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A Scoping Study on Driver's Perspective of Distracting Factors

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Abstract: Distracting activities while driving are common and can result in errors that threaten road users' safety. The main objectives of this study were to investigate drivers' perspectives of the factors contributing to distraction, determine the relative rank of types of distractions, recognize the road factors and environmental effects that make distractions more dangerous, and identify the most effective measures to reduce driver distractions. A survey was conducted to assess Jordanian drivers' experiences with distracted driving, and what solutions they believed could be implemented to solve the problems. The study's outcomes revealed that drivers perceive visual distractions as the most dangerous, followed by cognitive, manual, and auditory distractions, respectively. It was also found that "mobile phone texting or dialing" was ranked the top most dangerous visual and manual distracting factor. "Baby is crying or kids are fighting in the back seat" was perceived by all demographic groups as the riskiest auditory factor. Regarding cognitive distraction, four factors were perceived as the most serious, of which "Baby is crying", "Driving while angry or sad or agitated", "Talking on a cell phone—even a hands-free one" and "Conversing with passengers" were determined to be the top four distracting factors. The results also revealed that drivers believe that "laws and enforcement" is the most effective measure to reduce distractions while driving.

Keywords: attention; COVID-19; driver's distraction; mobile phone; perspectives; traffic safety

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1. Introduction

Distracting activities while driving are common and can result in driving errors that threaten road users' safety, as they might result in crashes. This is a crucial factor in the occurrence of traffic accidents, because the safety performance of the driver is reduced [1,2]. It has been reported that over 90% of traffic accidents are the outcome of human error and are caused by visual information acquisition issues [3]. Moreover, drivers are responsible for causing 90% of critical conditions in traffic [4,5].

Particular activities or events can distract the driver while driving. The distraction can be minimal or have no influence on the attention and driving performance of the driver, or it might be so extensive that the driver is not able to provide the required attention to the driving task, which greatly reduces his/her driving performance [6]. Hanowski et al. [7] described a distraction as occurring in the inattentive event, causing a delay in identifying information that is required for safely performing a driving task. Topolšek et al. [8] emphasized that there is no fundamental definition of driver distraction presently appropriate, but they argue that the most authentic definition would be that of Oviedo-Trespalacios et al. [9] who defined distraction as an occurrence encompassing

the diversion of a driver's attention, temporarily focusing on something not related to his driving, which particularly mitigates his awareness, performance, and ability to make driving decisions.

Causes of driving distractions can be associated with any cognitive procedure, such as solving mathematical issues, using information systems in the vehicle, mind-wandering, or daydreaming; all of these can impact a driver's attention that should be directed to the driving process [10]. Drivers are fundamentally flexible and can shift their driving-associated behavior in a manner that enables them to meet an elevated demand for activities not associated with their driving [7]. Kinnear and Stevens [11] categorized driver distractions into four categories, which are not mutually exclusive, and drivers have been known to be involved in more than one type of distraction at the same time.

- Visual: taking the eyes off the road and glancing elsewhere to engage in a secondary activity inside or outside the vehicle.
- Manual: taking one or both hands off the steering wheel to engage in another activity.
- Cognitive: taking one's mind off the driving task.
- Auditory: diverting attention while driving. This type is mostly mutual with other distractions.

Potentially the most common distracting factor is the use of mobile phones, explored in a previous study by Sterkenburg and Jeon [12]. The use of such devices reduces driving precision and causes up to 50% slower responses to risks, thus causing a deterioration in performance [13]. Wood et al. [13] indicated that the use of hands-free systems also induces distracting effects. In-vehicle entertainment systems also influence driving behavior through acts such as adjusting radio volume [14,15].

The use of navigation systems has different impacts on the efficiency of driving, associated with the manner of controlling the device, manually or vocally [16]. Jenness et al. [17] revealed that manually operated devices take more attention from the driver, require a longer time to operate, and cause drivers to take their eyes off the road, compared with voice-operated devices.

Elements of the roadside can also present critical driver distractions as compared to in-vehicle distractions. Although observation of the traffic environment and roadside is an essential activity in driving, some elements outside of the vehicle may draw drivers' attention and present a critical distraction. For instance, roadside billboards and posters, electronic billboards, and landscape heritage sites are considered key distractors to drivers [18–20].

Mind-wandering is another important distraction, which commonly occurs when a driver is 30–50% awake [21,22]. Née et al. [23] reported that half of the drivers acknowledge experiencing some mind-wandering prior to having a traffic accident. Xu et al. [24] examined the correlations and frequency of driver mind-wandering, and found that whilst mind-wandering drivers do not reveal most of the vehicle-control impairments, they barely focus their visual attention on the road. Therefore, mind-wandering is associated with a reduced ability to monitor one's environment. Xu et al. [24] also reported that mind-wandering is positively associated with risky driving, negative emotional or cognitive driving styles, aggressive driving, and driving under the impact of alcohol.

Cognitive distractions and visual distractions are the most important distractions that reduce driving performance, and include visual perception efficiency, steering control, response to hazards, and lane variation [25].

In Jordan, accident statistics show a relatively low level of traffic safety compared to that in developed countries, which causes large socio-economic losses. The Annual Report of Traffic Accidents in Jordan for the year of 2019 [26] presents the following facts about the status of traffic safety in Jordan:

- (161,511) traffic accidents occurred in Jordan (a country of 10 million people), of which (10,857) were accidents that caused human injuries, with (643) deaths and an estimated financial cost of JOD 454 million.

- Jordan was ranked among the top four countries to have (4.3) deaths per (10) thousand vehicles in 2017.
- Human error was responsible for 98.2% of accidents involving human injuries in 2019.
- Driver fault (i.e., not taking the necessary precautions) was completely responsible for a high percentage (i.e., around 40%) of injuries and deaths in 2019.
- In 2019, passengers constituted the highest percentage of the total injuries (41.13%), followed by drivers (33.03%), and pedestrians (25.84%), while passenger deaths scored the highest percentage (41.7%), followed by pedestrians (37%) and then drivers (21%).

Furthermore, the Jordan Traffic Institute's statistics show that distracted driving was responsible for 24.2% of traffic accidents on rural and suburban roads for the years 2014 to 2018.

Several research studies have examined the significance of different driver distractions on traffic accidents. However, none have investigated these distractions from the driver's perspective. It is important to understand how drivers perceive distraction factors, which would help researchers, auto-manufacturers, in-vehicle infotainment system developers, traffic experts, and public authorities identify the most effective measures to reduce driver distractions and teach different driver groups the best practices that fit their driving behaviors and keep them attentive. Therefore, as mentioned before, this study aims to investigate drivers' perspectives of factors contributing to driver distractions, determine the rank and order of distraction types, recognize the road factors and environmental effects that make distractions more dangerous, and identify the most effective measures that must be taken to reduce driver distractions. This study is the first in Jordan and, perhaps worldwide, that attempts to pinpoint and rank the major distraction factors and types from drivers' perspectives.

2. Methodology

To achieve the study's objectives, a survey was conducted among Jordanian drivers who are licensed and registered with the Vehicle License Department. The survey, written in the Arabic language, was randomly distributed and collected electronically. A total of 850 drivers responded intentionally and returned their responses within four months (July 2020–October 2020). However, due to incomplete responses to the questions, the final sample size used for the analysis was 826 responses that were relevant to the study's objectives.

The survey questionnaire was designed to collect demographic, behavioral, and perspective data from respondent drivers. The questionnaire was divided into (four) sections. Section A was designed to collect information about the driver's gender, age, education, employment type and the age of their car, driving license type, and the holding period. Sections B and C were to collect information related to the driver's behavior during driving and the driver's perspective about distraction types and factors. Section D collected information related to road factors and environmental effects that might increase distraction risks and consequences.

Furthermore, respondents were asked to rank (i.e., give weight or order) each factor of each type of distraction on a scale from 1 to 10 (i.e., 10 for highest danger and 1 for lowest danger) for visual, manual, and cognitive distraction types, and from 1 to 5 for auditory distraction. Moreover, respondents were asked to rank the distraction types from 1 to 4 according to their danger as perceived by drivers, with higher values indicating higher danger (section C). In addition, they were asked to select the most effective measure, in their opinion, to reduce the driver's distractions (section D).

The collected survey data were analyzed using both Microsoft Excel and SPSS software. Descriptive statistics were presented in the form of frequencies and percentages, and rating questions as means and medians. In addition, rankings, which were based on average weights provided by respondent drivers, were used to identify the types of distractions, and the most important distracting road and environmental factors for drivers.

3. Results

The analysis of the collected survey data is presented in the following subsections.

3.1. Demographic and Driving Characteristics

The demographic characteristics of respondents are summarized in Table 1. Male respondents constituted 68% of the respondents while 32% were female drivers. Out of 826 drivers, 38% of the drivers were aged 24–40 years, 35% 41–60 years, and 19% 18–23 years. Forty-four percent of the participants had a bachelor's degree, 28% had a master's degree, and 18% had a high school certificate. Table 1 clearly shows that the respondents were a rich reflection of the basic profile of both the population of Jordan, and of Jordanian licensed drivers. The respondents cut across different age groups, genders, and education levels.

Table 1. Demographic profile of respondents.

Factor	Frequency	Percent
Gender		
Male	558	68
Female	268	32
Age (years)		
18–23	160	19
24–40	314	38
41–60	286	35
>60	66	08
Education		
High school	152	18
Diploma	78	09
Bachelor degree	366	44
Master's degree and above	230	28
Employment		
Full-time	440	53
Part-time	76	09
Retired	76	09
Student	130	16
Home maker/others	104	13

The driving characteristics of participants are presented in Table 2. The majority of the participants had a privately owned vehicle (76.0%). About fifty-two percent (51.6%) had driven vehicles manufactured in the last 10 years. About 44.3% of drivers always wore seat belts and a similar percentage (44.3%) had never been involved in a crash. Fifty-four percent (54.0%) of the respondents occasionally sent text messages, whereas (28.6%) of the drivers kept their mobile phones close and within reach. Mobile phones were used by (61.7%) as a means for navigation when car navigation was not available and (48.2%) of the drivers used only one hand to hold the steering wheel except when passing by the police, or during heavy traffic or bad weather. About forty-one percent (41.4%) of drivers used the radio knob to adjust the volume or change the channel, whereas (53.5%) of the drivers occasionally listened to very loud music. In addition, (58.8%) of the drivers occasionally ate, drank, or smoked while driving.

3.2. Drivers' Perceptions of Distraction Factors and Types

As stated earlier, respondents were asked to rank (i.e., give weight to) each of the distracting factors for each type of distraction on a scale from 1 to 10 (i.e., 10 for highest danger and 1 for lowest danger) for visual, manual, and cognitive distraction types, and from 1 to 5 for auditory distraction. Respondents were also asked to rank the distraction types from 1 to 4 according to their danger level as they perceived them, with higher values indicating higher danger.

Table 2. Driving characteristics of respondents.

Factor	Observations	Percent
Number of years having a driver's license		
<2	118	14.3
2–5	116	14.0
5–10	118	14.3
>10	474	57.4
Type of driving license		
Private (Type 3)	704	85.2
Public (Type 4)	64	7.7
Two axles bus and truck < 7.5 ton (Type 5)	36	4.4
All vehicle (Type 6)	22	2.7
Vehicle type		
Private/owned	628	76.0
Private/rented	18	2.2
Private/work	28	3.4
Private/borrowed	70	8.5
Public/car	48	5.8
Public/bus	34	4.1
Vehicle age (year)		
<10	426	51.6
10–20	262	31.7
>20	138	16.7
Wearing seat belt		
Always	366	44.3
Occasionally	332	40.2
Never	128	15.5
Crash involvement and cause		
Never	366	44.3
Speeding	94	11.4
Close following (tailgating)	122	14.8
Distracted	138	16.7
Others	106	12.8
Text messaging while driving		
Always	66	8.0
Occasionally	446	54.0
Never	314	38.0
Mobile phone position in vehicle		
Never use phone while driving	110	13.3
In hand	210	25.4
Fixed on dashboard	102	12.3
Close so it can be reached easily	236	28.6
Use of blue tooth	168	20.3
Navigation system Used		
Car navigation system	58	7.0
Mobile phone because car navigation has no local maps identified	166	20.1
Mobile phone because car navigation is not available	510	61.7
Mobile phone even if the car has navigation system	92	11.1
Holding steering wheel		
Both hands all the time	106	12.8
One hand all the time	64	7.7
Both hands most of time	258	31.2
One hand most of time except when passing police or in bad weather or heavy traffic	398	48.2
Adjust volume or change channel by:		
Radio knob	342	41.4
Steering wheel control (if available)	340	41.2
Radio knob even if steering wheel control available	144	17.4
Turning the volume to very loud when listening to favorite music		
Always	130	15.7
Occasionally	442	53.5
Never	254	30.8
Eating, drinking, or smoking while driving		
Always	144	17.4
Occasionally	486	58.8
Never	196	23.7

Table 3 presents the ranking of distraction factors by type as reported by all respondents. The average value of all the ranks (weights) was used as the basis for ranking the distraction factors and types in Table 3. According to respondents, the visual distraction type was perceived as the most dangerous type of distraction (i.e., ranked 4/4). The second riskiest distraction type was the cognitive distraction, followed by manual distraction, while the auditory distraction was perceived as the least dangerous type.

Table 3. Ranking of distraction factors by type as reported by all respondents.

Distraction Type	Factors	Average of Weights	* Rank Based on Average Weight	Median of Weights
Visual (Overall)		3.338	4/4	4
	Mobile phone texting or dialing	8.184	10/10	10
	Outside person, object, event	6.842	9/10	8
	Rubbernecking	6.406	7/10	6
	Smoking, looking for a cigarette or lighter	5.016	2/10	4
	Programming the navigation (GPS)	5.332	3/10	6
	Searching for or changing radio station or car controls	3.801	1/10	2
	Looking for something in car or in purse	5.830	5/10	6
	Distracting events (spilled packages or drinks or dropped cigarette)	6.653	8/10	6
	Moving persons/objects in the vehicle (kids, pets, equipment, things)	6.213	6/10	6
	Fixing clothes or putting on makeup (grooming)	5.447	4/10	6
Cognitive (Overall)		2.791	3/4	3
	Talking on a cell phone—even a hands-free one—or running in-vehicle voice command systems	6.518	10/10	6
	Conversing with passengers	5.656	6/10	6
	Thinking about a problem that needs solving	5.215	4/10	6
	Focusing on an engaging news report	4.029	1/10	4
	Engine is making a weird noise	5.297	5/10	6
	Music is loud	5.113	2/10	4
	Baby is crying	6.440	7/10	6
	Reprimanding children (kids are fighting in the back seat)	6.518	10/10	6
	Driving while holding a full bladder	5.147	3/10	4
	Driving while angry or sad or agitated	6.484	8/10	6
Manual (Overall)		2.622	2/4	3
	Using phone (texting, dialing, charging)	8.343	10/10	10
	Changing the radio station or volume	4.387	3/10	4
	Checking navigation (GPS) programming (no voice operated GPS system)	6.314	7/10	6
	Adjusting car climate control	4.038	1/10	4
	Adjusting mirror, seats, or opening window	4.135	2/10	4
	Reaching for a sandwich or drink	5.443	3/10	6
	Smoking; reaching for a cigarette or lighter	5.452	4/10	
	Looking for something in car or in purse	6.803	9/10	8
	Moving objects in the vehicle (kids, pets, equipment, things)	6.610	8/10	6
	Fixing clothes or putting on makeup (grooming)	5.966	6/10	6
Auditory (overall)		2.266	1/4	2
	Mobile phone ringing	2.481	2/5	2
	Engine is making a weird noise	3.019	4/5	3
	Music is loud	2.886	3/5	3
	Baby is crying or kids are fighting in the back seat	3.566	5/5	4
	Audible vehicle warning (seat belt warning or lane departure warning)	2.438	1/5	2

* Higher values reflect higher danger and lower values reflect lower danger.

Among the visual and cognitive factors, "mobile phone texting or dialing" and "talking on a cell phone" or "dealing with vehicle voice command systems" were the factors that most distracted the respondents from the surrounding traffic environment. Moreover, "outside person, object or event", "distracting events", "rubbernecking", "moving objects in the vehicle", and "looking for something in the car" were other visual factors that distracted the attention of Jordanian drivers. Likewise, "driving while angry, sad or agitated", "crying baby", "conversing with passengers", and "weird engine noise" were other cognitive factors that distracted their attention (Table 3).

In terms of manual factors, "use of phone", "looking for something in the car or in a purse", "moving objects in the vehicle", and "checking the navigation programming" were the factors distracting drivers' attention. In terms of auditory factors, "children making noises", "fighting or crying", and "engine making a weird noise" were some of the factors that distracted attention, according to respondents.

The median of weights was also used as another way to rank the distracting factors for each type of distraction as shown in Table 3. For visual distraction, the median value of (10) suggests that "Mobile phone texting or dialing" was perceived as the highest risk distraction factor in this type. Moreover, the median of weights was equal for a number of factors together, thus putting them in the same risk level. For example, in the case of cognitive distraction, the median values for all the factors were four or six, thus making it hard to order these factors according to risk. It is believed that using the average weights was much more helpful in ranking the factors based on how risky the respondents believe the consequences to be.

In order to investigate how each demographic group perceives distraction types, Table 4 was extracted from the collected data based on the average weight value of respondents' rankings. Table 4 lists the ranks of distraction types as perceived by each demographic group, the top ranked distraction factor among each distraction type, and the most effective measure to reduce distraction. Table 4 clearly shows that almost all demographic groups see that visual distraction is the most dangerous type, followed by cognitive distraction, with manual and auditory distractions coming last. Only educated people with master's degrees and above ranked manual distraction in second place and cognitive in third place, while visual and auditory shared the same ranking with other groups. To make Table 4 more informative, the percentage of drivers in each group who selected each factor as the most distracting one was presented.

Table 4 also shows that "mobile phone texting or dialing" was ranked the top most dangerous visual distraction factor by almost all demographic groups. Only the age group 18–23 and drivers with high school education believed that "Outside person, object, or event" was the most dangerous visual distraction factor. Among all manual distraction factors, "Using phone (texting, dialing, charging)" was perceived as the most distracting factor by all groups. Similarly, "Baby is crying or kids are fighting in the back seat" was perceived by all as the riskiest auditory factor.

Regarding the cognitive distraction type, four different factors were perceived as the most distracting by different demographic groups. "Baby is crying" was perceived as the most dangerous by females, drivers who had had their driving license for 5–10-years, and home makers. "Driving while angry or sad or agitated" was perceived as the most dangerous factor by males, age groups 24–40, and 41–60, people who had had their driving license for >10 years, full-time employees, and drivers with a bachelor's degree or higher. The "Talking on a cell phone—even a hands-free one" cognitive factor was perceived as most dangerous by drivers with part-time employment, retirees, students, people with high school and diploma certificates, people with 0–5 years driving experience, and drivers more than 60. Only one group (18–23 years young people) considered "Conversing with passengers" as the most dangerous cognitive distracting factor.

Table 4. Rank of distraction types and top ranked distraction factors as perceived by demographic groups.

Demographic Variable		Distraction Type Rank				Top Ranked Visual Factor ** (%)	Top Ranked Manual Factor ** (%)	Top Ranked Cognitive Factor ** (%)	Top Ranked Auditory Factor ** (%)	Most Effective Measure in Reducing Driver Distraction ** (%)
		Visual	Manual	Cognitive	Auditory					
Gender	Females	4	2	3	1	Mobile phone texting or dialing (27%)	Using phone (texting, dialing, charging) (31%)	Baby is crying (22%)	Baby is crying or kids are fighting in the back seat (18%)	Laws and enforcement (19%)
	Males	4	2	3	1	Mobile phone texting or dialing (57%)	Using phone (texting, dialing, charging) (66%)	Driving while angry or sad or agitated (25%)	Baby is crying or kids are fighting in the back seat (26%)	Laws and enforcement (38%)
Age	18–23	4	2	3	1	Outside person, object, or event (48%)	Using phone (texting, dialing, charging) (65%)	Conversing with passengers (41%)	Baby is crying or kids are fighting in the back seat (39%)	Laws and enforcement (43%)
	24–40	4	2	3	1	Mobile phone texting or dialing (57%)	Using phone (texting, dialing, charging) (56%)	Driving while angry or sad or agitated (28%)	Baby is crying or kids are fighting in the back seat (29%)	Laws and enforcement, Education and training (29%)
	41–60	4	2	3	1	Mobile phone texting or dialing (62%)	Using phone (texting, dialing, charging) (66%)	Driving while angry or sad or agitated (20%)	Baby is crying or kids are fighting in the back seat (21%)	Laws and enforcement (41%)
	>60	4	2	3	1	Mobile phone texting or dialing (67%)	Using phone (texting, dialing, charging) (94%)	Talking on a cell phone—even a hands-free one (61%)	Baby is crying or kids are fighting in the back sea (46%)	Laws and enforcement (49%)
Driving Experience (Number of years having driving license)	<2	4	2	3	1	Mobile phone texting or dialing (46%)	Using phone (texting, dialing, charging) (58%)	Talking on a cell phone—even a hands-free one (39%)	Baby is crying or kids are fighting in the back seat (32%)	Laws and enforcement (46%)
	2–5	4	2	3	1	Mobile phone texting or dialing (48%)	Using phone (texting, dialing, charging) (64%)	Talking on a cell phone—even a hands-free one (41%)	Baby is crying or kids are fighting in the back seat (43%)	Laws and enforcement (33%)
	5–10	4	2	3	1	Mobile phone texting or dialing (46%)	Using phone (texting, dialing, charging) (63%)	Baby is crying (17%)	Baby is crying or kids are fighting in the back seat (25%)	Laws and enforcement (25%)
	>10	4	2	3	1	Mobile phone texting or dialing (63%)	Using phone (texting, dialing, charging) (67%)	Driving while angry or sad or agitated (24%)	Baby is crying or kids are fighting in the back seat (26%)	Laws and enforcement (40%)

Table 4. *Cont.*

Demographic Variable		Distraction Type Rank				Top Ranked Visual Factor ** (%)	Top Ranked Manual Factor ** (%)	Top Ranked Cognitive Factor ** (%)	Top Ranked Auditory Factor ** (%)	Most Effective Measure in Reducing Driver Distraction ** (%)
		Visual	Manual	Cognitive	Auditory					
Education	High School	4	2	3	1	Outside person, object, or event (76%)	Using phone (texting, dialing, charging) (86%)	Talking on a cell phone—even a hands-free one (66%)	Baby is crying or kids are fighting in the back seat (49%)	Laws and enforcement (46%)
	Diploma	4	2	3	1	Mobile phone texting or dialing (54%)	Using phone (texting, dialing, charging) (72%)	Talking on a cell phone and baby is crying (59%)	Baby is crying or kids are fighting in the back seat (44%)	Laws and enforcement (49%)
	Bachelor degree	4	2	3	1	Mobile phone texting or dialing (56%)	Using phone (texting, dialing, charging) (54%)	Driving while angry or sad or agitated (31%)	Baby is crying or kids are fighting in the back seat (32%)	Laws and enforcement (31%)
	Master's degree and above	4	3	2	1	Mobile phone texting or dialing (63%)	Using phone (texting, dialing, charging) (64%)	Driving while angry or sad or agitated (23%)	Baby is crying or kids are fighting in the back seat (22%)	Laws and enforcement (39%)
Employment	Full-time	4	2	3	1	Mobile phone texting or dialing (56%)	Using phone (texting, dialing, charging) (60%)	Driving while angry or sad or agitated (25%)	Baby is crying or kids are fighting in the back seat (21%)	Laws and enforcement (36%)
	Part-time	4	2	3	1	Mobile phone texting or dialing (40%)	Using phone (texting, dialing, charging) (66%)	Talking on a cell phone—even a hands-free one (32%)	Baby is crying or kids are fighting in the back seat (37%)	Laws and enforcement (34%)
	Retired	4	2	3	1	Mobile phone texting or dialing (63%)	Using phone (texting, dialing, charging) (95%)	Talking on a cell phone—even a hands-free one (47%)	Baby is crying or kids are fighting in the back seat (40%)	Laws and enforcement (47%)
	Student	4	2	3	1	Mobile phone texting or dialing(43%)	Using phone (texting, dialing, charging) (62%)	Talking on a cell phone—even a hands-free one (40%)	Baby is crying or kids are fighting in the back seat (37%)	Laws and enforcement, Technical approaches to restrict distraction (66%)
	Home Maker	4	2	3	1	Mobile phone texting or dialing (52%)	Using phone (texting, dialing, charging). (65%)	Baby is crying (23%)	Baby is crying or kids are fighting in the back seat (40%)	Laws and enforcement (46%)

** (%) percentage of drivers in each group who selected this as the most distracting factor.

Table 4 also conveys an interesting finding on how drivers in Jordan think about corrective measures to reduce distractions. Most demographic groups believe that "laws and enforcement" is the most effective measure to reduce distraction on the road. This reflects the belief of Jordanian drivers, who daily witness and commit many traffic violations, that the only way to succeed in reducing such violations is by enforcing traffic laws and showing no tolerance to careless driving.

3.3. Drivers' Perceptions Regarding Effect of Environment, Vehicle Type, and Road Factors

Table 5 presents drivers' perceptions of environmental and vehicle type factors on distraction. From the findings, (61.3%) of the participants indicated that both "non-daylight" and "adverse weather conditions" had a similar effect on distraction while driving. However, (64.6%) indicated that driving a non-passenger car was more distracting, while (30.3%) believed that driving a passenger car or a non-passenger car had a similar effect.

Table 5. Drivers' perceptions of environmental and vehicle type factors on distraction.

Effect	Frequency	Percent
Environmental		
Non-day light	98	11.8
Adverse weather conditions	222	26.9
Both will have similar effect	506	61.3
Vehicle Type		
Passenger car	42	5.1
Non-passenger car (SUVs, pickup trucks, vans)	534	64.6
Both will have similar effect	250	30.3

Drivers were also asked if wearing a face mask while driving as a precaution against COVID-19 might cause them any kind of distraction and affect their driving. Of the respondents, 284 (34.4%) agreed that it had an effect, while 266 (32.2%) disagreed with such a statement, and the remaining (33.4%) had a neutral perception of the mask's effect on distracting drivers and adversely affecting their driving skills. Table 6 shows the ranking of road factors that influence drivers' distractions based on the average weight given by respondents. According to the responses, intersections were perceived as the most dangerous road element to distracted drivers, followed by high-speed roads >70 km/h, non-level grade, and roadways with more than two lanes.

Table 6. Ranking of road factors' effect on distracting drivers as reported by all respondents.

Road Factor	Intersections	Roadways with More than 2 Lanes	Non Level Grade	High Speed Roads > 70 km/h
Average of Weight	3.208	2.254	2.617	2.695
* Rank based on Average Weight	(4)	(1)	(2)	(3)
Median of Weights	4	2	3	3

* Rank: higher value reflects higher danger and lower value reflects lower danger.

3.4. Drivers' Perception of Measures to Reduce Drivers' Distraction

One of the core objectives of this study was to emphasize the measures that can be used to reduce distraction. Figure 1 shows drivers' responses to the questions related to the aforementioned objective. They reveal that laws and enforcement is the drivers' preferred choice to reduce distraction, followed by measuring and understanding the effect of distraction on safety, and then by education and training.

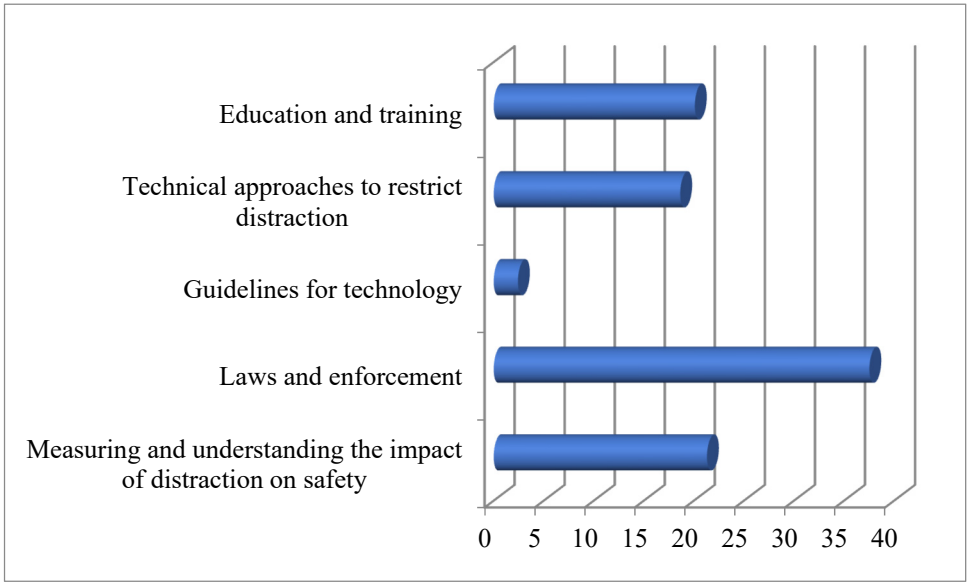

Figure 1. Drivers' choices of measures to reduce driver's distraction.

4. Discussion

The main goal of this study was to rank the major distraction factors and distraction types from drivers' perspectives. The methods often used in studies of driver distraction are not always effective or feasible in certain conditions. To achieve the purpose of the current research, a naturalistic method was followed to evaluate drivers' distractions in Jordan. Observational studies are considered the most feasible, effective, and appropriate for the recording of continuous data, with the core advantage being the fact that driving is very close to natural reality. Therefore, a high degree of validity and reliability can be associated with the findings.

As introduced earlier, Jordan suffers from a high rate of accidents, resulting in a large socio-economic loss. In fact, it has been ranked among the top four countries in traffic deaths for the year of 2017 [26]. In 2019, traffic accidents in Jordan resulted in 10,857 human injuries and 643 deaths at a financial cost estimated at JOD 454 million. Several factors have been confirmed to cause traffic accidents, mostly related to vehicle, road, or human error. Among these factors, driver fault ("Not taking the necessary precautions") was reported as the cause of a high percentage (around 40%) of injuries and deaths in 2019 [26].

The analysis above showed that Jordanian drivers perceive visual distraction as the most dangerous distraction type, followed by cognitive distraction, manual distraction, and auditory distraction, in this order. It could be observed that drivers of all demographic groups are well aware of the effects of visual distraction on driving, as it involves taking the eyes off the road and glancing elsewhere to engage in a secondary activity inside or outside the vehicle. Such an action may negatively interfere with the driver's performance, causing a prolonged period of reaction time, poor response to road signals, and difficulty keeping to the appropriate lane, or to an appropriate tracking distance. Similar effects can be observed with cognitive distractions, as the drivers' attention is taken away from what is happening during driving. This finding is consistent with Alizadeh and Dehzangi [25] who found that cognitive and visual distractions are the most important noted distractions that negatively influence performance, including visual perception efficiency, steering control, response to hazards, and lane variation.

In addition, it was observed that the use of a mobile phone is one of the most distracting risk factors. Responses indicated that drivers practice risky acts by using their mobile phones while driving, without paying attention to its consequences. For example, it was noticed that the extent of mobile phone usage for activities other than talking was alarming. More than 50% of respondents occasionally sent a text message, and more than 90% of respondents used mobile phones for navigation. These practices cause the drivers to take

their eyes off the road, their attention away from the task of driving, and their hands off the wheel, which would increase crash risks. This finding is also consistent with Sterkenburg and Jeon [12], and Niu et al. [27], who highlighted the very negative impact of mobile phones on performance.

Furthermore, the results showed that respondents perceived the use of wireless technologies and hand-free systems as a cause for distraction, which is consistent with earlier findings by Wood et al. and Jenness et al. [13,17]. Wood et al. indicated that the use of hands-free systems led to multiple distractions. Jenness et al. [17] revealed that manually operated navigation systems are a major source of distraction because they take even more attention from the driver and a longer time to operate.

Moreover, the acts of eating, drinking, or smoking were observed by more than half of the drivers as a cause of distraction, despite the fact that these factors are not commonly emphasized by safe driving campaigns. Theses campaigns tend to focus instead on mobile phone use, despite the numerous other distractions which have unfavorable effects on driving. These findings are consistent with others by Huemer and Vollrath [28], who revealed that drivers were predisposed to agree that secondary task involvement can be generally hazardous. However, a majorly mitigated ratio in the same study agreed that they were distracted on particular occasions in which they were involved in secondary activities; an even smaller ratio acquiesced that being involved in such factors put themselves at risk of crashing.

Additionally, drivers' responses revealed that more than 60% believed that both "non-daylight" and "adverse weather conditions" had a similar effect on distraction while "driving a non-passenger car" was more distracting than driving a passenger one. A similar finding was reported by Stutts et al. [29], where distractions were more likely to occur while driving during non-daylight hours, and while driving a pickup truck, van, or sport utility vehicle.

Drivers' perceptions of road factors also showed that intersections were perceived as the most dangerous road component to distracted drivers, followed by high-speed roads of >70 km/h, non-level grade, and roadways with more than two lanes. Drivers' awareness of the most dangerous sections of the roadway may cause them to be more alert and attentive when going through these sections. This interpretation supports Stutts et al. [29], who found that those who were distracted at the time of crashes were less likely to be traveling on multilane roadways and less likely to have crashed at an intersection or other road junction.

In addition, it was observed that most Jordanian drivers did not follow driving instructions or use safety features. A considerable percentage of them did not wear seatbelts, held the steering wheel with one hand, ate or smoked while driving, and listened to very loud music while driving.

Based on the previous discussion, generally a good agreement can be observed between the analyzed perceptions of Jordanian drivers and findings in the literature regarding distractions rankings, the impact of using mobile phones, wireless technologies and hand-free systems, eating, drinking, or smoking, and road and environmental factors [12,13,17,25,27–29].

Similarly, a good agreement can be observed between the opinions of Jordanian drivers, and the real causes of traffic accidents related to drivers' faults in Jordan. Al-Rousan et al. [30] examined the characteristics of traffic accidents caused by distracted driving on rural and suburban roadways in Jordan. The study analyzed 10,200 accidents on nine road segments in Amman, Jordan's capital city, from 2014 through to 2018. It was found that 73% of reported accidents were related to the drivers' faults. Among these, 25.95% were related to distracted driving, while 9.6%, 2.63%, 2.44%, and 1.63% were related to traffic rules violations, reckless driving, loss of control, and ignoring road signs, respectively.

Furthermore, Albdour and Marafi [31] analyzed data of traffic accidents that were caused by the fault of the driver in Jordan from 2009 to 2012. It was observed that these

faults were the leading cause of traffic accidents in Jordan. Moreover, it was found that "Tail gating", "Not taking the necessary precautions while driving", "Using Incorrect Lane", "Priorities false", and "Reversing Incorrect" were the main factors related to traffic accidents. The authors recommended enhancing driver training before licensing them to drive on the road, increasing traffic education campaigns in schools and universities, and strengthening the written and practical driving tests to reduce accidents caused by driver faults.

In addition, Al-Omari and Obaidat [32] analyzed the pedestrian accidents in one Jordanian city (i.e., Irbid city) for the period of 1999–2001. The study data showed that 37% and 0.57% of pedestrian accidents related to the driver's fault were caused by "Not Giving Priority to Pedestrians" and "Failing to Comply with Obligatory Traffic Signs", respectively.

As indicated earlier, the analysis revealed that Jordanian drivers did not follow traffic laws or safe driving instructions and did not use the safety features in their cars. A considerable percentage of drivers did not wear seatbelts, consumed food and drink or smoked while driving, and used mobile phones while driving. Although drivers were aware of laws banning such acts, they still engaged in them.

Responses demonstrated that the majority of Jordanian drivers considered traffic laws and their enforcement as the most effective measure to reduce distraction. Traffic laws in Jordan are very strict regarding behaviors which are distracting to drivers. Fines are applied for distracting behaviors such as smoking and eating while driving and for installing any devices or gadgets inside the vehicle that contribute to the driver's distraction. For example, a JOD 15 (USD 21) fine is issued for drivers caught holding their mobiles in their hands to make a call or use its applications [33].

These laws have been legislated and must be well enforced, as a lot of traffic violations have been reported. For example, 20,493 fines were issued during a two-day traffic campaign in mid-June 2018 [34]. Moreover, around 217,000 traffic violations were recorded by 42 cameras across Amman during the third quarter of 2018 [35]. Additionally, 553,616 traffic violations were reported in 2016 [36]. In 2015 and 2016, the total value of traffic fines was estimated to be around JOD 88.5 million (USD 125 million) [37]. Due to a large number of violations, including frequent phone use, there is a will to modify traffic laws in Jordan by increasing the penalties for violations that lead to hazardous situations and/or cause accidents [33].

Currently, several other strategies are applied to reduce the numbers and consequences of traffic accidents in Jordan. Traffic surveillance and traffic awareness are among the strategies of the Jordanian Central Traffic Department (JCTD). Traffic surveillance of different forms (i.e., exposed, hidden, or modern (using cameras)) is used to cover most of the roadway networks and inhibit traffic violations [33].

Furthermore, the level of traffic awareness among drivers, pedestrians, and cyclists at the national level is one of the main goals of the Public Security Directorate's (PSD) work plans. Several approaches are used to enhance awareness levels, including traffic awareness brochures and booklets, traffic awareness lectures given in universities and schools, sending traffic awareness messages via Short Message Service (SMS), the publishing of a traffic news magazine, producing videos covering traffic violations and their consequences and broadcasting them through the national TV Station, and developing an effective communication channel with the public to obtain feedback and to receive suggestions and complaints [33].

In addition, education and awareness campaigns are held to increase awareness on the dangers of phone use while driving, urging people to respect traffic laws, and helping to promote the culture of safe driving by evading dangerous traffic violations [33]. These campaigns are performed regularly and increase during the activation of seasonal surveillance plans in the summer, during the fasting month of Ramadan when traffic greatly increases, especially during the late afternoon hours, schools opening, and winter emergency plans. They are held in coordination with the participation of other parties such as the Ministry of Public Works and Housing, municipalities, the Royal Automobile Club,

and several civil society organizations (unions, associations, and clubs). These companies are held at the national level and can sometimes target specific locations or categories such as one city/town, or only the youth, depending on the traffic situations and risks.

However, the current implemented approaches (e.g., law enforcement, education and awareness campaigns) have a limited effect in most cases [38]. For example, drivers can hide their phones to avoid police surveillance. So, certain inventive methods may be essential to reduce distraction risks. Oviedo-Trespalacios et al. [39] suggested the use of mobile phone applications which would reduce distractions while driving. These applications limit interactions with the mobile device (for example, block text messaging and/or browsing) while the vehicle is in motion. Nguyen-Phuoc et al. [40] proposed reducing distractions through custom-made interventions involving a variety of players (legislators, police enforcement, psychological health specialists, advocacy groups and the extensive community) in order to increase awareness, adjust attitudes and improve risk perceptions related to the use of mobile phones during driving. They suggested educational tools and road safety campaigns that include customizing road safety programs for individuals and groups affected by problematic mobile phone use through targeted advertising.

A limitation of this study is that the findings are based on an analysis of Jordanian drivers' perspectives, which may have unique social, demographic, cultural, and other, conditions. Therefore, the findings may not be extendable to other countries. The authors recommend following an approach similar to the one in the current study to explore intercultural differences and to get a deeper understanding of drivers' faults that contribute to distraction. Another limitation of the present study is that it relied on self-assessment of general driving experiences, as compared to an external objective assessment. Thereby, the study proposes that similar research be conducted with an objective measuring of cognitive and visual distractions, while eliciting drivers' perceptions of changes in their traffic environment.

5. Conclusions

Jordan has suffered from a high rate of traffic accidents, resulting in a large socio-economic loss. Human error was responsible for 98.2% of accidents involving human injuries in the year of 2019. Among these errors, driver fault ("Not taking the necessary precautions") has been confirmed as the most recurrent cause responsible for a high percentage of injuries and deaths [26]. This study aimed to investigate and rank the major distraction factors and distraction types causing accidents from the drivers' perspectives. Based on the findings of this study, the following can be concluded:

1. Visual distraction was perceived as the most dangerous type, followed by cognitive distraction, and then manual distraction, while auditory distraction came last.
2. Among visual and manual distraction types, "mobile phone" was one of the highest risk factors that distracted drivers; therefore, more campaigns should be launched to elucidate its risks and enforce the banning of its use in driving.
3. "Crying babies" and "fighting kids in the back seat" were the riskiest auditory factors.
4. Regarding cognitive distractions, four factors were perceived as the most distracting by different demographic groups. They are the following: "Baby is crying", "Driving while angry or sad or agitated", "Talking on a cell phone—even a hands-free one", and "Conversing with passengers".
5. Laws and their enforcement were perceived as the most effective measure to reduce distraction on the road. Therefore, legislated laws that ban handheld phones and careless driving should be well enforced. In addition, phone applications that can reduce distractions should be considered.
6. Educational tools and road safety awareness campaigns to encourage and enforce personal responsibility for driving safely should focus on individuals and groups with problematic driving behaviors, such as using mobile phones while driving, not putting on seatbelts, holding steering wheel with one hand, and eating, drinking or smoking while driving.

7. Navigation systems with voice commands can be a better choice and a safer alternative for using mobile phones for navigation.

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