

Assessing the Influence of Roadside Advertising on Traffic Distraction and Its Interplay with Inside Vehicle Distractions: A Cross-Cultural Study in Jordan and Kuwait

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Abstract

Limited research has explored roadside advertisements' effects on road user behavior in Middle Eastern countries. This study aims to understand distraction perceptions, including advertisements, their impact on behavior, and potential influences from advertisement type, in-vehicle distraction, and country factors (reflecting culture and environment). A standardized questionnaire was administered in Jordan and Kuwait, complemented by observations across three segment types: roadside advertisements, commercial signs, and road signs as control segments. Descriptive and inferential statistics were used. Results indicated a significant disparity in distraction perception between the two groups. Advertisement presence influenced Kuwaiti but not Jordanian behavior. Behavior varied by advertisement type in Jordan, not Kuwait, and in-vehicle distraction did not impact driver behavior. The study suggests explicitly revising advertising policies with a traffic safety focus. Overall, the study contributes insights into road user perceptions and behaviors, highlighting the complex interplay of distractions and advertising on road safety. Further research is required to validate these findings and shape road safety regulations.

Keywords

Roadside Advertisement, Billboard, Distraction, Perception, Behaviour in Traffic, Inside, Vehicle Distraction

1. Introduction

Driving is a multitasking activity involving three control layers: operational, tac-

tical, and strategic. It requires cognitive skills, sensing and perception, and decision-making abilities. Cognitive impairment or distraction is essential to driving and controlling a motor vehicle. It describes attention deficits or poor judgment, which may delay the driver's response if exposed to an unexpected event or external source of danger or threat. The factors associated with impaired drivers' actions include vehicle type, gender, age, seatbelt use, and other driving activities such as failure to keep lane and tailgating [1].

1.1. Distraction Definition

There has been extensive research on driver distraction in recent years, but a consensus on its definition has not yet been reached [2]. The literature contains numerous definitions of driver distraction. Treat defined it [3] as hindrances to a driver's recognition of crucial driving-related information due to events, activities, objects, or individuals inside and outside the vehicle, causing the driver to divert their attention from the driving task. Meanwhile, Steff and Spradlin's [4] definition defines it as a shift of focus from necessary driving-related stimuli to stimuli unrelated to safe driving. Regan *et al.* [5] state that distraction "is the diversion of attention away from activities critical for safe driving toward a competing activity." The source, location, intention, process, and outcome can define the distraction. For example, if a driver picks up a phone call involving sad news, the source of distraction is the activity of picking up the phone, not the tragic news. This distraction happens in the vehicle, and the driver will be compelled by the information, causing a diversion of attention and increasing crash risk. A review of driver distraction detection methods was completed, creating a comprehensive framework from the identified approaches. Covering manual, visual, and cognitive distractions, the framework encompasses sensor use, data measurement, computation, event identification, behavior inference, and distraction type classification [6]. Driver self-evaluation data was used to define which elements attract the most visual and cognitive distractions that negatively impact drivers' perception of crucial changes in the traffic environment. The results showed that cognitive distraction could be related to thinking about personal problems, chores and errands, and roadside advertisements, while looking at advertisements and the natural environment is related to visual distraction [7].

1.2. In-Vehicle Distraction

As vehicle technology increases, like cell phones and advanced driver assistance systems, driver distraction concerns have increased. In safety-critical situations, texting can compromise driving performance. A study addresses this gap using visual tracking in a driving simulator. Trials were conducted at the Technical University of Munich, measuring driving performance and incorporating eye tracking. In diverse safety-critical events and traffic environments, distractions affected longitudinal and lateral performance control while compensating for reaction time during safety-critical events [8]. Drivers' use of mobile phones

contributes to crash risk, a widely held belief. Additionally, distractions like eating or manipulating vehicle controls are also recognized as sources of in-vehicle distractions. Discrete video cameras with specialized systems were strategically placed at four elevated locations along roads in South Australia for covert surveillance. This was to provide a quantitative assessment of in-vehicle drivers' distracting behaviors while in motion [9].

VicRoads, Australia commissioned a project to identify driving behaviors associated with in-vehicle and portable technology use (mobile, radio, screen, head-mounted displays, etc.) and assess their impact on safety and performance. A taxonomy was developed to link distraction-related behaviors. However, most studies reviewed did not identify specific behaviors associated with driver engagement with the selected technologies. They also did not recognize their impacts on driving performance and crash risk [10]. One of the leading causes of accidents among young drivers is distracted driving. Self-reported studies investigated common distractions, assessed their impact, and identified crash risk factors. Most participants reported frequently using their cell phones while driving. Other activities include smoking, eating, drinking, and adjusting audio devices. A structural equation model was used to identify latent variables influencing crash risk. The analysis showed a significant correlation between in-vehicle distractions and crash likelihood [11]. Due to increasing road traffic, distractions are a growing issue, particularly those that can be avoided. This study examines the effects of in-vehicle distractions on the visual focus of 23 participants during real-driving conditions on a test track. Using a mobile phone and managing a car's systems (climate control, navigation, radio, etc.) can significantly reduce your ability to focus on driving-related aspects, even simple tasks like adjusting mirrors [12].

1.3. Roadside Advertisement External Source of Distraction

Roadside advertisement is an external source of distraction that drivers can choose not to react to its content. This would influence the response. Conversely, it should be designed to capture attention, thus affecting response time and increasing crash risk. A thorough literature review of the safety effect of digital roadside advertising as a part of a European-funded project covers studies on crash risk, behavior, and situation awareness [13]. A review of 13 articles on the impact of roadside advertising on changes in drivers' visual behavior found that billboards would not attract glances lasting more than two seconds, and the distraction appeared to be minor and controlled by drivers, but this may not be true in general [14]. A review of the literature on the impact of roadside advertising on driving behavior found that young drivers who interact with roadside advertising have trouble distinguishing between relevant and irrelevant driving information [15].

A before and after statistical analysis with control groups was applied on road sites of different characteristics in Athens, Greece, to investigate the correlation

between the placement or removal of advertising signs and road accident occurrence; it shows no statistical correlation between road accidents and advertising signs in none of the examined sites [16]. A similar study, before and after with the control group, in Toronto, Canada, suggested that static electronic signs do not impact road safety along the adjacent roadway sections [17]. However, crash risks increase near static digital billboards [18]. A cross-sectional study comparing control areas downstream of digital billboard locations in 18 sites in Alabama and Florida found a positive correlation between crash rates and billboard presence [19]. The effects of roadside advertising signs on driving performance are based on using a questionnaire to simulate drivers' behavior and their opinions on the distraction caused by such signals. Drifting from lanes and recklessly crossing dangerous intersections were significantly worse in the test section with advertising signs than with no advertisement. The number of tailgating times, speeding, and turning or changing lanes without signaling were also worse on the road section with advertising signs, but the difference was statistically insignificant. The questionnaire responses showed that half of the respondents indicated being distracted by roadside advertising signs at least once [20].

Herrstedt *et al.* [21] examined the impact of rural roadside advertising on driver attention and road safety in Denmark. Scandinavian countries have traditionally limited such advertising to safety and aesthetics, but financial interests have increased signs along these roads. Advertisements aim to attract drivers' attention visually, but this diversion can cause drivers to react slowly to unexpected situations, possibly resulting in accidents. The study uses a camera-equipped car with GPS and laser scanners to track eye movements, speed behavior, and distance from other road users. According to the findings, roadside advertisements divert drivers' attention and compromise road safety. A study from the UK examined advertisement type and position and the exposure duration. The results showed that when approaching the video advertisement, the drivers braked harder and then slowed down as they passed the ad as they spent longer looking and frequently glanced at it. It was found to cause more significant impairment in driving performance than static adverts, supported by questionnaire results [22].

A study using a driving simulator was conducted to investigate the impact of billboards on drivers, particularly those who are older or inexperienced and may be more susceptible to distractions. The study found that billboards altered drivers' visual attention patterns, caused delays in responding to road signs, and led to an increase in errors [23]. Both experienced and inexperienced drivers may be at risk of missing hidden hazards and exposed moving threats if they spend too much time looking at road signs. According to a study by Divekar *et al.* [24], this is a common occurrence. Furthermore, field experiments conducted on road segments in China have shown that billboards can cause driver distraction and increase traffic risks. Zhang *et al.* [25] found that random and haphazard billboard installation, particularly at night, is a safety concern.

Using a questionnaire method, an assessment of the impact of the outdoor advertisement was conducted among the general population of Guwahati City, India. A sample of 200 participants was divided equally by gender to provide non-biased and balanced results. The responses were collected when participants traveled out of their homes. The results showed that 37% of the respondents paid attention to the sign because of its size and shape, while 24% of them were attracted to an advertising panel for the picture or image of a Celebrity; 39% of the respondents can read an outdoor advertising message within 5 seconds and 29 within 10 seconds [26]. A 70 sample completed a modified version of the Attention Network Test, a computerized testing measure developed to measure attention to advertisement signs. The reaction times were significantly longer when ads had longer slogans than shorter ones [27].

1.4. Study Objectives

Despite extensive global research on advertisement-related distractions, no investigation has occurred in individual countries or regions in the Middle East. This study explores road users' perceptions of various distraction sources, accounting for country context. The research scrutinizes road users' behaviors when encountering roadside advertisements ("Billboards") or commercial business signs compared to segments with solely traffic signs as a control group. This study considers cross-cultural behavioral differences or similarities. Moreover, the study delves into the interplay between inside-vehicle and outside-vehicle distractions caused by advertising signs and how the inside-vehicle distraction influences the driver's decision in traffic, especially when exposed to external sources of distraction like roadside advertisements. This study aims to bridge the gap in this field by testing the following hypotheses:

1st Hypothesis: Road users' general reactions and perceptions toward distractions and roadside advertising, in particular, are consistent across countries and environments.

2nd Hypothesis: Road users behave similarly on road segments with or without roadside advertisements.

3rd Hypothesis: Road users' reaction to roadside advertisements is consistent regardless of their type.

4th Hypothesis: The inside vehicle distraction does not affect road users' responses to roadside advertisements.

2. Research Methodology

A flow chart describing the research methodology is presented in **Figure 1**.

2.1. Study Area

The study areas are Jordan and Kuwait, two Middle Eastern countries (**Figure 2**). The two countries have differences in area, population, vehicle ownership, and economic status. Kuwait's population density (253 people per km²) is

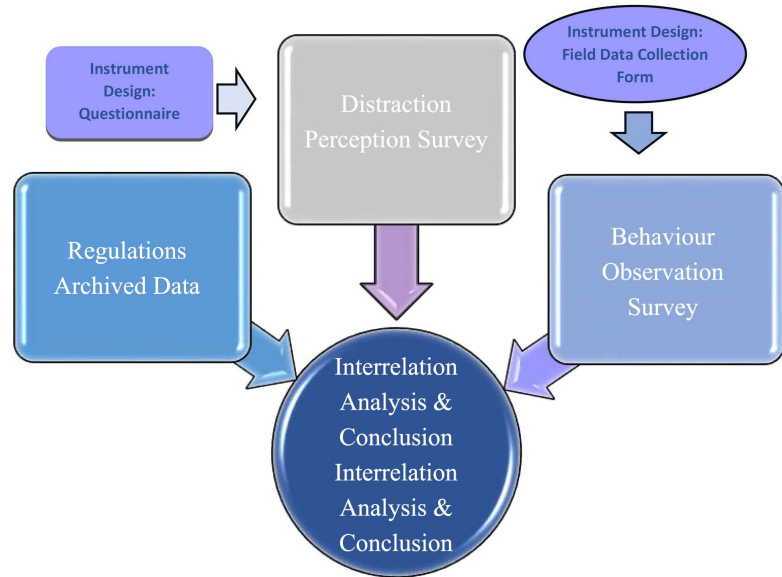
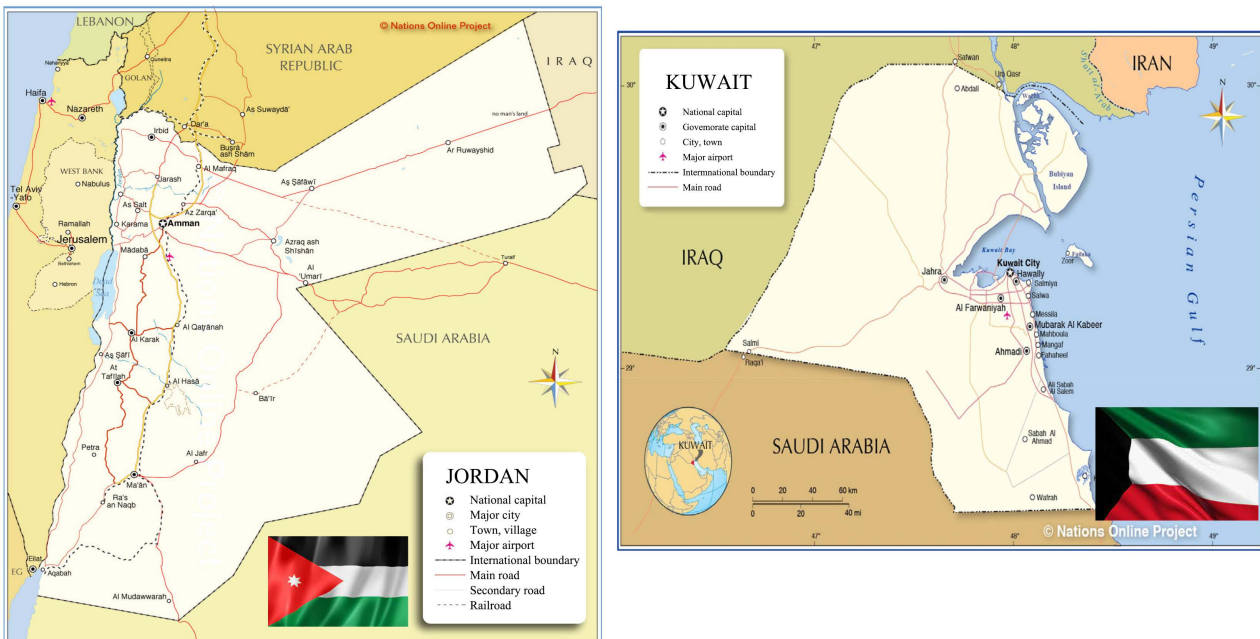


Figure 1. Research methodology flow chart.



Indicator	Jordan	Kuwait
Area (km ²)	89,342	17,818
Population (million)	10.6	4.74 ¹
Capital	Amman	Kuwait
GDP per Capita 2021 (USD)	4047 ²	32,187 ²
# of Vehicles	1,795,215 ³	2,456,606 ⁴

Figure 2. The General Location of the study Area. 1. Statista is a German online platform [30]. 2. World Bank Open Data: <https://data.worldbank.org/> [31] 3. JPSD, 2022 [28] 4. CEIC: Global Economic Data, Indicators, Charts & Forecasts. <https://www.ceicdata.com/> [32].

approximately 2.12 times larger than Jordan's (119 people per km²), indicating a relatively lower population density than Jordan's. Kuwait's GDP per capita is roughly eight times larger than Jordan's, highlighting a significant difference in economic prosperity. Kuwait's vehicles per person (538 vehicles per 1000 people) are about 3.17 times more than Jordan's (169 vehicles per 1000 people), suggesting a relatively higher vehicle ownership rate than Jordan's. Kuwait's GDP per capita per vehicle is around 2.22 times greater than Jordan's, offering a more robust economic impact on vehicle ownership in Kuwait.

Specific trends become apparent when comparing road safety statistics between Jordan and Kuwait. Jordan's road crashes in 2021 are significantly greater at 160,600 [28] than Kuwait's 68,770 [29]. This could indicate that Jordan experiences more accidents on its roads. According to the latest updates, Jordan has reported 589 deaths, while Kuwait has reported 323 fatalities. This suggests that Jordan shares more road-related fatalities than Kuwait. Jordan's fatalities per 10,000 vehicles are higher at 3.3, compared to Kuwait's relatively low rate of 1.31. This suggests that Kuwait has a safer road safety system compared to the number of vehicles. Kuwait's fatalities per 100,000 population are higher at 6.8, whereas Jordan's is lower at 5.3. This implies that considering the population size, Jordan has a relatively safer road safety record. These statistics underscore the different facets of road safety in Jordan and Kuwait, with each country having strengths and challenges. Considering its population, Jordan has a safe road safety record. Kuwait demonstrates a lower fatality rate relative to vehicle numbers. However, the high number of road crashes and fatalities in Jordan highlights the need for continued efforts to improve road safety measures.

The study area for this research covers the urban areas in Jordan and Kuwait. Amman, the capital of Jordan, is in the middle region of the country; it is the centre of the largest populated governorate. The metropolitan area includes 22 districts and covers 800 km², with 322 km² designated as built-up. It is home to 4,061,150 people as of 2021. The road network spans 8777 km and consists of 37,973 road segments, with an average length of 231 m per segment. Kuwait is a high-income city-state emirate divided into six governorates. The national territory covers an area of 17,818 km² [33]; the urban area covers 853 km², and the built area only constitutes 424 km² [34]. Kuwait has a population of 4.67 million people as of 2021. It has 5749 Km of road network, of which 4887 Km is paved (85% of the entire network).

2.2. Data Collection

Two surveys were conducted in both countries, employing two distinct research approaches: questionnaire distribution and observation. Additionally, the dataset included information about legal regulations governing roadside advertising.

2.2.1. Perception Survey

The study aims to investigate the sources of distraction for road users, both inside and outside vehicles, and determine if roadside advertisements contribute to

hazardous perceptions in traffic. A survey instrument was designed to investigate road users' perceptions of distraction in traffic. The study examined their associated risks, perceptions, and self-reported exposure to some distractions and road-use reflections on them. Participants were asked about roadside ads and if they found them distracting. The questionnaire covered demographics such as age, gender, education level, professional category, license type, and driving experience. Additional data collected encompassed daily travel distance, violation records, and types of violations. Three hundred forty-seven completed questionnaires were received (150 from Jordan and 197 from Kuwait). There was a statistically significant difference in gender in both countries, with more than 80% of respondents being male (Table 1).

The young group accounts for three-fourths of the Kuwait sample and only half of the Jordan sample. In Kuwait, approximately 80% of participants are non-professional, compared to 63% in Jordan, reflecting vehicle ownership levels. Participants in the Kuwaiti sample have less driving experience; many hold university degrees and work as employees. The results of the chi-square tests revealed significant differences in sample structure due to driver types, car ownership, driving experience, profession, and qualification due to the subject country.

2.2.2. Behaviour Survey

Observations on three road segments with two types of advertising signage systems were collected: the advertising roadside advertising and commercial signs posted on business venues and the control segment containing only regular traffic signs (Figure 3). Observations were made on three road segments with two advertising signage systems: roadside advertising, commercial signs posted on

Table 1. Perception survey sample structure by factors tested and country, with statistical tests.

Factor	Level	Jordan	Kuwait	Statistical Test	Factor	Level	Jordan	Kuwait	Statistical Test
Gender	Male	84.7	86.8	$t = 0.32$, $p = 0.57$	Education Level	High School	43.3	3.6	$\chi^2 = 126$ $p = 0.00$
	Female	15.3	13.2			Associate	34.7	30.5	
Age	Young < 40	50.7	76.1	$\chi^2 = 27.24$, $p = 0.00$	Bachelor	18.0	58.9		
	Middle Age 40 - 60	39.3	21.9		Postgraduate	4.0	7.1		
	Senior > 60	10	2		Students	4.7	21.3		
Car Ownership	Yes	86	99.5	$t = 26.1$ $p = 0.00$	Professional Category	Employee	29.3	67	$\chi^2 = 12.2$ $p = 0.002$
	No	14	0.5			Craft man	46.7	2	
Driver Type	Non-Professional	63.3	79.7	$t = 12.2$ $p = 0.002$		Businessman	12	6.6	
	Professional	36.7	20.3			Unemployed	7.3	3	
Driving Experience (Year)	<25	10.7	4.6	$\chi^2 = 19.6$ $p = 0.000$	Sample	150	197		
	15 - 24	46	26.9						
	<15	43.3	68.5						

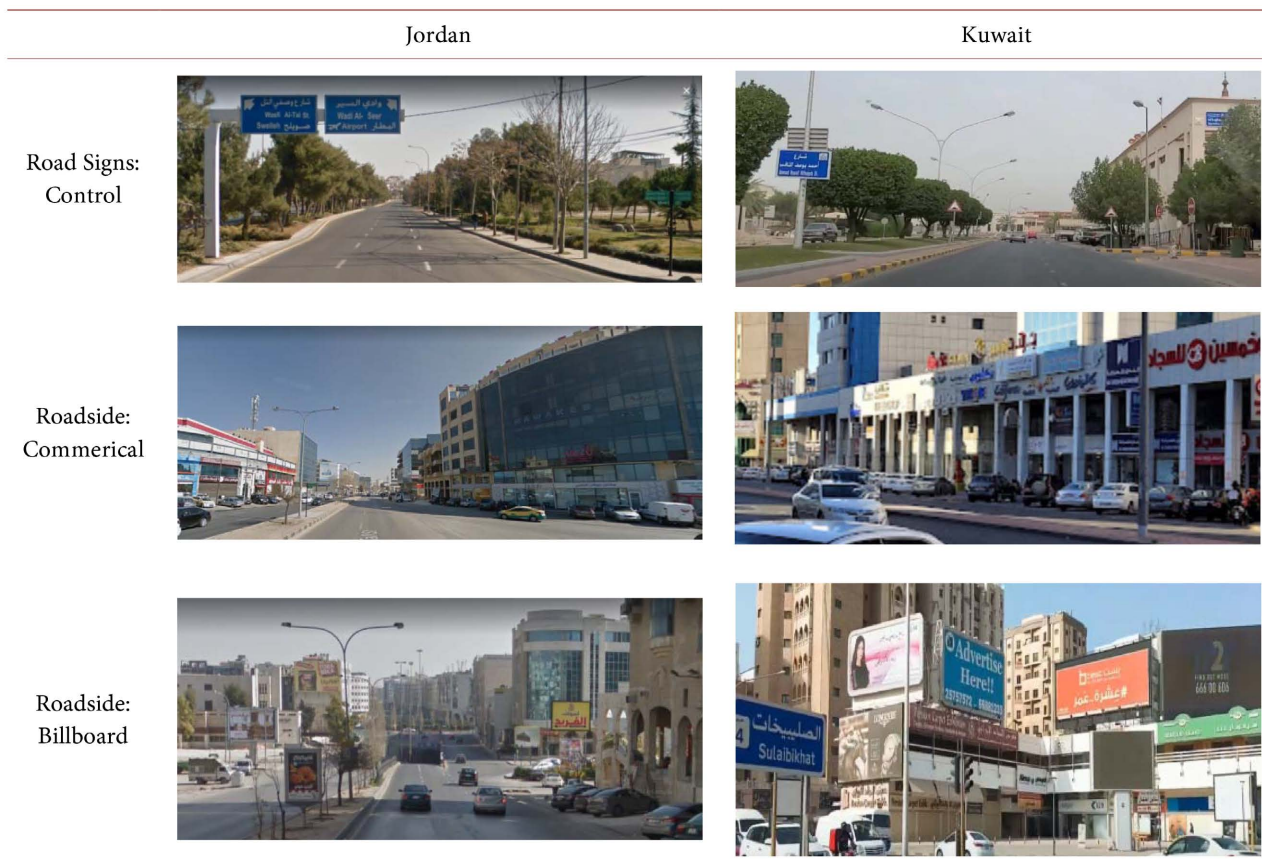


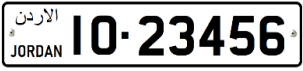
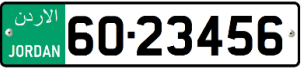
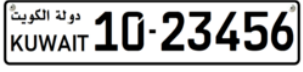

Figure 3. Types of segment considered for road user behaviour observations.

business venues, and a control segment with only regular traffic signs. The streets chosen are divided into four or six-lane major arterials with high traffic volumes, making them ideal for advertising. The selected three segments in Jordan are located along Wasfi Al Tal Street, while in Kuwait, they are distributed in the Hawally district.

In addition to road users' behavior as a response to the existence of roadside advertising signs, drivers' gender, estimated age group (young under 40 years old, middle-aged > 40 and <60 years senior, ≥ 60 years), vehicle type, and vehicle plate (private or public), reflecting professionalism (non-professional or professional, (see **Table 2**), are all examined.

Two observers were stationed on-site; the first recorded the driver's actions as s/he passed the observation point (changing lane, alternating the cruising speed, stopping, etc.), recording the vehicle and plate type. The other observer documented what the driver inside the vehicle did (talking to another car occupant, listening to loud music, eating, or using the mobile phone) in addition to the driver's gender and estimated age, which was a bit challenging is why the three categories were wide enough to accommodate human capacity limitations in judging the age relatively in a short time. The incident was recorded when the driver held the phone or talked over Bluetooth. Still, some incidents were not recorded when the driver passed the observation point and only listened to the

Table 2. A sample of private and public plates.

Country	Private Vehicle: Non-Professional Drivers	Public Vehicles: Professional Drivers.
Jordan		
Kuwait		

other side of a phone conversation. Loud music incidents are reported when the sounds are high, and some movements showing that the driver or other car occupants enjoyed the music, dancing or singing, etc., were evident.

Throughout the day and off-peak hours, the researchers made observations in both Jordan and Kuwait. They observed 249 cases, with 103 in Jordan and 146 in Kuwait. Most observed individuals were males, 93.2% in Jordan and 86.3% in Kuwait. The most observed groups in both countries were middle-aged drivers who drove personal passenger cars and were not professional. **Table 3** provides further details on this. Although there were significant differences in the sample structure between the two countries, there were no differences based on gender. In their analysis, the researchers plan to use descriptive and inferential techniques, such as t-tests and chi-squared tests.

Table 3. The structure of observed sample by country and statistical tests.

Factor	Level	Jordan	Kuwait	χ^2 Test	Factor	Type	Jordan	Kuwait	χ^2 Test
Gender	Male	94.1	89.7	$t = 2.98$ $p = 0.084$	Vehicle Type	Passenger Car	60.7	77.4	$\chi^2 = 11.3$ $p = 0.0024$
	Female	5.9	10.3			Pickup	7.4	6.2	
Age	Young	22.2	37.6	$\chi^2 = 18.2$ $p = 0.000$		Taxi	17.0	8.7	
	Middle age	60.0	56.1			Bus	9.6	4.6	
	Senior	17.8	6.3			Truck	5.2	3.1	
Driver Type	Non-Professional	74.1	88.2	$\chi^2 = 6.44$ $p = 0.011$		Sample	103	146	
	Professional	25.9	11.8						

3. Results







A qualitative and quantitative analysis of the collected data was conducted based on the data type. Analysis of the narrative text was used to analyze the advertisement bylaws qualitatively. Comparatively, perception and behavior data were analyzed quantitatively using descriptive, inferential, and correlational analyses.

3.1. Roadside Advertisement by Laws “Billboard”


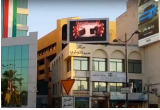
The legislative framework for road advertising in both countries was reviewed and summarized in **Table 4**. The dimensions of the signs are, to a great extent, similar. The regulation in Kuwait is currently under review, where the intention

is to reduce the spacing between two successive characters. According to the current Kuwaiti bylaw [35], the spacing of Mupi signs (1.2 m × 1.8 m) is like the current Amman city bylaw [36]. The current spacing for medium and large-sized signs is relatively tiny, and Kuwait requires nearly half of that in Amman. However, the proposed new bylaw proposes spacing like Amman's. The two factors that determine their safety impact and distraction (vertical and horizontal) are the size, spacing, and clearance of traffic signs. The lateral distance is not specified in Kuwaiti law but is acceptable in Jordan. The regulations demand not to advertise on road signs. Still, both bylaws do not display the space to the nearest traffic control sign to avoid obscuring the view and diverting the driver's attention away from traffic control devices.

Table 4. A summary of roadside advertisement regulations in Jordan and Kuwait.

	Sign Type		Site		Clearance			Area		
	Type	Illustration	Description	Location	Spacing m	Lateral m	Vertical m	Width m	Length m	Area m ²
	Mupi		Lit two-face, static or variable	Intersections, Plazas, U-turns if the width ≥ 1.5 m	50	5	Median: ≥60 cm Sidewalk: ≥1.5 m	1) 1.3 2) 1.2	1.9 1.8	2.5 2.2
Jordan	Roadside sign 4 × 4; 3 × 4; 2.5 × 4		Lit-two-face, static or variable	Island, Plazas, and Intersections	250	5	3	4 - 8	2.5 - 4	24
	Roadside sign 14 × 4		Lit-two-face, static or variable	City entrance Island, Plazas, Intersections	300	10	8	4	14	32
	Roadside sign 1.2 × 0.8		Lit-two-face signs	On-light post on commercial and arterial Streets			3	0.8	1.2	1
Kuwait	Roadside sign 1.2 × 1.8		Lit-two-face signs	Intersection and U-turns	50 -		2	1.2	1.8	2.2
	Roadside sign 3.0 × 4.0		Lit-two-face signs	Plaza and arterial street			3 ≤ cl. ≤ 5 2 ≤ cl. ≤ 3	3.0	4.0	12

Continued

Roadside sign		Lit-two-face signs	Plaza and arterial street not on residential streets	1) 400 - 200 2) 700 - 300	1) $5 \leq cl. \leq 8$ 2) $5 \leq cl. \leq 9$ 3) $9 \leq cl. \leq 12$	1) 3 2) 4.5	8 14	24 63
1) 3.0×8.0 2) 4.5×14	4							
Digital: Big LED Screen		More than one screens in different direction	Plazas and Intersection		$3 \leq cl. \leq 8$	4	5.5	22
4 × 5.5	5							

¹https://www.timeskuwait.com/news/wp-content/uploads/2022/02/10000-1645356885319_large.jpeg;

²https://2.bp.blogspot.com/-z3HjiY0AJm8/V6d8HGK0f1I/AAAAAAAAAOeU/BuHNvdzuqoor7Z03aSw2i8LHgi3gg9gTACLcB/s400/20160807_145726.jpg; ³<https://www.kuna.net.kw/NewsPictures/2019/7/1/aef63d68-7dd4-4647-8db2-568b8d49c051.JPG>;

⁴Driving in Kuwait City|awesome|roads|vehicles|2020: <https://www.youtube.com/watch?v=9o9Nx3LcFXQ>.

It is necessary to elaborate on other factors, particularly the locations where they are permitted at intersections. Even without advertising, intersections pose certain risks. According to the regulations, advertising should not be allowed on sites with inadequate sight distances or obscure driver visibility. However, such a general statement would not provide adequate guidance for its implementation because it is subject to high subjectivity.

3.2. Travel Pattern Indicator

On average, Jordanian participants travel slightly more per day (113 km) than Kuwaiti participants (106 km); however, there is no statistically significant difference ($t = 0.493$, $p = 0.623$). On the other hand, Kuwaitis commit more traffic violations per year (3.5) than Jordanians (1.5), and the difference is statistically significant ($t = -7.322$, $p = 0.00$). According to the analysis, males in both countries commute four times more than females and violate three times more violations. Jordan's senior group travels nearly three times as much as the Kuwaitis but commits half the violations. Young Kuwaitis travel less than the middle-aged group and engage in more breaches than the other two groups. While Jordanian drivers violate less than three-quarters of the Kuwaiti's violations, they drive twice as far as Kuwaiti drivers.

In contrast, non-professionals in Jordan travel half of the daily travel distance of the Kuwaitis, committing less than one-fourth of the Kuwaitis' violations. There was no statistically significant difference between the participants in the two countries in the distance travel by male or female, young or middle age group. There was a significant difference between other tested parameters for the daily trip and the traffic violations, except for the senior age group violations, as indicated in the boldface font (**Table 5**).

3.3. Distraction Perception

3.3.1. Distraction Perception and Recent Involvement

In Kuwaiti subjects' opinion, cell phone use is the primary source of distraction

Table 5. Travel pattern indicators by gender, age, driver type, and country.

Factor	Level	Km Driven				Number of Annual Violations			
		Country	N	Mean	Std. Deviation	T-test Results	Mean	Std. Deviation	T-test Results
Gender	Male	Jordan	127	125.7	109.8	$t = 0.539,$ $p = 0.590$	1.7	1.9	$t = -6.974,$ $p = 0.000$
		Kuwait	171	116.0	179.2		3.8	3.3	
	Female	Jordan	23	42.8	58.4	$t = 0.364,$ $p = 0.718$	0.5	1.0	$t = -2.241,$ $p = 0.030$
		Kuwait	26	37.3	46.9		1.8	2.7	
Age	Young	Jordan	76	117.9	109.6	$t = 0.945,$ $p = 0.346$	1.5	1.5	$t = -7.270,$ $p = 0.000$
		Kuwait	150	103.2	112.4		3.9	3.4	
	Middle	Jordan	59	102.3	106.1	$t = -0.402,$ $p = 0.688$	1.5	1.9	$t = -2.137,$ $p = 0.035$
		Kuwait	43	119.2	298.6		2.3	2.2	
	Senior	Jordan	15	129.7	107.4	$t = 2.45,$ $p = 0.027$	1.8	2.7	$t = -.832,$ $p = 0.417$
		Kuwait	4	47.3	38.0		3.3	4.5	
Driver Type	Non-Professional	Jordan	95	48.6	43.9	$t = -4.01,$ $p = 0.000$	0.9	1.4	$t = -8.640,$ $p = 0.000$
		Kuwait	157	110.3	184.7		3.6	3.4	
	Professional	Jordan	54	223.3	94.3	$t = 7.09,$ $p = 0.000$	2.5	2.1	$t = -1.722,$ $p = 0.088$
		Kuwait	40	87.2	90.4		3.4	2.7	
All	Jordan	150	113.0	107.7	$t = 0.493,$ $p = 0.623$	1.5	1.8	$t = -7.322,$ $p = 0.000$	
	Kuwait	197	105.6	169.9		3.5	3.3		

inside vehicles. Mobile phones and radio listening were also perceived as distracting by Jordanian participants. Both groups' immediate distraction outside vehicles is other drivers' behaviour (Table 6). Both groups see children inside cars as distractions. There is a statistically significant difference between the two groups' perceptions of distraction ($\chi^2 = 152.39, p = 0.00$) and their recent interaction with such a distraction ($\chi^2 = 118.85, p = 0.00$).

The participants in the Jordanian group highlighted that the main recent distraction they faced was the behavior of other drivers (25.3%). Following closely were mobile phone usage (22.0%) and radio listening (20.7%), which matched the overall perception of road users, albeit to different extents. Intriguingly, the participants considered recent incidents of mobile phone usage and radio listening more distracting than their general perception of these activities. The percentage of participants indicating recent involvement in these incidents was 4.7% higher for mobile phone use and 4% higher for radio listening than their general perceptions. Participants also ranked pedestrian behaviour as the fourth most common distraction based on their general perceptions (14.7%). According to Table 6, a few subjects in the sample reported being distracted recently due to pedestrian behaviour (3.3%), pushing this cause of distraction to seventh place.

Table 6. Outside and inside vehicle distraction's source by country (%).

Source of Distraction	Cause of Distraction	General Perception		Self-Reported Recently Distraction Exposed	
		Jordan	Kuwait	Jordan	Kuwait
Outside Vehicle External	Other Drivers Behavior	24.0	14.2	25.3	8.6
	Pedestrian Behavior	14.7		3.3	1.5
	Advertisement	7.3	0.5	6.7	1.0
Inside Vehicle Internal	Mobile Use	17.3	77.2	22.0	76.6
	Listening to Radio	16.7	0.5	20.7	1.0
	Children in the vehicle	8.0	6.6	9.3	5.1
	Passenger in the vehicles	5.3	0.5	9.3	2.0
	Eating and Drinking	2.7	0.5	2.7	2.0
	Others	4.0		0.7	2.0

In Kuwait, respondents exhibited consistency in their perceptions of distractions and their recent encounters with such distractions. Mobile phone usage emerged as the primary source of distraction, with 77.2% of those interviewed identifying it as their main distraction and reporting recent incidents related to mobile phone use (76.6%). The behavior of other drivers ranked second in both overall perception and recent encounters. However, recent instances of distraction caused by other drivers accounted for only 8.6% of all recent incidents, despite 14.2% of drivers considering it the primary distraction. Interestingly, roadside advertisements were not deemed distracting, particularly among the Kuwaiti participants. In the Jordanian group, a few participants found advertising distracting, and even fewer had recently experienced distractions from roadside advertisements.

Further analysis of the collected data to link into the connection between how participants perceive distractions and their recent interaction with them. To measure this relationship, Spearman correlation coefficients are used to determine the consistency of the ranking given to each type of distraction. The Kuwaiti group has the strongest association ($r = 0.923$, $p = 0.003$), followed by the Jordanian group ($r = 0.853$, $p = 0.0030$). For the general perception of both groups, Jordanian-versus Kuwaitis ($r = 0.768$, $p = 0.044$), the association is slightly significant on a one-tailed test but loses its significance when subjected to a two-tailed test. Furthermore, there is a weak correlation between the two groups regarding their recent exposure to the specified distraction ($r = 0.436$, $p = 0.241$). Additionally, there is a significant difference between the general perception of distraction and recent experience for each country ($\chi^2 = 112.00$, $p = 0.00$ and $\chi^2 = 346.8$, $p = 0.00$ for Jordan and Kuwait, respectively).

3.3.2. Roadside Advertisement Distraction Perception

Figure 4 illustrates the perception of roadside advertisement distractions in Jordan

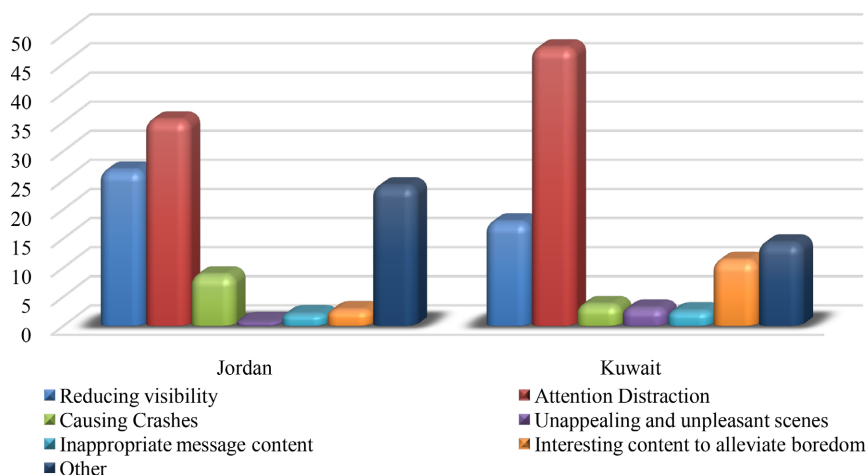


Figure 4. Roadside advertisement distraction by country (%).

and Kuwait offer valuable insights into the populace's attitudes in these countries. In Jordan, 26.7% of respondents believe that roadside advertisements reduce visibility, indicating a prevalent concern about impaired vision caused by these ads. In comparison, Kuwait reports a slightly lower but still significant percentage of 17.8%, suggesting a related apprehension among its residents. Furthermore, attention distraction emerges as a considerable issue in both nations. Kuwait notably records a high 47.7% of respondents feeling distracted by roadside advertisements, a figure significantly higher than Jordan's 35.3%. This disparity underscores a pressing concern in Kuwait regarding the impact of these ads on drivers' focus. In contrast, Jordan exhibits a higher percentage (8.7%) of respondents perceiving roadside advertisements as a cause for crashes, indicating a more alarming perception of the role of advertisements in accidents among Jordanian respondents compared to Kuwait's 3.6%.

Moreover, Kuwait stands out with a significantly higher percentage (11.2%) of respondents finding roadside advertisements interesting enough to alleviate boredom, whereas Jordan's figure is notably lower at 2.7%. This disparity suggests a stark contrast in the effectiveness of ads in engaging the audience for these purposes. Interestingly, the "Other" category in both countries is substantial, accounting for 24% in Jordan and 14.2% in Kuwait. These diverse responses highlight concerns and distractions not covered by specific categories, underlining the need for a nuanced approach to addressing various issues related to roadside advertisements. The data reveals significant disparities in distractions faced by drivers in Jordan and Kuwait, and the difference in responses between groups is statistically significant ($\chi^2 = 25.2$, $p = 0.00$).

3.3.3. Distraction and Incident Risk

Figure 5 presents a compelling overview of the diverse distractions and their influence on incident involvement in Jordan and Kuwait. Mobile phone use is a significant concern, with 18.7% of incidents in Jordan linked to mobile phone distractions, escalating to 35.5% in Kuwait. This stark difference emphasizes a

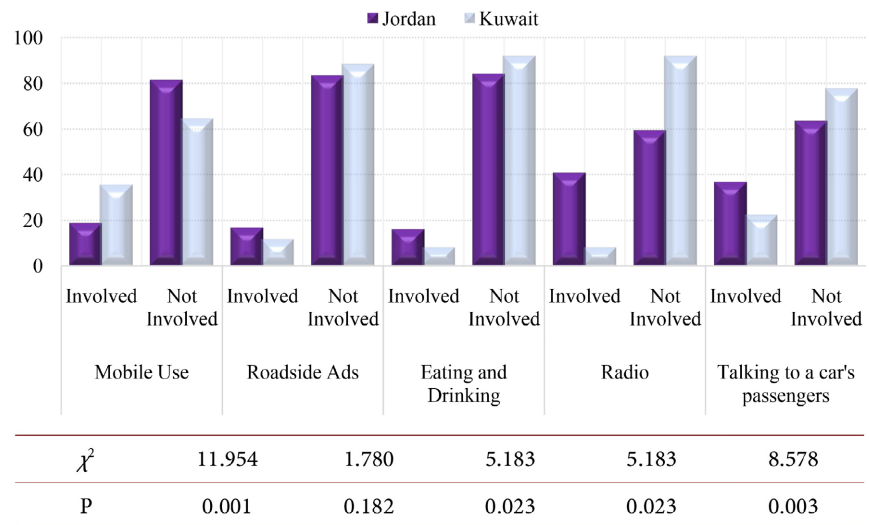


Figure 5. Distraction and incident involvement by country.

pressing need for targeted measures to reduce mobile phone-related distractions, especially in Kuwait, which significantly impacts road safety. Roadside advertisements contribute to 16.7% of incidents in Jordan, slightly higher than the 11.7% in Kuwait. Eating and drinking distractions influence 16.0% of incidents in Jordan and 8.1% in Kuwait. Eating and drinking distractions influence 16.0% of incidents in Jordan and 8.1% in Kuwait. Radio-related distractions impact 40.7% of incidents in Jordan, contrasting sharply with the 8.1% in Kuwait. Additionally, conversations with car occupants affect 36.7% of incidents in Jordan and 22.3% in Kuwait.

The figures underscore the importance of tailored interventions. While both countries share concerns about distractions, the nature and extent of these distractions vary significantly. Addressing these differences with specific awareness campaigns, stricter law enforcement, and behavioral interventions is crucial. This nuanced approach can enhance road safety, ensuring a safer driving environment in Jordan and Kuwait. Aside from the roadside advertisement, there was no statistically significant difference in the two groups (Jordanian and Kuwaiti) involvement in serious incidents when subjected to other distraction sources (Figure 5).

The report presented in Table 7 examines the factors that could explain the distraction driving patterns of drivers in Jordan and Kuwait. The study revealed that various factors such as gender, age, and professional category contribute to distinct challenges in both countries. In Kuwait, mobile phone distractions affected 80.1% of male drivers and 57.7% of female drivers, whereas in Jordan, only 19.7% of male drivers and 4.3% of female drivers were affected. Radio as distraction was higher among Jordanian males (18.9%) than Kuwaiti males (0.6%). Eating and drinking distractions affected 2.4% of Jordanian male drivers and 4.3% of females, whereas only 0.6% of Kuwaiti male drivers were impacted.

The study also observed that young Kuwaiti drivers faced significantly higher mobile phone distractions (79.3%) than their Jordanian counterparts (17.1%).

Table 7. The analysis of stated source of distraction by tested factors and country (%).

Distraction Source	Driver Gender				Driver Age						Driver Professionalism			
	Jordan		Kuwait		Jordan			Kuwait			Jordan		Kuwait	
	Male	Female	Male	Female	Young	Middle	Senior	Young	Middle	Senior	Non-Professional	Professional	Non-Professional	Professional
Mobile phone	19.7	4.3	80.1	57.7	17.1	16.9	20	79.3	67.4	100	16.8	18.5	76.4	80
Radio	18.9	4.3	0.6		15.8	13.6	33.3	0.7			16.8	14.8	0.6	
Kids in the vehicle	7.1	13	4.7	19.2	9.2	5.1	13.3	4	16.3		6.3	11.1	5.7	10
Passenger in the vehicles	4.7	8.7	0.6		5.3	5.1	6.7	0.7			7.4	1.9	0.6	
Eating & Drinking	2.4	4.3	0.6		3.9	1.7		0.7			1.1	5.6	0.6	
Pedestrian Behaviour	15	13			10.5	20.3	13.3				15.8	13		
Other Drivers Behaviour	21.3	39.1	12.9	23.1	26.3	25.4	6.7	14	16.3		27.4	18.5	15.3	10
Advertisement	7.9	4.3	0.6		7.9	6.8	6.7	0.7			5.3	11.1	0.6	
Others	3.1	8.7			3.9	5.1					3.2	5.6		

Statistical Tests investigating the difference within a country for the factor and between the countries for levels of tested factors

Difference in the behaviour Within Country	t-value = 11.311, p = 0.185	t-value = 10.977, p = 0.089	$\chi^2 = 10.518$, p = 0.838	$\chi^2 = 10.750$, p = 0.550	$\chi^2 = 14.158$, p = 0.587	$\chi^2 = 2.578$, p = 0.860	
Factor's Level	Male	Female	Young	Middle-Age	Senior	Non-Professional	Professional
Difference in the behaviour Between Countries	$\chi^2 = 130.4$, p = 0.000	$\chi^2 = 23.3$, p = 0.000	$\chi^2 = 98.20$, p = 0.000	$\chi^2 = 43.3$, p = 0.000	$\chi^2 = 8.67$, p = 0.000	$\chi^2 = 110$, p = 0.000	$\chi^2 = 41.3$, p = 0.000

Radio distractions were also higher among young Kuwaiti drivers (33.3%) than Jordanian young drivers (15.8%). Distractions from other drivers' behavior were more prevalent for young in Jordan (26.3%) than in Kuwait (14%). Professional drivers in both countries face similar distractions, with mobile phone distractions being the most prevalent. The study found that 18.5% of professional drivers in Jordan and 80% of professional drivers in Kuwait were affected. Distractions from children in the vehicle were slightly higher among Kuwaiti professional drivers (10%) compared to Jordan (6.3%). Advertisement distractions were reported by 11.1% of professional drivers in Kuwait and 5.3% in Jordan.

3.4. Behaviour Survey Analysis

3.4.1. Outside Vehicle Distraction

Table 8 compares driver action types based on distraction sources, countries (Jordan and Kuwait), and road segment types. The data reveals percentages for various actions, focusing on outside vehicle-traffic interactions. In both Jordan and Kuwait, a significant portion of drivers engage in lane changes when passing segments with roadside advertisements, with 15.6% in Jordan and 17.0% in Kuwait. Speeding is also noted, though at a lower rate, with 3.1% in Jordan and 4.3% in Kuwait. Interestingly, specific data regarding stopping actions is absent. In this broader context, 18.7% of drivers in Jordan and 21.3% in Kuwait engage in some form of action. Conversely, most drivers, constituting 81.3% in Jordan and 78.7% in Kuwait, are observed to do nothing, indicating a prevalent lack of interaction or response while driving. This data sheds light on the varying driving behaviors across these countries, emphasizing the need for targeted interventions to address specific distractions and enhance road safety.

Table 8. Driver action type by distraction source, country and road segment types (%).

Segment	Acting	Outside Vehicle-Traffic Interaction			Inside Vehicle		
		Type	Jordan	Kuwait	Type	Jordan	Kuwait
Segment with Advertisement Signs	Do Something	Lane Change	15.6	17.0	Mobile Phone	18.8	25.5
		Speed	3.1	4.3	Talking: car occupants	40.6	34.1
		Stopping			Smoking		
					Eating & Drinking		
		All Actions	18.7	21.3	All Actions	59.4	59.6
		Do Nothing	81.3	78.7	Do Nothing	40.6	40.4
Segment with Commercial Business signs	Do Something	Lane Change	33.3	30.6	Mobile Phone	23.8	10.2
		Speed	21.4	2.0	Talking: car occupants	23.8	36.7
		Stopping	2.4	6.1	Smoking	2.4	4.1
					Eating & Drinking		
		All Actions	57.1	38.8	All Actions	50	51
		Do Nothing	42.9	61.2	Do Nothing	50	49
Segment with traffic sign-Control Section	Do Something	Lane Change	13.8	14.0	Mobile Phone	20.7	18
		Speed	65.5	10.0	Talking: car occupants	31	42
		Stopping	3.4		Smoking	13.8	14
					Eating & Drinking		6
		All Actions	82.8	24	All Actions	65.5	80
		Do Nothing	17.2	76.0	Do Nothing	34.5	20

In the control segments, Jordanian drivers exhibit active responses such as braking, accelerating, or swerving in 82.8% of cases, a stark contrast to Kuwaiti drivers' meager 24% engagement, representing less than one-third of the Jordanian group's activity ($\chi^2 = 25.55$, $p = 0.00$). When encountering commercial segments, 57.1% of Jordanian drivers respond, while 38.8% of Kuwaiti drivers do the same, although this difference lacks statistical significance ($\chi^2 = 3.06$, $p = 0.08$). Both countries show minimal responses in the advertisement segments, with a negligible difference ($\chi^2 = 0.075$, $p = 0.78$) between Jordan and Kuwait (Table 8). A comparison between actions in the control and roadside advertisement segments revealed a statistically significant difference ($\chi^2 = 14.56$, $p = 0.002$ and $\chi^2 = 9.51$, $p = 0.023$ for Jordan and Kuwait groups, respectively). This contrast was not observed when comparing actions in the commercial business segment to the control segment. Although still statistically significant for Jordan ($\chi^2 = 31.47$, $p = 0.00$), the difference was insignificant for the Kuwait group ($\chi^2 = 1.27$, $p = 0.529$).

At the national level, significant variations in driver behavior were evident between control segments and those featuring advertisements ($\chi^2 = 24.94$, $p = 0.00$) or commercial signs ($\chi^2 = 5.14$, $p = 0.023$) in Jordan. Conversely, these differences failed to reach significance in Kuwait ($\chi^2 = 0.81$, $p = 0.47$ and $\chi^2 = 2.51$, $p = 0.113$ for advertisement and commercial segments, respectively). Furthermore, at the national level, no significant differences were found in the actions taken across the three segments for the Jordanian group ($\chi^2 = 13.8$, $p = 0.01$) and were insignificant for Kuwait ($\chi^2 = 8.98$, $p = 0.06$).

Notably, responses and actions of drivers across the three analyzed road segments significantly differed, particularly in Jordan. Lateral shifts were frequently observed when passing segments with roadside advertisements, whereas speed-related actions were prevalent in Jordan's control segment. Kuwaiti drivers exhibited more lane changes compared to their Jordanian counterparts. However, no significant distinctions emerged in the type of action at the roadside advertisement segment based on the country ($\chi^2 = 0.102$, $p = 0.95$). In contrast, the difference between the control and commercial sections was statistically significant ($\chi^2 = 31.99$, $p = 0.00$) and ($\chi^2 = 9.96$, $p = 0.019$).

Examining inside-vehicle behaviors, roughly 60% of drivers in both nations engage in distracting actions when passing advertisements, a rate that drops to around 50% in commercial segments. In Kuwait, distraction rates spiked to 80% in control segments, surpassing Jordan's 65.5%. Jordanian drivers exhibit non-significant differences between advertisement and control segments ($\chi^2 = 0.244$, $p = 0.621$) and ($\chi^2 = 1.68$, $p = 0.195$), but significant disparities in Kuwait ($\chi^2 = 4.82$, $p = 0.028$ and $\chi^2 = 9.22$, $p = 0.002$ for roadside advertisements and commercial sections respectively). Across both countries and various road segments, conversations with other car occupants emerge as the primary inside-vehicle distraction, trailed by mobile phone usage. Occasionally, drivers engage in eating and drinking (non-alcoholic). While differences based on the country surface in behavior ($\chi^2 = 0.61$, $p = 0.435$; $\chi^2 = 3.97$, $p = 0.138$; $\chi^2 = 1.997$, $p = 0.573$ for roadside advertisements, commercial advertisements, and control sections, respec-

tively), Jordan exhibits no significant variations when comparing advertising to control segments ($\chi^2 = 4.98$, $p = 0.173$). However, in Kuwait, substantial differences emerge ($\chi^2 = 13.82$, $p = 0.008$). When evaluating behavior in commercial segments versus control sections, the disparity remains insignificant in Jordan ($\chi^2 = 4.53$, $p = 0.21$) but attains significance in Kuwait ($\chi^2 = 12.91$, $p = 0.012$).

Figure 6 compellingly illustrates significant disparities in driver behavior across various road segments in Jordan and Kuwait irrespective of the driver action inside the vehicle. The Jordan group exhibits considerable variations in their actions, particularly in their responses to road segments featuring roadside advertisements and those with only traffic signs. When encountering segments with roadside advertisements, both Jordanian and Kuwaiti drivers commonly opt for lane changes, with 83.3% in Jordan and 80.0% in Kuwait. Moreover, 16.7% of Jordanian and 20.0% of Kuwaiti drivers adjust their speed, indicating minor differences in their response strategies. Stopping at the advertisement signs was not noticeable in Kuwait, while only 4.2% stopped in the tested segment, which is unrelated to the installed signs.

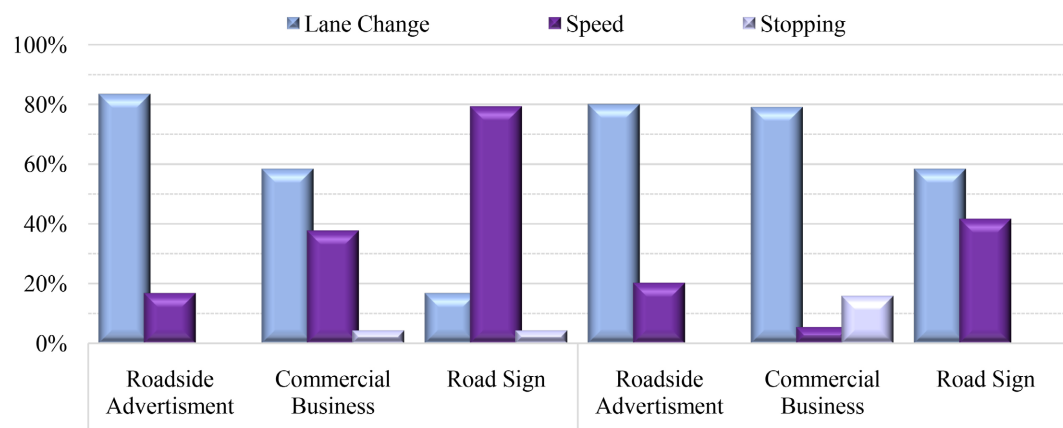


Figure 6. Driver behaviour when passing the tested segment by country and road segment type.

In segments marked by commercial business signs, Kuwaiti drivers are more inclined toward lane changes (78.9%) than their Jordanian counterparts (58.3%). Conversely, Jordanian drivers are more likely to reduce speed (37.5%) in these areas, reflecting a cautious approach. Kuwaiti drivers, however, demonstrate a lower tendency (5.3%) to modify their speed, suggesting potential variations in driving behaviors in these specific zones. Additionally, Kuwaiti drivers are more inclined to stop (15.8%) in these segments, indicating heightened caution, while the stopping response is less prevalent in Jordan.

Responses to control segments, where only road signs are present, unveil significant differences. In Jordan, most drivers (79.2%) adjust their speed based on road signs, while in Kuwait, a higher percentage (58.3%) opt for lane changes. This variation underscores diverse interpretation patterns and adherence levels to road signs in the two countries, as confirmed by statistical tests.

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3.4.2. Inside vs Outside Vehicle Distraction

The data presented in **Table 9** sheds light on the striking disparities in driver responses within the tested segments, differentiating between distracted and non-distracted drivers in Jordan and Kuwait. The idea is to investigate if the driver is subjected to some distraction inside his vehicle; they might or might not interact with external sources of distraction like roadside advertisements or commercial business signs. In Jordan, non-distracted drivers exhibited a range of responses. When passing segments with advertisement signs, 69.2% acted like lane changing, speeding, etc., which dropped to 47.6% in segments with commercial business ads and decreased to 20.0% in segments controlled by road signs. Conversely, 30.8% of non-distracted Jordanian drivers refrained from taking action in segments with advertisement signs, 52.4% in segments with commercial business ads, and a substantial 80.0% in segments with road sign control. Kuwaiti non-distracted drivers showcased a more consistent pattern. Approximately 68.4% took action in segments with advertisement signs, 54.2% in segments with commercial business ads, and 90.0% in segments controlled by road signs. Only 31.6% of non-distracted Kuwaiti drivers chose not to act in segments with advertisement signs, 45.8% in segments with commercial business ads, and merely 10.0% in segments with road sign control. The chi-square statistics related to the two groups showed no significant difference in the driver's response to external sources of distraction due to the type of segment under scrutiny ($\chi^2 = 5.491$, $p = 0.064$ for Jordan, and $\chi^2 = 4.116$, $p = 0.128$ for Kuwait).

Distracted Jordanian drivers exhibited noticeable hesitancy in their responses. Only 10.5% refrained from taking action in segments with advertisement signs, 61.9% with commercial business ads, and 84.2% in segments controlled by road signs. In contrast, 89.5% of distracted Jordanian drivers took action in segments with advertisement signs, 38.1% in segments with commercial business ads, and 15.8% in segments with road sign only-control segment. Distracted Kuwaiti drivers also displayed a degree of indecisiveness. Approximately 14.3% took no action in segments with advertisement signs, 32.0% in segments with commercial business ads, and 27.5% in segments controlled by road signs. In contrast,

Table 9. Inside vehicle distraction vs the driver response by country and road segment type (%).

Inside Vehicle Distraction	Country	Response in Traffic	Segment Type			Total	χ^2
			Advertisement sign	Commercial Ads	Control Segment		
Not Distracted	Jordan	Do Nothing-Not acting in traffic	30.8%	52.4%	80.0%	23	$\chi^2 = 5.491,$ $p = 0.064$
		Do something-acting in traffic	69.2%	47.6%	20.0%	21	
	Kuwait	Do Nothing-Not acting in traffic	31.6%	45.8%	10.0%	18	$\chi^2 = 4.116,$ $p = 0.128$
		Do something-acting in traffic	68.4%	54.2%	90.0%	35	
Distracted	Jordan	Do Nothing-Not acting in traffic	10.5%	61.9%	84.2%	31	$\chi^2 = 21.831,$ $p = 0.00$
		Do something-acting in traffic	89.5%	38.1%	15.8%	28	
	Kuwait	Do Nothing-Not acting in traffic	14.3%	32.0%	27.5%	23	$\chi^2 = 2.515,$ $p = 0.284$
		Do something-acting in traffic	85.7%	68.0%	72.5%	70	
Testing the Difference between countries							
Driver Response	Roadside Advertisement Signs		Commercial Business Ads		Control Segment: Road Sign		
	χ^2	p-value	χ^2	p-value	χ^2	p-value	
Do Nothing	0.002	0.961	0.192	0.661	9.899	0.002	
Do Something	0.144	0.705	4.114	0.043	16.691	0.000	

85.7% of distracted Kuwaiti drivers took action in segments with advertisement signs, 68.0% in segments with commercial business ads, and 72.5% in segments with road sign control.

The chi-square statistics for the Jordanian group showed a significant difference in the distracted driver's response to external sources of distraction due to the type of segment under scrutiny ($\chi^2 = 21.831$, $p = 0.00$). In contrast, the difference was insignificant for the Kuwaiti group ($\chi^2 = 2.515$, $p = 0.284$). Chi-square test results investigating the relationship between acting in traffic and the distraction status inside the vehicle for each type of segment and the two country groups showed no significant difference in the driver interaction in traffic that may have contributed to the inside vehicle distraction ($\chi^2 = 2.076$, $p = 0.150$; $\chi^2 = 0.389$, $p = 0.533$; $\chi^2 = 0.081$, $p = 0.775$ for segments with roadside advertisement, commercial business ads, and control segment, respectively in Jordan and the corresponding statistics for the Kuwait group are $\chi^2 = 2.021$, $p = 0.155$; $\chi^2 = 0.987$, $p = 0.320$; $\chi^2 = 1.343$, $p = 0.246$). The country-wise comparison results in **Table 9** showed no significant connection between the country and the drivers' tendency to do nothing in response to distractions, except for one exception related to the control segment. However, if it is a side test, a significant relationship was found in the "Do Something-acting" category, specifically for the control and commercial business ads segments.

4. Discussion of Results

The road user perception of distraction and behavior on three road segments

describing different signing and advertising conditions in Jordan and Kuwait were investigated to validate the research hypotheses. In addition to field observations, a questionnaire was designed to address the research questions and related hypotheses. Testing driver behavior in actual traffic conditions was conducted using non-intrusive observation methods. Such a method indeed includes some judgment and subjective elements; still, it provides indications of the pronounced interactions and actions in traffic that could be notable by road users without the need for sophisticated equipment and influence the drivers as observed through an experimental study.

The study examined travel patterns and safety inclination based on traffic violations. The findings indicated no significant difference between Jordanian and Kuwaiti participants regarding daily travel distance (113 km vs. 106 km), except for driver type (professional vs. non-professional), which yielded significant results. However, Kuwaitis exhibit notably higher annual traffic violations (3.5) than Jordanians (1.5). The study found statistically significant differences in distance and violations despite specific cases involving senior and professional drivers. Regarding gender, males in both nations commute four times more than females and commit three times the violations. Across all age groups, Jordan's seniors travel almost three times as much as Kuwaitis but commit only half the violations. While young Kuwaitis travel less than their middle-aged counterparts, they engage in more violations. Non-professional Jordanian travelers cover half the daily distance of Kuwaitis and have fewer violations, while professionals travel twice as far as Kuwaitis but still commit fewer violations. These findings, however, are based on self-reported data, which sometimes undermine the facts or vice versa.

Kuwaiti and Jordanian participants identify cell phone use as the primary in-vehicle distraction and other drivers' behavior as a common external distraction. Yet, their perceptions and recent experiences of distraction are significantly different. Participants found other drivers' behavior, mobile phone use, and radio listening distractions in Jordan. In contrast to their general perception, they rated recent mobile phone use and radio listening as more distracting. This aligns with previous research findings that mobile phones are primarily a source of distraction [8] [9] [10] [12]. The general perception of pedestrian behavior ranks fourth but falls to seventh due to rare recent incidents. In Kuwait, coherence exists between overall perception and recent distraction encounters, with mobile phone use and driver behavior being prominent. Notably, recent exposure to less impactful actions is riskier. The strong correlation between perception and engagement is notable in both groups, especially in Kuwait ($r = 0.923$) and Jordan ($r = 0.853$). Both countries have a significant difference between general perception and recent distraction experiences. Both groups do not consider roadside advertisements a serious distraction, especially among Kuwaitis. Participants in both groups believe it deviates attention more than increasing crash risk.

The validation of the formulated hypothesis yields mixed results, with some hypotheses being validated, some falsified, and others lacking clear-cut conclusions. The first hypothesis states that road users' general reactions and perceptions toward distractions and roadside advertising are consistent across countries and environments. The study showed that few Jordanians found advertising distracting, while no Kuwaitis did. Nonetheless, half of them felt the signs distracted the driver's attention, compared to 35% of Jordanians. The statistical analysis revealed a significant difference between the two groups' responses. The difference was evident irrespective of the factors used to describe the subjects. As the perception survey confirmed, the two groups perceive the impact of roadside advertisements differently, which suggests the falsification of the first hypothesis.

According to the second hypothesis, users behave similarly on road segments with and without roadside advertisements. It was found that road users respond consistently to all types of roadside advertisements. Observable distractions inside the vehicle do not affect road users' responses to the roadside advertisement. Jordanian drivers frequently change their behavior when passing the control section (82.8%) without advertising but not when approaching advertisement signs (18.7%). There was no difference in Kuwaiti road behavior when passing either the control segment or the segment with roadside advertising signs: 76% (Road Sign) and 78.7% (Roadside Advertisement). Kuwaiti data confirmed the hypothesis, but Jordanian data did not. For a conclusive conclusion, further research is needed to falsify or validate the hypothesis.

According to the third hypothesis, road users' reaction to roadside advertisements is consistent regardless of their type. Verification was done by comparing driver behaviors with ads or commercial signs when passing through road segments. Around 81% of the Jordanian group did not react when passing the roadside advertisement segment. This is compared to 42% of drivers who took evasive action in the commercial segment, and this difference is statistically significant. Kuwaiti drivers performed, to some extent, similarly in those two segments (78.7% and 61.2% of drivers did not react to roadside advertisements and commercial road segments). While the difference in Jordan was statistically significant, it was not in Kuwait. Kuwait data demonstrate the validity of the third hypothesis, but not Jordan. To conclude, further research is needed to falsify or validate the hypothesis.

The fourth hypothesis holds that inside vehicle distraction does not affect road users' responses to roadside advertisements. Data from aggregated roadway segments revealed that distracted drivers are more likely to take evasive action in traffic; non-distracted drivers also tend to take action in traffic, implying that distraction does not affect traffic incidents. However, behavior may differ depending on the type of road segment. Drivers act on roadside advertisements regardless of driver group or distraction status. Jordanians are hesitant to act irrespective of distraction status in the control segment, whereas Kuwaitis are inclined to take action irrespective of distraction status. Therefore, what distracts drivers inside the car doesn't necessarily affect their interaction with other driv-

ers in traffic, which supports the fourth. However, since the observations were non-intrusive, more evidence is needed to support the validation, which could be obtained through experimental studies.

The study did not show evidence that advertising activities may adversely affect road user behavior in traffic. Although, some of the Jordanian group participants indicated that it distracts them. The study may contradict previous findings showing that advertising attracts drivers' attention and influences their behavior [25] [26] [27] on the one hand and agrees with other studies that suggest a minor influence on their presence [14].

Both countries need to revise their advertising regulations to emphasize safety aspects, which are not explicitly emphasized. The location of traffic control devices and geometric road characteristics, including intersections and other road facilities, are included in this.

The study underscores the need for tailored strategies in Jordan and Kuwait to address specific concerns related to roadside advertisements, ensuring a safer driving environment. Customized regulations and targeted awareness campaigns are essential to tackle diverse distraction challenges faced by drivers. Clearer road signage, consistent rules, and focused education are crucial for a predictable driver response in different road segments. The research highlights distraction's impact on driver behavior, emphasizing the urgency of targeted educational efforts and interventions to enhance road safety in various traffic scenarios. Further research and policies are vital to improve driver responsiveness across diverse road situations.

Conflicts of Interest

No potential competing interest was reported by the author.

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