related accidents due

to their limited attention capacity. Inexperienced drivers also struggle with managing unexpected situations because they are still developing automatic driving skills (Lansdown, 2002). As such, external stressors, whether from road conditions or other drivers, significantly impair driving performance and safety. The implications of this are clear: raising awareness of environmental factors in driver training programs, particularly for novice drivers, can help reduce accidents caused by distraction and stress. Furthermore, programs should address techniques for better coping with environmental stressors to improve road safety.

4.2. Emotional Responses

The second theme, "Emotional Responses," centers on how auditory and visual stimuli like honking and flashing headlights trigger emotional reactions, which in turn influence driver behavior. Emotional responses, particularly drivers' ability to regulate emotions in stressful traffic situations such as flashing lights or congestion, significantly affect driving behavior. Wu et al. (2018) found that higher emotional control skills were associated with fewer aggressive reactions and accidents, suggesting that emotional regulation plays a protective role in challenging driving conditions. However, our findings show that novice drivers demonstrate heightened emotional reactions to stimuli like honking, with many participants reporting feelings of anger, anxiety, and tension. This heightened emotional response has been linked to an increase in risky driving behaviors, such as speeding or aggressive overtaking, as noted by Deffenbacher et al. (2003). High anxiety levels hinder cognitive processing and motor tasks, which could elevate the risk of accidents, especially for younger and less experienced drivers. To mitigate these emotional responses, it is crucial to incorporate emotional intelligence and stress management training into driver education. By helping novice drivers better understand and regulate their emotional responses to stressful situations, we can promote safer, more composed driving behaviors.

4.3. Driver Behavior

The third theme, "Driver Behavior," reveals that auditory and visual stimuli, such as honking and headlight flashing, not only affect the emotional state

of drivers but also influence their subsequent behavior on the road. This theme was divided into two subthemes: "Response to Stimuli" and "Driver's Use of Stimuli." Our study showed that most participants assess whether they made a mistake when they hear a horn or see headlights flashing and adjust their behavior accordingly. The nature of the response depended on whether the stimulus was deemed necessary or unnecessary. For example, participants typically responded to honking by changing lanes or accelerating, while headlight flashing was often interpreted as a "move out of the way" signal. For instance, research by Dula and Geller (2003) emphasizes that aggressive driving behaviors, including honking, are often linked to feelings of anger and perceived injustices on the road. Their study found that drivers frequently resort to honking as a form of retaliation or to express their displeasure in response to other drivers' actions, reinforcing the notion that honking serves as a communication tool in high-stress driving situations. On the other hand, headlight flashing was more commonly used to request or demand compliance from other drivers, further reflecting the communicative power of these stimuli. While the appropriate use of honking and headlight flashing can improve safety by alerting other drivers to potential risks, misuse can lead to panic, distraction, and confusion. This suggests that educating drivers on the proper use of these stimuli is crucial in ensuring they do not inadvertently contribute to road safety risks.

4.4. Communication

The fourth theme, "Communication," emphasizes how honking and headlight flashing serve as forms of communication on the road. Research by Takada et al. (2017) highlighted that honking, when used inappropriately, may be perceived as an ineffective communication tool due to the lack of clear, universally understood messages. Our findings, however, suggest that honking and headlight flashing play a significant role in traffic communication, provided they are used in the right context. Participants reported that honking to signal danger or indicate presence helped facilitate smoother traffic flow, whereas excessive honking or using it in the wrong context created tension and aggression. This aligns with the findings of Berdoulat et al. (2013), who discusses how impulsivity and emotional

responses, such as anger, can lead to aggressive driving behaviors, including the use of the horn. Hence, there is a need for clearer guidelines and training on how these stimuli should be used to foster safer and more effective communication in traffic.

4.5. Attitudes

The final theme, "Attitudes," explores the development of attitudes toward other drivers and one's own driving performance, especially in relation to honking and flashing headlights. This theme was divided into three subthemes: "Attitudes Toward Others," "Attitudes Toward Own Driving," and "Attitudes Changing with Experience." Our study found that drivers' attitudes toward others were shaped by the context and appropriateness of honking and headlight flashing. When these stimuli were used correctly, participants viewed the behavior of the other driver positively. Conversely, inappropriate or excessive use was often seen as aggressive, leading to negative perceptions of the driver. Interestingly, some participants associated frequent use of these stimuli with impatience or even gendered stereotypes, specifically linking them to male drivers. Concerning their attitudes toward their own driving, many participants reported a decrease in self-confidence when exposed to honking or flashing headlights, particularly when they perceived themselves as at fault. However, with more driving experience, the emotional impact of these stimuli decreased, and drivers became more confident and less reactive. These findings suggest that exposure to these stimuli over time can reduce their emotional impact, and that more experienced drivers may become less anxious and more self-assured. Therefore, incorporating strategies to reduce emotional responses to external stimuli can not only improve novice drivers' attitudes toward their own driving but also contribute to better overall performance.

4.6. Practical Implications

The findings of this study have several practical implications for improving road safety, particularly for novice drivers. Firstly, the study highlights the importance of incorporating emotional regulation and stress management training into driver education programs. By equipping novice drivers with strategies to cope with emotional stimuli like honking and headlight flashing, they can become more

composed and safer drivers. Additionally, training programs should focus on improving risk perception and communication skills, especially in stressful driving environments such as traffic congestion. Educating drivers on the proper use of auditory and visual stimuli can help reduce confusion and road aggression. Moreover, the study suggests that awareness campaigns about the psychological impacts of environmental factors and emotional responses can enhance drivers' overall performance and reduce accidents.

A comprehensive approach that includes emotional regulation training, risk perception enhancement, educational campaigns, and simulator-based training can significantly reduce aggressive driving behaviors among novice drivers. By equipping young drivers with the necessary skills and knowledge to navigate the complexities of driving, we can improve road safety and reduce the incidence of aggressive driving.

4.7. Theoretical Implications

This study contributes to the growing body of research on aggressive driving behaviors by providing a comprehensive analysis of the psychological and emotional responses to environmental stimuli, particularly honking and headlight flashing. The findings support the frustration-aggression hypothesis, showing that environmental stressors can elicit aggressive responses. Furthermore, the study emphasizes the role of emotional intelligence in driving safety, offering a theoretical framework for incorporating emotional regulation and cognitive coping strategies into traffic psychology research. This research also advances our understanding of the interaction between emotional and cognitive factors in driving behavior, particularly for novice drivers.

A comprehensive approach that includes emotional regulation training, risk perception enhancement, educational campaigns, and simulator-based training can significantly reduce aggressive driving behaviors among novice drivers. By equipping young drivers with the necessary skills and knowledge to navigate the complexities of driving, we can improve road safety and reduce the incidence of aggressive driving.

4.8. Emergent Findings

The study primarily examined novice drivers' psychological and behavioral responses to honking and headlight flashing, several unexpected but valuable themes emerged from the participants' narratives. Female participants frequently mentioned feeling more affected when exposed to aggressive behaviors from male drivers. This may suggest an underlying influence of social power dynamics and perceived gender-based patterns in Turkey. Also, several participants described engaging in passive-aggressive or retaliatory behaviors, noting that they felt disturbed by another driver's actions, they sometimes intentionally mirrored those actions to express their anger. This revealed behavioral patterns that, while not considered as performance indicators, provide insights into novice drivers' adaptive responses.

Horn and headlight flashing were not interpreted uniformly. While some participants viewed these signals as helpful for communication and correction, others experienced them as unnecessary and frightening. These differences may show subjectivity in traffic communication and lead to misunderstandings, which could potentially escalate into accidents or road conflicts.

In addition, it was observed that participants gradually normalized aggressive driving experiences. They described stress and aggression in traffic as something normal or part of a routine. This normalization in traffic may lead to emotional desensitization or reduced sensitivity to risky driving cues. Some participants stated that they developed personal coping strategies—such as internal self-talk, humor, or calming techniques—to deal with repeated exposure to stressful stimuli. These coping strategies suggest a psychological adaptation process in novice drivers navigating challenging traffic environments. Finally, some participants noted that non-verbal cues such as body posture, exaggerated hand gestures, and vehicle positioning offered alternative ways of interpreting the reasons behind honking or headlight flashing. This observation highlights the importance of novice drivers taking situational cues into account when evaluating the behaviors of other drivers.

4.9. Limitations and Future Research

While this study provides valuable insights into the psychological and behavioral responses of novice drivers, there are several limitations that should be addressed in future research. The sample size was relatively small, and the participants were primarily drawn from a specific demographic, which may limit the generalizability of the findings. Future studies could expand the sample size and include drivers from diverse age groups and backgrounds to gain a broader perspective on the issue. Additionally, the study relied on self-reported data, which may be subject to biases such as social desirability or recall bias. Moreover, the use of different communication modes (i.e., video conferencing and face-to-face interviews) may have influenced participants' responses, particularly in terms of emotional expression and perceived anonymity. This variation in interview settings should be acknowledged as a methodological limitation, as differences in setting might have influenced participants' ability to express their ideas comfortably, this could have potentially led to bias. Using observational methods or in-vehicle data collection could provide more objective insights into driver behavior. Lastly, future research should explore the long-term effects of training programs aimed at reducing emotional responses and improving risk perception, as well as the effectiveness of these programs in real-world driving scenarios. Exploring the impact of different interventions, such as mindfulness training or cognitive-behavioral therapy, could also offer new avenues for improving novice driver safety.

Ethics Committee Approval Statement

Ethical approval for the research was obtained from the TOBB ETU Human Research Ethics Committee (E-27393295-100-69434).

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